



Transmittal 1

Appendix A & A-1

# PORT OF LOS ANGELES

TRUNKED RADIO SYSTEM UPGRADE & INTEROPERABILITY PROJECT

NOVEMBER 1, 2019

## MISSION CRITICAL RADIO SYSTEM

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# EXECUTIVE OVERVIEW

## 1.1 EXECUTIVE OVERVIEW

As a member of the Los Angeles UASI area the Port of Los Angeles will be upgrading their existing Public Safety radio system to support the same P25 Trunking Radio platform in use throughout the region. The Port of Los Angeles currently operates a Motorola radio system including a core, dispatch consoles, conventional simulcast cell, standalone remote sites, and subscriber radios.

This project will add P25 trunking and data features to the existing core, upgrade the microwave backhaul system, implement a P25 trunking simulcast cell, and expand the capabilities of the existing UHF backup channel. By partnering with Motorola, the Port can leverage its existing investments into the system and subscribers and is able to match the technology platform under implementation across the region.

The system upgrade project will include an Inter RF Subsystem Interface (ISSI) layer that will allow the Port of Los Angeles to directly connect their system to the other City of Los Angeles radio systems along with the LA-RICS regional radio system. This connection will allow Port dispatchers and officers to seamlessly communicate with other dispatchers and officers from the rest of the region.

This project will include the upgrade / implementation of the following major components.

- Adding P25 Trunking and Data Features to the existing system core.
- Implement a 7/800MHz Trunking Simulcast Cell
- Enhance the existing P25 conventional UHF backup channel
- Upgrade and implement additional hops to the existing Microwave System
- Upgrade the software and capacity of the existing Dispatch Consoles
- Add a redundant Core and Comparators to the radio system
- Upgrade two (2) existing BDA's to support 7/800MHz

To meet the UASI grant funding cycles the Port will break the radio system upgrade project into multiple phases. The first phase, covered in UASI 18, is expected to include the implementation of the primary core, backup core, dispatch consoles, data and interoperability features. The second phase, covered in UASI 19, will complete the installation of the trunking upgrade and will include implementation of the 7/800MHz simulcast cell, UHF simulcast cell, additional interoperability connections, system testing, coverage testing, and potential in-building amplifiers.

This multi-phase upgrade project will bring a mission critical, best-in-class trunking radio system to the Port of Los Angeles and will provide the Port with a communication platform that provides direct connection and interoperability with neighboring agencies throughout the county.



## 1.2 CAPACITY ANALYSIS

In order to meet the voice and data needs for the Port of LA a traffic loading study was conducted by Motorola. As a result, it is recommended the upgraded 700MHz sub-system consist of 8 RF channels / frequencies.

### Capacity Analysis Inputs / Goals:

- Bush Hour Voice Users (Including ISSI): 600
- Traffic Loading: 4.994 Erlangs
- 0.4% GoS (Grade of Service)
- Data Users: 500
- Data GPS Cadence: 60 Seconds
- Active Talkgroups: 24
- Data Message Reliability: 95%

### Capacity Analysis Results:

- Number of Total Channels: 8
  - Voice Only Channels: 5 (10 Talkpaths)
  - Control Channels: 1
  - Data Protected Channels: 2



# SYSTEM DESCRIPTION

## 2.1 ASTRO 25 INFRASTRUCTURE

Motorola Solutions, Inc. (Motorola Solutions) proposes our ASTRO® 25 platform with Integrated Voice and Data (IV&D) to provide secure and reliable communications for the Port of Los Angeles (the Port). ASTRO 25 offers a future-ready, wireless platform that combines uncompromising, real-world performance and reliability.

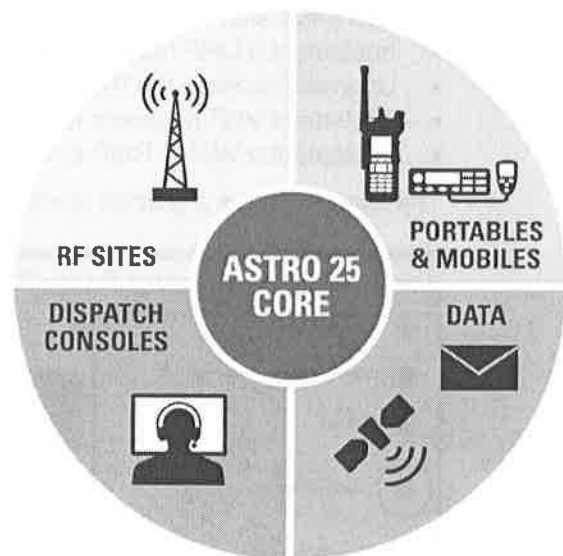
ASTRO 25 offers the Port a Project 25(P25), standards-based Internet Protocol (IP) solution with a flexible, modular network. ASTRO 25 can expand to accommodate additional radio users, increased geographic coverage, enhanced data applications, and connectivity to other networks, ensuring that the Port will have efficient and cost-effective communications for decades to come.

ASTRO 25 also provides advanced call processing capabilities designed to meet the needs of public safety. On an ASTRO 25 network, first responders can share voice and data communications between members of the same team, across an agency, or among different agencies. In addition, the network's centralized command and control capabilities will enable the Port to deploy resources, track personnel, and maintain communication security more efficiently and effectively.

The system's P25-compliant IV&D operation allows data traffic to travel seamlessly over the ASTRO 25 radio system, improving in-field efficiency and providing a platform for additional capabilities. By creating a data transport layer capable of supporting both industry-standard IP and customer-developed applications, IV&D will provide the Port with a number of important benefits:

- Conserves valuable airtime.
- Increases communications accuracy.
- Allows queries in the field without involving dispatch.

Because ASTRO 25 automatically prioritizes voice communications over data transmissions, the Port's personnel will always be able to transmit and receive mission-critical communications.



## 2.2 PROPOSED SYSTEM ARCHITECTURE

Motorola Solutions is pleased to provide the Port of Los Angeles with a proposal for upgrading the existing UHF conventional radio system to a P25 trunked 7/800MHz radio system. The new/upgraded system will implement the 700 MHz layer on-top of the existing UHF conventional system. Two backup, single channel, UHF layers will be added to provide the Port with a backup and city-wide communication plan. It will also integrate other subsystems in use at the Port. The proposed system upgrade includes the following major components and services:

- Upgrade Conventional core to a Trunking core at the latest shipping release
  - Add P25 Trunking features to the existing core
  - Add P25 data features to the existing core
  - Add Enhanced data capabilities
- Include a redundant geo-separated core to the system
- Upgrade the existing dispatch positions
- A NICE logger recorder
- Add a five site, 700MHz simulcast cell
- Implement a UHF backup cell
- Upgrade/Increase the Backhaul system to support the new design
- Implement VHF receivers for Marine communication.
- Implement a WAVE RoIP system.

The figure below is a graphic representation of the proposed system upgrade.

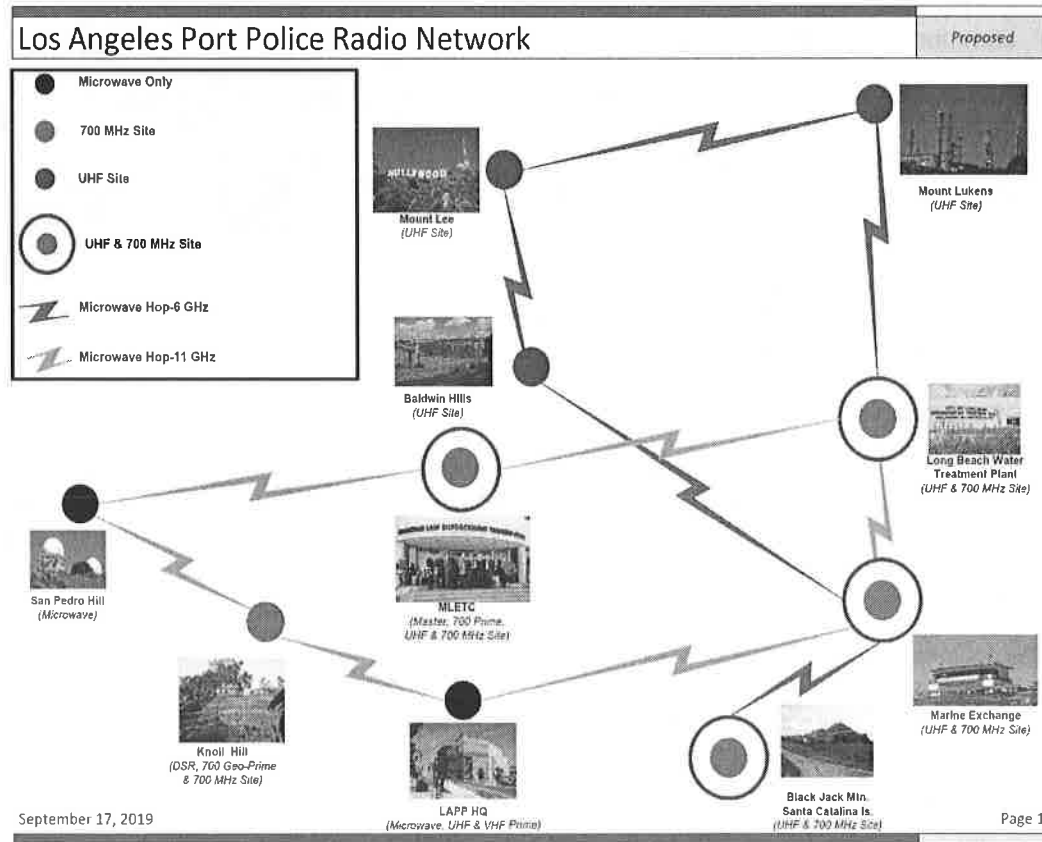


Figure 2-1: System Architecture

The “master site”—where core equipment is located—provides a central point of control for the operation of the radio communication system. From the master site, the Port’s system administrators will have access to the hardware and software components that control call processing, network management, and system configuration. Common Server Architecture (CSA) reduces physical space and individual component requirements at the master site by using Virtual Management Servers (VMSs) to host server applications in a Virtual Machine (VM) environment.

The proposed ASTRO 25 Standalone Repeater (ASR) Sites provide base radios to route the Port’s voice traffic to the system for distribution to other sites. The base radios also repeat each transmission to support other local user radios. ASR sites support packet data and route data traffic to the site controller. The site controller then routes these data packets upstream to the zone controller for further processing and routing.

The proposed Simulcast Sites provides simultaneous broadcast of the same voice or message from multiple transmitters on the same frequency. Simulcast sites provide consistent communications throughout large geographical areas, such as a large city, metropolitan area, county, or country. The architecture of a simulcast cell includes a simulcast prime site, which controls the cell and communicates with the system’s master site, and one or more simulcast remote sites, which provide simulcast coverage to users. Because each simulcast cell operates like a single-site system, the Port’s users benefit from simplified roaming and talkgroup configurations.

The proposed ASTRO 25 radio system includes a Digital Conventional Simulcast, which will enable digital simulcast operation with IP transport in the Port’s conventional system.

The proposed Conventional Base Radio Sites provides coverage over the distance of the transmitter/receiver signals. A mobile or portable radio within range of the base radio or console can communicate with the dispatch operator and other mobile/portable users.

The proposed Voting Sites provide multiple satellite receivers to cover “dead spots” created by buildings or nature. Since the receivers operate on the same frequency, a field radio may simultaneously hit multiple sites when transmitting. A voting comparator compares and selects the best signal. This signal is then forwarded to the transmitter for rebroadcast to the user radios, as well as the console for dispatch operator monitoring.

## 2.3 CORE UPGRADE

The functionality and features of the Core will include the latest release of the ASTRO P25 systems. Features such as:

- TDMA operation for increased capacity
- Transcoding and Dynamic Assignment to fully utilize TDMA and FDMA resources
- User Login Alias Update for easier user identification
- Provision Management to facilitate additions/modifications to the system
- Enhanced Data to support a richer set of data-driven applications
- Location on PTT to enable tracking of subscribers with minimal system impact
- Key Management Facility to automatically manage and control encryption keys

These features will be described in more detail later in this document.

The new Core configuration also includes Inter-RF Subsystem Interface 8000 (ISSI). With this feature, the Los Angeles Port has the capability and flexibility of connecting to three (3) other



P25 systems, facilitating interoperability. This connection is available to P25 systems operating in different frequency bands, different system releases, or different manufacturers.

Another enhancement to the current system is the implementation of Dynamic System Resilience (DSR). The design includes two Cores, located at different geographical location in the Harbor District. The Primary Core will be located at the Police Headquarters Building and the secondary core will be located at Knoll Hill. This system configuration maintains critical radio communications in the event one core is lost, by immediately switching to the secondary Core. The switch occurs automatically, typically in less than 30 seconds. The fact that each core is at a separate location, enhances the total system resilience.

Geographic redundancy is also applied to the Prime Site for the 700MHz simulcast cell. Prime sites for this cell will be located at both the 300 Water Street location and the Police Headquarters Building. This again enhances system resilience in the same manner as DSR for the core. Switch-over will occur automatically, within 60 seconds but typically in less than 30 seconds.

## 2.4 RF SUB-SYSTEM DESIGN

The RF design is the base for defining the operational areas with the minimum voice and data guidelines. The goal of the RF design is to maximize the coverage over the operational area, while using the existing assets available to the Port of Los Angeles. The RF design is comprised of three distinct layers:

- One 700 MHz layer
- One UHF Citywide layer

The site and channel distribution for the 700 MHz trunk design is shown in Table 2-1, and its coverage concentrates on the Harbor District. Additional information and coverage maps are included in the 700 MHz Coverage section of the proposal.

**Table 2-1: 700MHz Sub-System**

Site	Band/Modulation	Channels	Cell
MLETC	Trunk 700 MHz/TDMA	8	Harbor District
Marine Exchange	Trunk 700 MHz/TDMA	8	Harbor District
Long Beach Water	Trunk 700 MHz/TDMA	8	Harbor District
Knoll Hill	Trunk 700 MHz/TDMA	8	Harbor District
Black Jack	Trunk 700 MHz/TDMA	8	Harbor District

The site and channel distribution for the conventional, UHF design is shown in Table 2-2.

**Table 2-2: UHF Sub-System's**

Site	Band/Modulation	Channels	Cell
MLETC	Conventional Digital FDMA	1	Citywide
Marine Exchange	Conventional Digital FDMA	1	Citywide
Long Beach Water	Conventional Digital FDMA	1	Citywide
Black Jack	Conventional Digital FDMA	1	Citywide

Site	Band/Modulation	Channels	Cell
Mt. Lukens	Conventional Digital FDMA	1	Citywide
Mt. Lee	Conventional Digital FDMA	1	Citywide
Baldwin Hills	Conventional Digital FDMA	1	Citywide

The VHF Voting site consists of 3 receiver-only RF locations with a voting site at the Police HQ Building. It is intended to improve inbound coverage of the Marine Band in the Port area. The VHF sites are listed in Table 2-3.

**Table 2-3: VHF Voting System**

Site	Band/Modulation	Channels	Cell
MLETC	Conventional Analog	1	Marine VHF
Berth 84	Conventional Analog	1	Marine VHF
Gaffey Street	Conventional Analog	1	Marine VHF

## 2.5 SYSTEM RESILIENCY

### 2.5.1 Dynamic System Resilience

Dynamic System Resilience (DSR) maintains critical radio system communications in the event in case one core is lost by switching immediately to a second core. Having the cores in different locations further enhances system resilience.

The DSR option maintains full system functionality, including network management features and core component redundancy, assuring your system remains active at your most critical time of need—thus maintaining strategic communications and preserving the safety of your jurisdiction.

**MAINTAIN COMMUNICATIONS  
DURING SYSTEM FAILURES**

The switch between master sites is automatic and seamless, with minimal interruption to radio system users. DSR provides redundant data components that switch independently of voice components.

Dynamic System Resilience provides:

- **Real-time synchronization**—Without operator intervention, core configuration data syncs for rapid core switch-over.
- **Fast switchover**—Most systems return to wide-area trunking operation in less than 30 seconds.
- **Geographic Redundancy**—Having cores in two locations provides the highest level of system outage protection to deliver constant communications.
- **Failure testing**—Manual core switching enables periodic testing of failure protection and both cores.



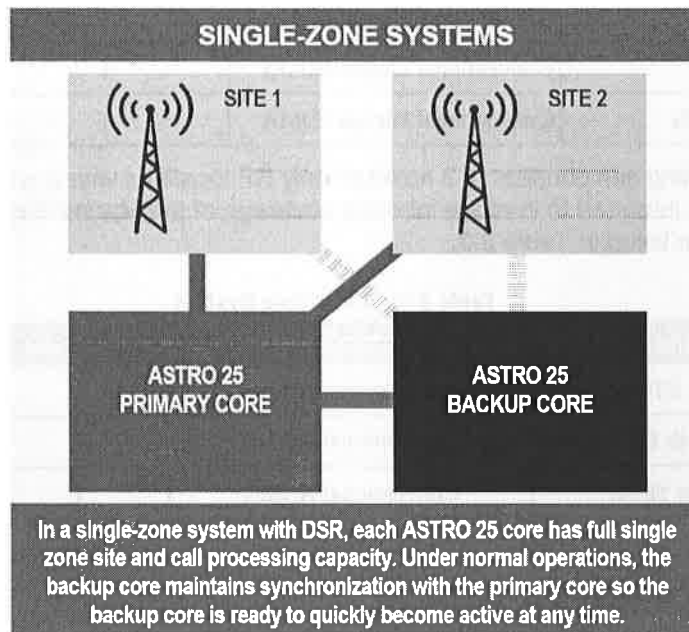


Figure 2-2: Dynamic System Resilience

## 2.5.2 Geographically Redundant ASTRO 25 Prime Sites

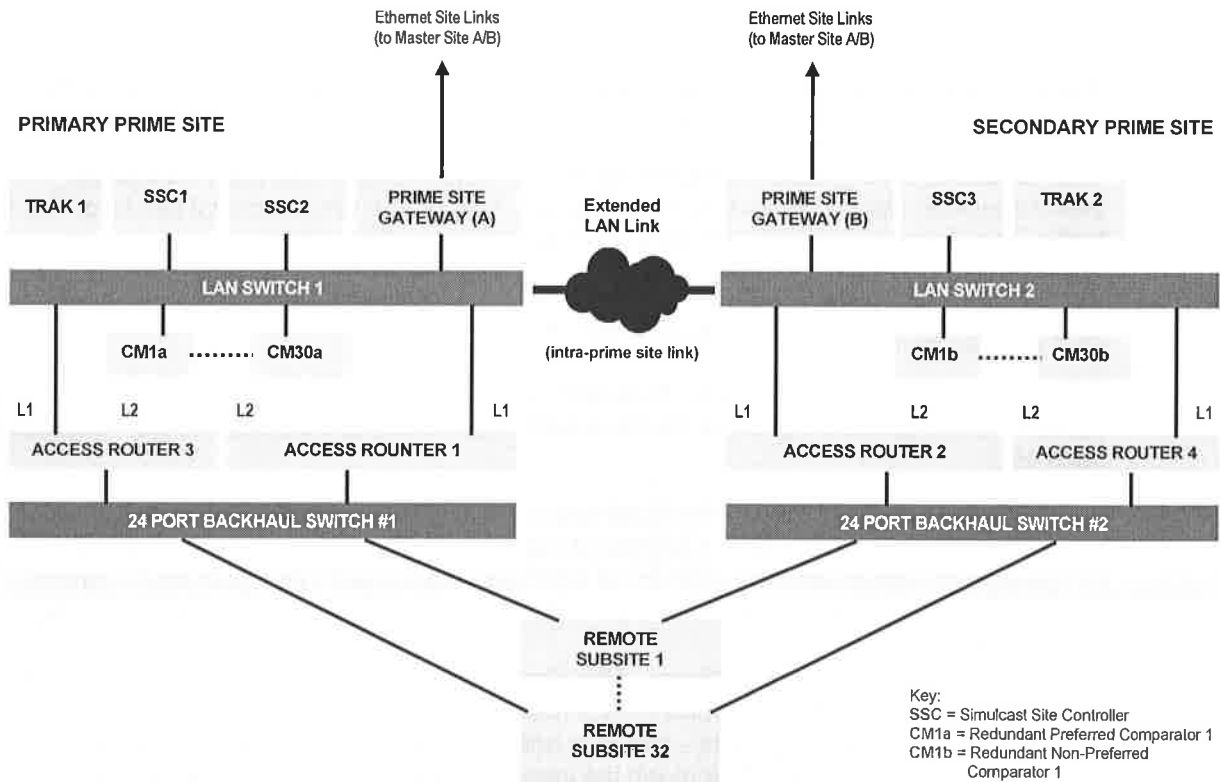
Geographically redundant ASTRO 25 prime sites keep wide-area simulcast subsystems operating even after a catastrophic loss of one of the prime sites. If the prime site becomes unavailable, the system automatically restores wide area operation with the secondary prime site.

**SWITCHOVER IS  
FAST, AUTOMATIC**

The ASTRO 25 system keeps users connected through a major catastrophe:

- Full functionality is provided on all the channels at the subsites.
- Redundant systems are easy to operate
  - All equipment is centrally managed
  - Simple, familiar system configuration and maintenance
  - Multiple locations appear to the system as a single prime site

A typical configuration is shown below.



Sample Geographically Redundant Prime Site Configuration

Figure 2-3: Sample Redundant Prime Site Configuration.

## 2.6 SYSTEM INTEROPERABILITY (ISSI)

Critical communications may come from a variety of sources and equipment. The proposed system will provide the Port with a gradual migration path to future system enhancements by supporting the following legacy Motorola Solutions equipment and technologies:

The proposed solution will provide the Port with extended interoperability features to connect the proposed system with other elements of the Port's communications.

Certain situations require first responders from different departments and jurisdictions to work together. ASTRO 25 provides the interoperability needed to coordinate a multi-agency response and communicate effectively during these mutual aid incidents. Through the Inter-RF Subsystem Interface 8000 (ISSI 8000) feature, the Port will have the flexibility to connect as a node on another P25 network regardless of that other system's radio frequency bands, manufacturer type, and release versions—allowing the creation of regional multi-system communications networks. These larger networks will allow multiple agencies to communicate seamlessly and share the costs of network infrastructure while still maintaining control over their own internal communications.

To enhance the interoperability added through ISSI 8000, the proposed ASTRO 25 radio system includes Inter-System Data to enable data services for radios roaming between systems that are connected through ISSI 8000. With Inter-System Data, the Port's IV&D data users will retain use of data applications and encryption while roaming across an ISSI connection.

## 2.7 SYSTEM VOICE ENCRYPTION

The proposed system supports end-to-end encryption using the AES encryption algorithm to ensure that only authorized radios can listen to encrypted transmissions on the network.

The **Advanced Encryption Standard (AES)** is an improvement over Data Encryption Standard (DES) algorithms and uses keys of 128, 192, or 256 bits to encrypt blocks of 128-bit traffic. The Motorola Solutions secure voice solution uses a 256-bit key.

## 2.8 SYSTEM CYBERSECURITY

In addition to system-level security capabilities, ASTRO 25 includes a robust set of cybersecurity service standards that will provide communications continuity and security for the Port's system, such as:

- **Centralized Authentication** – Provides one control point for identification, authentication, and authorization services, using Centralized Authentication, Authorization, and Accounting (AAA) with Active Directory (AD) for all Windows, Solaris and Linux platforms. Remote Authentication Dial-In User Service (RADIUS) extends the service to infrastructure network devices.
- **Secure Network Communications** – Provides secure point-to-point connections between two different machines through Secure Shell (SSH).
- **Secure Network Management** – Secures network traffic between network managers and SNMPv3-enabled elements through the inherent authentication and encryption capabilities of SNMPv3.
- **Router Access Control Lists (ACLs)** – Ensure that only authorized traffic can traverse the network by filtering traffic at core, exit, gateway, and site routers.
- **Ethernet Switch Port Security** – Prevents unauthorized access to the system through the ports on a network switch by providing an additional layer of security at the physical location of the equipment.
- **Secure Software Download (SWDL)** – Ensures that transfer operations are authenticated and encrypted, based on the Secure File-Transfer Protocol (SFTP), impeding interception of transmissions by unauthorized devices.
- **Backup and Recovery** – Enables the quick restoration of system devices under failure conditions through the centralized management of data backup and restore operations.
- **Transparent Element Hardening** – Removes nonessential tools, services, and utilities from the Windows Operating System, which could be used by an attacker to gain unauthorized access to system settings or data.

## 2.9 SYSTEM CAPACITY AND SPECTRUM MANAGEMENT

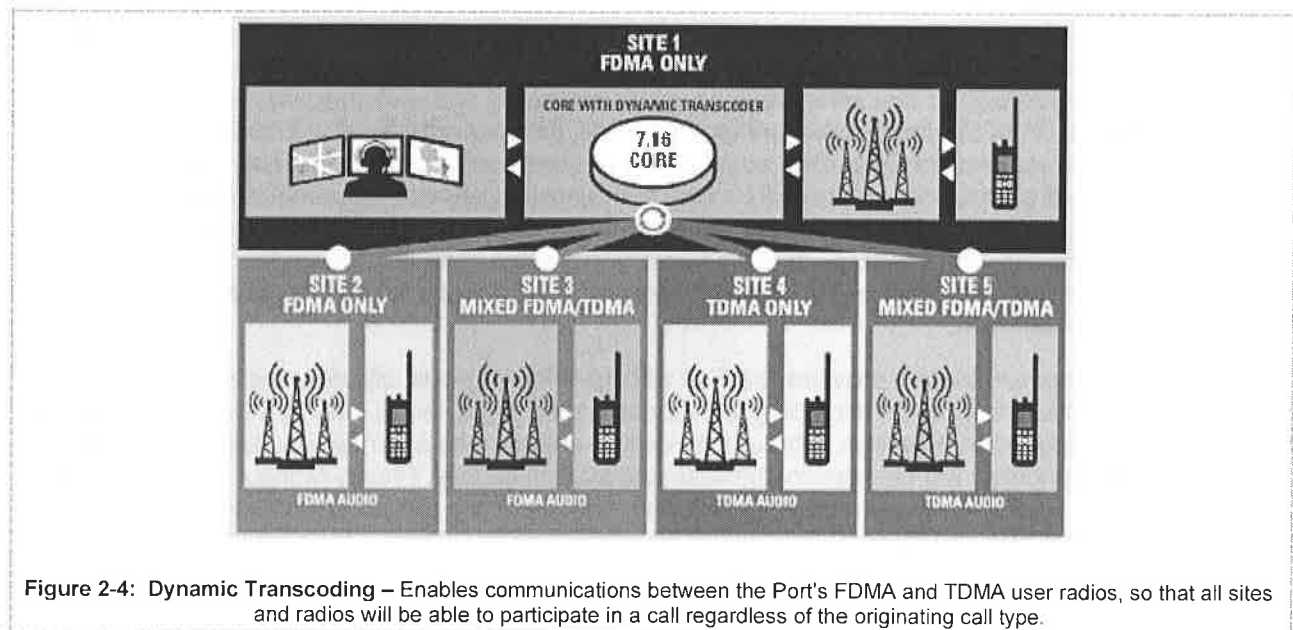
The level of traffic on the Port's system may vary depending on the time of day, day of the week, and emergency situations. Motorola Solutions takes great care to design systems that can meet peak performance levels without requiring resources that remain unused during slow periods. The proposed ASTRO 25 radio system includes features to ensure that resources are efficiently used.

The proposed system will support both **P25 Frequency Division Multiple Access (FDMA)** and **P25 Time Division Multiple Access (TDMA)** to provide the Port with the efficiency and

interoperability to accommodate a diverse fleet of user and mobile radios. With FDMA, radio frequencies are divided into smaller frequency bands, each with its own carrier frequency. TDMA divides each channel into two time slots, leveraging 2:1 channel efficiency to double talkpath capacity in the same radio frequency bandwidth allocation. Motorola Solutions' TDMA operation complements FDMA operation on the ASTRO 25 platform. Channels can be selectively configured to operate as either TDMA-only or FDMA-only. With TDMA operation enabled, voice calling capacity is increased over FDMA alone, without having to abandon FDMA operational stations and user radios.

**Dynamic Dual Mode** will enhance the ease of use and system operation for the Port's mixed fleet of P25 FDMA and P25 TDMA user radios. System administrators will not need to pre-assign base stations as P25 TDMA or P25 FDMA, because the system will automatically assign the appropriate station mode based on the needs of the radio user.

**Dynamic Transcoding** enables communications between the Port's FDMA and TDMA user radios, so that all sites and radios will be able to participate in a call regardless of the originating call type (see figure titled "Dynamic Transcoding" below). The call type is determined on a site-by-site basis, so more sites will operate in TDMA—even in the Port's mixed fleet of FDMA and TDMA radios. Each site operates in the best mode based on the channel resources available and capabilities of the radios at that site. Radio users communicate without a console patch or the need to downgrade the call. Radio users from TDMA-only and FDMA-only sites are able to join a Dynamic Talkgroup without changing the call type at either site, increasing the efficient use of channels and frequencies throughout the system.



**Figure 2-4: Dynamic Transcoding** – Enables communications between the Port's FDMA and TDMA user radios, so that all sites and radios will be able to participate in a call regardless of the originating call type.

Dynamic Talkgroup Assignment allows the Port's dispatch operators to automatically coordinate between P25 TDMA radio users and P25 FDMA radio users, with no need to track or patch radio users together. Talkgroups will be automatically assigned as FDMA or TDMA modes depending on the capabilities of the affiliated user radios.

## 2.10 SYSTEM VOICE COMMUNICATIONS MANAGEMENT

The successful completion of calls is a vital factor in the ASTRO 25 radio system design. Targeting communications is important for both privacy and efficiency. Some information may be sensitive and intended for a specific person, while other information may be important for an entire group of radio users. Communications that are relevant for one group should not distract another group, and some radio users may need priority over other radio users when the system is busy. The proposed system for the Port includes a collection of features to maximize communications availability, target and prioritize communications, and minimize the effort required by radio users to complete calls.

The zone controller manages call processing in the system. If a zone controller failure prevents channel requests from being acknowledged, the Automatic Retry feature will continue sending channel requests from the individual user radio until the request is acknowledged, or until a total of 16 automatic retries occur. If a radio user presses the push-to-talk (PTT) button and fails to find an open channel, Busy Queuing/Call Back will deliver a busy tone and place the call into a busy queue. As channels become available, they will be assigned to calls in the queue using pre-assigned priority levels. Radio users will be notified of the assigned channel through a call-back tone.

To ensure uninterrupted communications, Recent User Priority will give priority over other radio users to radio users who have been recently assigned a voice channel. Recent User Priority will provide priority system access for up to 10 seconds between transmissions to a talkgroup engaged in a conversation. Misdirected Radio Protection uses embedded signaling to ensure a radio from one talkgroup cannot accidentally be assigned to a voice channel being used by a different talkgroup. If a user radio is accidentally assigned to a different talkgroup channel, the radio will recognize that it has been assigned incorrectly and automatically revert to the control channel. With Continuous Assignment Updating, the control channel will continue to transmit the channel assignment for as long as a talkgroup is using an assigned channel. This ensures a radio just coming into service will be sent to the appropriate voice channel to join the rest of its talkgroup. Radio Talkgroup Muting will allow the radio user to mute all voice traffic for the currently selected talkgroup, including emergency voice received. The radio can be automatically unmuted by the dispatch operator or another radio user by sending the muted radio a Call Alert.

The proposed system provides the Port with 10 Priority Levels, allowing system administrators to segment radio users according to their communications needs. Priority 1 is always reserved for emergencies. Priorities 2 through 10 can be assigned on a per radio or talkgroup basis. These priorities are only applicable when the system is busy. Priority Monitor allows the radio user to scan talkgroups in their system, and mark up to two talkgroups in their scan list as Priority. A non-priority conversation will be interrupted by Priority 1 or Priority 2 talkgroup activity.

Dispatch operators can selectively call and carry on a Private Call with another individual radio, as long as that radio is not already engaged in another Private Call. The calling radio receives an acknowledgment of a successful Private Call. If the receiving radio has a display, it shows the calling party's radio ID. To protect channel availability for mainstream operations, Private Call management can control how many resources are dedicated for private calls at a trunking RF site. The system administrator can pre-configure and limit the number of simultaneous private calls that are active at a particular site, or even disallow private calls entirely.

Dispatch operators can make a simultaneous call to multiple talkgroups, with all radios configured for talk-back capability. Dispatchers can program this Multi-Group Call to operate in one of two ways:

1. The requesting radio user waits for all requested talkgroups to finish all calls in progress.
2. The requested call immediately interrupts other conversations in progress without waiting for active radio users to de-key. Radio users who are transmitting on a voice channel do not hear the call until they de-key.

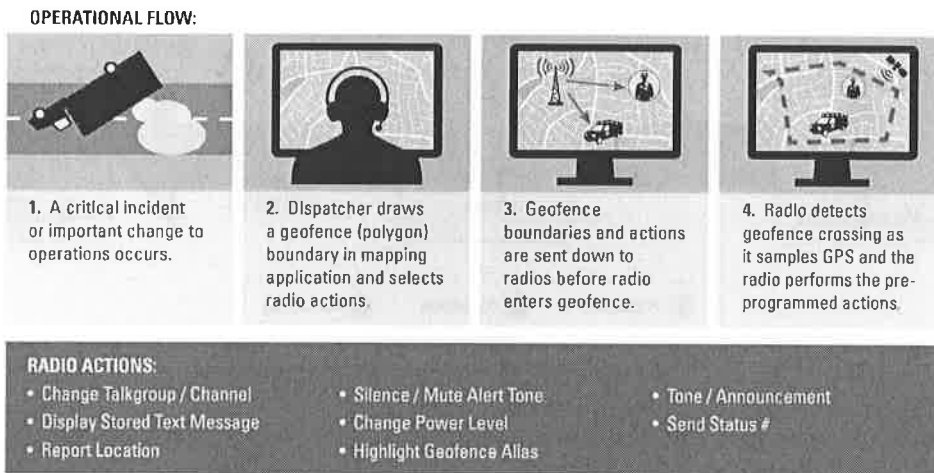
The proposed system provides a dispatch function called Dispatch Console/Talkgroup Merge to allow multiple talkgroups to operate together on one voice channel, improving channel efficiency.

The proposed system allows the Port to establish Conventional Talkgroups to separate voice communications between multiple agencies sharing an RF conventional channel. Radio users and dispatch operators using the same talkgroup can communicate with each other, while radio users from other talkgroups on the same channel cannot hear them. Dispatch Operators receive and transmit only to their associated radio user groups (or agencies), enabling dispatch operators to clear their own emergencies without affecting other talkgroups.

When using an ASTRO 25 radio equipped with GPS, the Geo Select feature dynamically changes that radio's operating talkgroup based on their current location. With Geo Select, dispatch operators can draw a boundary on their MotoMapping application so that radio users in, arriving to, or departing from the defined area are automatically placed in the correct talkgroup. The Geo Select feature will provide the following capabilities to the Port:

- Enables hands free, automatic talkgroup selection and optionally notifies personnel with text message and/or alert tone as they enter and exit designated areas.
- Allows radio users to be shifted to the right talkgroup as they approach incident scenes and worksites.
- Enables radio users to override the assigned talkgroup.
- Supports permanent or dynamic boundaries.

The Enhanced Geo Select feature enables an APX radio to immediately take action upon crossing a defined geographical boundary, or "geofence". This feature allows for quicker incident response times and simplified operations for radio users based on their geographic location. By providing automatic incident alerts and auto talkgroup channel selections, Enhanced Geo Select results in more effective communications and enhanced safety for field personnel.



**Figure 2-5: Enhanced Geo Select Operational Flow**

The proposed system offers the capability to designate certain channels as "Mutual Aid" channels, so that emergency responders can communicate and lend assistance across jurisdictional boundaries. This may be required due to an emergency response that exceeds local resources, such as a disaster

or a multiple-alarm fire. Radio communications between these organizations may be shared on a Mutual Aid radio channel.

PROVIDE SUPPORT  
ACROSS  
JURISDICTIONAL  
BOUNDARIES

Mutual Aid channels have been, and usually still are, conventional analog channels; however, all digital and mixed-mode channels are supported. These conventional Mutual Aid channels count against the overall station count in the overall system channel capacity.

## 2.11 SYSTEM DATA COMMUNICATIONS MANAGEMENT

The proposed system's Project 25-compliant Integrated Voice and Data (IV&D) operation allows data traffic to seamlessly use the the Port's ASTRO 25 radio system, improving in-field efficiency. The IV&D service creates a data transport layer capable of supporting both industry-standard IP and customer-developed applications.

Over-The-Air Rekeying (OTAR) employs encryption keys to keep communications secure, and updates those keys automatically without the delays, inconvenience, and administrative cost of having radio users bring their radios into the shop for manual reprogramming.

POP25, or Programming over P25, updates the configuration parameters of fielded user radios over-the-air while the radios remain in use, enabling quick reprogramming of the entire fleet of radios with no disruption to operations.

The Over-the-Air (OTA) Software Update feature provides a more efficient way to distribute radio software to an entire fleet of APX radios. This feature allows updates to be sent as a background service over the ASTRO 25 trunking radio system, without interrupting day-to-day operations. The OTA Software Update feature saves time, effort, and expenses related to system updates by eliminating the need to pull radios out of the field and into the shop for manual radio maintenance.

The figure below demonstrates how APX radios receive different types of updates from Radio Management via the OTA Software Update feature.

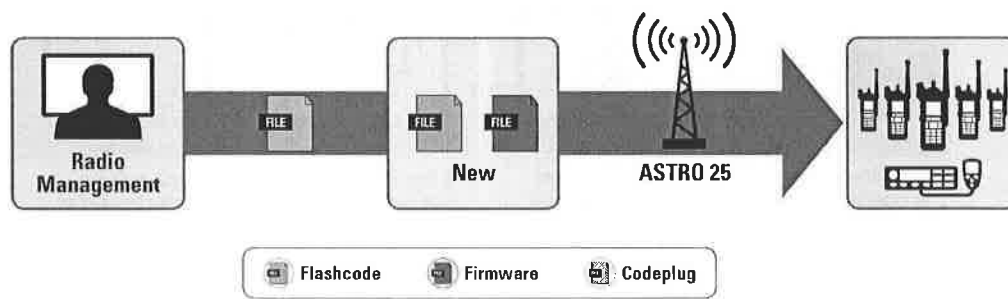


Figure 2-6: Firmware Download Process

Location Capabilities pinpoints the geographic location of user radios, enabling dispatch operators to deploy nearby personnel for quick response and to swiftly aid first responders who are in need of assistance.

The Location on Push-to-Talk (PTT) feature enables ASTRO 25 trunked radio systems to continuously track the location of individual radio users while they are involved in voice

calls. With each transmission, the APX radio with Location on PTT will send its Global Positioning System (GPS) location to the dispatch mapping application. ASTRO 25 Location on PTT provides timely, accurate location information when needed most – during emergencies and critical incidents that require intense voice collaboration.

ASTRO 25 Advanced Messaging Solution helps radio users convey detailed information, offload voice traffic, share knowledge, run queries and communicate with other devices through SMTP email in situations where verbal communication is less desirable because the environment is too loud or radio users do not want to be overheard.

Enhanced Data introduces a new type of data channel to support short, periodic inbound messages, such as GPS location, on APX user radios. Dispatch operators use these inbound messages to track radio users' status and location. ASTRO 25 Enhanced Data provides up to 12 times the capacity of a P25 standard data channel. For agencies using carriers for broadband traffic, Enhanced Data moves the short-burst inbound traffic to the ASTRO 25 network, avoiding carrier charges and coverage limitations. Converting P25 FDMA channels to TDMA makes room for additional channels for voice and data. Channels can be dedicated to data to optimize throughput and access times, while emergency voice traffic continues to automatically take priority. Enhanced Data enables several data-driven applications (i.e. SCADA, geofencing, telemetry, and biometrics) over the ASTRO 25 radio system. When supporting a variety of special-purpose applications, Enhanced Data can help provide a more timely and detailed view of resource locations and conditions.

Transit25 enables the addition of a third-party transit application to the proposed ASTRO 25 IV&D system, in order to transmit messages to a fleet of vehicles. Transit25 can be used to track the location of vehicles that belong to the fleet, and communicate between vehicle and dispatch operator using both data and voice.

**SEAMLESS COMMUNICATION  
BETWEEN DISPATCH AND YOUR  
FLEET OF VEHICLES**

Group Services uses talkgroups to broadcast data, sending information to multiple APX radio users simultaneously. Group Services allows APX radios to take advantage of two data features: Talkgroup Text Messaging and Alias Group Download. These functions provide simultaneous, mass transmission of text and alias information to all APX radios in a voice talkgroup. Group Services improves operational efficiency by eliminating the need for texts to be sent one radio at a time and aliases to be entered manually. Group Services works in the background, giving voice traffic priority on the talkgroup.

Alias Group Download allows system administrators to remotely update the push-to-talk (PTT) ID alias information for APX radios that are enabled for Group Services. Alias Group Download eliminates the need for physical access to a radio to do a codeplug update to change the radio PTT ID alias, instead, activating PTT updates the radio's ID alias, saving time and eliminating errors caused by entering the alias information in two places.

AMS Talkgroup Text Messaging improves dispatch operator efficiency and the safety of personnel in the field by sending one-to-many text messages over the voice channel to APX radios that are enabled for Group Services. This ASTRO 25 feature allows dispatchers to quickly broadcast high priority text alerts, including Be On the Look Out (BOLO), AMBER Alert, All Points Bulletin (APB), and Weather Alert.

Text messages can also be used to discreetly advise personnel of sensitive situations, providing incident information in a form that can be quickly referenced. These one-way outbound messages are transmitted simultaneously to the entire talkgroup, rather than being sent individually to each radio user over the data channel.

**ALL RADIOS IN A TALKGROUP  
RECEIVE TEXT MESSAGES  
SIMULTANEOUSLY**

This feature helps dispatchers to coordinate field personnel with uniform text messages and alerts. AMS Talkgroup Text Messaging supports text messages from the following sources:



- MCC 7500 and MCC 7100 console positions.
- Advanced Messaging Solution (AMS) through Smart Client, PremierOne CAD, and Mobile Clients.
- Third-party CAD systems.

## 2.12 LOCATION SERVICES

Location Capabilities pinpoints the geographic location of user radios, enabling dispatch operators to deploy nearby personnel for quick response and to swiftly aid first responders who are in need of assistance.

The Location on Push-to-Talk (PTT) feature enables ASTRO 25 trunked radio systems to continuously track the location of individual radio users while they are involved in voice calls. With each transmission, the APX radio with Location on PTT will send its Global Positioning System (GPS) location to the dispatch mapping application. ASTRO 25 Location on PTT provides timely, accurate location information when needed most—during emergencies and critical incidents that require intense voice collaboration.

The figure below demonstrates how a portable radio sends its location via PTT to a dispatch operator.

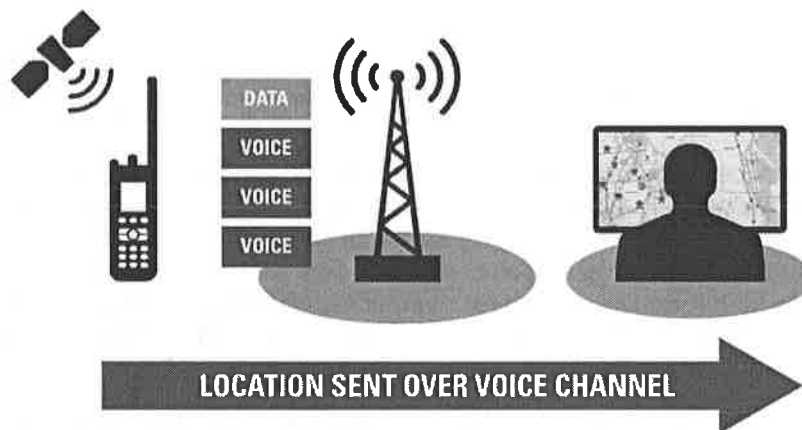


Figure 2-7: Location on PTT Over Voice Channels

The Enhanced Geo Select feature enables an APX radio to immediately take action when crossing a defined geographical boundary, or “geofence”, allowing for quicker incident response times with automatic incident alerts and auto talkgroup channel selections.

Radios no longer need to send their information to the mapping application and wait for the mapping application to send geofence commands back to the radio, radios respond virtually immediately to new geofence and radio action information.

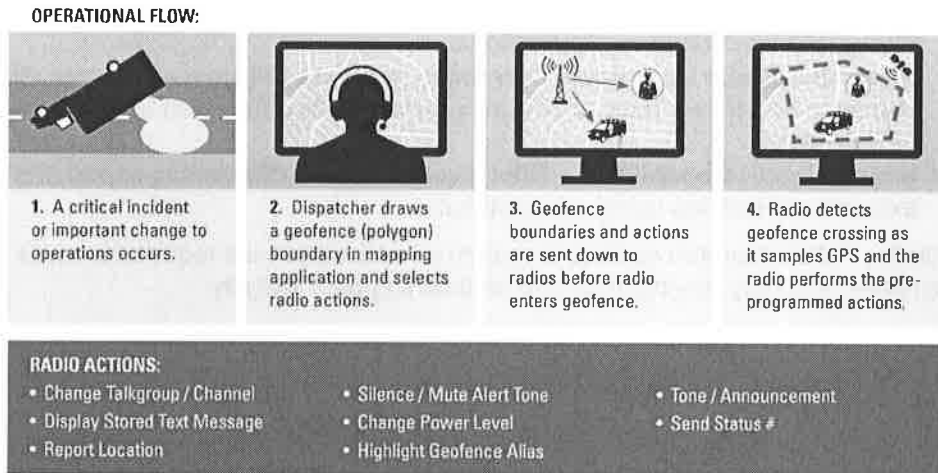


Figure 2-8: Enhanced Geo Select Operational Flow

## 2.13 SYSTEM CONFIGURATION MANAGEMENT

The ASTRO 25 system will provide the Port's system administrators with a centralized approach to configuring the proposed system.

With the Unified Network Configurator (UNC), the Port's system administrators will be able to configure networks and devices in the ASTRO 25 system through easy editing screens and configuration "wizards." Role-based radio user setup, auto discovery of devices/configurations, and minimized data entry reduces configuration errors and initial configuration time. Personnel can quickly access historical configuration and forensic information, and quickly roll back to previous configuration versions, if necessary.

The UNC can direct comparison between the current system configuration with any planned changes, simultaneously displaying the configurations and enabling the scheduling of any changes for distribution during off hours, minimizing the impact of system changes on communications. The UNC is highly secure, supporting SSH and SNMP passwords and providing an automated mechanism to seamlessly roll passwords and passphrases.

The Provisioning Manager (PM) enables the Port's system administrators to provision the infrastructure and devices in the ASTRO 25 radio system through a GUI. The PM offers a well-rounded set of features:

- **Streamlined Web-Based Graphic User Interface** – Requires fewer keystrokes to manage critical information. Provides a central point for the configuration of operational parameters for mobile and portable radios, dispatch operator positions, and system administrators.
- **Batch Creation of Radios and Talkgroups** – Minimizes data entry and reuses configuration information through "Multi-Instance Creation."
- **Enhanced Agency Partitioning** – Allows system administrators to define data partitions of system management resources among various agencies and radio users.
- **Provisioning Manager Audit** – enables stricter enforcement of system policies and provides an efficient way of troubleshooting configuration issues. Allows the system administrators to navigate between an audit record and the corresponding configuration record.
- **External Provisioning Manager Interface** – Provides an interface that partners with an identified third-party vendor (Genesis, MCM, Premier One, NGI) to provide an integrated

solution for critical customer applications on the system, such as, Asset Management, Billing, and Fleet Mapping applications.

- **Radio and Radio User fields Combined into One Window** – Provides efficient management of user radio provisioning by eliminating the need to enter device information multiple times.
- **Import/Export Capabilities** – Offer a convenient mechanism to export and import data from external applications using .csv protocol.

With the PM's integrated database, system administrators are required to enter data only once, improving accuracy, saving time, and maintaining data integrity.

## 2.14 SYSTEM PERFORMANCE MANAGEMENT

The ASTRO 25 performance suite will enable the Port's system administrators to monitor, manage, and report on system performance in near real-time, as well as proactively plan for expansion. The performance suite comprises both Motorola Solutions and third-party management applications that are certified, integrated, and supported by Motorola Solutions. Together, these applications provide a complete picture of how the system is operating.

GenWatch3<sup>®</sup> enables the Port's system administrators to view and monitor live traffic, report on system activity, and manage system resources down to the user-radio level. It provides at-a-glance views of network performance from every angle—system, site, channel, slot, agency, talkgroup, and user radio. GenWatch3 monitors networks from a centralized location and sends alerts during critical system events. Key Performance Indicators display real-time activity on calls, busies, connections, and peak usage.

ZoneWatch is a performance management tool that has customizable displays and grids to monitor real-time communications activity. The information displayed will help the Port's system administrators become proactive in resource planning decisions, such as when additional channels are needed. ZoneWatch also receives fault information related to repeater sites, console sites, and the zone controller from the Unified Event Manager (UEM).

Affiliation Display provides a dynamic view of the affiliated sites for all operating radios, allowing the Port's system administrators to monitor how radio users travel between different sites and communicate with assigned talkgroup members and those outside of their talkgroup. Affiliation Display traces the state/location of each user radio on the system and can also identify each user radio's location and affiliation information by site, console site, radio, channel, and talkgroup.

The Radio Control Manager (RCM) allows the Port's dispatch operators to monitor and manage radio events, issue and monitor commands, and make informational queries of the system database. The RCM allows dispatch operators to perform the following tasks:

- Send commands to radios over the air and monitor their status.
- Check the status of a radio.
- Monitor events sent from radio users in near real time as the information becomes available in the system.

InfoVista will provide the Port with interfaces to obtain data from multiple network devices that support Simple Network Management Protocol (SNMP), including the master site gateways, Ethernet LAN switches, and Cooperative Wide Area Network Routing (CWR). This data includes CPU utilization, memory utilization, buffer utilization, port characteristics, and traffic analysis. In particular, InfoVista performs the following tasks:

- Collects Management Information Base (MIB) data at specified time intervals.
- Reports and graphs MIB data for single or multiple devices, spanning daily, weekly, monthly, and yearly time periods.
- Uses pre-configured report templates to provide customized reports for network transport devices.

InfoVista sends warnings and major traps to the Unified Event Manager (UEM) for the key statistics that it collects. The traps sent to UEM are generated from the daily reports for the individual devices. All key statistics have two thresholds:

- Threshold warning (Tw) – If the statistic exceeds this value, a warning trap is sent.
- Threshold major (Tm) – If the statistic exceeds this value, a major trap is sent.

These warning messages can be acted on immediately or collected into InfoVista performance management reports that can be used to troubleshoot network performance and plan for increases in capacity.

The Software License Manager will provide the Port with a central interface for network management licenses, reducing the time, effort, and complexity of software and license management. The Software License Manager enables the management of system capacity, system features, application user sessions, and trial licenses. A consolidated view of software licenses in the system allows system administrators to view current licenses, determine whether licenses are underutilized, and purchase new features and capabilities.

Flexible Air Traffic Information Access (ATIA) allows an external computer to record and archive air traffic information for all the call processing activities and other site events in the system. ATIA messages include the date, time, and description of the event that occurred, such as a user radio registration, call request, or site handover. This information provides system administrators with details of what is happening on the system. ATIA stream data can be integrated with third-party applications to produce detailed reports custom-built to the Port's specific requirements.

Historical Reports will provide the Port with statistical data that is gathered at specific, predefined time intervals. System administrators can use these reports to monitor and analyze information about sites, channels, talkgroups, and radio users. This data is displayed using predefined report templates and parameters. Historical reports allow system administrators to do long-term analysis of traffic data.

**Radio Control Manager (RCM) Reports** will allow the Port to create, view, print, schedule, and export standard reports from actual RCM server database information. These reports use a common format so the data can be displayed and manipulated through standard spreadsheet applications. RCM Reports enable system administrators to display and analyze data showing RCM activity on the system.

Dynamic Reports monitor and report usage trends to improve radio and talkgroup system management. System administrators will be able to closely examine what happens during a shift or set period of time, for example, checking the busy count to see if calls are being missed. Through the analysis of data delivered by Dynamic Reports, the Port can develop plans for system expansion and design upgrades to improve communications.



## 2.15 SYSTEM FAULT MANAGEMENT

System performance depends on the proper functioning of the system's software and components. The proposed system includes the following features to facilitate the detection, isolation, and resolution of events that are reported by system components.

The Unified Event Manager (UEM) provides critical fault management, including processing and presentation of events that are sent by managed devices. Historical and real-time traffic screens will give the Port's system administrators access to radio events, radio status, and any device alarms.

The UEM supports the following main functions:

- **Device discovery** – The UEM is optimized to quickly discover the managed devices in the system.
- **Fault management** – Fault management in the UEM includes processing and presentation of events sent by a managed device.
- **Supervision** – The UEM periodically checks its ability to communicate with the devices it manages.
- **Synchronization** – The UEM performs synchronization automatically, by validating the health of a device with the information stored in the fault management database.

The UEM will provide secure communications with the Port's managed devices. If a loss of communication with a managed device occurs, that failure will be reported to the UEM, which will alert administrators according to the severity of the event. The UEM's alarm view dynamically updates based on the condition of the reported device (that is, the alarm will be cleared from the alarm view when a device sends a clear event to the UEM).

The UEM is the system's main fault manager, aggregating all system health information and managing the status of non-Motorola Solutions equipment through SDM3000 Remote Terminal Units (RTUs). Devices from other manufacturers managed by the UEM include power and security equipment, microwave radios, and environmental alarms for doors, and control tower lights.

UEM Enhanced Navigation enables advanced navigation and data visualization capabilities in the UEM client. The user can navigate through zone and system health information using a drill-down navigation concept, traversing through additional views and visualizing data related to infrastructure health. The enhance navigation enables the following features:

- System Map.
- Site View.
- Network Element View.
- Visualization of RTU Digital Input/Digital Output/Analog Input information.
- Advanced drill-down navigation.

The UEM Microwave View enables an advanced map view of microwave radio infrastructure, enabling system administrators to view the status of all microwave radios in a system on a single map screen. The microwave radios are represented as symbols on a static or geographical map, including the capability to mark the link relation between specific microwave radios.

The UEM Simple Network Management Protocol (SNMP) Element Management Toolkit enables third-party vendors to define SNMP messages between their devices and the UEM, allowing system administrators to monitor faults on critical third-party devices directly from the UEM.

UEM Email Alarm Notifications will allow the Port's system administrators to configure e-mail notifications for events and alarms in the Unified Event Manager (UEM) application. Alarm notifications can also be forwarded to a mobile device such as a cell phone or personal digital assistant (PDA).

North Bound Interface (NBI) describes an interface offered by many Network Management System (NMS) products, such as Unified Event Manager (UEM), which allows for NMS features, functions, and data to be accessible for Operations Support System (OSS) and Manager of Managers (MoM). NBI uses SNMPv3 and the User-Based Security Model (USM) to provide secure communication between the UEM and NMS. NBI offers the following services:

- **NBI Event Forwarding** – The events reported on the UEM are sent to registered NMS products using SNMPv3 traps.
- **NBI Notification Persistence** – The UEM stores the last 300 forwarded events to enable the NMS to quickly retrieve any events it may have missed.
- **NBI Event Synchronization** – The UEM provides the means for the NMS to query and obtain a set of events from the UEM datastore. This feature is typically used to obtain events missed due to lost traps or when connectivity between the UEM and NMS is lost temporarily.
- **Getting QuickSync events** – The UEM provides the means for the NMS to query and obtain a set of events from the UEM datastore. This feature is typically used when the missed trap is within the most recent 300 traps captured in the NMS.
- **NBI Alarm Synchronization** – The UEM provides the means for the NMS to query and obtain a set of alarms from the UEM datastore. This feature is typically used to re-synchronize fault information on the NMS after an extended outage.

## 2.16 SYSTEM ALERTING CAPABILITIES

Certain circumstances require the immediate alerting of personnel. Whether a specific individual or an entire group of radio users needs to be notified, the proposed system will provide the Port with the capabilities needed to alert dispatch operators and radio users of important information and critical situations.

The Call Alert feature uses the control channel to enable a dispatch operator or radio user to page another dispatch position or individual radio without affecting voice channel capacity. Call Alert sounds a tone on the receiving radio and returns an acknowledgement to the initiating radio. If the receiving radio is in a voice call, the alert tone sounds in the background, so the voice message continues to be clearly heard.

The Emergency Alarm and Emergency Call features provide the alerting capabilities needed for critical situations. With Emergency Alarm and Emergency Call, a radio user can quickly inform the dispatch operator of a life-threatening situation. The simple press of the radio's emergency alarm button sends an audible and visible alarm and the user radio's ID to the dispatch operator and, potentially, other talkgroup members.

**ALERT DISPATCH OF AN EMERGENCY WITH THE PUSH OF A BUTTON**

The dispatch console receives immediate notification, even when the system is busy, and an available channel is assigned immediately to the emergency call. If the system is busy, the Port's dispatch operators will be able to choose between two alternatives for handling emergency traffic:

- **Top of the Queue** – The emergency caller is put at the top of the busy queue. As soon as the first radio user on any channel de-keys, the emergency caller is assigned that channel. This approach prevents contention for the channel.
- **Ruthless Preemption** – The zone controller re-assigns the channel with the lowest priority call to the emergency caller—a feature unique to Motorola Solutions trunking systems.



With Site Selectable Alerts, the proposed ASTRO 25 radio system will allow the Port to customize preconfigured alert tones and voice messages to all APX user radios at selected RF sites. The alert sounds in the background of an active call and on idle radios. User radios display a short message. Up to 15 alerts can be configured in advance, and then selected by user radio to be broadcast once or repeated at a specified cadence. Preconfigured notifications are ideal for alerting team members to take appropriate actions, such as “vacate the area”, “move to Stage 3”, or “return to the command post”.

## 2.17 SYSTEM BACKHAUL EFFICIENCY

The efficiency, reliability, and capacity of the ASTRO 25 radio system backhaul are crucial to overall network performance. The proposed solution for the Port includes MPLS Routers to efficiently manage and segregate IP traffic between destinations.

## 2.18 SYSTEM COMPONENTS

An ASTRO 25 radio system is comprised of a master site and one or more radio frequency sites. This section provides descriptions of the components at each location.

### 2.18.1 Master Site Core Components

The equipment at an ASTRO 25 master site provides an adaptable and affordable platform for mission critical wireless communications in a scalable and virtualized configuration. The master site equipment comprises the system’s core components, including a common server architecture (running the applications that provide command and control for the system) and LAN switches (routing information to and from the master site to the radio frequency sites that provide system coverage).

#### 2.18.1.1 Common Server Architecture

A master site’s Common Server Architecture (CSA) deploys server applications with the Linux/Windows operating systems on a HP DL380 Virtual Management Server (VMS) host. The VMS hosts the following server applications through VMware in a Virtual Machine (VM) environment:

- **Air Traffic Router (ATR)** – Captures data exhibited by Affiliation Display, Dynamic Reports, Historical Reports, Radio Control Manager (RCM) Reports, and for systems with the Inter-RF System Gateway (ISGW) employing the ISSI 8000/CSSI 8000 feature. The ATR also captures foreign talkgroup and foreign Subscriber Unit Identifier information for ZoneWatch to display.
- **Backup and Recovery (BAR) Server** – Backs up and restores critical data.
- **Core Security Management Server (CSMS)** – Provides antivirus service and multi-factor authentication.
- **User Configuration Server (UCS)** – Stores information about user radios, talkgroups, critical sites, and security information.
- **Zone Database Server (ZDS)** – Exports infrastructure and subscriber information it receives from the User Configuration Server (UCS) to consoles and site gateways (conventional channel interface).
- **Zone Statistics Server (ZSS)** – Provides database storage of statistics and back-end processes required for zone-level functions.

- **Zone Controller (ZC)** – Provides centralized control for call processing and mobility management functions.
- **License Manager** – Stores and manages software licenses.
- **Unified Event Manager (UEM)** – Provides fault management.
- **Unified Network Configurator (UNC)** – Provides controlled and validated configuration management of system devices.
- **Authentication Center (AuC) Server** – Provides key management function in the system and stores authentication keys.
- **Firewall Management Server (FMS)** – Enables ongoing monitoring, management, and resolution of events and alarms generated by the firewalls.
- **Centralized Event Logging Server (Syslog) Server** – Captures Operating System (OS) events generated by most devices in the Radio Network.
- **Unified Network Configurator (UNC) Device Server (UNCDS)** – Enables the UNC to manage up to 15,000 devices.
- **System Statistics Server (SSS)** – Stores and provides statistical data for the system.
- **vCenter Appliance** – Manages all fault tolerant Packet Data Gateways (PDGs) and ATRs.
- **Network Management (NM) Client** – Provides a virtual workstation for system administrators and technicians to use for various system-related tasks.
- **Dynamic Transcoders** – Allows talkgroup calls and radio-to-radio (private) calls to communicate between TDMA channels and FDMA channels at different sites.
- **Intersystem Gateway (ISGW)** – Supports an ISSI interface and a CSSI interface for interconnectivity with P25 compatible systems and consoles.
- **IP Packet Capture (IPCAP)** – Captures transactions between network elements and collects performance data for Virtual Management Servers (VMSs).

### 2.18.1.2 Firewall

A firewall provides network boundary enforcement and attack detection features. The firewall restricts traffic to known sources, destinations, and protocols, based on the hosts and services that are specified in the firewall configuration. All undefined traffic is discarded.

### 2.18.1.3 LAN Switches

The master site includes one or more LAN switches. The LAN switches aggregate all the Ethernet interfaces for all servers, clients, and routers at the core.

The proposed system for the Port will include redundant LAN switches for added system resilience.

## 2.18.2 Radio Frequency Site Component Descriptions

An ASTRO 25 Radio Frequency (RF) site supports a wide variety of configurations to meet critical communications requirements for present and future communication needs. Depending on the RF site configuration, each RF site has several different components. The following components are included in the RF sites provided as part of our solution for the Port.

### 2.18.2.1 GTR 8000 Expandable Site Subsystem

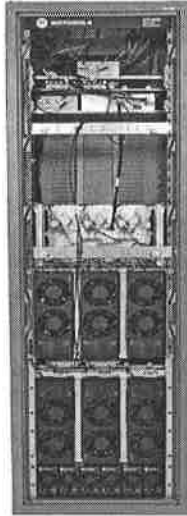
The GTR 8000 Expandable Site Subsystem (ESS) (see the figure titled "GTR 8000 Expandable Site Subsystem") enclosure integrates reconfigured GTR 8000 base stations, site LAN switches,



and GCP 8000 controllers, along with an optional Radio Frequency Distribution System (RFDS), depending on the needs of the proposed configuration, into a single cabinet.

The ESS provides the following important benefits:

- Integrated design provides a smaller footprint at the site.
- Front/top access design and minimized cabling reduces install and service labor.
- Increased power supply redundancy through common power bus.



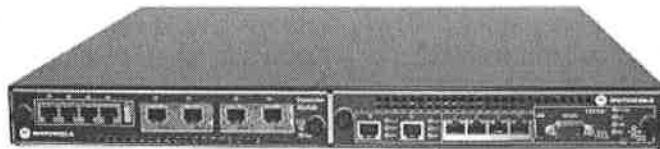
**Figure 2-9:** GTR 8000 Expandable Site Subsystem – Integrates base radios, site controllers, reference distribution modules, and Ethernet LAN switches in a single cabinet.

Voice traffic is routed from each of the site base stations to the system for distribution to all sites associated with the call.

### 2.18.2.2 Enhanced GGM 8000 Conventional Channel Gateway

Enhanced Conventional Channel Gateways (ECCGWs) connect dispatch operators to analog or digital conventional channels in the system. Up to 16 conventional channels can be connected to the eight analog and eight V.24 ports on a GGM 8000-based ECCGW in any mixture of analog, MDC 1200 digital or mixed mode.

In addition to the 16 channels supported on the analog and V.24 ports, the ECCGW can support up to 16 digital conventional channels through its IP port. Mixed mode channels must use a V.24 port for the digital portion.



**Figure 2-10:** Enhanced GGM 8000 Conventional Channel Gateway - Connects dispatch operators to analog or digital conventional channels in the system.

### 2.18.2.3 G-Series Site Components

G-series site equipment uses a standard chassis (see the figure titled "G-Series Chassis") for individual site components. Six basic modules create the entire G-series platform, resulting in reduced spare parts inventory. Modules have front access to improve serviceability with hot-swap support to ensure channels are back on the air in minimum possible time. Standard battery revert and charging capability is built into every G-series power supply. Integrating these capabilities eliminates the need for a large uninterrupted power supply and saves valuable site space.

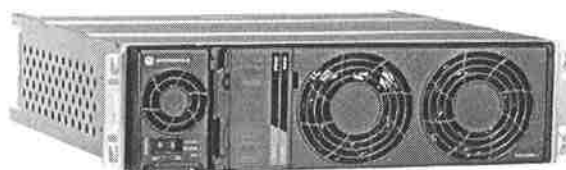


Figure 2-11: G-Series Chassis – A single chassis and six basic modules create the entire G-series platform, resulting in reduced spare parts inventory.

- **GTR 8000 Site Repeater/Base Radio** – The GTR 8000 base radio consists of a transceiver module, power amplifier module, fan module, and power supply. The transceiver module includes the functionality for the exciter, receiver, and station control. The base radio software, configuration, and network management, as well as inbound/outbound traffic handling, are performed through this transceiver module. On-board serial and Ethernet ports are located on this module for local servicing through Configuration/Service Software (CSS). The power amplifier module amplifies the low-level modulated RF signal from the transceiver module and delivers the amplified signal on the path to the transmit antenna. The power supply module supports the transceiver and power amplifier modules, and can also provide auxiliary power to a connected site controller or receive multicoupler/low noise amplifier.
- **GCP 8000 Site Controller** – The GCP 8000 Site Controller is used at an ASTRO 25 trunking site to assign voice and data channels, manage and report alarms on site resources, provide Ethernet switching capability, and provide a frequency reference to GTR 8000 Base Radios. The frequency reference is provided either via a GPS receiver or an ultra high stability oscillator. The nature of these frequency references eliminates or minimizes site visits for frequency tuning servicing.
- **GCP 8000 Conventional Site Controller** – The GCP 8000 Conventional Site Controller provides mission critical call processing and mobility management throughout the ASTRO 25 conventional system. The GCP 8000 interfaces through the Ethernet LAN switch, providing access to the packet switched network through the core gateway. Equipped with a single controller module, the GCP 8000 can support the full set of dispatch consoles, archiving interface servers, and conventional gateways.
- **GCM 8000 Comparator** – The GCM 8000 Comparator supports up to 32 trunking remote sites and up to 64 conventional sites for simulcast or receiver voting. It performs frame-by-frame voting on multiple received signals and recombines the frames to produce a signal with the best possible audio quality. GPS launch-delay timing ensures seamless broadcast of the voted frames from multiple voice signals into one high-quality transmit signal.
- **GPW 8000 Receiver** – In conventional and trunking voting or simulcast voting applications, the GPW 8000 Receiver increases in-bound signal coverage for subscribers. Physical space is optimized at receive-only sites with the GPW 8000 space efficient dual receive module design. The GPW 8000 receiver will allow the Port to reuse legacy receive-only stations.

Trunking GPW 8000 Receivers also support TDMA. A GPW 8000 unit with two TDMA-enabled receive modules supports four simultaneous voice or data streams.

#### 2.18.2.4 Simulcast High Availability (HA)

The Simulcast Prime Site High Availability feature replaces the standard two LAN switch configuration (three switches for more than 15 remote sites) at the simulcast prime site with four LAN switches setup in a mesh configuration. When the same site resources are spread across four LAN switches, the failure of a single switch will remove fewer resources, improving the general availability of resources and preserving redundancy.

#### 2.18.2.5 Prime Site Ethernet Switches

Two paired Ethernet switches form the prime site LAN in a system with IP simulcast sites. They are paired for redundancy so if one of them fails, half of the hosts (site controllers, comparators) on the LAN are still connected to a working Ethernet switch. In addition to these switches, a third Ethernet switch is required for IP simulcast prime sites equipped with more than 15 remote sites.

#### 2.18.2.6 Dual Prime Site Link

In a dual prime site link configuration, there are two prime site routers, each of which is attached to a different prime site LAN switch. This ensures that if either switch fails, there is still a path to a prime site router for connectivity to the master site.

#### 2.18.2.7 Dual Remote Site Link Switches

In a dual remote site link configuration, two switches are used so that there is no single point of failure for the remote site's entire IP network.

#### 2.18.2.8 Dual Remote Site Link Routers

The remote site access routers, located at the prime site, provide the IP network routing interfaces between the prime site and all of the remote sites. In the dual remote site link configuration, two remote site access routers each serve as the endpoint for one of the remote site's Wide Area Network (WAN) links. The remote site access routers support T1, FT1, E1, FE1 and Ethernet links.

#### 2.18.2.9 GGSN Router

Motorola Solutions' General Packet Radio Service (GPRS) Gateway Service Node (GGSN) router provides for the internetworking between the ASTRO 25 data system and the Customer Enterprise Network (CEN), allowing for independent management of IP addresses across networks.

The GGSN router handles the IP routing services in support of end-to-end IP data messaging. These services include Static and Dynamic IP addressing, IP fragmentation, and ICMP error reporting messaging for diagnostics and troubleshooting.

#### 2.18.2.10 SDM3000 Remote Terminal Units (RTUs)

The SDM3000 Remote Terminal Units (RTUs) (see the figure titled "SDM3000 Remote Terminal Unit") enables the Unified Event Manager (UEM) to acquire information regarding the

fault and configuration of elements/devices in sites. Each SDM3000 RTU has a web server that provides service access through a standard web browser. An RTU can retrieve the topology map of the site and alarms stored in the events buffer.



Figure 2-12: SDM3000 Remote Terminal Unit – Enables the UEM to acquire information regarding the fault and configuration of elements/devices in sites.

### 2.18.2.11 GGM 8000 Gateway

The GGM 8000 core gateways provide routing control of audio, data, and network management traffic for devices that forward packets beyond their local LAN. The gateways replicate packets while achieving the fast access levels required by real-time voice systems.



Figure 2-13: GGM 8000 Gateway – Provides routing control of audio, data, and network management traffic for devices that forward packets beyond their local LAN.

**Note:** Redundant gateways have been provided in the proposed system design.

### 2.18.2.12 TRAK 9100 Simulcast Site Reference

The TRAK 9100 Simulcast Site Reference (see the figure titled “TRAK 9100 Simulcast Site Reference”) is a GPS-based frequency and time reference. The TRAK frequency reference provides the simulcast system 1 Pulse per Second (PPS), 5 Millions of Pulses per Second (MPPS), and 1 PPS + 5 MPPS composite signals. These signals are used to synchronize the simulcast transmissions, improving overall performance and coverage. The TRAK 9100 provides a high-level of redundancy, including redundant GPS receivers, a backup rubidium standard, and redundant power supplies.

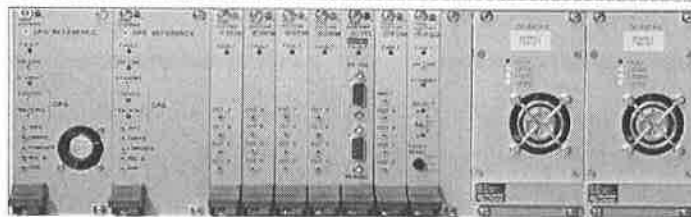


Figure 2-14: TRAK 9100 Simulcast Site Reference – Provides the simulcast system 1 PPS, 5 MPPS, and 1 PPS + 5 MPPS composite signals to synchronize the simulcast transmissions.

### 2.18.2.13 Radio Frequency Distribution System

The Radio Frequency Distribution System (RFDS) connects base radios and antennas, allowing for a completely contained and more compact installation footprint. For the transmitters, this can include isolators, combiners, TX filters, diplexers, and power monitors. For the receivers, this can include duplexers, site preselectors, and multicouplers.

### 2.18.2.14 Network Time Protocol Server

The Network Time Protocol (NTP) Server performs time-synchronization of devices on a network. Time synchronization is critical because activities to manage, secure, and troubleshoot network devices often involve determining the timing of the alarms, events, and other information captured by the event logs and software applications that manage and support the system. The NTP can provide synchronization within several milliseconds of Coordinated Universal Time (UTC), and NTP servers often employ Global Positioning System (GPS) receivers to provide time synchronization.

### 2.18.2.15 Site LAN Switch

The site LAN switch provides a LAN interface for site equipment and a LAN port for the site gateway. Through the switch, the service technicians gain access to service the site, and also access to the system's Graphical User Interface (GUI).

### 2.18.2.16 Terminal Server

The Terminal Server provides serial access to Network Management (NM) servers and network transport equipment in the Radio Network Infrastructure (RNI). The terminal server has a separate direct RS-232 connection to each of its supported devices. In the event of a major failure, the Terminal Server provides dial-up access for troubleshooting. This interface is intended exclusively for Motorola Solutions Service personnel.

### 2.18.2.17 KMF Web-Based Thin Client

The Key Management Facility (KMF) is a robust encryption key management solution that supports Motorola Solutions-specific and P25 features, including Over-the-Air-Rekeying (OTAR). Using the KMF Web-Based Thin Client, users can generate detailed reports, receive status updates, and monitor system data visualizations. This information can be created, inventoried, and distributed to encrypted endpoints, including consoles and radios.



Figure 2-15: KMF Web Based Thin Client Sample Screens

## 2.18.2.18 KVL 4000 Key Variable Loader

The KVL 4000 (see the figure titled “KVL 4000 Key Variable Loader”) is Motorola Solutions’ encryption Key Variable Loader for secure-enabled Motorola Solutions products. Equipped with the Motorola Solutions MC55 handheld, the key loader is outfitted with state-of-the-art features and a user interface for increased efficiency and programming flexibility. A large LCD color display, paired with an easy-to-use alphanumeric keypad, enables simple viewing and data entry. Built with legendary Motorola Solutions quality and security, the KVL 4000 withstands everyday use in federal and public safety environments.



**Figure 2-16: KVL 4000 Key Variable Loader** – Features a large LCD color display and a user interface for increased efficiency and programming flexibility.

## 2.19 MCC7500 DISPATCH CONSOLES

Motorola Solutions proposes our MCC 7500E dispatch console to provide the Port of LA with the confidence of state-of-the-art secure communications, seamless IP-based connectivity, flexible system architecture with scalable components, and centralized console management.

Motorola Solutions designs its console to help reduce the total cost of owning an IP-based, feature-rich dispatch system without compromising quality and reliability. The console provides the Port of LA with sophisticated network management and easy migration to future capabilities.

### 2.19.1 Dispatch Console Configuration for the Port of LA

The proposed console will interface seamlessly with the Port's ASTRO® 25 system.

The proposed solution offers the Port 9 dispatch positions. The figure titled "MCC 7500E Dispatch Position" shows an MCC 7500E operator position.



Figure 2-17: MCC 7500E Dispatch Position provides a small form factor, familiar GUI, and advanced features.

The table titled "Dispatch Locations" outlines the number of consoles and their location.

Table 1: Dispatch Locations

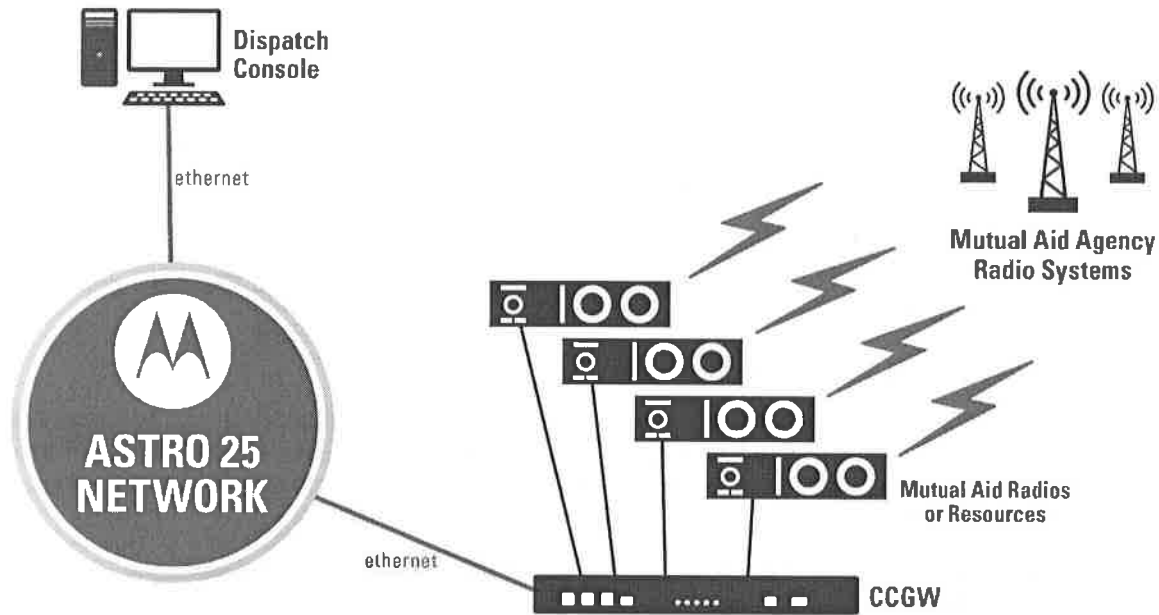
Number of Operator Positions	Location Name
7	Primary Dispatch Center
2	Remote Access Consoles

### 2.19.2 Embracing Interoperability and Integration

Motorola Solutions is an active participant in establishing P25 standards for interoperability. The proposed console is a key component for the interoperability of the ASTRO 25 system. When a situation requires coordination between multiple agencies, the proposed dispatcher can patch

together Mutual Aid radios and required subscribers on the ASTRO 25 system (see the figure titled "Mutual Aid Components").

Incident conversations are seamless from the moment of the patch initiation and can be recorded like any talkgroup conversation within the Land Mobile Radio (LMR) network. The dispatcher can also take part in and monitor conversations for the duration of the incident, as necessary.



**Figure 2-18: Mutual Aid Components** - Mutual Aid agency radio systems connect to the ASTRO 25 network through a CCGW.

### 2.19.2.1 Integration with the ASTRO 25 Network

The proposed dispatch console seamlessly integrates into the Port's ASTRO 25 system without interface boxes, digital voice gateways, or backroom electronics for an integrated, mission-critical network. This tight union between radio infrastructure and console equipment has several operational benefits to the Port of LA.

The physical space to accommodate the proposed console is comparable to that required for a personal computer. The console can access both trunked talkgroups and conventional radio channels over the same network. This architecture reduces overall transport costs and the need for duplicate fixed network equipment.

### 2.19.2.2 Connection to ASTRO 25 System

The flexibility of the ASTRO 25 system architecture allows the connection of the proposed console to be suited specifically to the Port's needs.

#### Dual Site Link

The proposed console site for the Port is remote from the core site and features redundant site links to provide path diversity. The console site has two logical connections to the core site with each connection using a different core router.

Each console site gateway provides an interface that handles the following IP traffic between the proposed console center and the Port's ASTRO 25 core site:

- Network management traffic.
- Call control and audio traffic for all the calls being handled by the dispatch positions.
- Aux I/O traffic for the Aux I/Os being handled by the dispatch positions.

The site gateways fragment large IP packets according to industry standards, prioritize packets, and convert Ethernet data to the desired transport medium.

### **LAN Switches**

The site LAN switches provide LAN interfaces for console site equipment and a LAN port for the link to the core site. Through the switch, service technicians can access the system's configuration manager and service the equipment.

### **Advanced Conventional**

This option provides the dispatcher with the ability to control ASTRO 25 conventional channels and/or MDC 1200 channels.

#### **Conventional Base Station Interfaces**

The proposed consoles access and control the Port's analog and digital conventional base stations through the use of Enhanced Conventional Channel Gateways (ECCGW). The console processes audio received from the station and controls various features on the stations, such as frequency selection, private line selection, and repeater on/off.

Additionally, the ECCGWs allow for recovery of MDC 1200 and digital signaling, such as unit ID and emergency alarm.

## **2.19.3 Making Consoles Easy to Operate**

Motorola Solutions designs its proposed console to provide mission-critical audio between the dispatcher and users in the field. It is optimized for real-time audio, prioritizing emergency calls over other traffic, and minimizing voice queuing. Using robust error mitigation to maintain call quality even when the system is heavily loaded, the proposed console reduces communication errors that may force dispatchers or radio users to repeat their transmissions.

### **2.19.3.1 Customizable Dispatch Interface**

The proposed console provides dispatchers with a graphical user interface (GUI) that can be customized by agency or by individual users to optimize user efficiency. Based on dispatcher preference, the proposed GUI can be customized to show details of trunked and conventional RF channels on a per-channel basis.

Busy dispatchers can respond to a missed call by simply clicking on an entry in the Activity Log. The number of calls and call information displayed in the Activity Log is customizable to suit the needs of the user. The status of Auxiliary I/Os can be easily interpreted from the GUI with the use of familiar graphical icons, such as a door shown open or closed.

#### **Inbound Event Display**

For those users who prefer a call-based GUI, the proposed console supports the Inbound Event Display (IED) GUI. The IED GUI displays incoming radio events in a queue format. The dispatcher can manage and respond to these events directly from the queue.

Filtering and sorting features are available to allow the information in the queue to be tailored to the needs of the dispatcher. The console can be configured to operate in “quiet mode” when using the IED GUI. This is well suited to customers who operate in a Request-To-Talk (RTT) environment.

### 2.19.3.2 Auxiliary Inputs/Outputs

The proposed console supports Global Auxiliary Inputs/Outputs (Aux I/Os) for remote status indications or remote control through dispatch positions. Global Aux I/Os are typically implemented by hardware that is independent of the dispatch positions in a system and may be accessible to multiple dispatch positions. Aux I/O Servers provide the Aux I/O feature for the consoles.

### 2.19.3.3 Standard Radio Transmission and Reception

A typical proposed dispatch position has a headset and two speakers. One speaker is for selected audio and the second speaker is for all remaining unselected audio. Additional speakers can be added to a console allowing dispatchers to configure a specific speaker for a set of designated audio sources. This simplifies multitasking between multiple audio sources and allows flexibility in the way the audio is presented to the dispatcher.

#### **Receiving Calls from the Field and Other Dispatchers**

The proposed console provides dispatchers with greater flexibility for how to hear calls from field radio users and other dispatchers. Each dispatcher can define his or her own audio reception profile by selecting a single audio source, whether conventional or talkgroup, to be heard on a selected speaker or headset (Single Select). The dispatcher can also define groups of radio resources that can all be heard on a selected speaker or headset (Multi- Select).

#### **Initiating Calls to the Field and Other Dispatchers**

The dispatcher has several different ways of initiating a call. In most circumstances, a General Transmit is appropriate. With the General Transmit, the dispatcher selects a resource on the console and activates the transmission through a footswitch, headset transmit button, or a microphone transmit button. If the dispatcher needs to quickly transmit on a resource that is not selected, the dispatcher uses the Instant Transmit function.

An Instant Transmit safety switch prevents accidental activation of functions that may cause negative consequences. The safety switch can be used with Aux I/Os and preprogrammed pages, as well as Instant Transmit switches.

#### **Audio Communication to the Field and Other Dispatchers**

The dispatcher can transmit audio in different ways. They can make calls to all users listening to a specific conventional radio resource or a specific trunking talkgroup. When multiple resources are required, the dispatcher can select additional talkgroups and/or conventional channels, as needed using the Multi-Select feature.

The proposed console also enables dispatchers to make private calls to individual field radio users or dispatchers. Once a private call is established, it can be patched in with another resource at the dispatcher's discretion.

#### **Controlling Console Audio**

The proposed console offers dispatchers several different ways of controlling or muting the audio on their consoles, such as the following:



- Audio volume can be changed for any specific resource.
- All non-selected resources on the console can be muted for 30 seconds (All Mute) or unmuted, if already muted.
- A dispatcher can transmit on a resource while receiving audio from the same resource or other resources.
- A dispatch position can be configured to automatically mute the other dispatch audio on a shared resource to prevent acoustic feedback when a co-located dispatch position transmits.
- RF Cross Mute automatically mutes the receive audio from a specified channel when the dispatcher transmits on another specified channel to prevent acoustic feedback.

### **Controlling Network Audio**

Dispatchers can control audio on the ASTRO 25 network. The dispatcher can enable or disable radio users to compartmentalize traffic, reduce interruptions, and maintain communications between dispatch and the field. When this function is enabled or disabled, all dispatch consoles with this resource assigned are updated with the current status of the feature. This feature can be controlled from any dispatch position.

## **2.19.3.4 Emergency Radio Transmission and Reception**

As part of a mission-critical communications network, the proposed dispatch console facilitates immediate prioritization and resolution of emergency communications between the Port's dispatch and first responders in the field. This enables dispatchers and first responders to focus on their mission and not their equipment, especially during critical situations.

### **Receiving an Emergency Call**

When a user in the field or another dispatcher initiates an emergency call, the console emits both visual and audible indications (Emergency Alarm). The audible indication alerts the dispatcher that an emergency is underway; the visual indication directs the dispatcher's attention to the specific resource making the emergency call. The dispatcher can immediately reserve a voice channel for the duration of the emergency.

### **Responding to an Emergency Call**

A dispatcher can bypass the standard console interface to auto-open a quick list, which contains specific controls for recognizing an emergency call, initiating an emergency call, and ending an emergency call (Auto-Open of Quick List). The dispatcher can then recognize the emergency call, which ends the audible emergency indication and notifies all dispatchers that the emergency is being addressed (Emergency Recognize).

The audible emergency indication may also be muted by a dispatcher without recognizing the emergency alarm (Mute Tones at a Single Op). This can be used in a situation where one agency is monitoring a channel that belongs to another agency. That channel can be configured to not generate audible and/or visual emergency indications.

### **Ending an Emergency Call**

When an emergency is over, the dispatcher can end the Emergency Alarm. The visual indication on the dispatch position GUI is removed, and the console informs the other dispatch positions that the emergency is over (Emergency End/ Knockdown). The emergency mode remains active on the initiating radio unit until it is ended (reset) by the radio user.

### 2.19.3.5 Radio Patch Control

The dispatcher can patch communication between trunked and/or conventional radios that are normally unable to communicate with each other due to different features, programming, or even different frequency bands. A patch group is a group of linked resources that can both receive messages from a console and transmit to all other members of the patch group.

#### **Setting up a Standard Patch**

Patches are supported between trunked resources and/or conventional resources. After the patch is created, the dispatch position transmits all audio on one resource to all other resources in the patch group. In a patch between trunked resources, patched radio users with displays see the ID or alias of the other patched radio(s), as opposed to that of the console. This minimizes confusion and the need for the dispatcher to intervene in the call. Patches are automatically reestablished, if interrupted, so the dispatcher can concentrate on continuing operations.

#### **Predefined Patches**

Patches can be predefined and automatically reinitiated each time a dispatch position computer is restarted (Patch Auto-Start).

### 2.19.3.6 Call Management and Control

The dispatcher can use the following functionality to manage and control audio for different types of calls between the dispatch position and radio users or other dispatchers.

#### **Automatic Prioritization of Calls**

Calls on the dispatch position are prioritized through a transmission hierarchy. Calls from primary supervisors take priority over those from secondary supervisors, which in turn take priority over non-supervisors. Instant Transmit or All-Points Bulletin (APB) transmissions, regardless of whether they are from a supervisor, take priority over general or patch transmissions.

Multiple dispatchers can be designated as primary supervisors on the same system, which is useful when multiple agencies share one system. With the Network Manager Client installed, supervisors can disable and enable dispatch console functionality as needed.

#### **Manual Prioritization of Calls**

System Access Priority Select allows a dispatcher to prioritize trunked resources on the system as either normal or tactical. A dispatcher can change the priority of a trunked resource to tactical to give the resource a better chance of gaining communication access on a busy system. Only emergency calls have a higher priority than tactical.

When the System Access Priority Select status of a resource is changed, it is updated at all dispatch consoles in the systems that are monitoring that trunked resource.

#### **Using the Multi-Select Feature**

The Multi-Select feature allows a dispatch position to define groups of selected radio resources. When a Multi-Select group is opened, all of the resources in the group are simultaneously selected. Resources can be added or removed from a Multi-Select group while the group is open. The dispatcher can transmit on several resources simultaneously or can listen to multiple resources simultaneously in their headset or select speakers.



## Standard Call Indications

The dispatch position indicates the availability of any given resource, regardless of whether the resource is involved in a transmission. An inbound call indication provides the dispatcher with a visual cue of audio activity on a radio resource and allows a dispatcher to see at a glance what the status of a resource is at any moment.

## Call Alerting

A dispatcher can use Call Alert to page an unattended radio or dispatch position through a series of beeps and an indication of the sender's ID. When available, the radio user or dispatcher sees the unit ID of the calling dispatch console or radio ID and is able to return the call.

Additionally, a Call Alert can trigger an activity. For instance, a Call Alert may cause a vehicle's horn to sound and its lights to flash. The dispatcher can even send a Call Alert to a user who is involved in voice and data communications over the network.

## 2.19.4 Capturing and Logging Audio

The proposed console system includes a logging recorder subsystem that enables the recording and replay of audio and other information associated with real-time conversations over the network. These capabilities provide the Port's personnel with clear audio and enough information to easily understand the context and content of any recorded transmission.

This proposal includes logging recorders that record up to sixty (60) simultaneous conversations coming through the Archiving Interface Server (AIS).

In addition to recording audio, the logging recorder has the ability to capture the following information, if supported:

- Talkgroup and channel information
- User identification, such as unit ID and alias
- Call type, such as Talkgroup Call, Telephone Patch Call, and Emergency Call
- Non-voice events, such as Call Alerts, Radio Status Check, and Radio Message

Upon playback, this information can be displayed and searched to retrieve a desired call. The logging recorder's capacity is based on the number of radio transmissions it needs to record simultaneously, not on the number of channels that it can record.

A call can be saved either as a complete call (audio and any information associated with the call) or as a simple .wav file. Files saved as complete calls must be played using the application included with the logging recorder. Files saved as .wav files can be played on any application that supports them.

### 2.19.4.1 Record and Replay of Archived Calls

The logging recorder for the the Port of LA is an IP-based recorder that can record all IP traffic sent to it. It provides the Port with the capability to record audio at the same level of quality as that heard at the dispatch position. In addition, it can record information associated with the call beyond just the audio.

A replay station can access recordings on multiple recorders, even ones that are not being used with AISs. This provides the user with a complete view of everything being recorded from a single point.

## 2.19.4.2 Management of Logging Recorder Subsystem

Security and fault management for the logging recorder subsystem are configured and managed by a common administration application, residing on either a playback station or a dedicated PC. Administrative personnel can use the management controls of the logging recorder subsystem to configure how calls are recorded.

On a global level, administrators can define which calls are recorded by which agency or department. On a more granular level, administrators can define the following recording behavior:

- Which talkgroups and conventional resources to record and which resources are critical.
- Whether secure calls are recorded.
- What access rights are assigned to replay station user accounts.
- What operational characteristics are assigned to the recorders (for example watermark limits for the recording media, or what to do when the recording media fills up).

## 2.19.5 Protecting Consoles and Communications

The console enables end-to-end encryption from the dispatcher to the ASTRO 25 network, so that the Port's communications will not be undermined by unencrypted transmissions. Each dispatcher is able to fully participate in secure communications while being confident that sensitive, vital information is not heard by unauthorized individuals.

### 2.19.5.1 Secure Access to the Console

To use the dispatch position, a dispatcher must enter a valid radio system user account name and password. The dispatch position validates that information with the radio system's network manager and allows the dispatcher to access only the resources for which the user has access rights. This also applies to third-party applications that use the dispatch console's API.

### 2.19.5.2 Secure Communications at the Console

The console encrypts and decrypts radio voice messages. Thus, radio voice messages are encrypted from end-to-end between the radio user to the dispatch position. The dispatcher can choose whether to encrypt their transmissions on a particular trunked resource. Dispatchers can interface with agencies that have different encryption configurations without any manual intervention or delay.

## 2.19.6 Incorporating Console Configuration and Management

The proposed console system is configured and managed by the same configuration manager, fault manager, and performance reporting applications as the radio system. The user can define exactly which resources are available and how they are presented to the dispatcher. This provides the Port with a single point for configuring and managing the entire ASTRO 25 system. Changes are automatically distributed throughout the system.

This centralized approach saves valuable time and effort for system administrators and technicians and reduces the errors that can occur when radio IDs and other data are entered at multiple locations. In addition, call traffic and performance reports for each dispatch position can be generated from the system's network manager, enabling administrators to quickly and easily ensure optimal effectiveness and efficiency.



## 2.19.7 Dispatch Console Solution Components

The proposed components are connected together and to the rest of the ASTRO 25 system on an IP network through console site routers and switches. The console functions as an integrated component of the total radio system and fully participates in system-level features, such as end-to-end encryption and Agency Partitioning.

The console connects directly to the radio system's IP transport network without gateways or interface boxes. Audio processing, encryption, and switching intelligence for dispatch are performed within each software-based dispatch position without additional centralized electronics.

Since the network is IP-based, the system interfaces and components can be distributed physically throughout the network. Some of the available console components are identified below.

### 2.19.7.1 MCC 7500E Console Operator Position

The dispatch position supports commercially available accessories, including a USB microphone, USB headset, and USB footswitch, as shown in the figure titled "MCC 7500E Dispatch Position." The following list describes the components included in the proposed configuration.

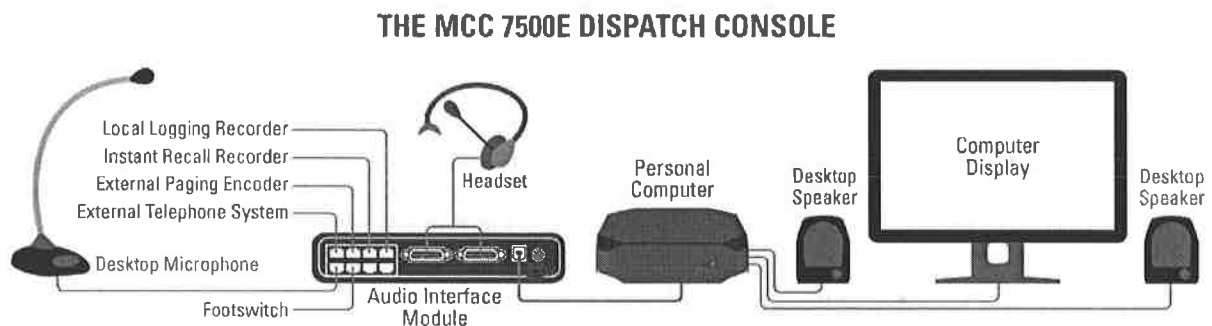


Figure 2-19: MCC 7500E Dispatch Position supports multiple accessories.

#### Audio Interface Module (AIM)

The USB Audio Interface Module (AIM) acts as an interface between analog devices and the dispatch position and as a general purpose input/output module. The USB AIM supports audio routing between the dispatcher and Motorola Solutions standard peripherals. The USB AIM connects to the MCC 7500E dispatch position with a USB cable.

#### Personal Computer (PC)

The personal computer included with the dispatch position is Windows-based and certified by Motorola Solutions.

#### Computer Display

The dispatch position will use a Touch Screen Computer Display.

#### Enhanced Integrated Instant Recall Recorder (IRR)

The Enhanced IRR is seamlessly integrated with the dispatch position's software, allowing audio and call data from any radio or telephony resource to be recorded and easily played back. Call

data includes PTT IDs, name of resource, start time and date, and stop time and date. Two analog inputs are available for use with recording audio from external devices.

### **Desktop Speakers**

Two (2) speakers have been included with each dispatch position and can be configured to transmit audio from a specific talkgroup or set of talkgroups. Each speaker is a self-contained unit, with individual volume controls, and can be placed on a desktop or mounted on a rack or computer display.

### **Headset Jack**

The dispatch position supports up to two headset jacks, both push-to-talk (PTT) and non-PTT-enabled, for simultaneous use by the dispatcher and a supervisor. The headset jack contains two volume controls for the separate adjustment of received radio and telephone audio.

### **Headset**

The proposed headset consists of two elements. The headset base includes an audio amplifier, a Push-to-Talk switch, and a long cord that connects to the dispatch position. The headset top consists of the earpiece and microphone as well as a short cable that connects to the headset base.

### **Gooseneck Microphone**

The microphone controls the dispatch position's general transmit and monitor features through two buttons on its base. The microphone can be fastened down or left loose. It can be used alone or in conjunction with a headset.

### **Footswitch**

Each dispatch position includes a dual pedal footswitch that controls general transmit and monitor functions.

### **Telephone Headset Interface Port**

The telephone/headset port provides a connection for an external telephone to the dispatch position. This allows the operator to use a single headset to communicate on both the radio system and a telephone system.

### **Redundant Ethernet Connection**

The optional redundant Ethernet connections increase MCC 7500E console availability by protecting against the loss of multiple dispatch positions. In the event of a LAN switch failure, the system will automatically detect and switchover with no manual intervention required. Dispatching operations will not be interrupted.

## **2.19.7.2 MCC 7500E Dispatch Console Telephony**

The MCC 7500E Dispatch Console Telephony is a scalable solution designed for centers with a few lines for call center-style operations. Console telephony is highly customizable, with a robust feature set including features such as global and local phone books, speed dials, call transfer and patching of phone lines to radio resources. Its seamless integration into the MCC 7500E dispatch position makes managing radio and telephony easy and simple.



## 2.20 APX8500 CONTROL STATION

- The APX 8500 Control Station is a multi-band radio supporting 700MHz, UHF and VHF.
- It requires no separate network connection and can auto-switch to a backup DC power supply (for example a marine-quality battery) to provide seamless communications even when the power has failed.
- Built with the legendary ruggedness of the APX product line, you can be sure that your APX 8500 will not let you down – even when everything else has.
- Six (6) multi-band APX8500 Mobiles are provided covering 700MHz, UHF and VHF.
- The mobiles are configured as Control Stations to allow backup access to all the communications capabilities of the system.

## 2.21 UHF CONVENTIONAL BACKUP CHANNEL

A single channel, digital, conventional UHF channel is proposed to provide backup communications coverage across the Los Angeles metropolitan area generally and the Harbor District specifically.

## 2.22 VHF MARINE RADIO SYSTEM INTEGRATION

The VHF Marine Radio receivers will allow the Port of Los Angeles to improve and integrate inbound radio communications coverage along the Port of LA Waterfront and its Waterways for the VHF Marine CH 16 frequency.

This solution provides the Port of LA the ability to monitor traffic on the VHF Marine channel from their existing console positions. This receiver voting network will increase the inbound radio coverage using the addition of three (3) sites located along the port. This receiver voting network will interface to the new trunking system using GPW 8000 Analog receivers, GRV 8000 Analog Comparator and a Conventional Channel Gateway (CCGW).

Coverage enhancement is for Inbound (Talk-In) only.

## 2.23 WAVE (LMR OVER BROADBAND)

Motorola Solutions' WAVE Workgroup Communications platform offers the Port of LA flexible and affordable push-to-talk (PTT) communications across different devices and networks. By bridging land mobile radio (LMR) networks and private networks (3G, 4G, LTE, and Wi-Fi broadband), the Port's users will have access to a unified, future-ready service where they can communicate instantly and securely via PTT. WAVE is a highly-scalable platform to tackle today and tomorrow's difficult environments.

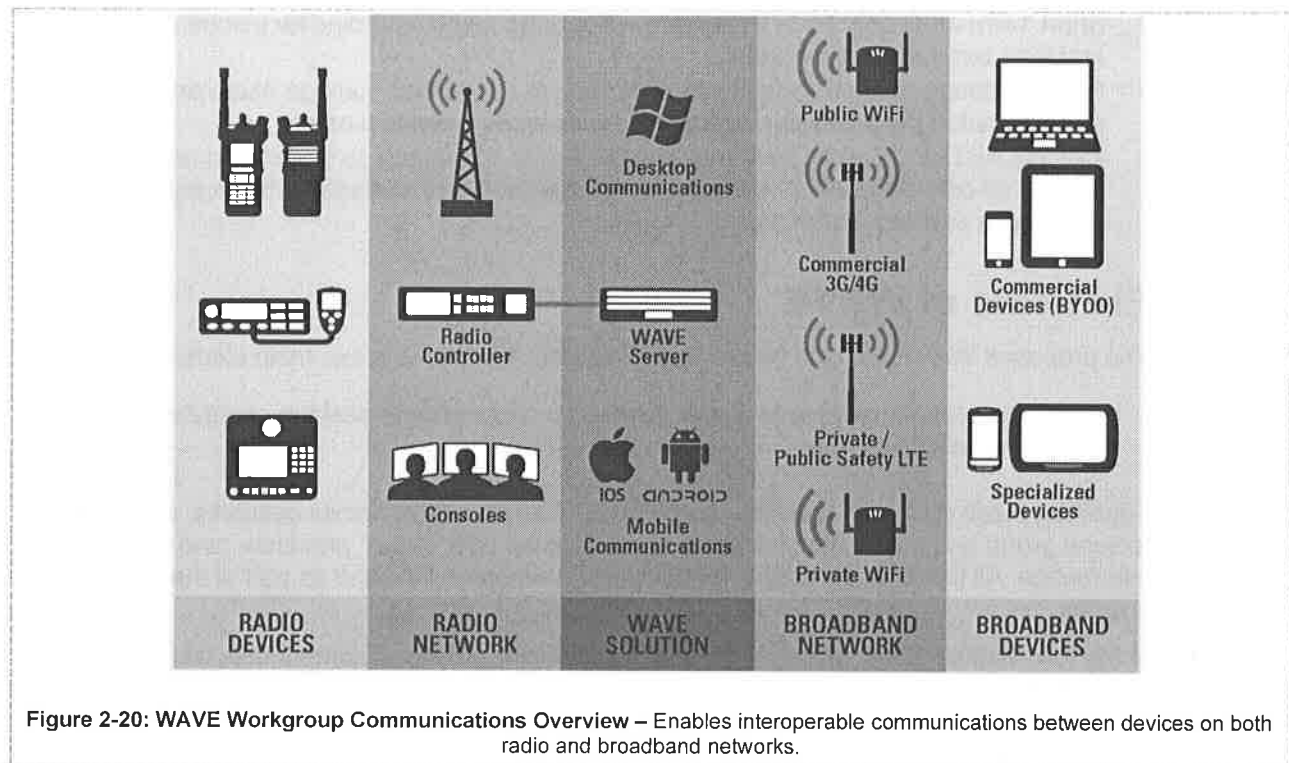


Figure 2-20: WAVE Workgroup Communications Overview – Enables interoperable communications between devices on both radio and broadband networks.

## 2.23.1 WAVE Solution Overview

The proposed WAVE solution is enterprise-grade PTT enabling the Port’s users to communicate on LMR systems using a suite of software clients installed on their mobile devices and laptop/desktop computers. Supporting up to 5,000 active users at a time, these LMR/broadband communications include secure and high-performance PTT services that extend communications beyond the coverage provided by an LMR system itself—a capability useful in a variety of circumstances.

The proposed solution includes the following capabilities:

- **Group Call** – Make group calls using any WAVE application with talkgroups of LMR and WAVE users, WAVE-only users, and LMR-only users. Users select the talkgroup and PTT just like a radio. All users on a talkgroup hear the speaker’s transmission and can reply. Talkgroups and their assigned participants are created and managed by the WAVE Management Server module.
- **Individual Private Call (One-to-One)** – Make private calls between two WAVE users. A user selects the person they wish to call from a contact list available within the WAVE application. Users communicate by pressing and releasing the PTT button in their application.
- **Late Call Entry** – Join in-progress talkgroup calls if users miss the start of a call.
- **Group Text Messaging** – Send and receive group text messages with other WAVE users in a talkgroup.
- **Private Text Messaging** – Send and receive individual text messages between two WAVE users.
- **Status, Presence & Location** – See the current status, presence, and location of other WAVE users using any WAVE Communicator. Whether a user shares their location data with other users is configurable in the applications.

- Short Term and Long Term Recording – Supports audio recording for instant recall playback and long-term archival recording.
- System Management – Provides the interface to create and manage users and talkgroups and turn on/off the ability to make private calls on an individual basis.
- Existing ASTRO 25 radio systems can use WAVE to connect to other radio networks (analog or conventional), providing true interoperability to address complex communications challenges and requirements.

## 2.23.2 Elements of WAVE

The proposed WAVE solution for the Port's includes the following two main elements:

- A communicator loaded onto a user device (i.e. smartphone, desktop computer).
- A server that runs WAVE.

Together, these elements provide a common PTT environment across networks, enabling users to send group and private text messages and transmit user status, presence, and location information. All licenses necessary for operation have been included as part of the Port's WAVE solution.

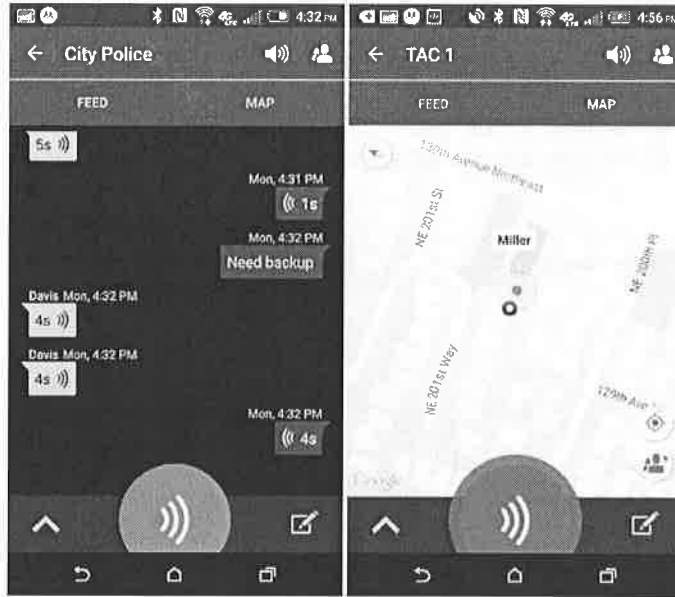
In the following sections, Motorola Solutions details the proposed components included in the Port's solution.

### 2.23.2.1 Proposed WAVE Communicator Applications

WAVE Communicator applications enable the Port's users to access any authorized talkgroups from their device using a suitable data connection (cellular service or Wi-Fi). With the appropriate WAVE communicator installed on a mobile device, laptop, or desktop computer, users can listen/talk on broadband-only talkgroups and talkgroups interconnected to LMR systems, as well as make and receive private calls with other WAVE users from anywhere with network access (local, regional, or global). The following WAVE Communicator applications are included as part of the Port's solution:

#### **WAVE Mobile Communicator**

The WAVE Mobile Communicator transforms users' Android/iOS smart device into a secure, multi-channel PTT handset without the cost of dedicated hardware. Enable instant communications with other individuals on a two-way radio, computer or another smart device. Extend workforce communication to anywhere with mobile broadband access on existing devices with the existing broadband service providers. Know that communication is protected with standards-based encryption and security protocols to provide privacy and data integrity across the WAVE platform.



### 2.23.2.2 WAVE Server Overview

The WAVE Server includes several software modules that provide the interface to the Port's system and integrate WAVE Mobile Communicators and PC clients to the WAVE system.

The following WAVE servers, installed as Windows-based virtual machines, are proposed as part of the Port's solution:

- Media Server
- Management Server
- WAVE Radio Gateway (WRG) Server
- Proxy Server

The WAVE Server supports PTT communications using commercially available Android and iOS smart devices running over 3G/4G/LTE public/private carrier networks and public/private Wi-Fi networks, and PC clients connecting over WAN/LAN networks.

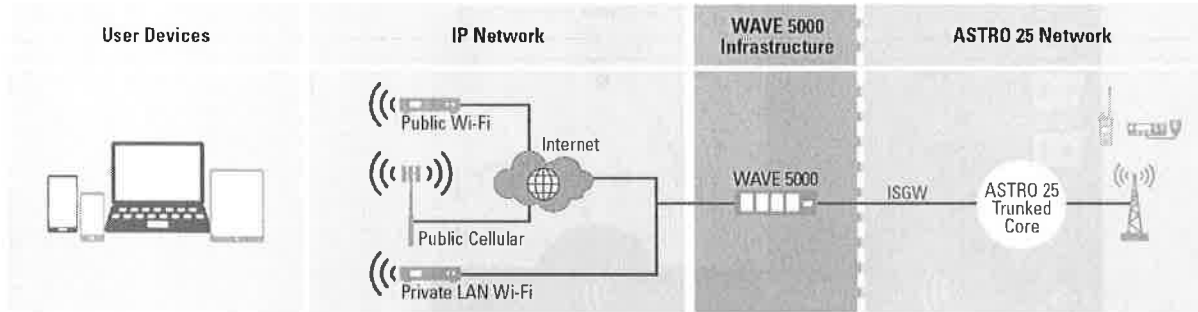
### 2.23.2.3 WAVE Server and Infrastructure

The WAVE Server is the self-contained central point of the WAVE solution, managing communications between WAVE Communicators/Clients and the WAVE system. The server supports up to 5,000 active users over any Broadband or IP network. The WAVE Server also offers the following key features for the Port:

- **Flexible Client Management:** Using the web-based Provisioning Portal, the Port can manage all aspects of user accounts, from adding/deactivating users, creating or managing talkgroups, and provision private call contacts for each user.
- **Call Logging:** Call logs are maintained on the WAVE server for seven days. Logs can be exported to a file (csv format) for long-term traceability and accountability.
- **Built-In Diagnostics:** Ships with built-in utilities that allow the Port to diagnose and resolve issues in network configuration.
- **Simple Upgrades:** New features and functionality can be added quickly and simply to the WAVE server as the Port grows and evolves.

## WAVE for ASTRO 25 Trunked Core

The WAVE Server will directly integrate with the Port's ASTRO 25 Trunked Core directly with an ISGW. This interface will provide an IP-based wireline connection to the ASTRO 25 Trunked Core system for a highly-scalable, reliable, and secure broadband PTT integration. ASTRO 25 encrypted talkgroups to WAVE are also supported, with encryption keys securely stored in the WAVE CRYPTR device.



## 2.24 MICROWAVE BACKHAUL UPGRADE

### 2.24.1 Microwave System Design Summary

This project covers deployment of ten (10) Wavence/MPT-HLC Microwave Systems HOPs as part of Motorola's solution in support of Port of Los Angeles, CA microwave network project. Nokia will furnish and install 10 hops of microwave radios. Nokia will install MPT shelves in new relay racks. Nokia will furnish and install the DC power systems for all site locations. Nokia will test and turn-up the newly installed microwave radios. Nokia will complete the microwave radio to transmission line connections and inter-bay cabling. Nokia will install new antennas, standard mounts and transmission lines at all sites that require them. In addition to providing microwave radios, Nokia will provide performance calculations, path and site surveys, path design, site engineering services, closeout documentation that includes radio RFC2544 tests, sweeps for newly installed waveguide runs and as built drawings. Any changes to the scope of this SOW due to the results of actual site surveys and/or customer changes may result in additional charges to the Port of Los Angeles.

#### 2.24.1.1 Equipment and Services in Scope

- Microwave Deployment Services
- 19 x MPT-HL Shelf Kit Single T-R
- 3 x MPT-HL Shelf Kit Dual T-R
- 5 x MPT-HLC XCVR L6 GHz WITH COMBINER (5720 - 6425)
- 5 x MPT-HLC XCVR U6 GHz (6425 - 7125)
- 7 x MPT-HLC XCVR U6 GHz WITH COMBINER (6425 - 7125)
- 9 x MPT-HLC XCVR 11 GHz (10700 - 11700)
- Associated Antenna equipment and cabling

#### 2.24.1.2 Microwave Deployment: Microwave Path Engineering Warranty

##### FEASIBILITY STUDIES

Nokia provides feasibility studies of microwave radio paths in support of bidding efforts or when purchased. Feasibility studies are performed using information provided by or on behalf of the Port of LA. Results of the feasibility study are provided to the Port of LA and may include (i) a system map, (ii) a path profile, (iii) path performance calculations, and (iv) a technical report.

Feasibility studies are preliminary in nature and are not intended to represent a final design. Therefore, no representations, warranty or guarantee is implied or provided. The Port agrees to assume all risks associated with installing any equipment based on spiderweb maps, preliminary network and system maps, preliminary path profiles (including antenna size and location), path calculations (estimated performance), Google Earth, and topology studies normally presented with a feasibility study.

### **PATH SURVEYS (DETAILED SURVEY WITH REPORT)**

Nokia offers detailed path surveying services to determine or verify site coordinates, site access, location, ground elevation, on-path obstruction location and height, tower information, proposed antenna centerline information, and other parameters required to engineer and implement a microwave radio link.

The present and anticipated future effect of observable on-path obstructions, such as vegetation and buildings, are also evaluated and incorporated into the path design where applicable. Where appropriate, roof top access may be utilized in the survey effort. Existing towers are not climbed as a part of this activity.

The results of the path survey are documented and presented in a formal survey report or technical report, as required, to Motorola. Some items performed and included in a formal survey report may include: site location map, site topographic map, access information, site plot plans, existing tower elevation profile, site photographs, site and path observations, path terrain feature descriptions, critical point data, engineering notes, path profiles, and proposed performance calculations.

For detailed Path Surveys, Nokia warrants that geodetic coordinates are accurate to within +/- 1-second of latitude, +/- 1-second of longitude, ground elevations are accurate to within +/- 1 meter, and that heights of identified on-path obstructions at critical points are accurate to within 5-feet. Nokia warrants only the actual paths surveyed.

### **PATH DESIGN**

Nokia offers path design services. Path design services are based on formal field survey data gathered by Nokia path surveyors and is warranted. Path designs include profiling a path to determine antenna centerline requirements, and path calculations to determine the antenna and radio types necessary to meet Motorola's microwave link performance and availability objectives.

Recommended antenna centerlines are determined for a range of K-factors expected to occur during an average year and by the Fresnel zone clearance criteria stipulated by Bell Laboratories. For areas where poor propagation conditions are known to exist, paths are assessed for susceptibility to obstruction fading outages using the Bell Laboratories Obstruction Fading (OBSFAD) model. Additionally, paths are analyzed for ground-based reflections.

Microwave link availability (path availability) is evaluated using current North American industry accepted models for predicting outage times and diversity improvement factors associated with normal atmospheric multipath fading (flat and dispersive), rain fading, and obstruction fading. Every effort is made by Nokia to anticipate the probable occurrence of abnormal propagation



conditions based on historical documentation, experience, geographical location, and field survey data.

The final path design documentation will include one or more of the following, depending on the services purchased by the Port: (i) a system map, (ii) a final path profile, (iii) final path performance calculations, and (iv) a technical report.

If radio path using Nokia equipment is installed based on Nokia's recommended path design, then Nokia warrants the radio path calculations shall conform to Motorola's availability objective for normal atmospheric multipath fading. Nokia will not be held responsible for excessive outages or degraded performance due to abnormal fading conditions. Abnormal fading conditions include, but are not limited to:

Formation of extreme radio refractivity gradients associated with:

- Exceptionally large temperature inversions
- Abnormal temperature/humidity layers
- Fog formation
- Signal trapping caused by surface or atmospheric ducting
- Reflections from unusual or unidentifiable on-path or off-path terrain features, physical structures, or atmospheric layers.
- Rain fading due to rainfall rates that exceed the published rates or charts used to predict rain induced outages.

If Nokia suspects that abnormal propagation conditions are the cause of degraded system performance, Nokia will assist Motorola in verifying the conditions leading to the degraded system performance. After the problem, has been identified, Nokia will support Motorola in identifying possible solutions to the problem and assess the incremental improvement expected from corrective actions. Any Implementation of corrective action to remedy this type of problem shall be the sole responsibility of the Port of LA.

## **FREQUENCY PLANNING**

Nokia offers frequency planning services including frequency selection, prior coordination process, interference case resolution, and FCC license application documentation preparation and submittal. Nokia warrants that the interference studies will be conducted using industry-accepted North American methods, hardware, software and algorithms; and that the frequency database will be maintained as accurately as possible at the time of the study. Nokia will not be held responsible for interference cases that arise due to errors or omissions in the database. Upon completion of the frequency planning services, some or all of the following documentation is provided to the Port of LA:

- Prior Coordination Notice
- Frequency Coordination Data Sheet
- Supplemental Showing pursuant to FCC Rules Part 101.103(d)
- Completed FCC Form 601 License Application and Preparation

In the event, frequency interference is detected during the implementation of a microwave link in which Nokia provided the frequency planning services, Nokia's total liability is limited to selection of an alternate frequency or frequencies. Should interference occur after the microwave link is deemed operational and accepted, corrective action is the sole responsibility of the Port.

## WARRANTY

Nokia warrants its path surveys and path designs to be substantially free of engineering defects and errors for a period of 12 months from the date of delivery of the study to Motorola. Nokia warrants its line of sight surveys to be substantially free of engineering defects and errors for a period of 6 months from the date of delivery of the study to Motorola. Nokia warrants its frequency planning and Form 601 License Application preparation to be substantially free of engineering defects and errors for a period of 6 months from the date the path was prior coordinated. In the event that, during the warranty period, a documented defect proven to be responsibility of Nokia, occurs, Motorola's sole remedy under this warranty provisions, shall be that Nokia will provide the incremental labor and material beyond what would have been required during initial installation to correct the particular error in the path survey or path design at no cost of the Port. In no case, shall Nokia be held liable for any indirect damages including but not limited to incidental, consequential or loss of capital, data, revenue or profit. In the event, that such error is not solely and directly related to Nokia's path engineering efforts, expenses for such labor and material shall be borne by the Port.

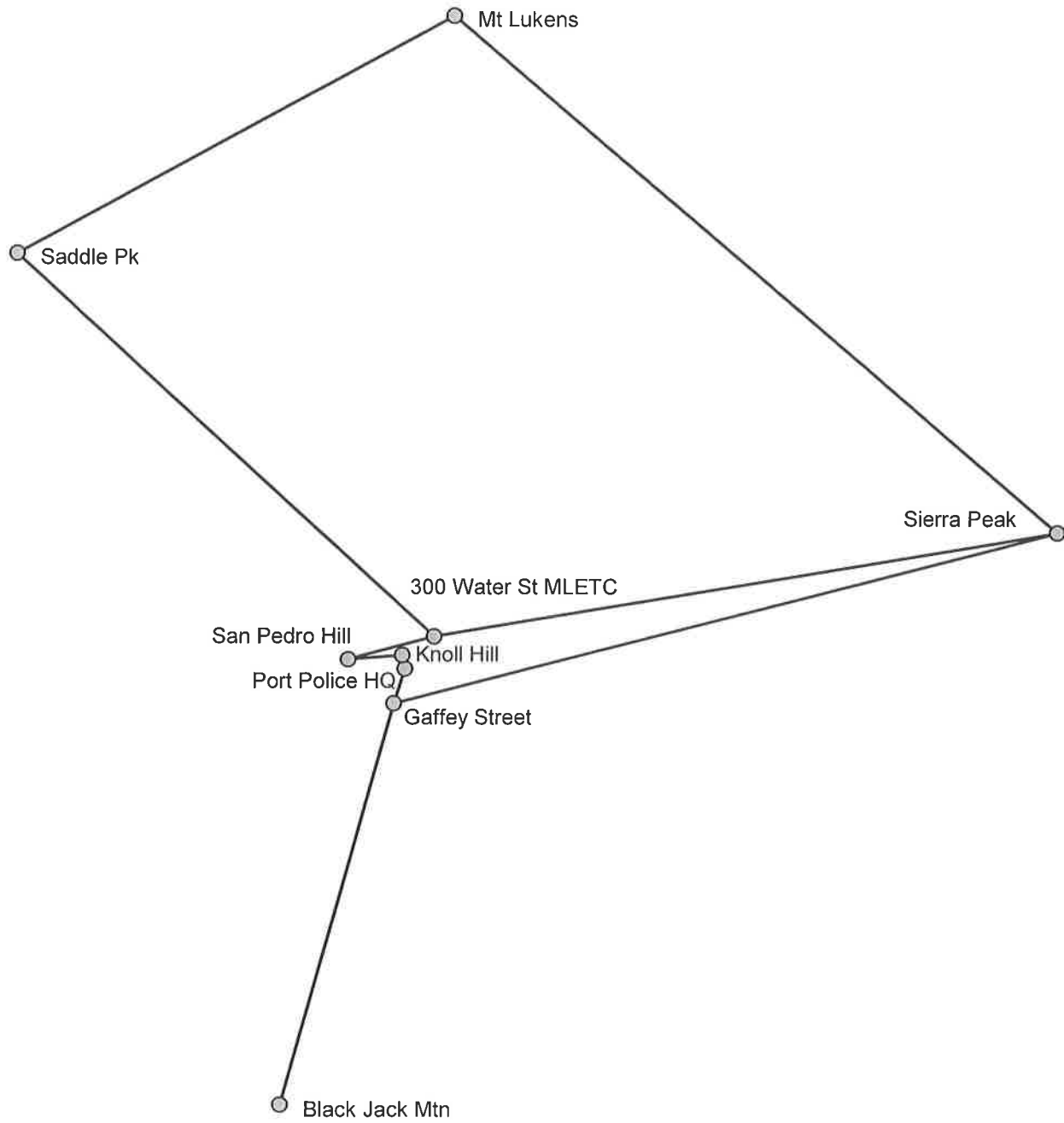
### 2.24.1.3 Equipment Decommission

6 antennas with 12 ODU and coax (Note: Port Authority will decommission equipment at Badger Bridge)

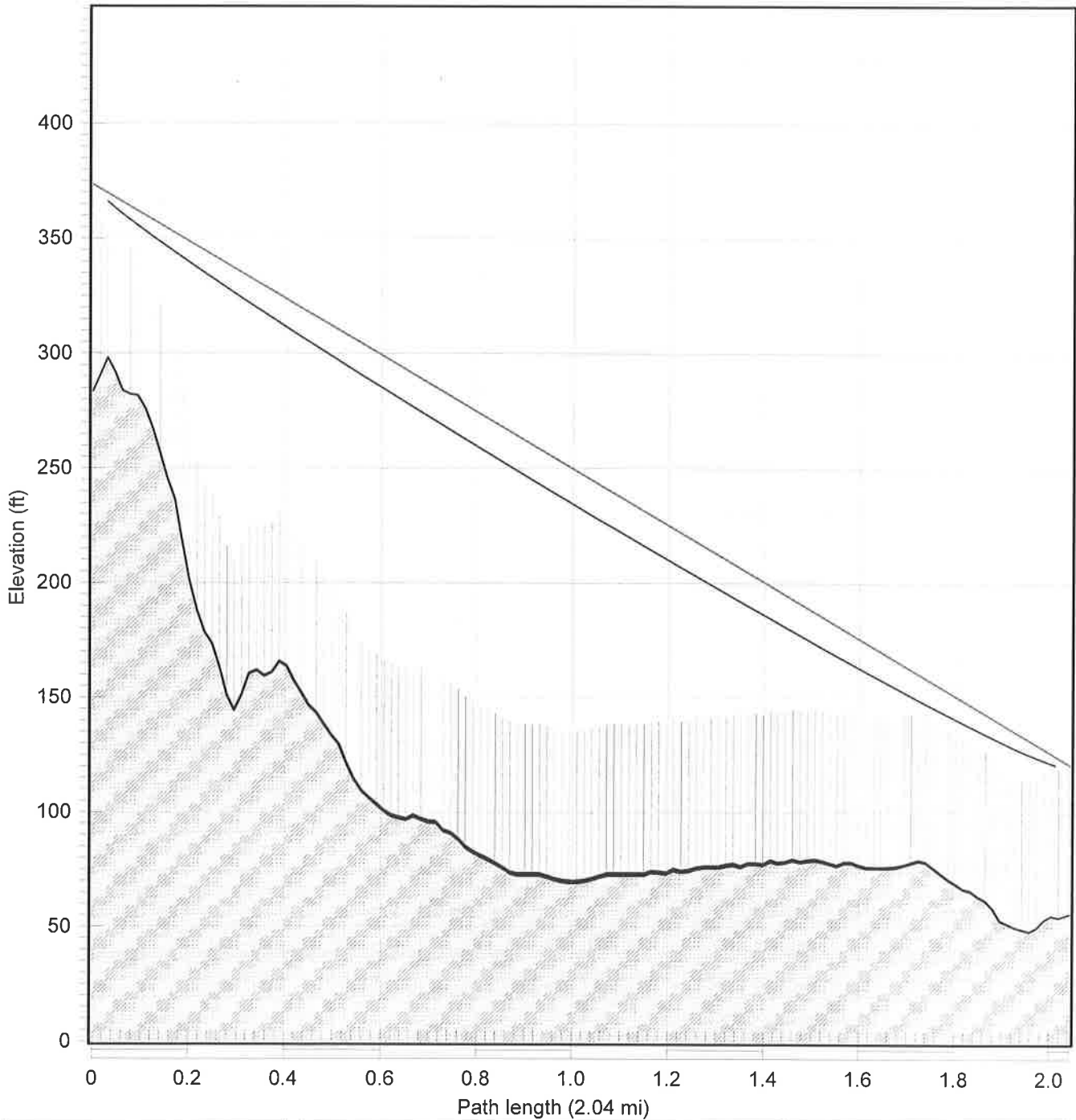
- San Pedro Hill (115' coax) to 300 Water St. (120' coax)
  - Both dishes are VHLP4-11 with two coax each (possible 2x2 mimo)
- 300 Water St. (155' coax) facing Badger Bridge
  - VHLP2-23 with two coax (possible 2x2 mimo)
- Gaffey St. (70' coax) facing Badger Bridge
  - VHLP800-11 with two coax (possible 2x2 mimo)
- Gaffey St. (61' coax) to Police HQ (115' coax)
  - Both dishes are VHLP4-11 with two coax each (possible 2x2 mimo)



## 2.24.2 Microwave Map



## 2.24.3 Microwave Paper Path Studies



Gaffey Street	
Latitude	33 42 43.10 N
Longitude	118 17 38.10 W
Azimuth	17.59°
Elevation	283 ft ASL
Antenna CL	90.0 ft AGL

Frequency (MHz)	= 11200.0
K	= 1.33, 0.50
%F1	= 100.00

Port Police HQ	
Latitude	33 44 24.80 N
Longitude	118 16 59.50 W
Azimuth	197.60°
Elevation	56 ft ASL
Antenna CL	65.0 ft AGL

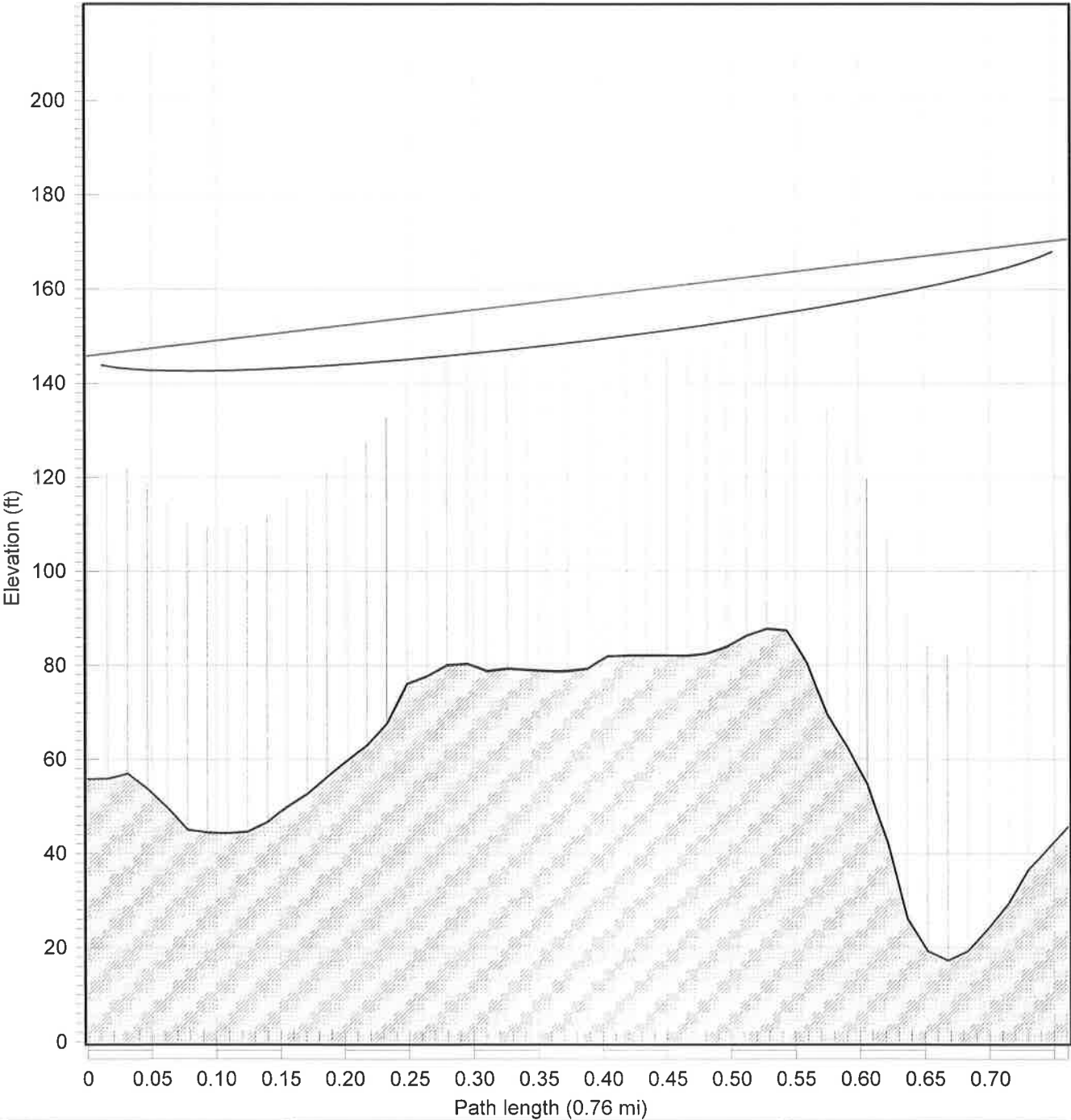
Transmission details (Gaffey Street-Port Police HQ.pl5)

	Gaffey Street	Port Police HQ
Latitude	33 42 43.10 N	33 44 24.80 N
Longitude	118 17 38.10 W	118 16 59.50 W
True azimuth (°)	17.59	197.60
Vertical angle (°)	-1.35	1.33
Elevation (ft)	283.46	55.77
Antenna model	SC3-W100A (TR)	SC3-W100A (TR)
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	90.00	65.00
TX line model	E-105	E-105
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	130.00	105.00
TX line loss (dB)	3.58	2.89
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.40	1.40
RX filter loss (dB)	1.70	1.70
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	2.04	
Free space loss (dB)	123.79	
Atmospheric absorption loss (dB)	0.05	
Net path loss (dB)	56.40	56.40
Configuration	NSB Diplexer Main	NSB Diplexer Main
Radio model	WVCE11-L-128F10S-52	WVCE11-L-128F10S-52
TX power (dBm)	26.00	26.00
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	59.53	60.21
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-78.50	-78.50
Receive signal (dBm)	-30.40	-30.40
Thermal fade margin (dB)	48.10	48.10
Dispersive fade margin (dB)	70.00	70.00

	Gaffey Street	Port Police HQ
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	48.07	48.07
Climatic factor	2.00	
Terrain roughness (ft)	52.38	
C factor	1.88	
Average annual temperature (°F)	60.67	
Fade occurrence factor (Po)	4.496E-004	
Worst month multipath availability (%)	100.00000	100.00000
Worst month multipath unavailability (sec)	0.02	0.02
Annual multipath availability (%)	100.00000	100.00000
Annual multipath unavailability (sec)	0.07	0.07
Annual 2 way multipath availability (%)	100.00000	
Annual 2 way multipath unavailability (sec)	0.13	
Polarization	Vertical	
Rain region	Los Angeles, California	
Rain rate (mm/hr)	0.00	
Flat fade margin - rain (dB)	48.10	
Rain attenuation (dB)	0.00	
Annual rain availability (%)	100.00000	
Annual rain unavailability (min)	0.00	
Annual rain + multipath availability (%)	100.00000	
Annual rain + multipath unavailability (min)	0.00	

Multipath fading method - Vigants - Barnett

Rain fading method - Crane



<b>Port Police HQ</b>	
Latitude	33 44 24.80 N
Longitude	118 16 59.50 W
Azimuth	348.23°
Elevation	56 ft ASL
Antenna CL	90.0 ft AGL

Frequency (MHz) = 11200.0
K = 1.33, 0.50
%F1 = 100.00

<b>Knoll Hill</b>	
Latitude	33 45 03.70 N
Longitude	118 17 09.20 W
Azimuth	168.23°
Elevation	46 ft ASL
Antenna CL	125.0 ft AGL

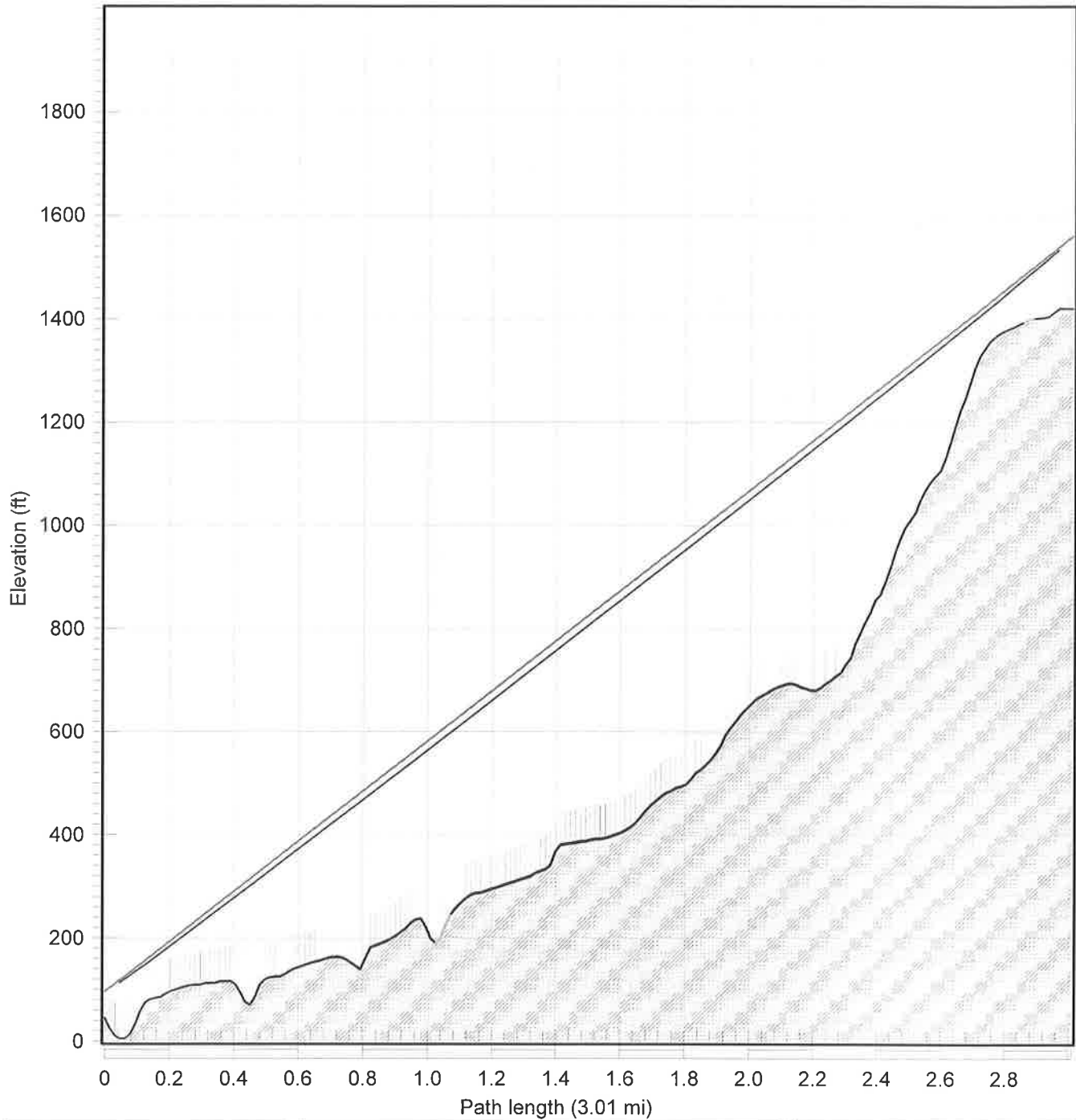
Transmission details (Port Police HQ-Knoll Hill.pl5)

	Port Police HQ	Knoll Hill
Latitude	33 44 24.80 N	33 45 03.70 N
Longitude	118 16 59.50 W	118 17 09.20 W
True azimuth (°)	348.23	168.23
Vertical angle (°)	0.35	-0.36
Elevation (ft)	55.77	45.60
Antenna model	SC3-W100A (TR)	SC3-W100A (TR)
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	90.00	125.00
TX line model	E-105	E-105
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	130.00	165.00
TX line loss (dB)	3.58	4.54
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.40	1.40
RX filter loss (dB)	1.70	1.70
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	0.76	
Free space loss (dB)	115.21	
Atmospheric absorption loss (dB)	0.02	
Net path loss (dB)	49.44	49.44
Configuration	NSB Diplexer Main	NSB Diplexer Main
Radio model	WVCE11-L-128F10S-52	WVCE11-L-128F10S-52
TX power (dBm)	20.00	20.00
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	53.53	52.56
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-78.50	-78.50
Receive signal (dBm)	-29.44	-29.44
Thermal fade margin (dB)	49.06	49.06
Dispersive fade margin (dB)	70.00	70.00

	Port Police HQ	Knoll Hill
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	49.02	49.02
Climatic factor	2.00	
Terrain roughness (ft)	21.15	
C factor	6.12	
Average annual temperature (°F)	60.57	
Fade occurrence factor (Po)	7.547E-005	
Worst month multipath availability (%)	100.00000	100.00000
Worst month multipath unavailability (sec)	0.00	0.00
Annual multipath availability (%)	100.00000	100.00000
Annual multipath unavailability (sec)	0.01	0.01
Annual 2 way multipath availability (%)	100.00000	
Annual 2 way multipath unavailability (sec)	0.02	
Polarization	Vertical	
Rain region	Los Angeles, California	
Rain rate (mm/hr)	0.00	
Flat fade margin - rain (dB)	49.06	
Rain attenuation (dB)	0.00	
Annual rain availability (%)	100.00000	
Annual rain unavailability (min)	0.00	
Annual rain + multipath availability (%)	100.00000	
Annual rain + multipath unavailability (min)	0.00	

Multipath fading method - Vigants - Barnett

Rain fading method - Crane



Knoll Hill	
Latitude	33 45 03.70 N
Longitude	118 17 09.20 W
Azimuth	265.64°
Elevation	46 ft ASL
Antenna CL	50.0 ft AGL

Frequency (MHz) = 11200.0
K = 1.33, 0.50
%F1 = 100.00

San Pedro Hill	
Latitude	33 44 51.70 N
Longitude	118 20 16.90 W
Azimuth	85.61°
Elevation	1421 ft ASL
Antenna CL	140.0 ft AGL

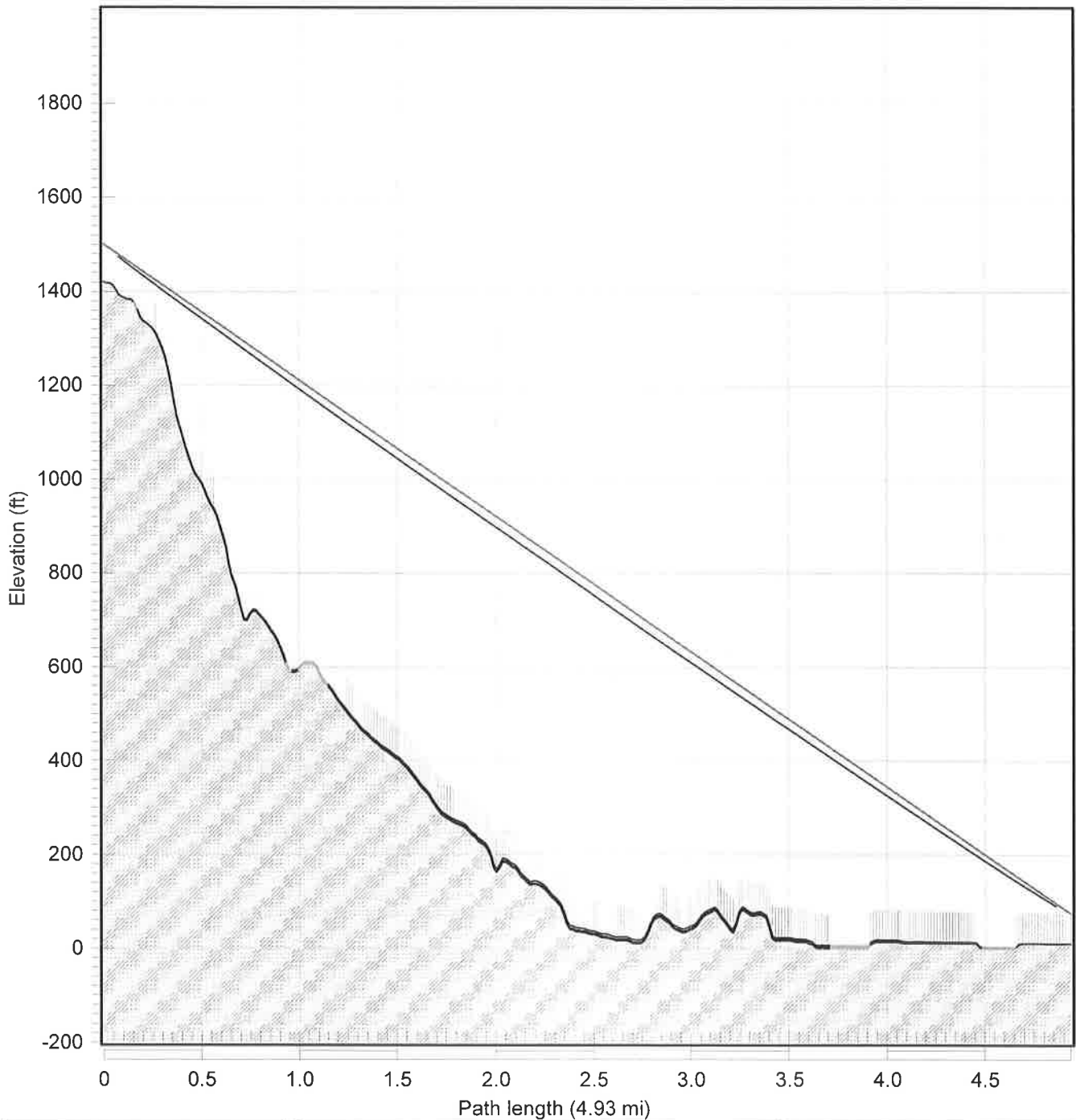
Transmission details (Knoll Hill-San Pedro Hill.pl5)

	Knoll Hill	San Pedro Hill
Latitude	33 45 03.70 N	33 44 51.70 N
Longitude	118 17 09.20 W	118 20 16.90 W
True azimuth (°)	265.64	85.61
Vertical angle (°)	5.25	-5.28
Elevation (ft)	45.60	1420.87
Antenna model	SC3-W100A (TR)	SC3-W100A (TR)
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	50.00	140.00
TX line model	E-105	E-105
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	90.00	180.00
TX line loss (dB)	2.48	4.95
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.40	1.40
RX filter loss (dB)	1.70	1.70
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	3.02	
Free space loss (dB)	127.19	
Atmospheric absorption loss (dB)	0.08	
Net path loss (dB)	60.80	60.80
Configuration	NSB Diplexer Main	NSB Diplexer Main
Radio model	WVCE11-L-128F10S-52	WVCE11-L-128F10S-52
TX power (dBm)	30.50	30.50
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	65.13	62.65
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-78.50	-78.50
Receive signal (dBm)	-30.30	-30.30
Thermal fade margin (dB)	48.20	48.20
Dispersive fade margin (dB)	70.00	70.00

	Knoll Hill	San Pedro Hill
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	48.18	48.18
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	60.60	
Fade occurrence factor (Po)	4.059E-004	
Worst month multipath availability (%)	100.00000	100.00000
Worst month multipath unavailability (sec)	0.02	0.02
Annual multipath availability (%)	100.00000	100.00000
Annual multipath unavailability (sec)	0.06	0.06
Annual 2 way multipath availability (%)	100.00000	
Annual 2 way multipath unavailability (sec)	0.12	
Polarization	Vertical	
Rain region	Los Angeles, California	
Rain rate (mm/hr)	388.65	
Flat fade margin - rain (dB)	48.20	
Rain attenuation (dB)	48.22	
Annual rain availability (%)	100.00000	
Annual rain unavailability (min)	0.00	
Annual rain + multipath availability (%)	100.00000	
Annual rain + multipath unavailability (min)	0.00	

Multipath fading method - Vigants - Barnett

Rain fading method - Crane



<b>San Pedro Hill</b>	
Latitude	33 44 51.70 N
Longitude	118 20 16.90 W
Azimuth	74.86°
Elevation	1421 ft ASL
Antenna CL	80.0 ft AGL

Frequency (MHz) = 11200.0
K = 1.33, 0.50
%F1 = 100.00

<b>300 Water St MLETC</b>	
Latitude	33 45 58.90 N
Longitude	118 15 19.00 W
Azimuth	254.91°
Elevation	10 ft ASL
Antenna CL	65.0 ft AGL

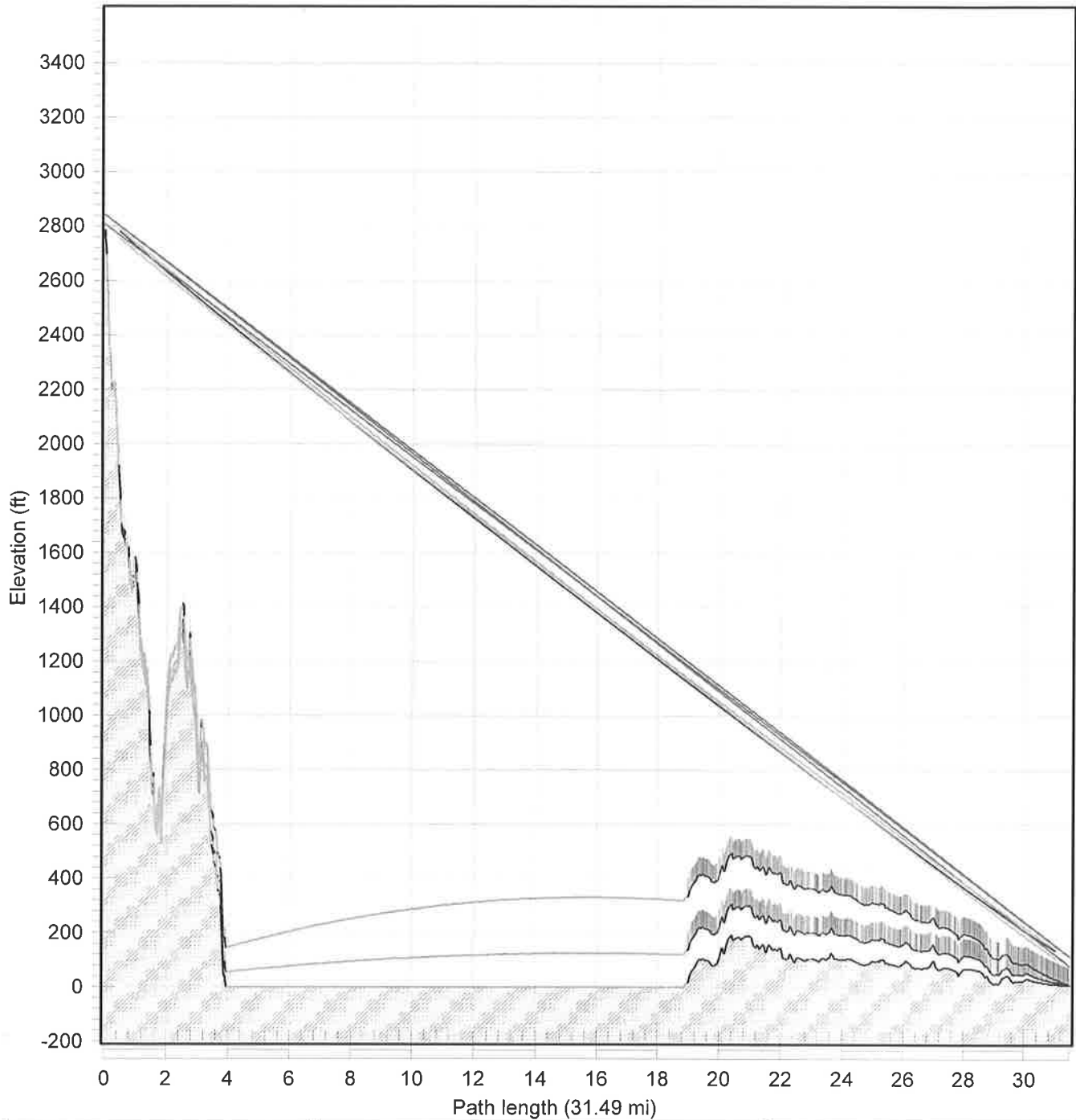
Transmission details (San Pedro Hill-300 Water St MLETC.pl5)

	San Pedro Hill	300 Water St MLETC
Latitude	33 44 51.70 N	33 45 58.90 N
Longitude	118 20 16.90 W	118 15 19.00 W
True azimuth (°)	74.86	254.91
Vertical angle (°)	-3.16	3.11
Elevation (ft)	1420.87	9.84
Antenna model	SC3-W100A (TR)	SC3-W100A (TR)
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	80.00	65.00
TX line model	E-105	E-105
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	120.00	105.00
TX line loss (dB)	3.30	2.89
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.40	1.40
RX filter loss (dB)	1.70	1.70
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	4.94	
Free space loss (dB)	131.46	
Atmospheric absorption loss (dB)	0.13	
Net path loss (dB)	63.88	63.88
Configuration	NSB Diplexer Main	NSB Diplexer Main
Radio model	WVCE11-L-128F10S-52	WVCE11-L-128F10S-52
TX power (dBm)	30.50	30.50
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	64.30	64.71
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-78.50	-78.50
Receive signal (dBm)	-33.38	-33.38
Thermal fade margin (dB)	45.12	45.12
Dispersive fade margin (dB)	70.00	70.00

	San Pedro Hill	300 Water St MLETC
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	45.11	45.11
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	60.54	
Fade occurrence factor (Po)	1.773E-003	
Worst month multipath availability (%)	99.99999	99.99999
Worst month multipath unavailability (sec)	0.14	0.14
Annual multipath availability (%)	100.00000	100.00000
Annual multipath unavailability (sec)	0.52	0.52
Annual 2 way multipath availability (%)	100.00000	
Annual 2 way multipath unavailability (sec)	1.04	
Polarization	Vertical	
Rain region	Los Angeles, California	
Rain rate (mm/hr)	261.81	
Flat fade margin - rain (dB)	45.12	
Rain attenuation (dB)	45.11	
Annual rain availability (%)	100.00000	
Annual rain unavailability (min)	0.02	
Annual rain + multipath availability (%)	99.99999	
Annual rain + multipath unavailability (min)	0.04	

Multipath fading method - Vigants - Barnett

Rain fading method - Crane



<b>Saddle Pk</b>	
Latitude	34 04 32.87 N
Longitude	118 39 30.60 W
Azimuth	132.52°
Elevation	2786 ft ASL
Antenna CL	55.0, 20.0 ft AGL

Frequency (MHz) = 6700.0
K = 1.33, 0.50
%F1 = 100.00, 60.00

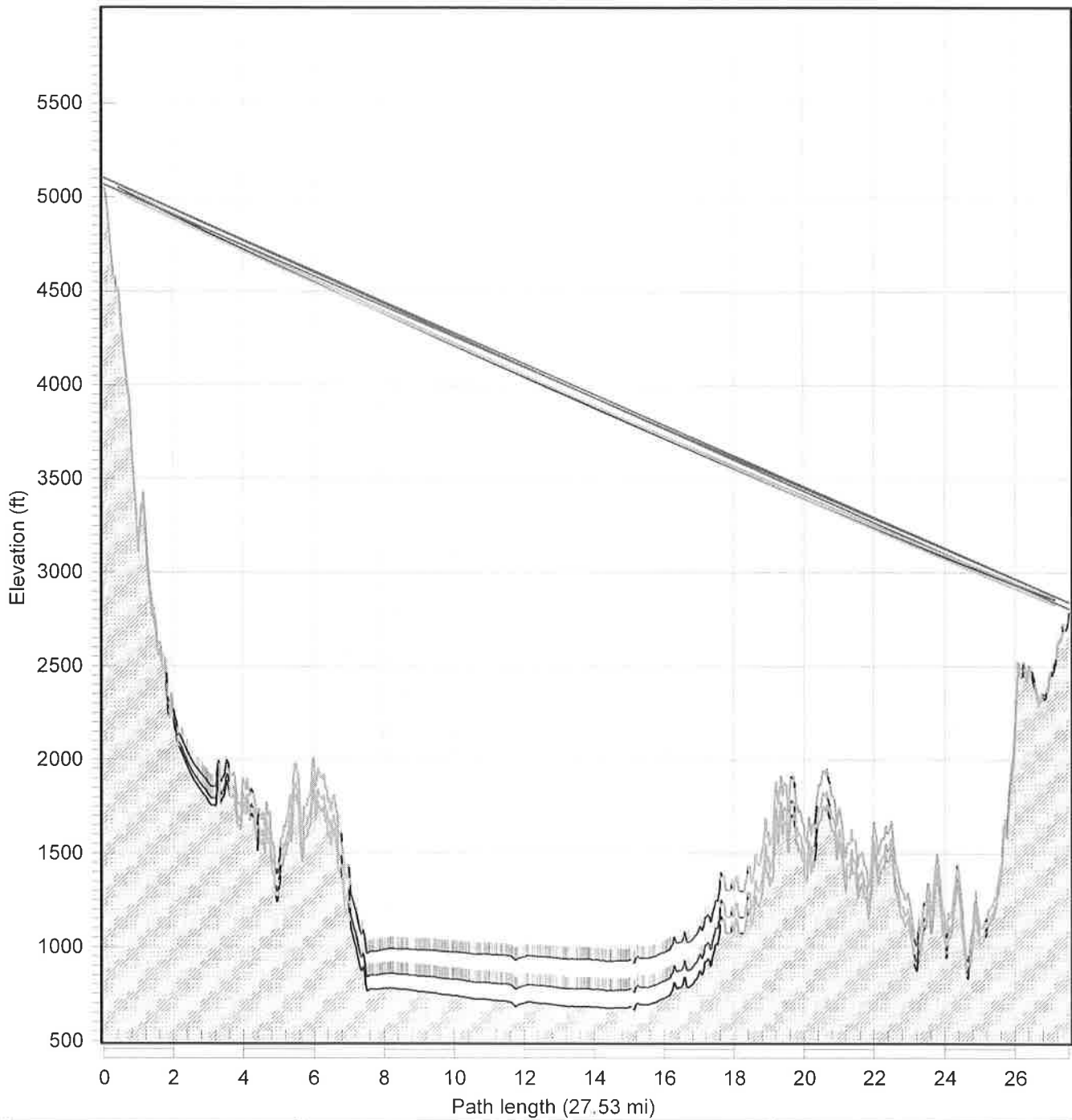
<b>300 Water St MLETC</b>	
Latitude	33 45 58.90 N
Longitude	118 15 19.00 W
Azimuth	312.74°
Elevation	10 ft ASL
Antenna CL	105.0, 70.0 ft AGL

Transmission details (Saddle Pk-300 Water St MLETC.pl5)

	Saddle Pk	300 Water St MLETC
Latitude	34 04 32.87 N	33 45 58.90 N
Longitude	118 39 30.60 W	118 15 19.00 W
True azimuth (°)	132.52	312.74
Vertical angle (°)	-1.11	0.77
Elevation (ft)	2786.30	9.84
Antenna model	PAD6-65B (TR)	PAD6-65B (TR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	55.00	105.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	95.00	145.00
TX line loss (dB)	1.33	2.03
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.30	1.30
RX filter loss (dB)	2.30	2.30
Antenna model	PAD6-65B (DR)	PAD6-65B (DR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	20.00	70.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	60.00	110.00
TX line loss (dB)	0.84	1.54
Connector loss (dB)	0.20	0.20
RX filter loss (dB)	2.30	2.30
Frequency (MHz)	6700.00	
Polarization	Vertical	
Path length (mi)	31.50	
Free space loss (dB)	143.09	
Atmospheric absorption loss (dB)	0.46	
Main net path loss (dB)	72.51	72.51
Diversity net path loss (dB)	72.02	72.02

	Saddle Pk	300 Water St MLETC
Configuration	NSB-SD Diplexer Main	NSB-SD Diplexer Main
Radio model	WVCE67-L-128F10S-52	WVCE67-L-128F10S-52
TX power (dBm)	32.50	32.50
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	68.87	68.17
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-79.00	-79.00
Main receive signal (dBm)	-40.01	-40.01
Diversity receive signal (dBm)	-39.52	-39.52
Thermal fade margin (dB)	39.48	39.48
Dispersive fade margin (dB)	70.00	70.00
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	39.48	39.48
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	60.06	
Fade occurrence factor (Po)	2.745E-001	
SD improvement factor	144.59	144.59
Worst month multipath availability (%)	99.99998	99.99998
Worst month multipath unavailability (sec)	0.56	0.56
Annual multipath availability (%)	99.99999	99.99999
Annual multipath unavailability (sec)	2.03	2.03
Annual 2 way multipath availability (%)	99.99999	
Annual 2 way multipath unavailability (sec)	4.06	

Multipath fading method - Vigants - Barnett



<b>Mt Lukens</b>	
Latitude	34 16 07.18 N
Longitude	118 14 15.40 W
Azimuth	241.25°
Elevation	5049 ft ASL
Antenna CL	55.0, 20.0 ft AGL

Frequency (MHz) = 6700.0
K = 1.33, 0.50
%F1 = 100.00, 60.00

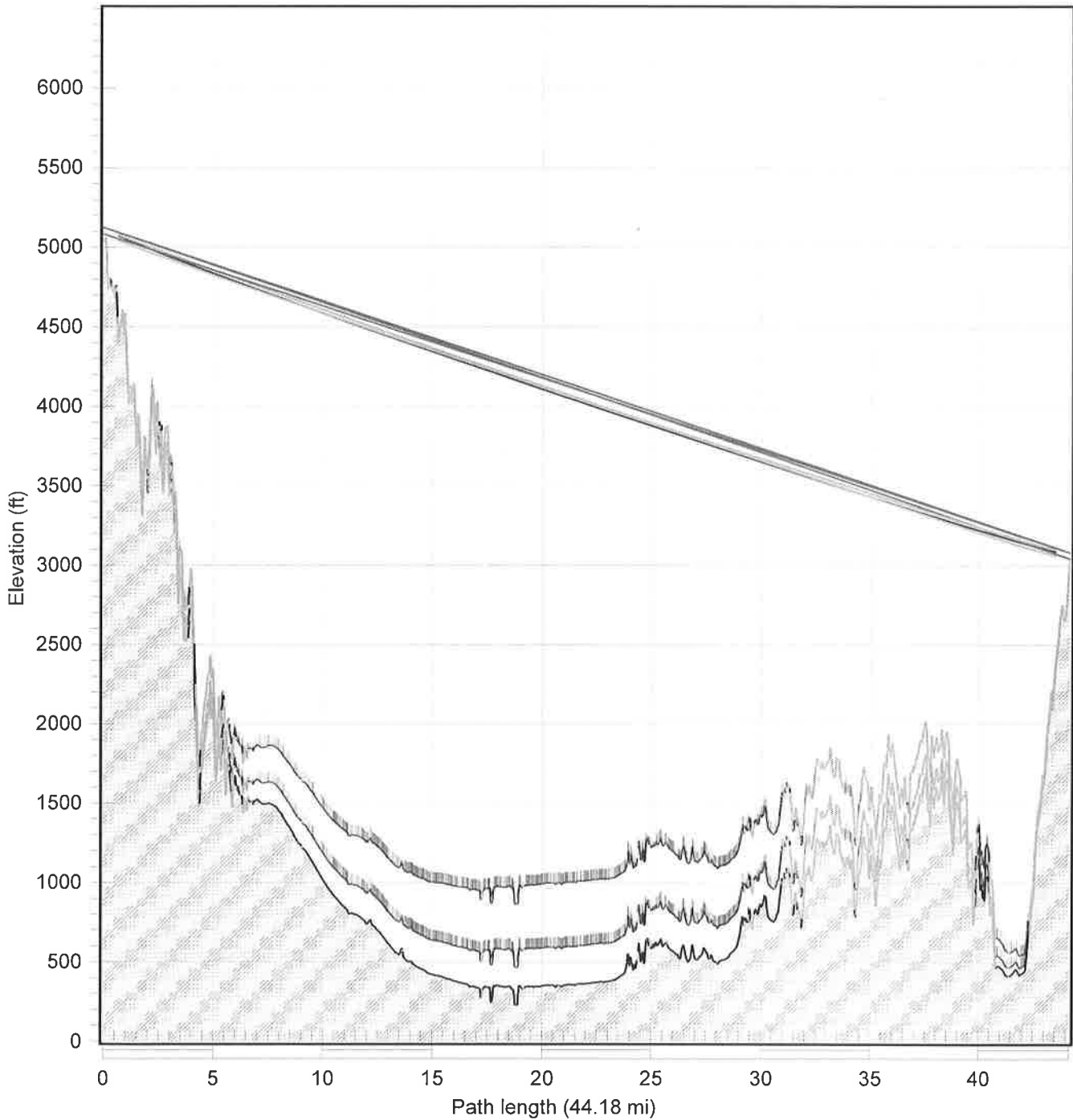
<b>Saddle Pk</b>	
Latitude	34 04 32.87 N
Longitude	118 39 30.60 W
Azimuth	61.01°
Elevation	2786 ft ASL
Antenna CL	55.0, 20.0 ft AGL

Transmission details (Mt Lukens-Saddle Pk.pl5)

	Mt Lukens	Saddle Pk
Latitude	34 16 07.18 N	34 04 32.87 N
Longitude	118 14 15.40 W	118 39 30.60 W
True azimuth (°)	241.25	61.01
Vertical angle (°)	-1.04	0.74
Elevation (ft)	5049.45	2786.30
Antenna model	PAD6-65B (TR)	PAD6-65B (TR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	55.00	55.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	95.00	95.00
TX line loss (dB)	1.33	1.33
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.30	1.30
RX filter loss (dB)	2.30	2.30
Antenna model	PAD6-65B (DR)	PAD6-65B (DR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	20.00	20.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	60.00	60.00
TX line loss (dB)	0.84	0.84
Connector loss (dB)	0.20	0.20
RX filter loss (dB)	2.30	2.30
Frequency (MHz)	6700.00	
Polarization	Vertical	
Path length (mi)	27.54	
Free space loss (dB)	141.92	
Atmospheric absorption loss (dB)	0.40	
Main net path loss (dB)	70.59	70.59
Diversity net path loss (dB)	70.10	70.10

	Mt Lukens	Saddle Pk
Configuration	NSB-SD Diplexer Main	NSB-SD Diplexer Main
Radio model	WVCE67-L-128F10S-52	WVCE67-L-128F10S-52
TX power (dBm)	32.50	32.50
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	68.87	68.87
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-79.00	-79.00
Main receive signal (dBm)	-38.09	-38.09
Diversity receive signal (dBm)	-37.60	-37.60
Thermal fade margin (dB)	41.40	41.40
Dispersive fade margin (dB)	70.00	70.00
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	41.40	41.40
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	58.93	
Fade occurrence factor (Po)	1.835E-001	
SD improvement factor	200.00	200.00
Worst month multipath availability (%)	99.99999	99.99999
Worst month multipath unavailability (sec)	0.17	0.17
Annual multipath availability (%)	100.00000	100.00000
Annual multipath unavailability (sec)	0.62	0.62
Annual 2 way multipath availability (%)	100.00000	
Annual 2 way multipath unavailability (sec)	1.24	

Multipath fading method - Vigants - Barnett



Mt Lukens	
Latitude	34 16 07.18 N
Longitude	118 14 15.40 W
Azimuth	130.62°
Elevation	5049 ft ASL
Antenna CL	75.0, 35.0 ft AGL

Frequency (MHz) = 6700.0
K = 1.33, 0.50
%F1 = 100.00, 60.00

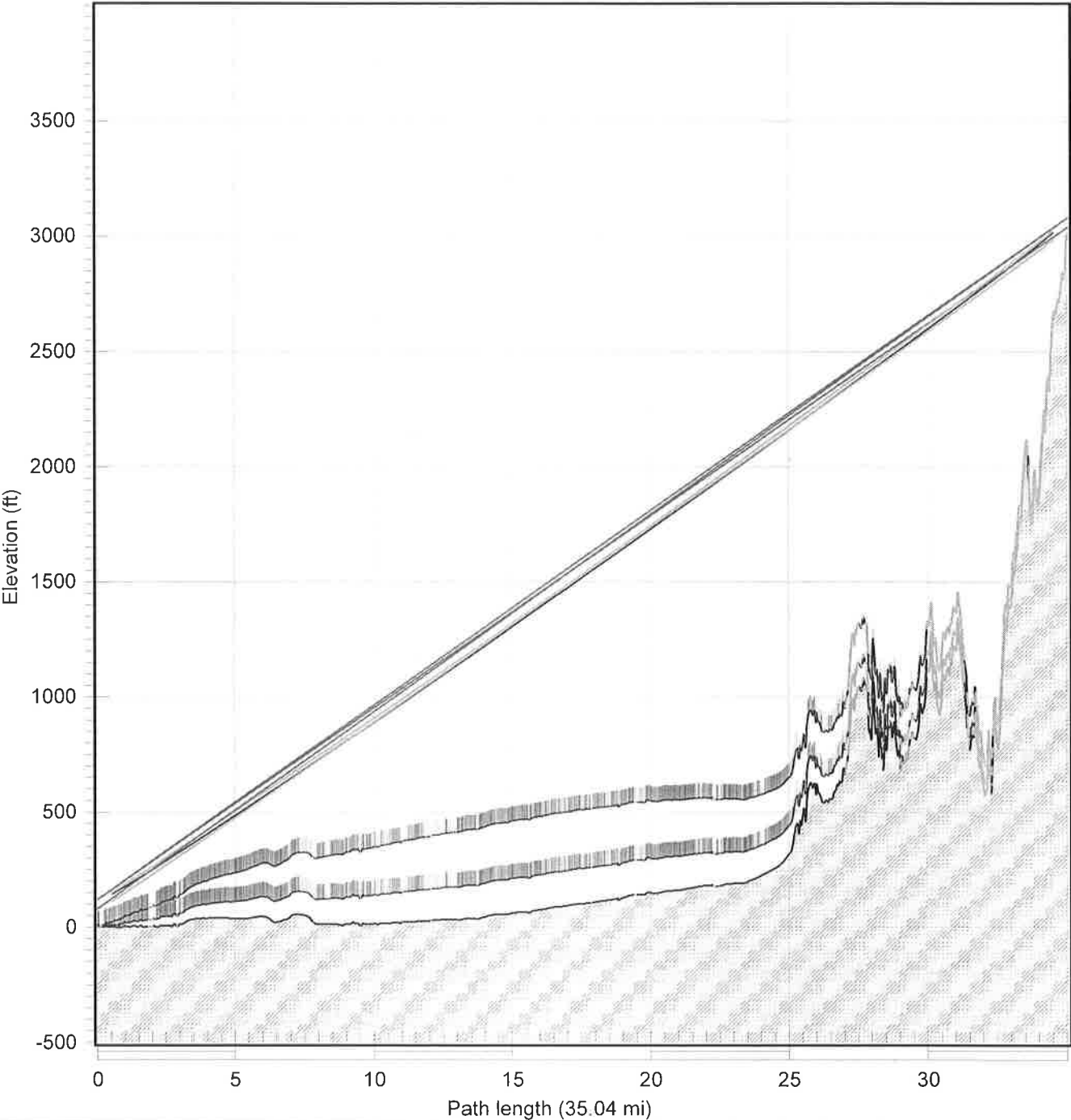
Sierra Peak	
Latitude	33 51 00.03 N
Longitude	117 39 16.30 W
Azimuth	310.95°
Elevation	3021 ft ASL
Antenna CL	60.0, 20.0 ft AGL

Transmission details (Mt Lukens-Sierra Peak.pl5)

	Mt Lukens	Sierra Peak
Latitude	34 16 07.18 N	33 51 00.03 N
Longitude	118 14 15.40 W	117 39 16.30 W
True azimuth (°)	130.62	310.95
Vertical angle (°)	-0.74	0.26
Elevation (ft)	5049.45	3021.42
Antenna model	PAD6-65B (TR)	PAD6-65B (TR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	75.00	60.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	115.00	100.00
TX line loss (dB)	1.61	1.40
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.30	1.30
RX filter loss (dB)	2.30	2.30
Antenna model	PAD6-65B (DR)	PAD6-65B (DR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	35.00	20.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	75.00	60.00
TX line loss (dB)	1.05	0.84
Connector loss (dB)	0.20	0.20
RX filter loss (dB)	2.30	2.30
Frequency (MHz)	6700.00	
Polarization	Vertical	
Path length (mi)	44.18	
Free space loss (dB)	146.03	
Atmospheric absorption loss (dB)	0.65	
Main net path loss (dB)	75.29	75.29
Diversity net path loss (dB)	74.73	74.73

	Mt Lukens	Sierra Peak
Configuration	NSB-SD Diplexer Main	NSB-SD Diplexer Main
Radio model	WVCE67-L-128F10S-52	WVCE67-L-128F10S-52
TX power (dBm)	32.50	32.50
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	68.59	68.80
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-79.00	-79.00
Main receive signal (dBm)	-42.79	-42.79
Diversity receive signal (dBm)	-42.23	-42.23
Thermal fade margin (dB)	36.77	36.77
Dispersive fade margin (dB)	70.00	70.00
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	36.77	36.77
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	58.63	
Fade occurrence factor (Po)	7.578E-001	
SD improvement factor	71.04	71.04
Worst month multipath availability (%)	99.99978	99.99978
Worst month multipath unavailability (sec)	5.90	5.90
Annual multipath availability (%)	99.99993	99.99993
Annual multipath unavailability (sec)	20.74	20.74
Annual 2 way multipath availability (%)	99.99987	
Annual 2 way multipath unavailability (sec)	41.48	

Multipath fading method - Vigants - Barnett



**300 Water St MLETC**  
 Latitude 33 45 58.90 N  
 Longitude 118 15 19.00 W  
 Azimuth 80.36°  
 Elevation 10 ft ASL  
 Antenna CL 110.0, 70.0 ft AGL

Frequency (MHz) = 6700.0  
 K = 1.33, 0.50  
 %F1 = 100.00, 60.00

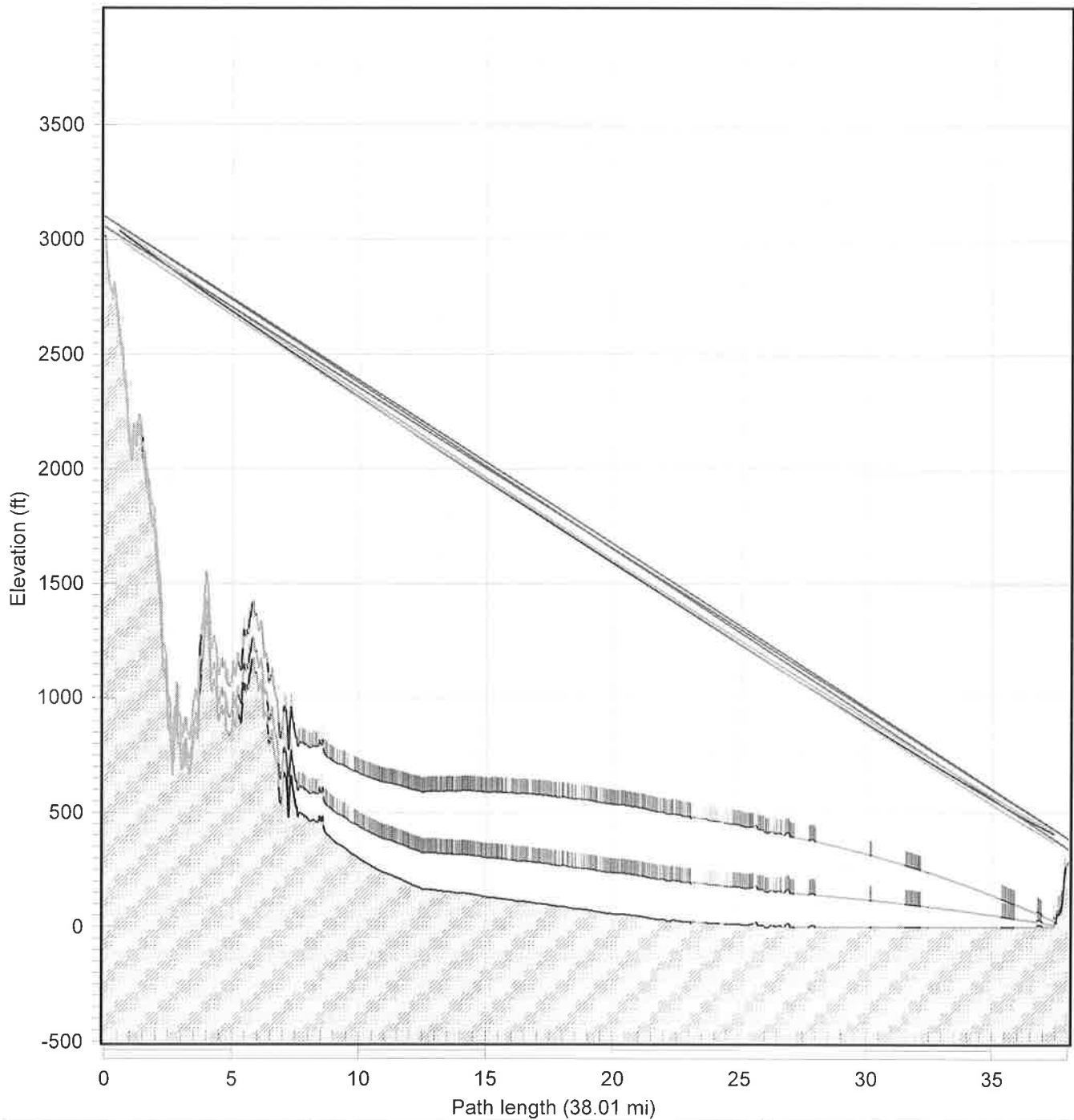
**Sierra Peak**  
 Latitude 33 51 00.03 N  
 Longitude 117 39 16.30 W  
 Azimuth 260.70°  
 Elevation 3021 ft ASL  
 Antenna CL 60.0, 20.0 ft AGL

Transmission details (300 Water St MLETC-Sierra Peak.pl5)

	300 Water St MLETC	Sierra Peak
Latitude	33 45 58.90 N	33 51 00.03 N
Longitude	118 15 19.00 W	117 39 16.30 W
True azimuth (°)	80.36	260.70
Vertical angle (°)	0.73	-1.11
Elevation (ft)	9.84	3021.42
Antenna model	PAD6-65B (TR)	PAD6-65B (TR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	110.00	60.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	150.00	100.00
TX line loss (dB)	2.10	1.40
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.30	1.30
RX filter loss (dB)	2.30	2.30
Antenna model	PAD6-65B (DR)	PAD6-65B (DR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	70.00	20.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	110.00	60.00
TX line loss (dB)	1.54	0.84
Connector loss (dB)	0.20	0.20
RX filter loss (dB)	2.30	2.30
Frequency (MHz)	6700.00	
Polarization	Vertical	
Path length (mi)	35.05	
Free space loss (dB)	144.01	
Atmospheric absorption loss (dB)	0.52	
Main net path loss (dB)	73.63	73.63
Diversity net path loss (dB)	73.07	73.07

	300 Water St MLETC	Sierra Peak
Configuration	NSB-SD Diplexer Main	NSB-SD Diplexer Main
Radio model	WVCE67-L-128F10S-52	WVCE67-L-128F10S-52
TX power (dBm)	32.50	32.50
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	68.10	68.80
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-79.00	-79.00
Main receive signal (dBm)	-41.13	-41.13
Diversity receive signal (dBm)	-40.57	-40.57
Thermal fade margin (dB)	38.43	38.43
Dispersive fade margin (dB)	70.00	70.00
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	38.43	38.43
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	59.78	
Fade occurrence factor (Po)	3.782E-001	
SD improvement factor	131.13	131.13
Worst month multipath availability (%)	99.99996	99.99996
Worst month multipath unavailability (sec)	1.09	1.09
Annual multipath availability (%)	99.99999	99.99999
Annual multipath unavailability (sec)	3.91	3.91
Annual 2 way multipath availability (%)	99.99998	
Annual 2 way multipath unavailability (sec)	7.81	

Multipath fading method - Vigants - Barnett



<b>Sierra Peak</b>	
Latitude	33 51 00.03 N
Longitude	117 39 16.30 W
Azimuth	255.68°
Elevation	3021 ft ASL
Antenna CL	80.0, 35.0 ft AGL

Frequency (MHz) = 6700.0 K = 1.33, 0.50 %F1 = 100.00, 60.00
---

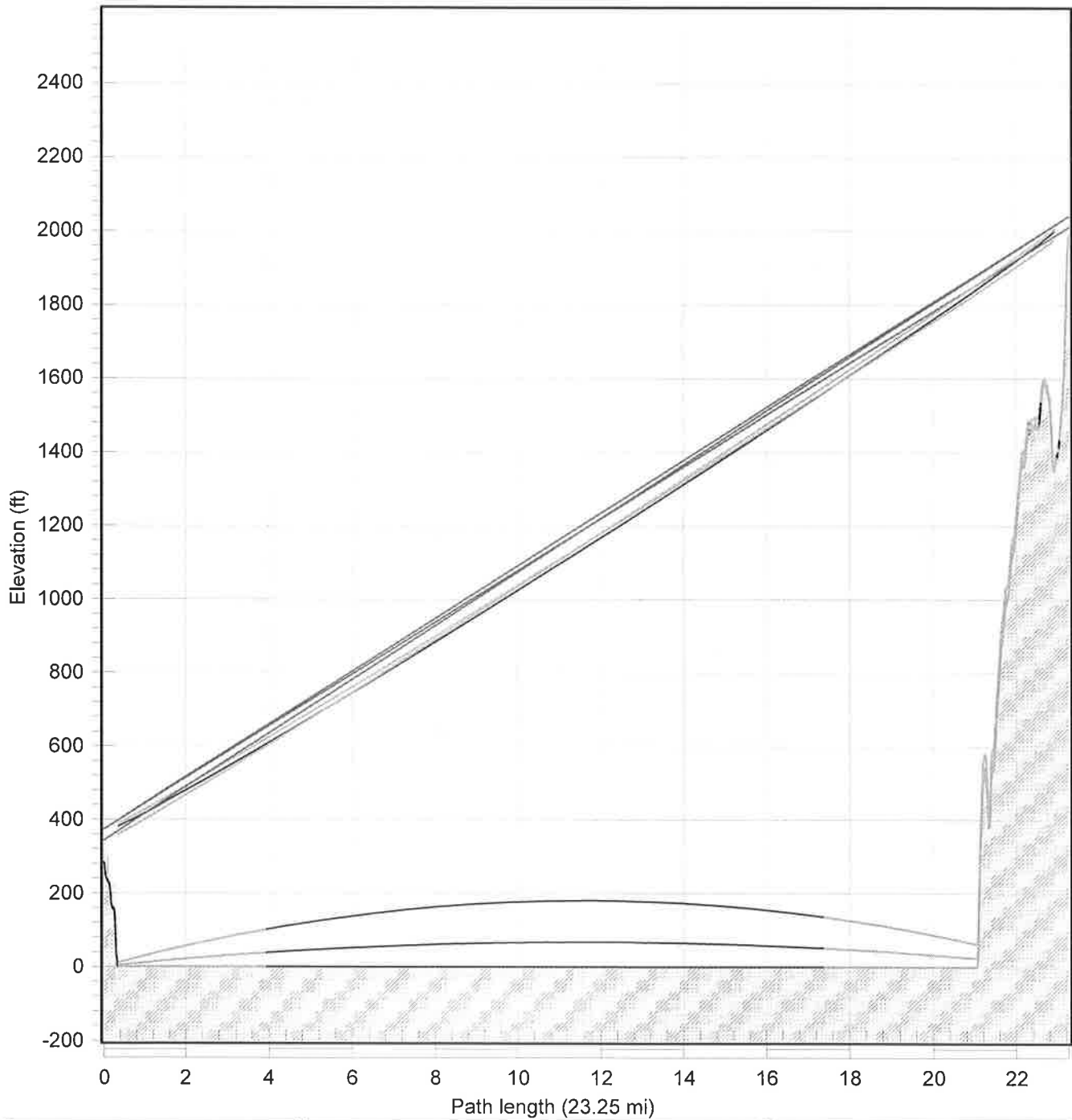
<b>Gaffey Street</b>	
Latitude	33 42 43.10 N
Longitude	118 17 38.10 W
Azimuth	75.33°
Elevation	283 ft ASL
Antenna CL	105.0, 60.0 ft AGL

Transmission details (Sierra Peak-Gaffey Street.pl5)

	Sierra Peak	Gaffey Street
Latitude	33 51 00.03 N	33 42 43.10 N
Longitude	117 39 16.30 W	118 17 38.10 W
True azimuth (°)	255.68	75.33
Vertical angle (°)	-0.98	0.57
Elevation (ft)	3021.42	283.46
Antenna model	PAD6-65B (TR)	PAD6-65B (TR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	80.00	105.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	120.00	145.00
TX line loss (dB)	1.68	2.03
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.30	1.30
RX filter loss (dB)	2.30	2.30
Antenna model	PAD6-65B (DR)	PAD6-65B (DR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	35.00	60.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	75.00	100.00
TX line loss (dB)	1.05	1.40
Connector loss (dB)	0.20	0.20
RX filter loss (dB)	2.30	2.30
Frequency (MHz)	6700.00	
Polarization	Vertical	
Path length (mi)	38.01	
Free space loss (dB)	144.72	
Atmospheric absorption loss (dB)	0.56	
Main net path loss (dB)	74.59	74.59
Diversity net path loss (dB)	73.96	73.96

	Sierra Peak	Gaffey Street
Configuration	NSB-SD Diplexer Main	NSB-SD Diplexer Main
Radio model	WVCE67-L-128F10S-52	WVCE67-L-128F10S-52
TX power (dBm)	32.50	32.50
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	68.52	68.17
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-79.00	-79.00
Main receive signal (dBm)	-42.09	-42.09
Diversity receive signal (dBm)	-41.46	-41.46
Thermal fade margin (dB)	37.54	37.54
Dispersive fade margin (dB)	70.00	70.00
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	37.54	37.54
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	59.93	
Fade occurrence factor (Po)	4.826E-001	
SD improvement factor	122.68	122.68
Worst month multipath availability (%)	99.99993	99.99993
Worst month multipath unavailability (sec)	1.82	1.82
Annual multipath availability (%)	99.99998	99.99998
Annual multipath unavailability (sec)	6.55	6.55
Annual 2 way multipath availability (%)	99.99996	
Annual 2 way multipath unavailability (sec)	13.11	

Multipath fading method - Vigants - Barnett



Gaffey Street	
Latitude	33 42 43.10 N
Longitude	118 17 38.10 W
Azimuth	195.43°
Elevation	283 ft ASL
Antenna CL	90.0, 60.0 ft AGL

Frequency (MHz)	= 6700.0
K	= 1.33, 0.50
%F1	= 100.00, 60.00

Black Jack Mtn	
Latitude	33 23 12.10 N
Longitude	118 24 03.20 W
Azimuth	15.37°
Elevation	1992 ft ASL
Antenna CL	50.0, 20.0 ft AGL

Transmission details (Gaffey Street-Black Jack Mtn.pl5)

	Gaffey Street	Black Jack Mtn
Latitude	33 42 43.10 N	33 23 12.10 N
Longitude	118 17 38.10 W	118 24 03.20 W
True azimuth (°)	195.43	15.37
Vertical angle (°)	0.65	-0.90
Elevation (ft)	283.46	1991.67
Antenna model	PAD6-65B (TR)	PAD6-65B (TR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	90.00	50.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	130.00	90.00
TX line loss (dB)	1.82	1.26
Connector loss (dB)	0.20	0.20
TX filter loss (dB)	1.90	1.90
RX filter loss (dB)	2.30	2.30
Antenna model	PAD6-65B (DR)	PAD6-65B (DR)
Antenna gain (dBi)	39.60	39.60
Antenna height (ft)	60.00	20.00
TX line model	E-65	E-65
TX line unit loss (dB/100 ft)	1.40	1.40
TX line length (ft)	100.00	60.00
TX line loss (dB)	1.40	0.84
Connector loss (dB)	0.20	0.20
RX filter loss (dB)	2.30	2.30
Frequency (MHz)	6700.00	
Polarization	Vertical	
Path length (mi)	23.26	
Free space loss (dB)	140.45	
Atmospheric absorption loss (dB)	0.34	
Main net path loss (dB)	70.07	70.07
Diversity net path loss (dB)	69.65	69.65

	Gaffey Street	Black Jack Mtn
Configuration	HSB-SD Diplexer Main	HSB-SD Diplexer Main
Radio model	WVCE67-L-128F10S-52	WVCE67-L-128F10S-52
TX power (dBm)	32.50	32.50
Emission designator	10M00D7W	10M00D7W
EIRP (dBm)	67.78	68.34
RX threshold criteria	1E-6 BER	1E-6 BER
RX threshold level (dBm)	-79.00	-79.00
Main receive signal (dBm)	-37.57	-37.57
Diversity receive signal (dBm)	-37.15	-37.15
Thermal fade margin (dB)	41.85	41.85
Dispersive fade margin (dB)	70.00	70.00
Dispersive fade occurrence factor	1.00	
Effective fade margin (dB)	41.84	41.84
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	61.55	
Fade occurrence factor (Po)	1.105E-001	
SD improvement factor	200.00	200.00
Worst month multipath availability (%)	100.00000	100.00000
Worst month multipath unavailability (sec)	0.10	0.10
Annual multipath availability (%)	100.00000	100.00000
Annual multipath unavailability (sec)	0.35	0.35
Annual 2 way multipath availability (%)	100.00000	
Annual 2 way multipath unavailability (sec)	0.70	

Multipath fading method - Vigants - Barnett

## 2.25 MPLS ROUTERS & NETWORK DESIGN

### System Description

The Backhaul Network will be an MPLS WAN Backhaul Network using Juniper network elements. The Juniper router family of products will be used to connect the microwave to Motorola Radio Gateways using ASTRO Ethernet Site Links (ESL). The Juniper routers will use MPLS in order to route traffic and maintain redundant links to all sites in the network. A backhaul IP plan, VLAN plan and routing/switching plan will be developed for the backhaul network. These plans are separate from the ASTRO RNI IP plan. A backhaul port layout plan will be developed for the backhaul network. The Juniper network equipment will be installed within the ASTRO equipment racks.

Multiprotocol Label Switching (MPLS) is a method for engineering traffic patterns by assigning short labels to network packets that describe how to forward them through the network. MPLS is independent of routing tables or any routing protocol and can be used for unicast packets. Traffic is engineered (controlled) primarily by the use of signaling protocols to establish label-switched paths (LSPs). The backhaul network will use MPLS to maintain and route traffic over the network architecture. In the event of a site link failure, the routers will reroute the traffic over the redundant links if available to maintain connectivity to all ASTRO radio sites. The traffic rerouting occurs in a small amount of time, so no interruption of service should be experienced.

From a high level, the backhaul network design consists of the Ethernet network, and will use Ethernet Site Links and IP-IP tunnels across the Flexible WAN Backhaul. ASTRO P25 does have specific network requirements and robust protocols should be used to help achieve meeting these network requirements. Spanning Tree Protocol should not be used. The use of the IP-IP tunnels reduces need for dynamic routing protocol interactions outside of the ASTRO P25 solution. QoS must be used to support ASTRO P25 traffic requirements.

Some of the benefits for using Ethernet Site Links (ESL) feature are:

- Ability to use a higher bandwidth to transport ASTRO P25 system traffic
- Ability to have a shared backhaul to transport ASTRO P25 radio communication system traffic with other network traffic from other potential public safety solutions. This has potential cost savings to public safety customers as contrast to having dedicated T1 circuits for all network links. QoS is a very important design consideration when more than just ASTRO P25 traffic will be on the backhaul carrying ESL.

Designing a backhaul network that meets ASTRO P25 requirements is not a trivial task and has higher requirements than typical Ethernet Enterprise style networks. Not having a suitable design and meeting requirements of ASTRO P25 will incur potential system impacts. To reduce potential system impacts, Backhaul Network designs need to address the following areas: Ethernet Link quality, Latency, Jitter and Packet Loss. Fault tolerance and backup network paths that converge quickly enough are also a concern to be addressed. All links must be designed correctly to transport different types of site link traffic and handle dual-site link configurations. There must be a correctly designed QoS plan. Using Motorola's DSR (for backup MASTER) feature adds to the complexity of these requirements. These impacts will result in system access time than can affect voice access time, speech truncation and Audio throughput delay. There can also be data service performance issues with reductions in throughput. Contact your Motorola representative for more details in regard to impact, requirements and constraints for designing a backhaul network. This will lead to the best design and deployment practices for a successful ASTRO P25 solution as per System Releases of 7.11 or better. It is highly recommended that someone has experience with designing and deploying backbone networks that transport ASTRO P25 traffic.

In your design, Motorola's NSE (Network Solutions Engineering team) will be used for the implementation. Motorola's NSE team can handle collaboration with custom network design and deployment to tailor backhaul designs towards specific customer needs. NSE will use their backhaul network best practices in the backhaul design. There are many best practices learned from designing ESL solutions for ASTRO P25, going through CCSi testing and field integrations. NSE will document the ESL BH solution to assist with those that will provide future support. There are many ASTRO P25 requirements and NSE Backhaul Network best practices around custom BH design that address these areas: IP plan, VLAN plan, System Port plan, QoS plan, Route plan, SNMP plan and troubleshooting practices. Inside the ASTRO P25 RNI all of this planning is accounted for and needs to be addressed on the backhaul. Contact your Motorola representative for more details about these services and other network backhaul lifecycle services than NSE can provide.

From a high-level look at our design there are a few areas or demarks to identify:

- **BHWANzone** – this is a network zone that provides site to site connectivity across the backhaul network. ASTRO P25 uses this zone to connect ASTRO sites together.
- **BHNMSzone** - this is network zone that provides secure management of the BH
- **RNI** – This is the inside Radio network that ASTRO operates on
- **CEN** - Customer Network Enterprise zone that carries customer network traffic
- **CNI** - Customer Network Interface is the area that non ASTRO traffic interfaces with ASTRO

The Juniper MX-104 and ACX-1100 have been selected for the Port of Los Angeles Backhaul. A MX-104 router is used at all ring locations. An ACX-110 is used at spur remote locations. These BH Nodes link the backhaul network to ASTRO radio gateways (GGM).

### **BHWANzone - Backhaul Nodes - Juniper Routers**

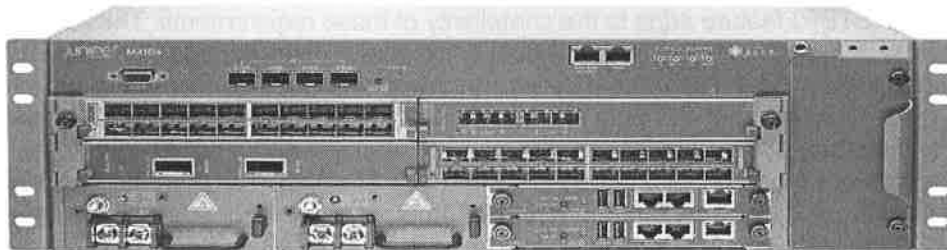
The Juniper MX and ACX Series Services Gateways are high-performance security, routing, and switching, solutions based on Dynamic Services Architecture that provides high port-density, advanced security, and flexible connectivity, in a single, easily managed platform. Consolidated routing, WAN connectivity, switching, and Unified Threat Management (UTM), simplifies deployment and administration, and deliver fast and consistent service quality regardless of user location.

Juniper routers create fast, secure, highly-available, branch networks at enterprise installations. A variety of MX and ACX Series products and options support a wide range of performance, functionality, security, and budget, requirements for networks of up to thousands of users.

Routing protocols include BGP, OSPF, RIP, IPv4, IPv6, MPLS, VPLS, extensive NAT, QoS, performance and SLA monitoring, and flow management.

MX and ACX Series Service Gateways are Junos based and include management tools that simplify deployment, reduce training costs, and promote ease of use.

### **Juniper MX-104**



The SDN-ready MX104 3D Universal Edge Router is a modular, highly redundant, and full-featured MX Series platform built for space- and power-constrained service provider and enterprise facilities.

The MX104 offers 160 Gbps of capacity, a redundant control plane for high availability, as well as four fixed 10GbE ports and four Modular Interface Card (MIC) slots for flexible network connectivity and virtualized network services. Optimized for mobile applications and central office deployments, the MX104 is also ETSI 300 compliant, environmentally hardened for deployment in outside cabinets and remote terminals, and supports advanced timing features.

Powered by Junos OS and the programmable Trio chipset, the MX104 shares the same advanced routing, switching, security, and service features that are available in large MX Series platforms, including support for a wide range of L2/L3 VPN services and advanced broadband network gateway functions.

Deployed in mission-critical service providers and enterprise networks worldwide, the MX104 helps network operators transform their networks—and their businesses—to thrive in our hyper-connected world. It is equipped with a user-configurable Modular Interface Card (MIC) slot for flexible network connectivity and an additional MIC slot in the rear to support a multiservice card for virtualized network services such as Carrier Grade NAT (CGNAT), stateful firewall, and IPsec.

### **BHNMSzone**

The Backhaul Network Management Zone starts with a Fortinet UTM devices that provide secure access to the BH. From within this BHNMSzone will be Juniper EX2200 switches providing layer 2 functions for secure management access into the BHWANzone. From these switches management functions like NSM using SNMP are handled. The BHNMSzone is the recommended location for additional overall management functions to be deployed from. This is not the zone where ASTRO specific management tools are based.

**Fortinet UTM/Firewalls** assist to help create the BHNMSzone, a Fortinet Firewall will be used to secure this zone. Not only does this create a secure zone to protect management resources, but also provides the ability for secure VPN/SSL remote access to assist in remote troubleshooting and network management. Motorola has extensive experience with using this element.

### **FortiGate-60D Network Security Appliance Features & Benefits:**

- Delivers market-leading 1 Gbps firewall throughput with 2 GbE WAN and 7 GbE switched LAN interfaces
- Rich feature set to protect next generation with application control, built-in wireless controller, local logging, and endpoint policy enforcement
- IPv4 & IPv6-ready platform with strong authentication options for secure network access and security policy compliance

A “single pane of glass” management console makes it easy for you to deploy and manage Fortinet has next generation security devices and virtual appliances are purpose-built to provide essential security services that are certified for government networks. They enable rapid deployment of essential security technologies, and the flexibility to scale with your growing public sector network. Multiple certifications, including Federal NIST, ensure compliance with government standards such as Federal NIAP Certification Support and Common Criteria EAL4+. The U.S. Department of Defense (DoD) Joint Interoperability Test Command (JITC)

certified FortiGate appliances for IPv6 support, and are listed on the DoD's Unified Capabilities Approved Products List (UC APL).

## 2.26 BI-DIRECTIONAL AMPLIFIERS (BDA) UPGRADES

Motorola has included two BDA's in this proposal to ensure the proposed 700MHz system provides adequate coverage to the Harbor Administration Building and the Port Police Headquarters Building. BDA's backroom equipment will be installed at each facility and RF distribution will be installed in each area throughout the building, as necessary.

The proposed solution and provided pricing assume easily accessible installation locations (e.g. drop ceilings, conduits between rooms, etc.)

LOCATION	SQUARE FOOTAGE	FLOORS
Port Police Headquarters – 700 MHz	192,000	B1, B2, B3, 1, 2, 3
Harbor Administration Building – 700 MHz	165,000	1, 2, 3, 4, 5

### 2.26.1 BDA Coverage Requirement:

-95 dBm coverage over 95% of the facilities.

### 2.26.2 Location Photos

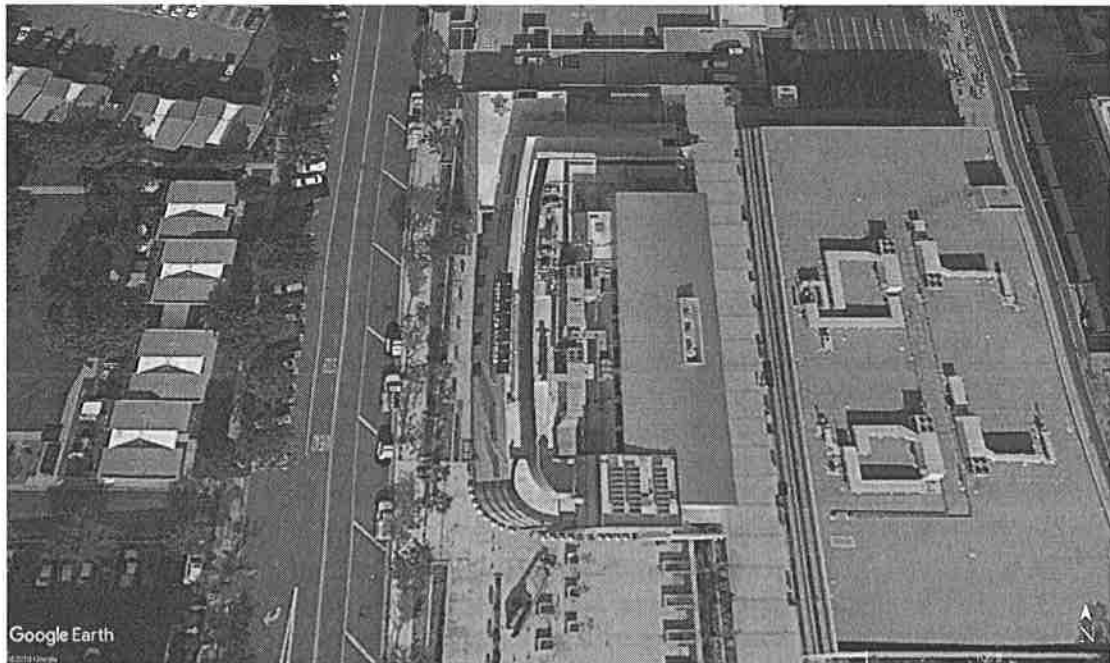


Figure 2-21: Port PD Headquarters

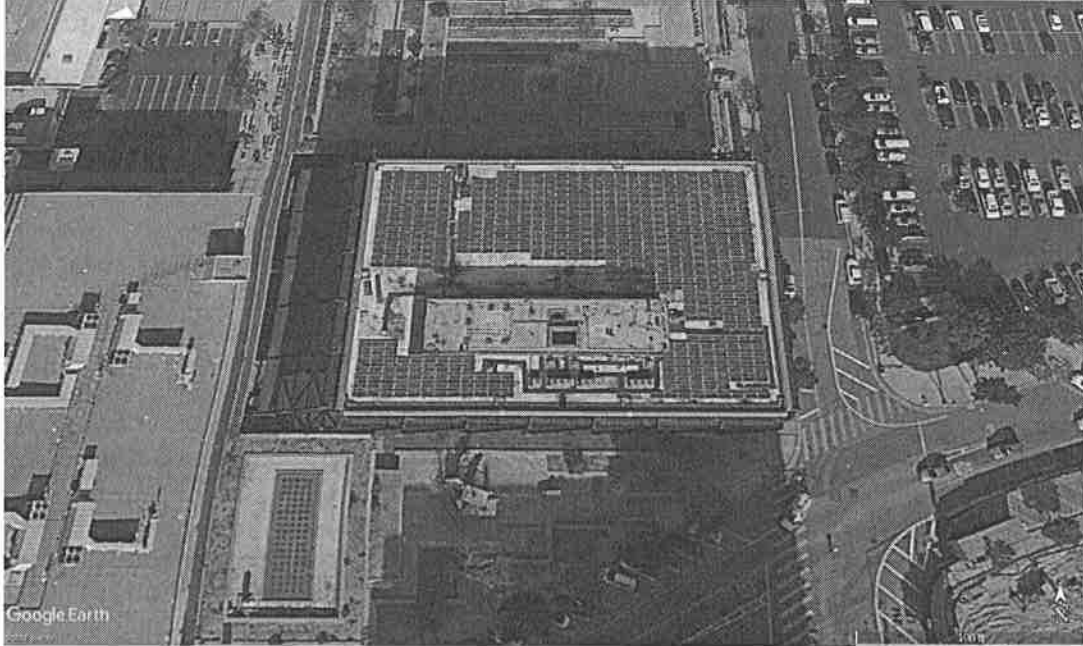


Figure 2-22: Harbor Administration Building

## 2.27 APX PORTABLE & MOBILE UPGRADES & PROGRAMMING.

To support the advanced features included in the proposed system upgrade Motorola has included the following feature upgrades to the ports existing APX radio fleet.

Quantity	Feature
320	ADD: ENHANCED DATA
320	ADD: GROUP SERVICES FLP

As part of the new system deployment Motorola has included a single-touch programming effort into the proposal. Existing APX Portable and Mobile implemented by the Port of LA will be reprogrammed to operate on the newly implemented sub-systems and will include an update to the latest firmware.

## 2.28 DESIGN ASSUMPTIONS

Motorola has based the system design on information provided by the Port and an analysis of their system requirements. All assumptions have been listed below for review. The Pricing provided is based upon these following assumptions. Modifications to these assumptions, equipment list, or scope of the project after contract will require a change order.

- All work by the Motorola team is to be performed during normal work hours, Monday through Friday 7:30 a.m. to 5:00 p.m. Modification to these times, either overall or on a case by case basis, is possible with agreement between both Motorola and the Port of LA.
  - Exceptions can be made as needed to ensure minimal impact to Port of LA operations.
- Motorola is not responsible for interference caused or received by the Motorola provided equipment except for interference that is directly caused by the Motorola-provided transmitter(s) to the Motorola-provided receiver(s). Should the Cities system experience interference, Motorola can be contracted to investigate the source and recommend solutions to mitigate the issue.
- All of sites in the proposal have sufficient space available for the system described.
  - This includes available spaces for proposed cabinets, cables, and cable entry ports.
- All existing towers at the proposed site locations have enough space to accommodate the new RF equipment. Any tower upgrades are the responsibility of the Port.
  - Motorola will work with the Port to temporarily mount new antennas in the event tower space is limited.
- All existing sites and equipment locations will have adequate electrical power and site grounding suitable to support the requirements of the system described.
- Any site/location upgrades or modifications to the existing sites are the responsibility of the Port.
- The Port is responsible for identifying and licensing all radio system frequencies.
  - Identifying includes providing a list of licensable, available, and viable 7/800MHz frequencies for analysis by Motorola to determine most optimal simulcast cell for implementation.
- Any necessary FCC licensing will be provided by the Port. Motorola Solutions will assist the Port of LA in preparing the required documentation to submit to the FCC and Regional Planning Committee.
- The Port will obtain any local, state, or federal permits required for the installation and operation of the proposed equipment.
- All Ethernet, microwave, and other necessary site connectivity will be provided by the Port. This excludes the MPLS routers configured previously by Motorola in Phase 1B.
- All civil site work at the proposed sites is the responsibility of the Port.
- Other than then APX subscriber's upgrades included here, no portable subscribers, mobile subscribers, or consolettes have been included in this proposal.

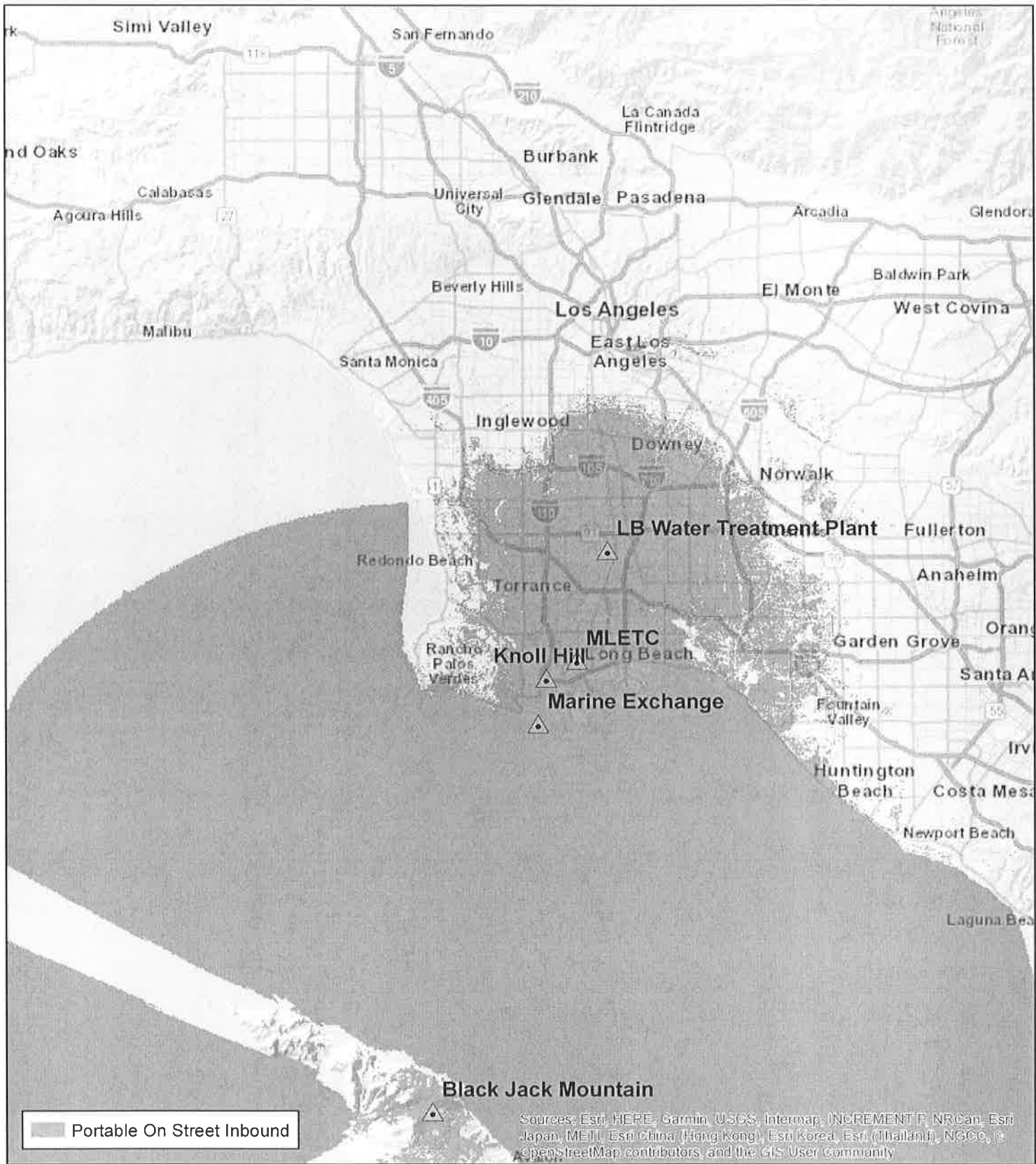
## 2.29 7/800 MHZ COVERAGE MAPS



# POLA, CA

For Information Only

5-Site ASTRO P25 700MHz TDMA 1-Cell Simulcast System  
 Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4



0 4.25 8.5 Miles

1 in = 7 miles

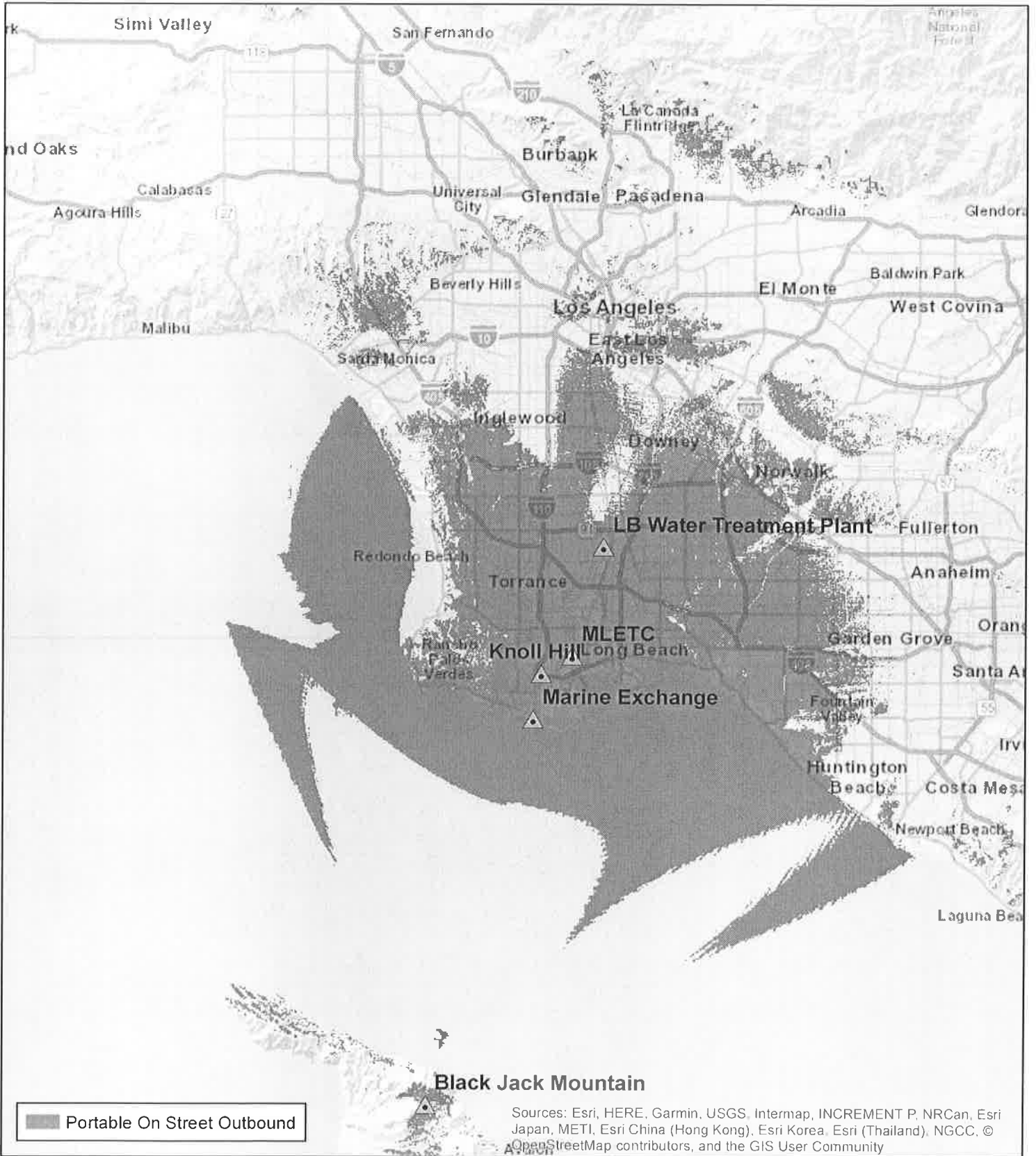
Oct 04, 2019  
 Hydra Stratus 2.6.7

**Portable Configuration**  
 APX 8000, 2.5W, Dual band antenna  
 Tx/Rx at hip (3.3') in swivel case and RSM

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

CA\_Port\_of\_Los\_Angeles  
 CA\_Port\_of\_LA  
 Design 52  
 TBXG34, CCDTLAB-800

5-Site ASTRO P25 700MHz TDMA 1-Cell Simulcast System  
Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4



0 4.25 8.5 Miles

1 in = 7 miles

**Portable Configuration**  
APX 8000, 2.5W, Dual band antenna  
Tx/Rx at hip (3.3') in swivel case and RSM

CA\_Port\_of\_Los\_Angeles  
CA\_Port\_of\_LA  
Design 52  
TBXG34, CCDTLAB-800

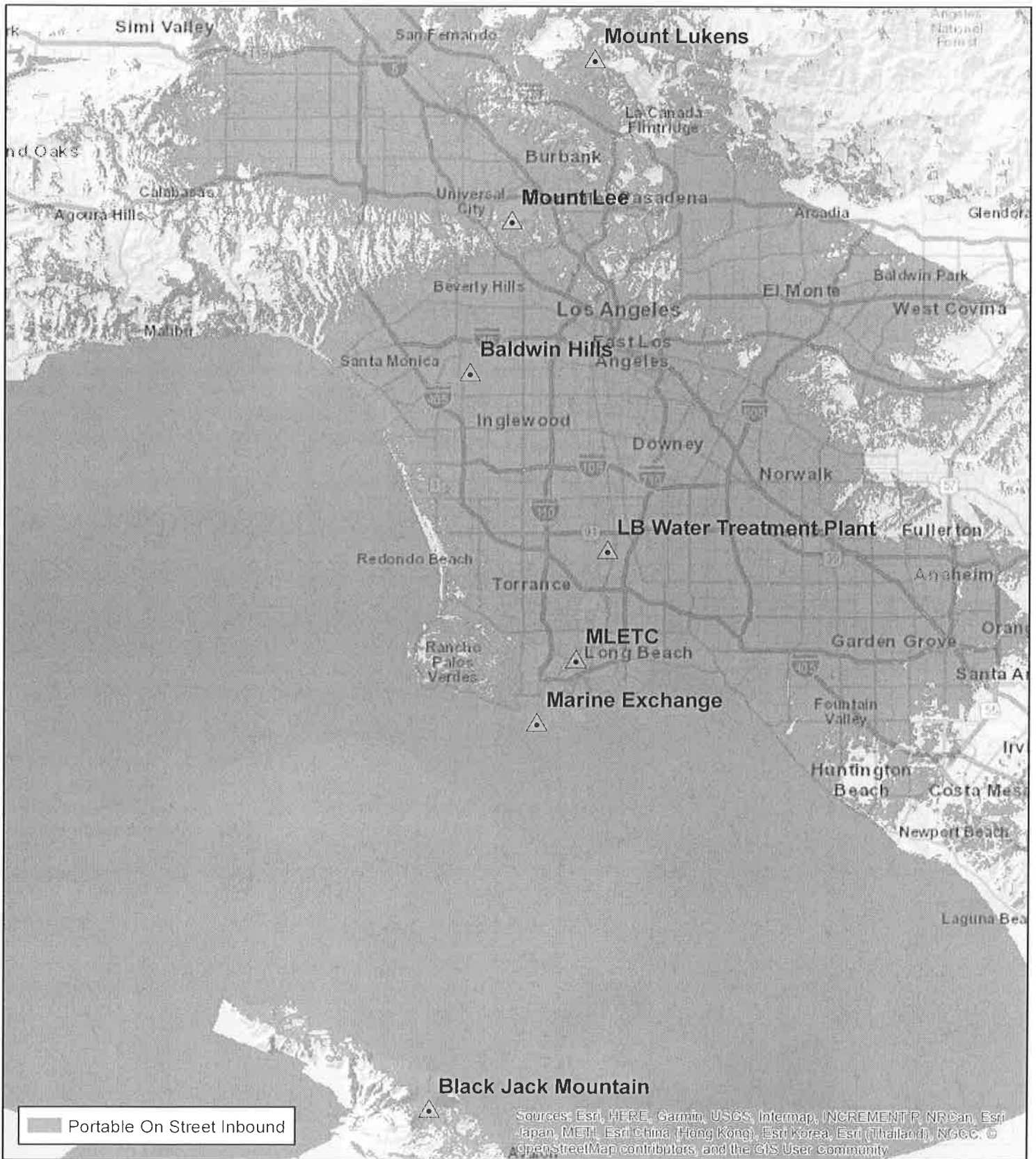
## 2.30 UHF CITY-WIDE OVERLAY COVERAGE MAPS



# POLA, CA

For Information Only

7-Site ASTRO P25 UHF LSM 1-Cell Simulcast System  
Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4



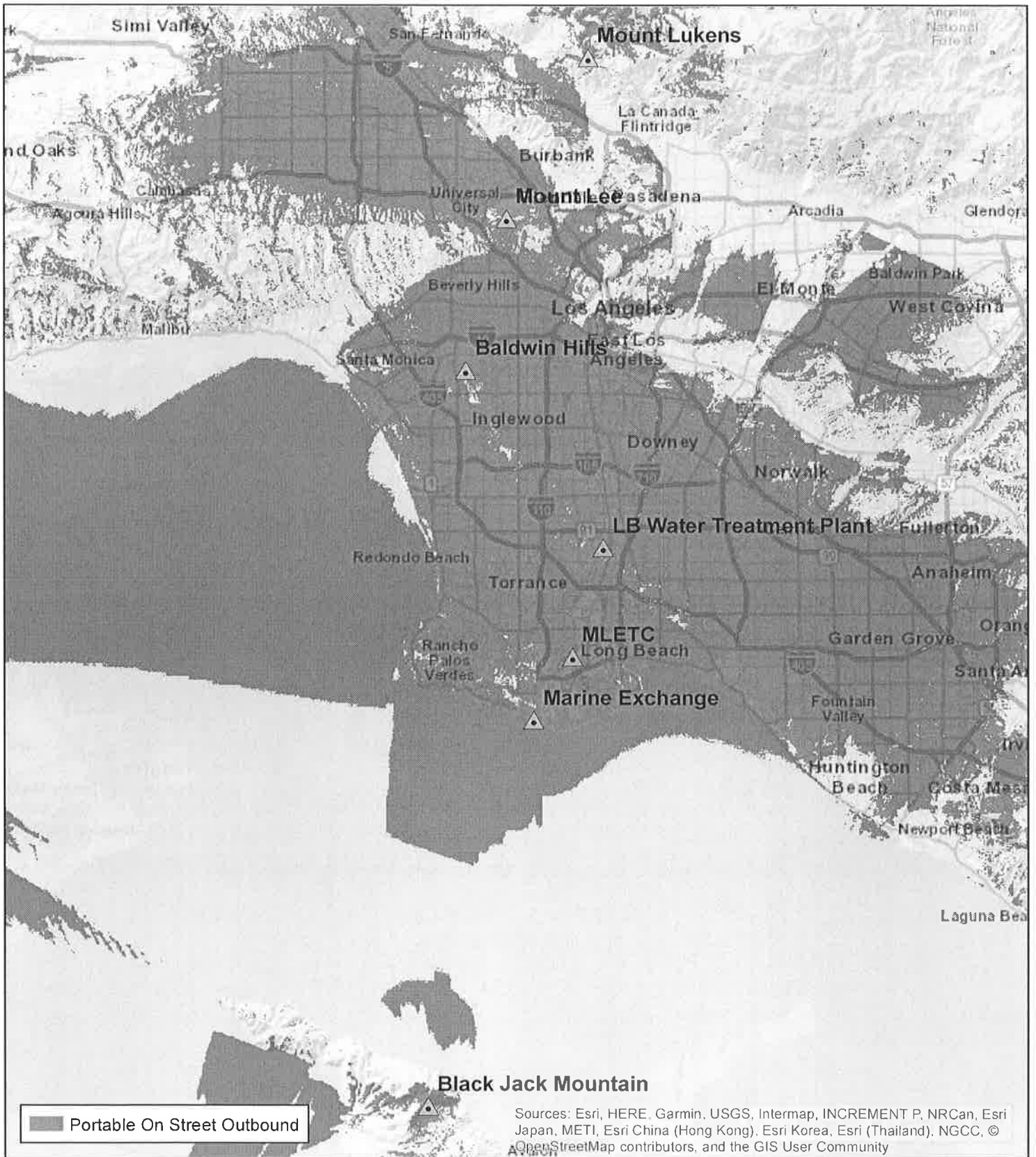
0 4.25 8.5 Miles

1 in = 7 miles

Portable Configuration  
APX 8000, 5W, Standard wideband  
Tx/Rx at hip (3.3') in swivel case and RSM

CA\_Port\_of\_Los\_Angeles  
CA\_Port\_of\_LA\_UHF\_digital  
Design 57  
TBXG34, CCDTLAB-800

7-Site ASTRO P25 UHF LSM 1-Cell Simulcast System  
Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4



0 4.25 8.5 Miles

1 in = 7 miles

**Portable Configuration**  
APX 8000, 5W, Standard wideband  
Tx/Rx at hip (3.3') in swivel case and RSM

CA\_Port\_of\_Los\_Angeles  
CA\_Port\_of\_LA\_UHF\_digital  
Design 57  
TBXG34, CCDTLAB-800

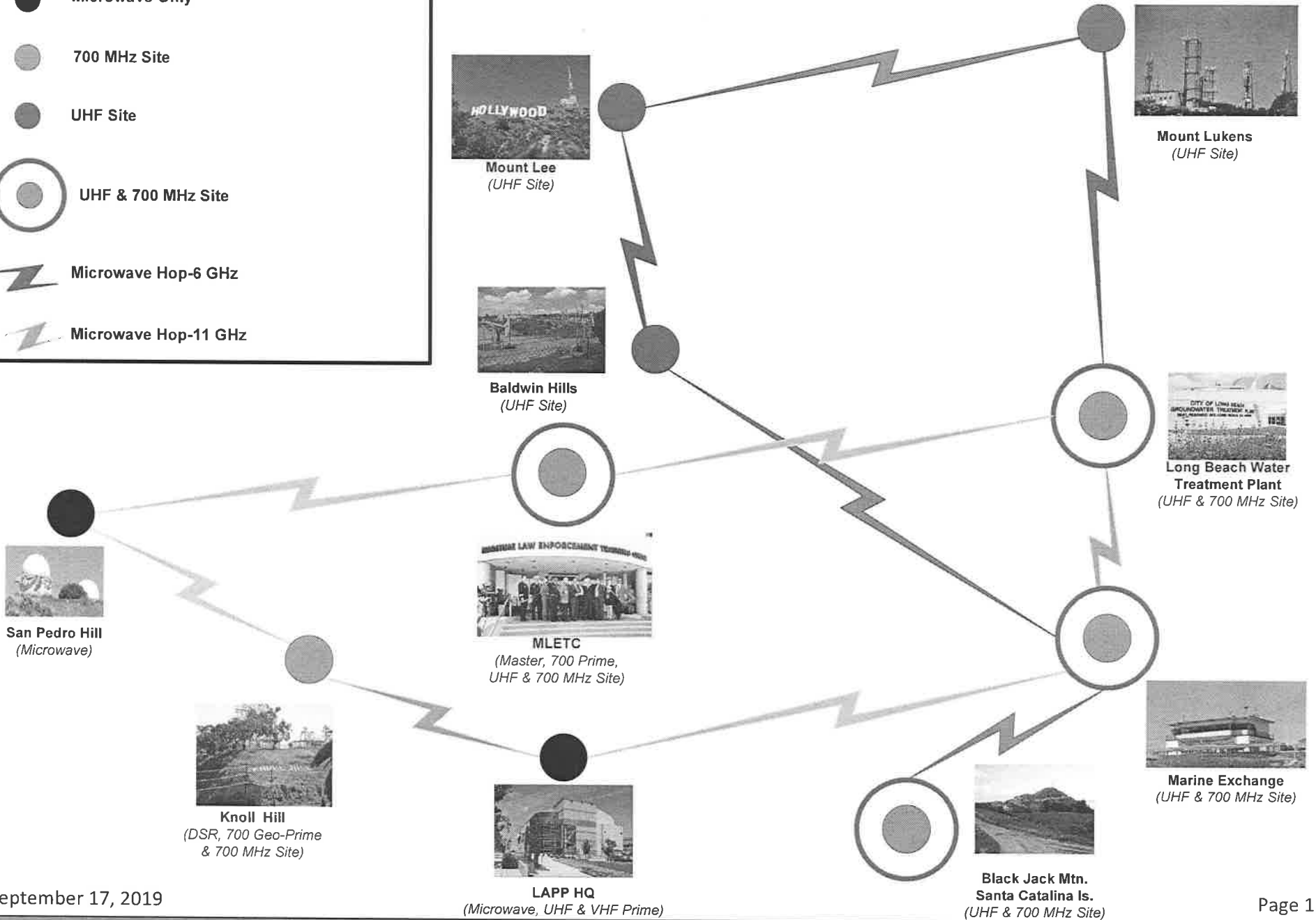
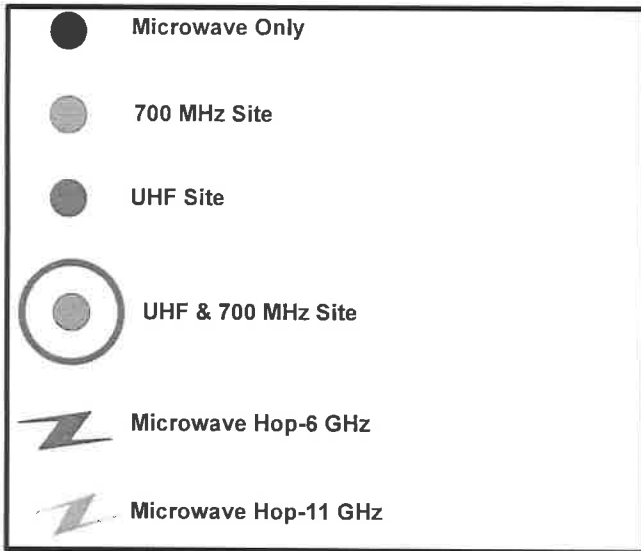
## 2.31 CATP COVERAGE & GRID MAPS

Note: The CATP Coverage Grid Maps will be completed and provided during the post-contract Design Review period.

## 2.32 SYSTEM BLOCK DIAGRAMS

# Los Angeles Port Police Radio Network

Proposed



## 2.33 RACK FACE DIAGRAMS

300 Centre St. (PD HQ)

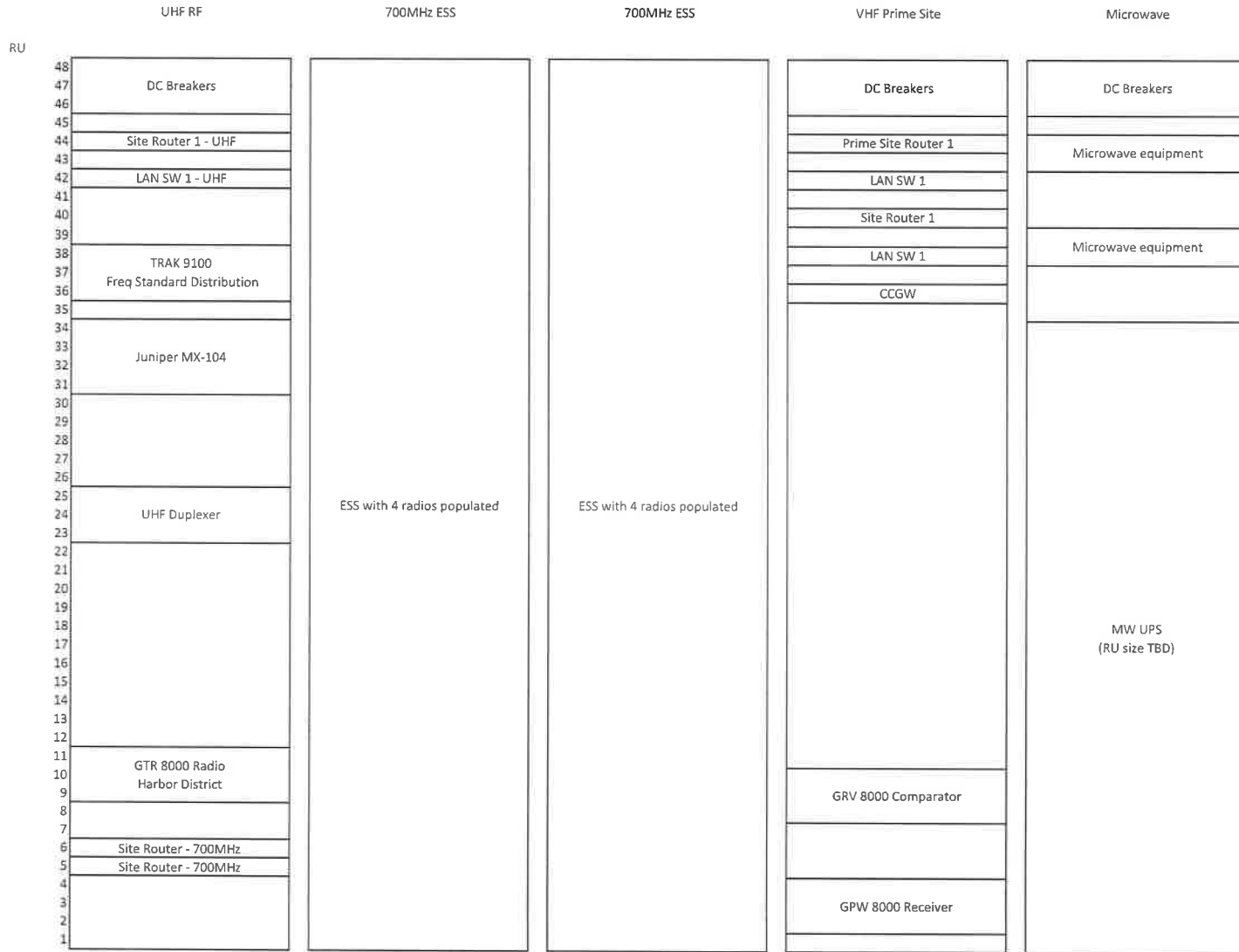
RU	M1 Core	700MHz Prime	VHF Rx Site	Microwave
48				
47	DC Breakers	DC Breakers	DC Breakers	DC Breakers
46				
45				
44	Juniper MX-104	Prime Site Router 1	Site Router 1	Microwave equipment
43		Access Router 1		
42		Access Router 2		
41		LAN SW		
40		Backhaul SW		
39	Terminal Server			
38				
37	TRAK 8835	TRAK 9100 Freq Standard Distribution		Microwave equipment
36				
35	KMF			
34		Site Router - 700MHz		
33		Site Router - 700MHz		
32				
31				
30				
29	ZCP Firewall			
28	LAN Switch			
27	LAN Switch			
26				
25	GGSN Gateway			
24	Border Gateway			
23	CEN Switch			
22	RNI/DMZ Firewall			
21				
20	Exit Router			
19	Backhaul SW			
18	Gateway Router 1			
17	Core LAN Switch			
16	Core LAN Switch	GCP 8000 Site Controller		
15	Core Router 1			
14	Core Router 2			
13				
12		GCM 8000 Comparator		
11	Firewall			
10	ISGW	GCM 8000 Comparator		
9				
8		GCM 8000 Comparator		
7	DAS			
6		GCM 8000 Comparator		
5	VMS			
4				
3	VMS	GCM 8000 Comparator	GPW 8000 Receiver	
2				
1	open space			MW UPS (RU size TBD)

Knoll Hill

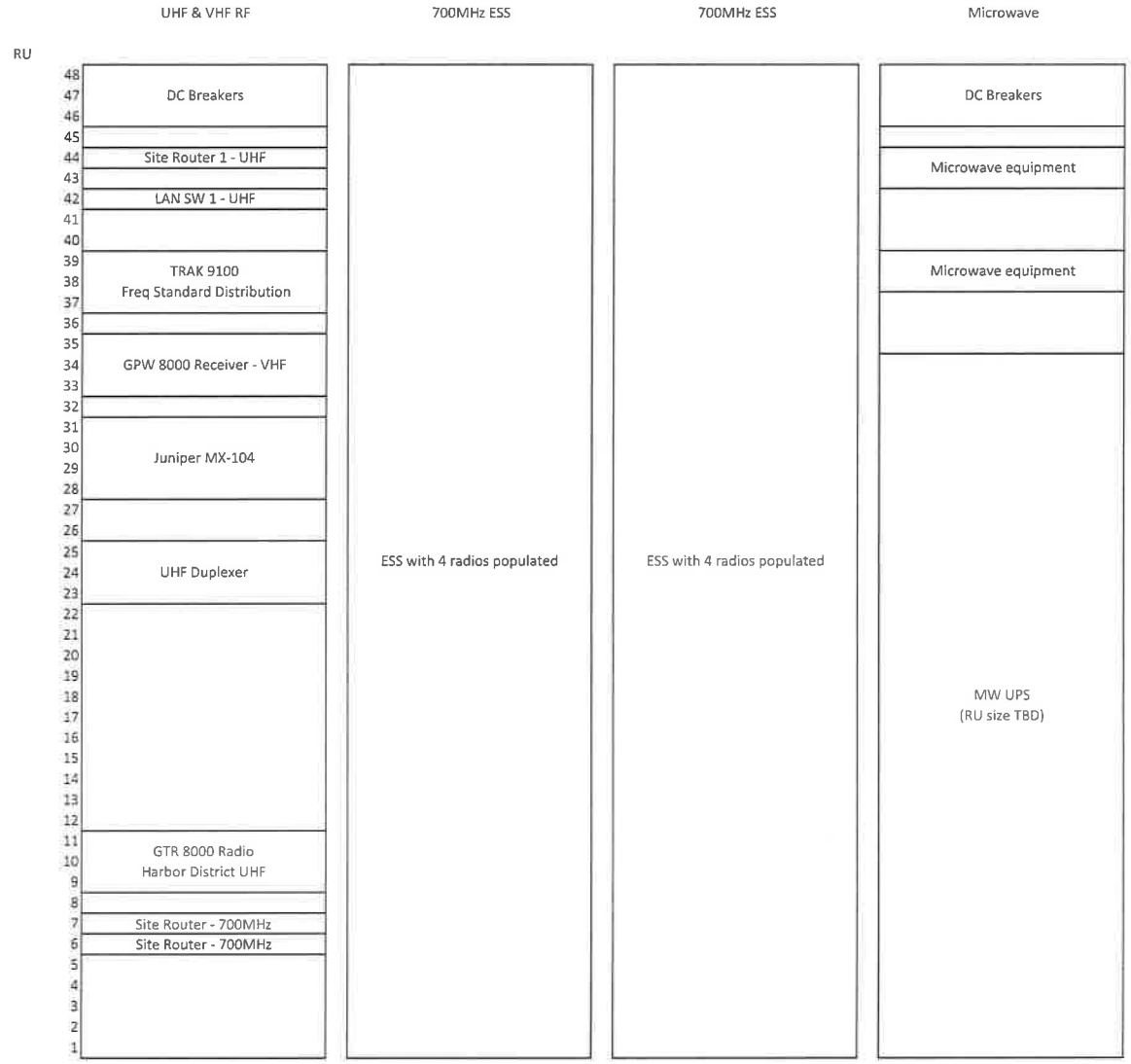
RU

	M1 Core	700MHz Prime	UHF Prime & RF	700MHz ESS	700MHz ESS	Microwave
48						
47	DC Breakers	DC Breakers	DC Breakers			DC Breakers
46						
45						
44	Terminal Server	Prime Site Router 1	UHF Harbor Prime Site Router			
43		Access Router 1	LAN SW			Microwave equipment
42	DMZ LAN Switch	Access Router 2				
41	Border Gateway	LAN SW	UHF CW Prime Site Router			
40	Core Backhaul Switch	Backhaul SW	LAN SW			
39						
38		TRAK 9100	UHF Harbor Site Router			Microwave equipment
37	Intersystem Firewall	Freq Standard Distribution	LAN SW			
36	RNI/DMZ Firewall					
35	GGSN					
34	reserved cable routing	Site Router - 700MHz	TRAK 9100			
33	TRAK 8835	Site Router - 700MHz	Freq Standard Distribution			
32	CEN Switch					
31						
30						
29	reserved cable routing					
28						
27	Juniper MX-104					
26						
25						
24			UHF Duplexer			
23	reserved cable routing					
22	hold for 2nd Edge Router					
21	Core/Exit Router & Firewall					
20	reserved cable routing					
19	Core LAN Switch	GCP 8000 Site Controller				
18	Core LAN Switch					
17	Extender Panel					
16	reserved cable routing	GCP 8000 Site Controller				
15						
14						
13	DAS					
12	VMS	GCM 8000 Comparator				
11						
10	VMS	GCM 8000 Comparator	GTR 8000 Radio Harbor District			
9						
8						
7	Enablement Server					
6	KMF	GCM 8000 Comparator	GRV 8000 Comparator Citywide			
5						
4		GCM 8000 Comparator	GRV 8000 Comparator Harbor District			
3						
2						
1						
				ESS with 4 radios populated	ESS with 4 radios populated	MW UPS

300 Water Street (MLETC)



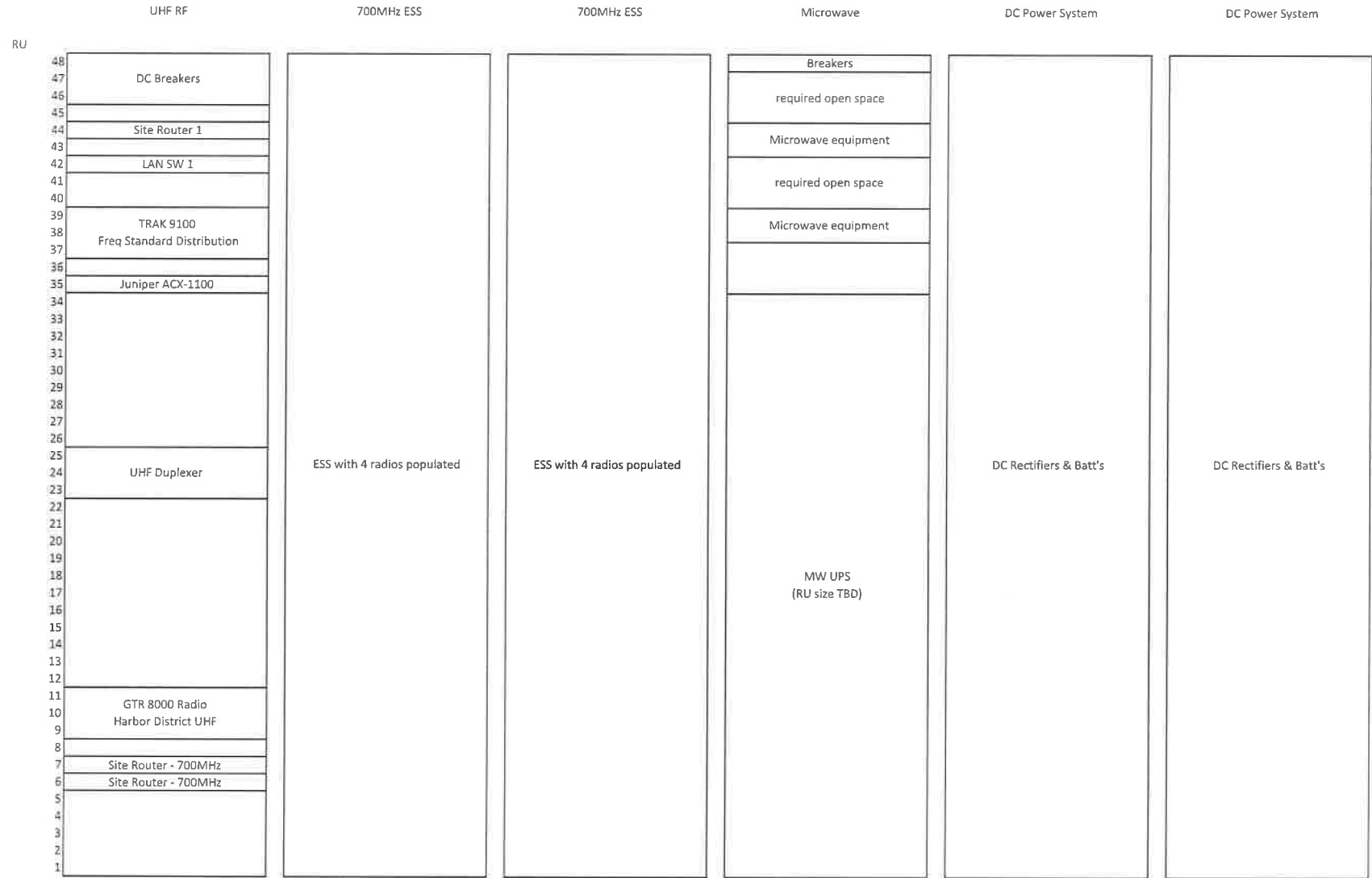
**Gaffey Street (Marine Exchange)**



San Pedro Hill

RU	UHF RF	700MHz ESS	700MHz ESS	Microwave		
48	DC Breakers	ESS with 4 radios populated	ESS with 4 radios populated	DC Breakers		
47						
46						
45						
44	Site Router 1 - UHF				Microwave equipment	
43						
42	LAN SW 1 - UHF					
41						
40						
39	TRAK 9100 Freq Standard Distribution				Microwave equipment	
38						
37						
36						
35	Juniper MX-104				MW UPS (RU size TBD)	
34						
33						
32						
31						
30						
29						
28						
27						
26						
25	UHF Duplexer					
24						
23						
22						
21						
20						
19						
18						
17						
16						
15						
14						
13						
12						
11	GTR 8000 Radio Harbor District UHF					
10						
9						
8						
7	Site Router - 700MHz					
6	Site Router - 700MHz					
5						
4						
3						
2						
1						

Catalina Island (Black Jack Mountain)



**Mt. Lukens**

	UHF RF	Microwave
48		Breakers
47	DC Breakers	
46		
45		
44	Site Router 1	Microwave equipment
43		
42	LAN SW 1	
41		
40		
39	TRAK 9100	Microwave equipment
38	Freq Standard Distribution	
37		
36		
35		
34	Juniper MX-104	
33		
32		
31		
30		
29		
28		
27		
26		
25	UHF Duplexer	
24		
23		
22		
21		
20		
19		
18		MW UPS (RU size TBD)
17		
16		
15		
14		
13		
12		
11	GTR 8000 Radio	
10	Citywide UHF	
9		
8		
7		
6		
5		
4		
3		
2		
1		

**Saddle Peak**

	UHF RF	Microwave
48		Breakers
47	DC Breakers	
46		
45		
44	Site Router 1	Microwave equipment
43		
42	LAN SW 1	
41		
40		
39	TRAK 9100	Microwave equipment
38	Freq Standard Distribution	
37		
36		
35		
34	Juniper MX-104	
33		
32		
31		
30		
29		
28		
27		
26		
25		
24	UHF Duplexer	
23		
22		
21		
20		
19		
18		MW UPS
17		(RU size TBD)
16		
15		
14		
13		
12		
11	GTR 8000 Radio	
10	Citywide UHF	
9		
8		
7		
6		
5		
4		
3		
2		
1		

Sierra Peak

Microwave

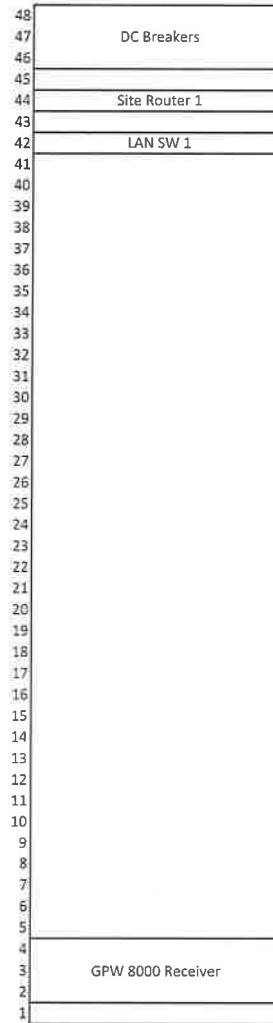
RU

48	Breakers
47	
46	
45	
44	Microwave equipment
43	
42	
41	
40	
39	Microwave equipment
38	
37	
36	
35	
34	MW UPS (RU size TBD)
33	
32	
31	
30	
29	
28	
27	
26	
25	
24	
23	
22	
21	
20	
19	
18	
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7	
6	
5	
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2	
1	

Berth 84

VHF Rx Site

RU



**Dispatch Location**

RU	Dispatch
48	
47	Breakers
46	
45	Breakers
44	
43	
42	
41	Site Router 1
40	Site Router 2
39	SW 1
38	SW 2
37	Firewall
36	
35	Aux I/O
34	
33	CCGW
32	
31	CCGW
30	
29	Z2 for CAM, Proxy
28	
27	
26	Control Station
25	
24	Control Station
23	
22	Control Station
21	
20	Control Station
19	
18	Control Station
17	
16	Control Station
15	
14	
13	
12	
11	
10	
9	
8	
7	GCP 8000 Site Controller
6	
5	
4	
3	
2	
1	

## 2.34 POWER REQUIREMENTS & HVAC LOADING REQUIREMENTS

Site Name / Location	Total Watts	Total BTU
<b>300 Water Street, MLETC</b>	<b>Total Watts</b>	<b>Total BTU</b>
700MHz Prime rack	1252.5	10337.7
UHF Prime+BS rack	1054.8	6378.2
700MHz ESS1 rack	2417.0	8315.0
700MHz ESS2 rack	2417.0	8315.0
VHF rack	220.0	1154.5
MW rack	1080.0	1806.0
Total	8441.3	36306.4
Total w/25% Buffer	10551.625	45383
<b>Gaffey Street, Marine Exchange</b>	<b>Total Watts</b>	<b>Total BTU</b>
UHF rack	755.0	3637.4
700MHz ESS1 rack	2417.0	8315.0
700MHz ESS2 rack	2417.0	8315.0
VHF rack	220.0	1154.5
MW rack	1080.0	2007.0
Total	6889	23428.9
Total w/25% Buffer	8611.25	29286.125
<b>3690 E. Crest Road, San Pedro Hill</b>	<b>Total Watts</b>	<b>Total BTU</b>
UHF rack	755.0	3637.4
700MHz ESS1 rack	2417.0	8315.0
700MHz ESS2 rack	2417.0	8315.0
MW rack	1080.0	1069.0
Total	6669	21336.4
Total w/25% Buffer	8336.25	26670.5
<b>Knoll Hill</b>	<b>Total Watts</b>	<b>Total BTU</b>
M1 Core rack	7385.7	25207.3
UHF rack	755.0	3637.4
700MHz ESS1 rack	2417.0	8315.0
700MHz ESS2 rack	2417.0	8315.0
MW rack	1080.0	1069.0
Total	14054.7	46543.7
Total w/25% Buffer	17568.375	58179.625

Site Name / Location	Total Watts	Total BTU
<b>Mt. Lukens</b>	<b>Total Watts</b>	<b>Total BTU</b>
UHF rack	755.0	3637.4
MW rack	1080.0	1861.0
Total	1835	5498.4
Total w/25% Buffer	2293.75	6873
<b>Saddle Peak</b>	<b>Total Watts</b>	<b>Total BTU</b>
UHF rack	755.0	3637.4
MW rack	1080.0	1431.1
Total	1835	5068.5
Total w/25% Buffer	2293.75	6335.625
<b>Black Jack Mountain, Catalina Island</b>	<b>Total Watts</b>	<b>Total BTU</b>
UHF rack	755.0	3637.4
700MHz ESS1 rack	2417.0	8315.0
700MHz ESS2 rack	2417.0	8315.0
MW rack	1080.0	1069.0
Total	6669	21336.4
Total w/25% Buffer	8336.25	26670.5
<b>330 Centre Street, HQ</b>	<b>Total Watts</b>	<b>Total BTU</b>
M1 DSR Core rack	7237.8	24702.8
700MHz Prime rack	1252.5	10337.7
UHF Prime rack	299.8	2740.8
VHF Rx+vote rack	299.8	2083.8
MW rack	1080.0	1069.0
Total	10169.9	40934.1
Total w/25% Buffer	12712.375	51167.625
<b>Dispatch Center</b>	<b>Total Watts</b>	<b>Total BTU</b>
M1 DSR Core rack	8310.6	31749.1
MW rack	1080.0	1069.0
Total	9390.6	32818.1
Total w/25% Buffer	11738.25	41022.625

# ADDITIONAL RADIO SITE CONSTRUCTION

## 3.1 SITE DEVELOPMENT SCOPE OVERVIEW

To meet the long-term desire of the Port to eliminate an existing microwave site and expand radio system coverage Motorola has included this new radio site construction section. Unlike the other sections of the proposal this scope is not included in the project pricing and is for budgetary guidance purposes only. Scope and pricing are subject to change after a detailed site walk is completed by Motorola's A&E division. Based upon data gathered on previous site walks, meetings, and discussions with the Port of LA it is believed that the design and cost estimates will allow the Port to determine if constructing a new radio site is desired.

## 3.2 NEW SITE LOCATION DEVELOPMENT

### 3.2.1 Site Scope Summary

- Engineering services for site drawings and regulatory approvals – Included.
- Site acquisition services – Not included.
- Zoning Services – Included
- New fenced compound/expansion size – 35-foot x 85-foot.
- Clearing type – Light.
- New power run – 150 feet
- Electrical service type – Underground, 300-amp - 120/240-volt, single-phase.
- New fuel tank size – 500 gallons, Type – Diesel sub-base.
- New generator size – 80 kW, Type – Outdoor.
- New tower to be used for antennas – 120-foot self-supported tower.
- New tower foundation size – 60 cubic yards, Type – Pier and pad.

### 3.2.2 Motorola Responsibilities:

#### 3.2.2.1 Site Engineering

- Prepare site construction drawings showing the layout of various new and existing site components.
- Conduct site walks to collect pertinent information from the sites (e.g., location of Telco, power, existing facilities, etc.).
- Perform a site and topographic survey for the property on which the communication site is located or will be located.
- Prepare a 2C/1A letter certifying the accuracy of the surveyed data for the tower.
- Prepare a lease exhibit and sketch of the site to communicate to the property owner the proposed lease space and planned development at the particular site location.



- Prepare zoning drawings that can be used to describe the proposed site installation in sufficient detail.
- Prepare record drawings of the site showing the as-built information.
- Conduct utility investigation and coordinate with local utility company for power hook up.
- Perform construction staking around the site to establish reference points for proposed construction.
- Prepare photo renderings of how a specific site or sites would look after completion.
- Conduct a balloon test to prepare site line graphs showing potential visibility of the proposed communication site.
- Provide an expert witness for up to 3 day(s) to attend or testify at public meetings and/or hearings to provide expert testimony to assist in obtaining zoning approvals.
- Perform NEPA Threshold Screening, including limited literature and records search and brief reporting, as necessary to identify sensitive natural and cultural features referenced in 47 CFR Chapter 1, subsection 1.1307 that may potentially be impacted by the proposed construction activity. This does not include the additional field investigations to document site conditions if it is determined that the proposed communication facility “may have a significant environmental impact” and thus require additional documentation, submittals, or work. Regional Environmental Review (RER) report submittals if required by FEMA have not been included. Perform Cultural Resource study as needed to identify sensitive historical and archaeological monuments that might be impacted by proposed construction
- Perform an ASTM E 1527-05 certified Phase I Environmental Site Assessment (ESA), to identify obvious and reasonably likely on-site and/or off-site potential sources of contamination that might pose a potential risk of leasing and building on a piece of property, and whether further environmental investigations are warranted. This study does not include Phase II assessments, risk/cost evaluations, and permitting assistance that may be required if risk factors are indicated.
- Conduct up to 40-foot deep soil boring test at tower location and prepare geotechnical report of soil conditions at locations of the tower foundation. Grouting of boring holes or access by Automatic Traction Vehicle (ATV) - mounted rig is not included.
- Conduct construction inspection of foundation steel prior to pour, materials testing of concrete and field density tests of backfill to ensure quality construction.
- Check tower erection for plumbness, linearity and alignment after installation.
- Perform inspection of the site and the work performed by the Contractor to document that the site is built in accordance with the “Site Plans” and document any deviations or violations.
- Prepare, submit and track application for local permit fees (zoning, electrical, building etc.), prepare FAA filings and procure information necessary for filing.
- FAA Filing (Air Space Analysis, FAA 7460-1; FCC ASR Notifications, FAA 7460-2 Part 1; FCC Notification, FAA 7460-2 Part 2; FRN Application; Local Publication
- Third Party Tower Inspection.

### 3.2.2.2 Site Preparation

- Obtain the permits such as electrical, building, and construction permits, and coordinate any inspections with local authorities that may be needed to complete site development work.
- Provide one-time mobilization costs for the construction crews. Any remobilization due to interruptions/delays that are out of Motorola's control will result in additional costs.
- Perform light clearing of brush, grubbing and disposal of vegetation and shrub growth in the site compound area and a 20-foot path around it (9,375 square feet).
- Grade the site compound and 10-foot path around it to provide a level, solid, undisturbed surface for installation of site components (Not to exceed 5,775 square feet).

- Supply and install gravel surfacing to a depth of 6 inches, including herbicide treatment and geotextile fabric installation within the fenced in site compound area, and a 3-foot path around it (Not to exceed 5,775 square feet).
- Supply and install (6) bollard guard posts.
- Provide silt fence around the compound to control soil erosion (not to exceed 240 linear feet).
- Supply and install 8-foot high chain-link fencing with a ten-foot wide gate around the shelter compound (not to exceed 559 linear feet).
- Perform site touch up (fertilize, seed and straw) disturbed areas not covered with gravel after completion of construction work. Landscaping, decorative fencing or any other aesthetic improvement that may be required by local jurisdictions has not been included and will be handled through a negotiated contract change notice.

### 3.2.2.3 Site Components Installation

- Construct 1 reinforced concrete foundation necessary for a 12-foot x 24-foot shelter.
- Construct 1 concrete slab for generator with up to 500 gallon above-ground diesel fuel tank below its base.
- Supply and install 1 prefabricated concrete shelter 12-foot x 24-foot.
- Supply and install 1 500-gallon sub-base diesel fuel tank(s), fill it with fuel and connect it to the generator.
- Supply and install fuel tank monitors on the tanks to monitor low fuel in tanks and run alarm wiring to the building located within 50 feet of the tank.
- Supply and install 1 standby power generator (80 kW) located within 20 feet of the ATS, including interconnection wiring between the generator, transfer switch, and site electrical service mains.
- Supply and install 1.97 120/240-volt, 300-amp, single-phase meter pedestal and hook-up for electrical service by the local utility.
- Provide all trenching, conduit, and cabling necessary for underground hook-up of power to the shelter from nearby utility termination located within 256 cable feet of the shelter.
- Supply and install a perimeter grounding system around the compound and shelter. The ground system is to tie to the fence and all new metal structures within the compound to meet current Motorola's R56 standards.
- Conduct 1 three-point ground resistance test of the site. Should any improvements to grounding system be necessary after ground testing, the cost of such improvements shall be the responsibility of Port of Los Angeles.
- Supply and install 1 freestanding 24-inch-wide cable/ice bridge from the tower to the shelter (up to 20 linear feet).

### 3.2.2.4 Tower Work

- Construct pier and pad type tower foundations including excavation, rebar and concrete (not to exceed 60 cubic yards).
- Erect new 120-foot self-supported tower.
- Supply and install grounding for the tower base for self-supported towers

### 3.2.2.5 Antenna and Transmission Line Installation

- Install (4) antenna(s) for the RF system.
- Install (2) 8-foot microwave dishes.
- Install up to 60 linear feet of 1/2-inch transmission line.

- Install up to 640 linear feet of 7/8-inch transmission line.
- Install up to 300 linear feet of EW90 waveguide for microwave dishes.
- Perform sweep tests on transmission lines.
- Perform alignment of each of 2 microwave paths to ensure that the microwave dishes are optimally positioned.
- Provide and install six-hole hanger blocks and attachment hardware for supporting transmission lines on the antenna support structure every three feet.
- Supply and install a ground buss bar at the bottom of the antenna support structure for grounding RF cables before they make horizontal transition.

### 3.2.2.6 Miscellaneous Work

- Project Management Administration
- Third party locates prior to construction
- Temporary fencing
- Water, toilet, temp power for construction
- Spoils off-haul and disposal
- Prevailing Wage Adjustment Included
- Structural Fill for Backfill of Tower Foundation

## 3.2.3 Customer Responsibilities:

### 3.2.3.1 Site Acquisition

- Purchase or execute an option/lease/license agreement (lease) and acquire clear land title/site lease/shared use agreement for the candidate site.

### 3.2.3.2 Site Responsibilities

- If required, prepare and submit Electromagnetic Energy (EME) plans for the site (as a licensee) to demonstrate compliance with FCC RF Exposure guidelines.
- As applicable, coordinate, prepare, submit, and pay for all required permits and inspections for the work that is the Customer's responsibility.
- Pay for all utility connection, pole or line extensions, and any easement or usage fees.
- Review and approve site design drawings within 7 calendar days of submission by Motorola or its subcontractor(s). Should a re-submission be required, the Customer shall review and approve the re-submitted plans within 7 calendar days from the date of submittal.
- Pay for the usage costs of power, leased lines and generator fueling both during the construction/installation effort and on an on-going basis.
- Pay for application fees, taxes and recurring payments for lease/ownership of the property.
- Provide personnel to observe construction progress and testing of site equipment according to the schedule provided by Motorola.
- As applicable (based on local jurisdictional authority), the Customer will be responsible for any installation or up-grades of the electrical system in order to comply with NFPA 70, Article 708
- Provide property deed or lease agreement, and boundary survey, along with existing as-built drawings of the site and site components to Motorola for conducting site engineering.
- Provide a right of entry letter from the site owner for Motorola to conduct field investigations.
- Maintain existing access road in order to provide clear and stable entry to the site for heavy-duty construction vehicles, cement trucks and cranes. Sufficient space must be available at

the site for these vehicles to maneuver under their own power, without assistance from other equipment.

- Secure power connection to the site, associated permitting and installation of a meter and disconnect within 50 feet of the proposed shelter location.
- Provide additional temporary space for staging of the construction equipment during the construction of new site facilities (tower, shelter, generator, fuel tank etc.).
- Customer responsible for costs of any permits as well as FAA/FCC filings.

### 3.2.4 Assumptions:

- Prevailing wage, certified payroll, mandatory union workers or mandatory minority workers are required for this work.
- All clarifications and exceptions contained in this Section (General Site Development Assumptions) take precedence over any other section of this Contract.
- All work is assumed to be done during normal business hours as dictated by time zone (Monday thru Friday, 7:30 a.m. to 5:00 p.m.).
- All recurring and non-recurring utility costs [including, but not limited to, generator fuel (except first fill), electrical, Telco] will be borne by the Customer or site owner.
- All utility installations shall be coordinated and paid for by the site owner and located at jointly agreed to location within or around the new communications shelter or equipment room.
- Site will have adequate electrical service for the new shelter and tower. Utility transformer, transformer upgrades, line, or pole extensions have not been included.
- Pricing has been based on National codes such IBC or BOCA. Local codes or jurisdictional requirements have not been considered in this proposal.
- Hazardous materials are not present at the work location. Testing and removal of hazardous materials, found during site investigations, construction or equipment installation will be the responsibility of the customer.
- A maximum of 30 days will be required for obtaining approved building permits from time of submission, and a maximum of 60 days will be required for zoning approvals from time of submittal.
- No improvements are required for concrete trucks, drill rigs, shelter delivery, and crane access.
- If extremely harsh or difficult weather conditions delay the site work for more than a week, Motorola will seek excusable delays rather than risk job site safety.
- In absence of geotechnical reports, foundations and subsurface conditions for tower design are based on Presumptive Sand soil parameters, as defined by EIA-222-G. Also, rock coring, piling, extensive dewatering of foundations, permanent casings or hazardous material removal has not been included.
- For zoning approvals, a maximum of 60 days will be required from time of submittal with attendance at maximum of two (2) required planning meetings.
- The new tower location will pass the FAA hazard study, zoning, FCC and environmental permitting.
- The restoration of the site surroundings by fertilizing, seeding and strawing the disturbed areas will be adequate.
- Tower and foundation sizing is based on the tower loading requirements as a result of the RF Antenna System design and the Microwave Antenna System design (i.e. - dish sizes and locations obtained from paper path studies). If after physical path studies, the dish sizes and locations change, then Motorola will then review the impact to tower structure and foundations and revise applicable costs.

- If as a result of NEPA studies, any jurisdictional authority should determine that a proposed communications facility "may have a significant environmental impact", the environmental impact studies or field testing and evaluation related to such determination have not been included.
- The site location can be finalized and lease agreement can be reached with the property owner within 60 calendar days after the start of the site acquisition effort.
- A waiver to zoning requirements like setbacks, tower height limitations, etc. can be obtained.
- The soil resistivity at the site is sufficient to achieve resistance of ten (10) ohms or less. Communications site grounding will be designed and installed per Motorola's Standards and Guidelines for Communications Sites (R56).
- Underground utilities are not present in the construction area, and as such no relocation will be required.
- Foundations for the shelter, generator and fuel tank are based "normal soil" conditions as defined by TIA/EIA 222-F. Footings deeper than 30 inches, raised piers, rock coring, dewatering, or hazardous material removal have not been included.

### 3.2.5 Completion Criteria

- Site development completed per issued for construction (IFC) construction drawings, project requirements, contractual obligations (including any customer/Motorola approved changes) and approved by the Port.
  - This shall be confirmed by contractor and reviewed with Motorola construction manager and project manager before inspections occur.
- All jurisdictional and contractual required testing and inspections to be performed by the contractor. (Contractual testing and inspections defined and agreed to with project team and customer prior to project kick off; vendor solely responsible for conducting, coordinating and paying for all jurisdictional testing and inspections ).
- Motorola site development checklist shall be completed and signed off by contractor prior to customer inspection. (Review with project team and customer and amend checklist as required at project kick off or before work begins).
- Site turn-over package completed and turned over to Motorola (As defined and agreed to with project team and customer).
- All punch list and deficiencies shall be completed prior to customer and Motorola inspections.

## 3.3 MOTOROLA STANDARD BUILDING SPECIFICATIONS

12x24 MSB Specifications	
Site Equipment Capacity	(12) 2'x2' rack locations
Building Size	Outside: 24' L x 11'8" W x 10'6" H Inside: 23' L x 10'8" W x 9'1" Interior clear
Load	Floor: 300 psf Roof: 150 psf Walls: 150 mph
Walls Roof	Concrete 2 hr. fire rated, Ballistics tested for UL-752 with 1/2" white embossed fiberglass paneling

12x24 MSB Specifications	
Insulation	Walls: R-11 Ceiling: R-19
Door	(1) 36" X 7'0" with dead bolt, anti-pick plate, door bumper & "T" tie back
Cable Ladder	24" wide cable ladder, gold chromate over equipment racks to cable entrance
Cable Entry	(1) 12 port cable entry with caps and (2) 3" PVC sleeve cast in concrete for Telco entry
Fire Protection	(1) Each Wall mounted 20lb. ABC and 10lb. CO2 extinguishers
Alarms	Smoke, Power Fail, High/Low temp, intrusion, Gen, ATS and UPS alarms on dry terminal 66 block with amphenol connector (see table 1)
Warranty	10-year manufacturer warranty from the date of shipment
<b>Lighting Specifications:</b>	
Interior	Ceiling: (10) 4 ft. fluorescent
Exterior	Security: (1) LED photocell
Emergency	(1) Twin bulb with battery EXIT sign located over doorway
<b>Electrical Specifications:</b>	
Electrical Service	120/240/200A 1 phase
Service Disconnect Secondary Surge Arrestor	(1) R56 Approved Type 1 Surge Protection Device (SPD)
Main Panel Surge Arrestor	(1) R56 Approved Type 2 Surge Protection Device (SPD)
Main Load Center	(1) 300A Main breaker
Exterior Outlets	(2) GFI duplex outlets
Service Outlets	(7) Duplex outlets
UPS Load Centers	(3) Load centers with circuits to feed racks
FNE Outlets	(3) Raceway containing dedicated simplex outlets mounted under cable ladder
<b>Grounding Specifications:</b>	
Grounding Standard	Meets or Exceeds Motorola's R56 Specifications
<b>Air Conditioning Specifications:</b>	
Air-Conditioning	(2) 4-ton air conditioning units with integrated heater strips, lead-lag controller
Warranty	2-year manufacturer warranty from the date of shipment
<b>Generator Specifications:</b>	
Generator	80kW, diesel fueled, 120/240V 1 phase 60HZ
Automatic Transfer Switch	300-amp, 240 volt
Warranty	2-year manufacturer warranty from the date of shipment
<b>U.P.S Specifications:</b>	
U.P.S	(2) 20kVA/18kW, maintenance bypass switch, 7 minute battery backup
Warranty	2-year manufacturer warranty from the date of shipment

# EQUIPMENT LISTS

## 4.1 EQUIPMENT LISTS

### 4.1.1 UASI-18 Equipment List

Qty.	Nomenclature	Description
<b>Master Site Equipment</b>		
1	SQM01SUM0323	ASTRO MASTER SITE
1	CA03515AA	ADD: NEW ZONE CORE
1	CA03507AA	ADD: RACK
5	UA00153AB	ADD: P25 FDMA TRUNKING OPERATION SI
5	UA00159AB	ADD: P25 PHASE 2 TDMA TRKNG OP SITE
5	UA00160AA	ADD: PHASE 2 DYNAMIC TG ASGNMT SITE
5	UA00408AA	ADD: ENHANCED DATA-P25 TRNK SITE
3	UA00156AA	ADD: MCC7500 CONSOLE LICENSES (QTY
1	CA01499AB	ADD:DSR NOTIFICATION
1	CA03509AA	ADD: EDGE ROUTER PAIR
2	UA00152AA	ADD:500 RADIO USER LICENSES
1	UA00664AA	ADD: 500 VISITING RADIO USER LICENS
2	UA00482AA	ADD: LOCATION ON PTT 500 USER LICEN
2	UA00700AA	ADD: GROUP SERVICES
2	UA00699AA	ADD: TRANSCODED SIMULTANEOUS CALLS
1	UA00146AA	ADD: UNIFIED EVENT MANAGER (UEM)
1	UA00149AA	ADD: RADIO CONTROL MANAGER
1	UA00139AA	ADD: NORTHBOUND INTERFACE
1	ZA00104AA	ENH: TECHNICAL ASSISTANCE, FOURTY H
35	UA00161AA	P25 TDMA PER BASE RADIO LICENSE
10	UA00162AA	DYNAMIC CHANNEL ASSIGNMENT PER BASE
1	UA00227AA	UEM SNMP ELEMENT MGMT TOOLKIT (QTY
1	DSTS453BE4GUS	NAS Server: QNAP J3455 QUAD CORE BA
1	T8597	ASTRO 2019.1 CLIENT
1	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
1	DSF1DC108V	18.5INCH WIDESCREEN RACK CONSOLE WI
4	DSF1D940106	BELKIN OMNIVIEW ENTERPRISE SERIES -
1	DSF2B56AA	ESB EXTERNAL DVD DRIVE
12	T7885	MCAFFEE WINDOWS AV CLIENT

Qty.	Nomenclature	Description
1	CLN1868	2930F 24-PORT SWITCH
1	SQM01SUM0257	INTELLIGENT MIDDLEWARE
1	CA02384AE	ADD: UNIFIED NETWORK SERVICES SOFTW
1	CA02354AA	ADD: ASTRO NETWORK APPLICATION INTE
1	CA02362AE	ADD: MCAFEE STANDALONE ANTI VIRUS S
1	CA03062AA	ADD: IMW HIGH TIER/NON-REDUNDANT
1	UA00015AA	ADD: 501-1000 RESOURCES FOR LOCATIO
1	UA00056AA	ADD: 501-1000 RESOURCES FOR PRESENC
1	UA00296AA	ADD: 0-100 RESOURCES FOR GROUP MANA
1	UA00290AA	ADD: 501-1000 RESOURCES FOR MESSAGI
1	CA02053AE	ADD: SUPPLEMENTAL CD IA (IMW)
1	CA02668AE	ADD: SQL SVR STD2014 EMB
1	DSTRAK91061	FOUR PORT DDM
1	T7776	ISSI 8000 / CSSI 8000 UPGRAGE Softw
1	UA00005AA	ADD: ISSI Automatic Roaming License
2	UA00184AA	ADD:ISSI AUTOMATIC ROAMING LICENSE
1	T7688	KEY MANAGEMENT FACILITY
1	ZA01180AA	ADD: KMF SERVER AND WEB CLIENT SW
1	CA01229AA	ADD: KMF REDUNDANCY SOFTWARE
1	TT2872	DL380 G9 SERVER WITH WINDOWS SERVER
1	SQM01SUM0222	KMF CRYPTR
1	CA00147AG	ADD: BASIC SOFTWARE OPTION
1	CA00182AV	ADD: AES 256 ENCRYPTION KIT
1	CA02066AA	AC Line Cord, North America
1	TKN9285	RACK MOUNT KIT FOR CRYPTR II
1	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
1	T8476B	KVL 5000
1	CA03358AA	ADD: ASTRO 25 MODE
1	CA00182AW	ADD: AES ENCRYPTION SOFTWARE
1	CA03467AA	ADD: NORTH AMERICA MICRO USB CHARGE
1	PMKN4012B	PORTABLE PROGRAMMING CABLE
1	PMKN4012B	PORTABLE PROGRAMMING CABLE
1	CB000262A01	CABLE,MICRO USB PROGRAMMING CABLE
1	PMPN4119A	CHARGER,CHGR VEHICULAR ADAPTER EXT
1	DVN4046B	MASTER SYSTEM KEY STARTER KIT
1	TRN7343	SEVEN AND A HALF FOOT RACK
1	T8586	FORTINET FIREWALL APPLIANCE
1	DSK3R64AA	HP 9.5MM SLIM SUPERMULTI DVD WRITER

Qty.	Nomenclature	Description
1	DLN8006	FRU: DL380 G10 POWER SUPPLY
1	DLN8007	FRU: DL380 G10 FAN
1	DLN6942	1.2 TB HARD DRIVE
1	DLN8013	FRU: DAS 4525 CHASSIS ONLY
1	DLN8014	FRU: DAS 4525 POWER SUPPLY
1	DLN8015	FRU: DAS 4525 CONTROLLER MODUL
1	DLN8016	FRU: DAS 4125 JBOD MODULE
1	DLN8017	FRU: 600GB HARD DRIVE, DAS 452
1	CLN1868	2930F 24-PORT SWITCH
1	CLN1869	2930F 48-PORT SWITCH
<b>Backup Master Site Equipment</b>		
1	SQM01SUM0324	DYNAMIC SYSTEM RESILIENCE
1	CA03520AA	ADD: DSR ZONE CORE
1	CA03507AA	ADD: RACK
2	UA00699AA	ADD: TRANSCODED SIMULTANEOUS CALLS
1	T8586	FORTINET FIREWALL APPLIANCE
1	T8597	ASTRO 2019.1 CLIENT
1	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
1	DSF1DC108V	18.5INCH WIDESCREEN RACK CONSOLE WI
4	DSF1D940106	BELKIN OMNIVIEW ENTERPRISE SERIES -
1	DSF2B56AA	ESB EXTERNAL DVD DRIVE
1	CLN1868	2930F 24-PORT SWITCH
1	DSTRAK91061	FOUR PORT DDM
1	T7688	KEY MANAGEMENT FACILITY
1	ZA01180AA	ADD: KMF SERVER AND WEB CLIENT SW
1	CA01229AA	ADD: KMF REDUNDANCY SOFTWARE
1	TT2872	DL380 G9 SERVER WITH WINDOWS SERVER
1	SQM01SUM0222	KMF CRYPTR
1	CA00147AG	ADD: BASIC SOFTWARE OPTION
1	CA00182AV	ADD: AES 256 ENCRYPTION KIT
1	CA02066AA	AC Line Cord, North America
1	TKN9285	RACK MOUNT KIT FOR CRYPTR II
1	DSTG191B	TECH GLOBAL EVOLUTION SERIES 19INCH
1	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
1	TRN7343	SEVEN AND A HALF FOOT RACK
1	T8586	FORTINET FIREWALL APPLIANCE
1	DLN8006	FRU: DL380 G10 POWER SUPPLY
1	DLN8007	FRU: DL380 G10 FAN

Qty.	Nomenclature	Description
1	DLN6942	1.2 TB HARD DRIVE
1	DLN8013	FRU: DAS 4525 CHASSIS ONLY
1	DLN8014	FRU: DAS 4525 POWER SUPPLY
1	DLN8015	FRU: DAS 4525 CONTROLLER MODUL
1	DLN8016	FRU: DAS 4125 JBOD MODULE
1	DLN8017	FRU: 600GB HARD DRIVE, DAS 452
1	CLN1868	2930F 24-PORT SWITCH
1	CLN1869	2930F 48-PORT SWITCH
<b>Dispatch Center</b>		
1	B1949	MCC 7500E SOFTWARE DVD
1	B1948	MCC 7500E DISPATCH POSITION LICENSE
9	UA00250AA	ADD: 30 RADIO RESOURCES LICENSE
9	UA00653AA	ADD: BASIC CONSOLE OPERATION
9	UA00654AA	ADD: ASTRO 25 TRUNKING OPERATION
9	UA00655AA	ADD: ADVANCED CONVENTIONAL OPERATIO
9	UA00658AA	ADD: SECURE OPERATION
9	UA00659AA	ADD: ADP/AES/DES-OFB ENCRYPTION
9	UA00660AA	ADD: OTEK OPERATION
9	UA00661AA	ADD: ENHANCED IRR
9	B1941	USB AUDIO INTERFACE MODULE
9	B1914	MCC SERIES DESKTOP GOOSENECK MICROP
9	B1913	MCC SERIES HEADSET JACK
9	RLN6098	HDST MODULE BASE W/PTT, 15 FT CBL
9	BDN6647G	MEDIUM WEIGHT SINGLE MUFF HEADSET W
9	DSTWIN6328A	PROVIDES ONE DUAL PEDAL FOOTSWITCH
9	T7885	MCAFFEE WINDOWS AV CLIENT
9	DSUSB31000S	STARTECH USB 3.0 TO GIGABIT ETHERNE
9	DSST7300U3M	STARTECH 7 PORT USB 3.0 HUB
9	DSRMP615A	SPD, TYPE 3, 120V RACK MOUNT, 15A P
1	DSF2B56AA	USB EXTERNAL DVD DRIVE
9	T7449	WINDOWS SUPPLEMENTAL TRANS CONFIG
9	DSEV221B	TECH GLOBAL EVOLUTION SERIES 22INCH
9	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
9	DSY7B61AA	HP Z2 MINI ARM WALL VESA MOUNT
18	B1952	SPEAKER, DESKTOP, USB
18	CA03406AA	ADD: AC LINE CORD, NORTH AMERICA
18	CA03413AA	ADD: USB CABLE, TYPE A TO TYPE C, 4
18	CA03405AA	ADD: POWER SUPPLY WITH DC CORD

Qty.	Nomenclature	Description
2	CLN1868	2930F 24-PORT SWITCH
2	CLN1866	FRU: 1M DAC CABLE
2	T8492	SITE AND HUB ROUTER AND FIREWALL- A
2	CA03445AA	ADD: MISSION CRITICAL HARDENING
2	CA03448AA	ADD: STATEFUL FIREWALL
1	SQM01SUM0205	GGM 8000 GATEWAY
1	CA01616AA	ADD: AC POWER
1	CA02086AA	ADD: HIGH DENSITY ENH CONV GATEWAY
1	SQM01SUM0205	GGM 8000 GATEWAY
1	CA01616AA	ADD: AC POWER
1	CA02086AA	ADD: HIGH DENSITY ENH CONV GATEWAY
1	BVN1013	MKM 7000 Console Alias Manager Soft
1	DSF2B56AA	USB EXTERNAL DVD DRIVE
1	BVN6079	PRX 7000 Proxy Application SW DVD
1	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
1	DSEV221B	TECH GLOBAL EVOLUTION SERIES 22INCH
1	T8492	SITE AND HUB ROUTER AND FIREWALL- A
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	T7038	GCP 8000 SITE CONTROLLER
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA03111AA	ADD: CEC COMPLIANCE
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	CA00303AA	ADD: QTY (1) SITE CONTROLLER
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01136AA	MCC 7500 CONVEN SITE OPER
1	T8343	GSERIES SOFTWARE LICENSING
1	UA00415AA	ADD: GSERIES SC-CONV
2	BLN1317	MCC 7500 AIS SOFTWARE FIELD-ADD LIC
2	BLN1302	OVER THE ETHERNET KEYING (OTEK) OPE
2	BLN1304	SECURE OPERATION FIELD-ADD LICENSE
2	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
9	DQG20GB612	POWER STRIP 6 OUTLET 15A 125VA
2	DSTSJADP	RACK MOUNT GROUND BAR, 19 IN FOR TS
2	DSRMP615A	SPD, TYPE 3, 120V RACK MOUNT, 15A P
1	B1948	MCC 7500E DISPATCH POSITION LICENSE
2	UA00653AA	ADD: BASIC CONSOLE OPERATION
2	UA00654AA	ADD: ASTRO 25 TRUNKING OPERATION

Qty.	Nomenclature	Description
2	UA00655AA	ADD: ADVANCED CONVENTIONAL OPERATIO
2	UA00659AA	ADD: ADP/AES/DES-OFB ENCRYPTION
2	UA00658AA	ADD: SECURE OPERATION
2	UA00249AA	ADD: 15 RADIO RESOURCES LICENSE
2	UA00661AA	ADD: ENHANCED IRR
2	UA00660AA	ADD: OTEK OPERATION
1	UA00254AA	ADD: PRX 7000 PROXY SW LICENSE (1-1
2	TT3493	ZBOOK 15 G5 NON RETURNABLE
2	RLN6098	HDST MODULE BASE W/PTT, 15 FT CBL
2	RMN5150A	OVER-THE-HEAD, MONAURAL, NOISE-CANC
2	DDN1428	XLR TO USB ADAPTER SHURE
1	B1952	SPEAKER, DESKTOP, USB
1	CA03406AA	ADD: AC LINE CORD, NORTH AMERICA
1	CA03405AA	ADD: POWER SUPPLY WITH DC CORD
1	B1914	MCC SERIES DESKTOP GOOSENECK MICROP
1	B1913	MCC SERIES HEADSET JACK
1	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
1	CLN1868	2930F 24-PORT SWITCH
1	CLN1866	FRU: 1M DAC CABLE
1	T8492	SITE AND HUB ROUTER AND FIREWALL- A
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	DLN6966	FRU: GCP 8000/GCM 8000/GPB 8000
1	DLN6781	FRU: POWER SUPPLY
1	B1948	MCC 7500E DISPATCH POSITION LICENSES
1	B1949	MCC 7500E SOFTWARE DVD
1	T7449	WINDOWS SUPPLEMENTAL TRANS CONFIG
2	B1905	MCC 7500 ASTRO 25 SOFTWARE
2	B1933	MOTOROLA VOICE PROCESSOR MODULE
2	CA00288AB	ADD: MCC 7500 ARCHIVING INTERFACE SERVER SOFTWARE LICENSE
2	CA00143AC	ADD: DES-OFB ALGORITHM
2	CA00182AB	ADD: AES ALGORITHM
2	CA00140AA	ADD: AC LINE CORD, NORTH AMERICAN
2	T7885	MCAFEE WINDOWS AV CLIENT
2	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
1	TT2669	120 SIMUL CALL MCC 7500 IP RECORDER
1	TT06274AA	ADD: IP LOGGING RECORDER FOR USE ON A2019 SYSTEMS

Qty.	Nomenclature	Description
1	TT06274AA	ADD: IP LOGGING RECORDER FOR USE ON A2019 SYSTEMS
2	T7885	MCAFEE WINDOWS AV CLIENT
2	TT3492	Z2 G4 MINI WORKSTATION NON RETURNAB
2	DSTG191B	TECH GLOBAL EVOLUTION SERIES 19INCH NON TOUCH
2	T7449	WINDOWS SUPPLEMENTAL TRANS CONFIG
2	T7885	MCAFEE WINDOWS AV CLIENT
2	B1952	SPEAKER, DESKTOP, USB
2	CA03413AA	ADD: USB CABLE, TYPE A TO TYPE C, 4.5M
1	DDN9748	19 INCH BLACK SHELF
1	TT2671	32 CHANNEL NRX BASE BUNDLE
8	TT05764AA	ADD: ADDITIONAL 8 RECORDING LICENSES - MAX OF 20
32	TT05771AA	ADD: ANALOG CHANNEL FLAG
32	TT05772AA	ADD: DIGITAL CHANNEL FLAG
32	TT05774AA	ADD: TELEPHONY VOIP CHANNEL FLAG
1	DS1101990	SPD, SHIELDED RJ-45 JACK, SINGLE LINE GBE (1000MBPS) R56 COMPLIANT
<b>WAVE Push To Talk</b>		
2	SQM01SUM0284B	WAVE 5000 SERVER
2	SQM01SUM0292	CRYPTR
2	CA02066AA	AC Line Cord, North America
2	CA02954AA	ADD: SECURE OPERATION
2	CA02933AA	ADD: ASTRO AES 256, DES-OFB, ADP ENCRYPTION KIT
1	SSV00S01291A	CRITICAL CONNECT BASIC SUBSCRIPTION (5 YEAR)
1	LSV00S01306B	CRITICAL CONNECT ONSITE SERVICE
10	SSV00S01500A	WAVE DISPATCH
50	SSV00S01499A	WAVE SUBSCRIPTION

#### 4.1.2 UASI-19 Equipment List

Qty.	Nomenclature	Description
<b>700MHz Radio System Prime Site</b>		
1	T7321	GCM 8000 COMPARATOR
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
2	CA01183AA	GCM 8000 COMPARATOR
2	CA01185AA	ADD: IP BASED MULTISITE OPERATION
2	CA01901AA	ADD: P25 TDMA COMPARATOR SOFTWARE
2	CA01974AA	ADD: TRUNKING REDUNDANT COMPTR SW
1	CA03111AA	ADD: CEC COMPLIANCE

Qty.	Nomenclature	Description
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
2	UA00402AA	ADD: GSERIES CM-P25 TRNK IP
2	UA00418AA	ADD: P25 TDMA TRNK COMPARATOR SW
2	UA00419AA	ADD: REDUNDANT CMPRTR P25 TRNK
1	T7321	GCM 8000 COMPARATOR
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
2	CA01183AA	GCM 8000 COMPARATOR
2	CA01185AA	ADD: IP BASED MULTISITE OPERATION
2	CA01901AA	ADD: P25 TDMA COMPARATOR SOFTWARE
2	CA01974AA	ADD: TRUNKING REDUNDANT CMPRTR SW
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
2	UA00402AA	ADD: GSERIES CM-P25 TRNK IP
2	UA00418AA	ADD: P25 TDMA TRNK COMPARATOR SW
2	UA00419AA	ADD: REDUNDANT CMPRTR P25 TRNK
1	T7321	GCM 8000 COMPARATOR
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
2	CA01183AA	GCM 8000 COMPARATOR
2	CA01185AA	ADD: IP BASED MULTISITE OPERATION
2	CA01901AA	ADD: P25 TDMA COMPARATOR SOFTWARE
2	CA01974AA	ADD: TRUNKING REDUNDANT CMPRTR SW
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
2	UA00402AA	ADD: GSERIES CM P25 TRNK IP
2	UA00418AA	ADD: P25 TDMA TRNK COMPARATOR SW
2	UA00419AA	ADD: REDUNDANT CMPRTR P25 TRNK
1	T7321	GCM 8000 COMPARATOR
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
2	CA01183AA	GCM 8000 COMPARATOR

Qty.	Nomenclature	Description
2	CA01185AA	ADD: IP BASED MULTISITE OPERATION
1	CA01901AA	ADD: P25 TDMA COMPARATOR SOFTWARE
2	CA01974AA	ADD: TRUNKING REDUNDANT COMPRTR SW
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
2	UA00402AA	ADD: GSERIES CM-P25 TRNK IP
1	UA00418AA	ADD: P25 TDMA TRNK COMPARATOR SW
2	UA00419AA	ADD: REDUNDANT CMPRTR P25 TRNK
1	T7038	GCP 8000 SITE CONTROLLER
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	CA00303AA	ADD: QTY (1) SITE CONTROLLER
1	CA01194AA	ADD: IP BASED MULTISITE SITE CONTRO
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
1	UA00405AA	ADD: GSERIES SC-P25 TRNK MS IP
1	T7038	GCP 8000 SITE CONTROLLER
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	CA00303AA	ADD: QTY (1) SITE CONTROLLER
1	CA01194AA	ADD: IP BASED MULTISITE SITE CONTRO
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
1	UA00405AA	ADD: GSERIES SC-P25 TRNK MS IP
1	DSTRAK91008EDC	PRIME/MASTER SITE REDUNDANT MODULAR
50	L1700	FSJ1-50A CABLE: 1/4" SUPERFLEX POLY
4	DDN9769	F1PNM-HC 1/4" TYPE N MALE CONNECTOR
1	CLN1869	2930F 48-PORT SWITCH
1	CLN1868	2930F 24-PORT SWITCH
1	T8555	EDGE ROUTER & FIREWALL DC
1	CA03445AA	ADD: MISSION CRITICAL HARDENING

Qty.	Nomenclature	Description
1	CA03448AA	ADD: STATEFUL FIREWALL
1	T8555	EDGE ROUTER & FIREWALL DC
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	TRN7343	SEVEN AND A HALF FOOT RACK
<b>700MHz Radio System Redundant Prime Site</b>		
1	T7321	GCM 8000 COMPARATOR
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
2	CA01183AA	GCM 8000 COMPARATOR
2	CA01185AA	ADD: IP BASED MULTISITE OPERATION
2	CA01901AA	ADD: P25 TDMA COMPARATOR SOFTWARE
2	CA01974AA	ADD: TRUNKING REDUNDANT COMPRTTR SW
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
2	UA00402AA	ADD: GSERIES CM-P25 TRNK IP
2	UA00418AA	ADD: P25 TDMA TRNK COMPARATOR SW
2	UA00419AA	ADD: REDUNDANT CMPRTR P25 TRNK
1	T7321	GCM 8000 COMPARATOR
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
2	CA01183AA	GCM 8000 COMPARATOR
2	CA01185AA	ADD: IP BASED MULTISITE OPERATION
2	CA01901AA	ADD: P25 TDMA COMPARATOR SOFTWARE
2	CA01974AA	ADD: TRUNKING REDUNDANT COMPRTTR SW
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
2	UA00402AA	ADD: GSERIES CM-P25 TRNK IP
2	UA00418AA	ADD: P25 TDMA TRNK COMPARATOR SW
2	UA00419AA	ADD: REDUNDANT CMPRTR P25 TRNK
1	T7321	GCM 8000 COMPARATOR
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
2	CA01183AA	GCM 8000 COMPARATOR
2	CA01185AA	ADD: IP BASED MULTISITE OPERATION

Qty.	Nomenclature	Description
2	CA01901AA	ADD: P25 TDMA COMPARATOR SOFTWARE
2	CA01974AA	ADD: TRUNKING REDUNDANT COMPRTR SW
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
2	UA00402AA	ADD: GSERIES CM-P25 TRNK IP
2	UA00418AA	ADD: P25 TDMA TRNK COMPARATOR SW
2	UA00419AA	ADD: REDUNDANT CMPRTR P25 TRNK
1	T7321	GCM 8000 COMPARATOR
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
2	CA01183AA	GCM 8000 COMPARATOR
2	CA01185AA	ADD: IP BASED MULTISITE OPERATION
1	CA01901AA	ADD: P25 TDMA COMPARATOR SOFTWARE
2	CA01974AA	ADD: TRUNKING REDUNDANT COMPRTR SW
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
2	UA00402AA	ADD: GSERIES CM-P25 TRNK IP
1	UA00418AA	ADD: P25 TDMA TRNK COMPARATOR SW
2	UA00419AA	ADD: REDUNDANT CMPRTR P25 TRNK
1	T7038	GCP 8000 SITE CONTROLLER
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	CA00303AA	ADD: QTY (1) SITE CONTROLLER
1	CA02474AA	ADD:GEO-REDUN BACK-UP SC LIC
1	CA01194AA	ADD: IP BASED MULTISITE SITE CONTRO
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA01400AA	ADD: POWER CABLE, DC
1	T8343	GSERIES SOFTWARE LICENSING
1	UA00405AA	ADD: GSERIES SC-P25 TRNK MS IP
1	DSTRAK91008EDC	PRIME/MASTER SITE REDUNDANT MODULAR
50	L1700	FSJ1-50A CABLE: 1/4" SUPERFLEX POLY
4	DDN9769	F1PNM-HC 1/4" TYPE N MALE CONNECTOR

Qty.	Nomenclature	Description
1	CLN1869	2930F 48-PORT SWITCH
1	CLN1868	2930F 24-PORT SWITCH
1	T8555	EDGE ROUTER & FIREWALL DC
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	T8555	EDGE ROUTER & FIREWALL DC
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	TRN7343	SEVEN AND A HALF FOOT RACK
1	DSTRAK91061	FOUR PORT DDM
1	CLN1868	2930F 24-PORT SWITCH
1	CLN1866	FRU: 1M DAC CABLE
1	CLN1869	2930F 48-PORT SWITCH
1	CLN1866	FRU: 1M DAC CABLE
1	DLN6966	FRU: GCP 8000/GCM 8000/GPB 8000
1	DLN6455	CONFIGURATION/SERVICE SOFTWARE
<b>700MHz Radio System Remote Site (x5)</b>		
1	T8547	SITE AND HUB ROUTER AND FIREWALL -
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	T8547	SITE AND HUB ROUTER AND FIREWALL -
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	SQM01SUM7054	GTR 8000 EXPANDABLE SITE SUBSYSTEM
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	CA00855AA	ADD: 700/800 MHZ
1	X304AE	ADD: QTY (4) GTR 8000 BASE RADIOS
4	CA01193AA	ADD: IP BASED MULTISITE BASE RADIO
1	CA03111AA	ADD: CEC COMPLIANCE
4	CA01842AA	ADD: P25 TDMA SOFTWARE
2	CA01902AA	ADD: P25 DYNAMIC CHANNEL SOFTWARE
1	CA02686AA	ADD: AC DC POWER DISTRIBUTION
4	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA00862AA	ADD: SITE & CABINET RMC W/CAPABILIT
1	CA00879AA	ADD: PRIMARY 6 PORT CAVITY COMBINER
1	CA00882AA	ADD: 700 MHZ TX FILTER W/PMU
2	CA01536AA	ADD: GPB 8000 REFERENCE DISTRIBUTIO
2	CA01537AA	ADD: REFERENCE DISTRIBUTION SOFTWARE

Qty.	Nomenclature	Description
1	X882AH	ADD: 7.5 FT OPEN RACK, 48RU
1	T8343	GSERIES SOFTWARE LICENSING
4	UA00400AA	ADD: GSERIES BR-P25 TRNK MS IP
2	UA00409AA	ADD: GSERIES RDM
1	PMUG1017A	GNSS REMOTE RECEIVER ASSY
1	DSWM4	HEAVY DUTY W STYLE WALL MOUNT WITH
1	DSP04268	ALUMINUM 6061-T6. PIPE 1 INCH SCHED
1	DS30C87465CO1	125FT OUTDOOR UV PROTECTED CABLE 6
1	SQM01SUM7054	GTR 8000 EXPANDABLE SITE SUBSYSTEM
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	CA00855AA	ADD: 700/800 MHZ
1	X304AE	ADD: QTY (4) GTR 8000 BASE RADIOS
4	CA01193AA	ADD: IP BASED MULTISITE BASE RADIO
1	CA03111AA	ADD: CEC COMPLIANCE
3	CA01842AA	ADD: P25 TDMA SOFTWARE
1	CA02686AA	ADD: AC DC POWER DISTRIBUTION
4	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA00877AA	ADD: CABINET RMC FOR EXPANSION RACK
1	CA00880AA	ADD: EXPANSION 6 PORT CAVITY COMBIN
1	CA01058AA	ADD: 700/800 PHASING HARNESS
2	CA00885AA	ADD: HIGH AVAILABILITY XHUB
1	X882AH	ADD: 7.5 FT OPEN RACK, 48RU
1	T8343	GSERIES SOFTWARE LICENSING
4	UA00400AA	ADD: GSERIES BR-P25 TRNK MS IP
1	DSTRAK91061	FOUR PORT DDM
1	DLN6895	FRU: PA 7/800 MHZ
1	DLN6885	FRU: XCVR 7/800 MHZ V2
1	DLN6634	FRU: 700/800 MHZ SITE LNA
1	DLN1306	FRU: 700/800 MHZ CABINET RMC MODULE
1	DLN6805	FRU: ENERGY EFFICIENT POWER SUPPLY
1	DLN6898	FRU: FAN MODULE
1	DLN6677	FRU: G-SERIES XHUB
1	DLN6455	CONFIGURATION/SERVICE SOFTWARE
15	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POL
2	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2
2	TDN9289	221213 CABLE WRAP WEATHERPROOFING
150	DSAVA550	AVA5-50, COAXIAL CABLE, CORRUGATED
2	DSA5DFD	D-CLASS 7-16 DIN FEMALE FOR AVA5-50

Qty.	Nomenclature	Description
4	DSSG7812B2U	SG78-12B2U SUREGROUND GROUNDING KIT
1	DSL5SGRIP	L5SGRIP 7/8" SUPPORT HOIST GRIP
5	MDN6817	42396A-5 7/8" CABLE HANGER STAINLE
1	DSTSXFMBF	RF SPD, 698-2700MHZ DC BLOCK HIGH P
1	DSGSAKITD	GROUND STRAP KIT - DIN
25	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POL
1	DDN1088	L4TNM-PSA TYPE N MALE PS FOR 1/2 IN
1	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2
15	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POL
2	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2
2	TDN9289	221213 CABLE WRAP WEATHERPROOFING
150	DSAVA550	AVA5-50, COAXIAL CABLE, CORRUGATED
2	DSA5DFD	D-CLASS 7-16 DIN FEMALE FOR AVA5-50
4	DSSG7812B2U	SG78-12B2U SUREGROUND GROUNDING KIT
1	DSL5SGRIP	L5SGRIP 7/8" SUPPORT HOIST GRIP
5	MDN6817	42396A-5 7/8" CABLE HANGER STAINLE
1	DSTSXFMBF	RF SPD, 698-2700MHZ DC BLOCK HIGH P
1	DSGSAKITD	GROUND STRAP KIT - DIN
25	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POL
1	DDN1088	L4TNM-PSA TYPE N MALE PS FOR 1/2 IN
1	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2
<b>700MHz Radio System Antennas</b>		
1	DSCC80706T3	OMNI, CORP COLLINEAR, 6DDBD, 746-87
1	DSCC80706T3	OMNI, CORP COLLINEAR, 6DDBD, 746-87
1	DSCC80706T3	OMNI, CORP COLLINEAR, 6DDBD, 746-87
1	DSCC80706T3	OMNI, CORP COLLINEAR, 6DDBD, 746-87
1	DSBPA74966013	PANEL ANTENNA, 11DBD, 746-960MHZ, 6
1	DSCC80706T3	OMNI, CORP COLLINEAR, 6DDBD, 746-87
1	DSCC80708T3	OMNI CORPORATE COLLINEAR 8DBD 746-8
1	DSCC80708T3	OMNI CORPORATE COLLINEAR 8DBD 746-8
1	DSBPA74966013	PANEL ANTENNA, 11DBD, 746-960MHZ, 6
1	DSCC80706T3	OMNI, CORP COLLINEAR, 6DDBD, 746-87
<b>MCD5000 Backup Desksets</b>		
6	L37TSS9PW1 N	ALL BAND CONSOLETTTE
6	G806	ENH: ASTRO DIGITAL CAI OP APX
6	G51	ENH: SMARTZONE OPERATION APX
6	G361	ENH: P25 TRUNKING SOFTWARE APX
6	GA00580	ADD: TDMA OPERATION APX

Qty.	Nomenclature	Description
6	L999	ADD: FULL FP W/05/KEYPAD/CLOCK/VU
6	W382	ADD: CONTROL STATION DESK GCAI MIC
6	CA01598	ADD: AC LINE CORD US
6	HKN6233C	APX CONSOLETTA RACK MOUNT KIT
6	G78	ADD: 3Y ESSENTIAL SERVICE
6	G996	ENH: OVER THE AIR PROVISIONING
6	QA03399	ADD: ENHANCED DATA
6	G298	ENH: ASTRO 25 OTAR W/ MULTIKEY
6	G843	ADD: AES ENCRYPTION APX
2	F2380	MCD 5000 DESKSET
2	FHN7469	MCD 5000 DESKSET / RGU POWER SUPPLY WITH USA POWER CORD
2	FKN8695	ETHERNET CABLE 10' WITH RED & BLACK LABELS
2	F7879	SM, RADIO GATEWAY UNIT (RGU)
2	FHN7469	MCD 5000 DESKSET / RGU POWER SUPPLY WITH USA POWER CORD
2	FKN8695	ETHERNET CABLE 10' WITH RED & BLACK LABELS
1	FTN7490	MCD 5000 DESKSET RGU RACK MOUNT PANEL PLUS SCREWS
1	FVN5847	MCD 5000 DESKSET SYSTEM CONFIG TOOL - SYSTEM W/OUT OMC
1	FHN7469AS	POWER SUPPLY KIT FOR SERVICE
1	CLN1868	2930F 24-PORT SWITCH

### 4.1.3 Non-UASI Funded Equipment List

Qty.	Nomenclature	Description
<b>UHF Channel Prime Site</b>		
1	DSTRAK91008E	PRIME/MASTER SITE REDUNDANT MODULAR
2	L1700	FSJ1-50A CABLE: 1/4" SUPERFLEX POLY
4	DDN9769	F1PNM-HC 1/4" TYPE N MALE CONNECTOR
1	T8493	EDGE ROUTER & FIREWALL AC
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	CLN1868	2930F 24-PORT SWITCH
1	T8341	GRV 8000 COMPARATOR
1	CA03084AA	ADD: COMPARATOR
1	CA03320AA	ADD: ASTRO 25 CONVENTIONAL SOFTWARE
1	CA03317AA	ADD: DIGITAL CONV SIMULCAST SOFTWARE
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE

Qty.	Nomenclature	Description
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	DSTRAK91061	FOUR PORT DDM
1	DLN6898	FRU: FAN MODULE
<b>UHF Channel Remote Site (x7)</b>		
1	T7039	GTR 8000 Base Radio
1	X640AL	ADD: UHF R2 (435-524 MHZ)
1	CA01948AA	ADD: CONVENTIONAL SOFTWARE
1	CA01502AA	ADD: ASTRO 25 CONVENTIONAL SIMULCAS
1	CA01503AA	ADD: FALL BACK IN SIMULCAST CABINET
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA03111AA	ADD: CEC COMPLIANCE
1	X265AP	ADD: BR PRESELECTOR 380-512 MHZ
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	CA01400AA	ADD: POWER CABLE, DC
1	DSBCDUP02BD	450-470MHZ SINGLE CH DUPLEXER/RX AM
1	CLN1868	2930F 24-PORT SWITCH
1	T8547	SITE AND HUB ROUTER AND FIREWALL -
1	CA03445AA	ADD: MISSION CRITICAL HARDENING
1	CA03448AA	ADD: STATEFUL FIREWALL
1	TRN7343	SEVEN AND A HALF FOOT RACK
1	TRN7343	SEVEN AND A HALF FOOT RACK
1	DLN6896	FRU: PA UHF R2
1	DLN6887	FRU: XCVR UHF R2 V2 PWR EFF OPT CRD
1	DLN6805	FRU: ENERGY EFFICIENT POWER SUPPLY
1	DLN6898	FRU: FAN MODULE
1	DLN6455	CONFIGURATION/SERVICE SOFTWARE
15	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POL
2	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2
2	TDN9289	221213 CABLE WRAP WEATHERPROOFING
150	DSAVA550	AVA5-50, COAXIAL CABLE, CORRUGATED
2	DSA5DFD	D-CLASS 7-16 DIN FEMALE FOR AVA5-50
4	DSSG7812B2U	SG78-12B2U SUREGROUND GROUNDING KIT
1	DSL5SGRIP	L5SGRIP 7/8" SUPPORT HOIST GRIP
5	MDN6817	42396A-5 7/8" CABLE HANGER STAINLE
1	DSVHF50DMAPGR	RF SPD, 100-512MHZ, DC BLOCK HIGH P

Qty.	Nomenclature	Description
25	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POL
1	DDN1088	L4TNM-PSA TYPE N MALE PS FOR 1/2 IN
1	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2
<b>UHF Channel Antennas</b>		
1	DSFSA4067DIN	DIRECTIONAL DIPOLE ARRAY, 9 DBD, 13
1	DSFSA4067DIN	DIRECTIONAL DIPOLE ARRAY, 9 DBD, 13
1	DSCOL41070	OMNI. MEANDER COLLINEAR, 9 DBD, 450
1	DSCOL41070	OMNI. MEANDER COLLINEAR, 9 DBD, 450
1	DSCOL41070	OMNI. MEANDER COLLINEAR, 9 DBD, 450
1	DSBA8067DIN	OMNI. EXPOSED DIPOLE ARRAY, 6 DBD,
1	DSBA8067DIN	OMNI. EXPOSED DIPOLE ARRAY, 6 DBD,
<b>VHF RX Prime Site</b>		
1	T8341	GRV 8000 COMPARATOR
1	CA03084AA	ADD: COMPARATOR
1	CA01949AC	ADD: ANALOG CONV ONLY SW
1	CA01951AC	ADD: ANALOG CONV VOTING SW
1	CA01953AA	ADD: POWER EFFICIENCY PACKAGE
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA00719AA	ADD: ASTRO SYSTEM RELEASE 7.19
1	DLN6898	FRU: FAN MODULE
<b>VHF RX Remote Site (x3)</b>		
1	T7540	GPW 8000 RECEIVER
1	X301AR	ADD: QTY 1 GPW 8000 RECEIVER
1	X530BH	ADD: VHF (136-174 MHZ)
1	CA01953AB	ADD: POWER EFFICIENCY PACKAGE
1	CA03111AA	ADD: CEC COMPLIANCE
1	X153AW	ADD: RACK MOUNT HARDWARE
1	CA01400AA	ADD: POWER CABLE, DC
1	CA01954AB	WILDCARD w/GPIO
1	X265AM	BR PRESELCTOR, 150-174 MHZ
1	CA03090AB	ADD: RX ANALOG CONV IP VOTING/SIMUL
1	CA00718AA	ADD: ASTRO SYSTEM RELEASE 7.18
1	DLN6893	FRU: XCVR VHF V2 W/OPTION CARD
1	DLN6781	FRU: POWER SUPPLY
1	DLN6898	FRU: FAN MODULE
1	DLN6455	CONFIGURATION/SERVICE SOFTWARE
15	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POL

Qty.	Nomenclature	Description
1	DDN1088	L4TNM-PSA TYPE N MALE PS FOR 1/2 IN
1	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2
2	TDN9289	221213 CABLE WRAP WEATHERPROOFING
150	DSAVA550	AVA5-50, COAXIAL CABLE, CORRUGATED
2	DSA5NFS	N FEMALE FOR AVA5-50 CABLE
4	DSSG7812B2U	SG78-12B2U SUREGROUND GROUNDING KIT
1	DSL5SGRIP	L5SGRIP 7/8" SUPPORT HOIST GRIP
5	MDN6817	42396A-5 7/8" CABLE HANGER STAINLE
1	DSIS50NXC2MA	RF SPD, 125-1000MHZ DC BLOCK FLANGE
25	L1702	FSJ4-50B CABLE: 1/2" SUPERFLEX POLY
2	DDN9682	F4PNMV2-HC 1/2" TYPE N MALE PLATED
<b>VHF RX Remote Site Antennas</b>		
1	DSBA8041DIN	OMNI, EXPOSED DIPOLE ARRAY, 6 DBD,
1	DSBA8041DIN	OMNI, EXPOSED DIPOLE ARRAY, 6 DBD,
1	DSBA8041DIN	OMNI, EXPOSED DIPOLE ARRAY, 6 DBD,
7	DSUC1142	PIPE TO PIPE CLAMP, 1.5" TO 5" PIPE
10	DSUC1143	PIPE TO PIPE CLAMP, 1.5" TO 5" PIPE
3	DSUC1142	PIPE TO PIPE CLAMP, 1.5" TO 5" PIPE
<b>Microwave &amp; MPLS</b>		
9	DSIGMX104PREMAC	MX104 PREM BNDL 4MIC SLOTS 2PS 2RES JUNOS CIF DVR W/ 8X480TV
18	DSIGMIC3D20GESFPE	MIC-3D-20GE-SFP ENHANCED MAC SEC & TIMING PHY MAX 256 APS
18	DSIGCBLPWRC15MHTMP	2.5M 13A/125V PWR CORD AC C15M STRAIGHT NEMA N5-15 TO HIGH TEMP
54	DSIGSFP1GEFE	SFP 10/100/1000 COPPER
9	DSIGSVCNDMX104	ND SUPPORT FOR MX104
1	DSFG60D	FG-60D - 10 X GE RJ45 PORTS
1	DSIGMX104PREMAC	MX104 PREM BNDL 4MIC SLOTS 2PS 2RES JUNOS CIF DVR W/ 8X480TV
2	DSIGMIC3D20GESFPE	MIC-3D-20GE-SFP ENHANCED MAC SEC & TIMING PHY MAX 256 APS
4	DSIGSFP1GEFE	SFP 10/100/1000 COPPER
1	DSIGSVCNDMX104	ND SUPPORT FOR MX104
1	DS_POLA_NOKIA_MW_V1	CUSTOM NOKIA MICROWAVE QUOTE
<b>Knoll Hill Greenfield Site</b>		
1	TT1001	MSB 12X24 1-RM BLDG. INCLS GENERAC 70KW LP GEN & (2) 16KW UPS
1	TT01020AA	ADD: SIESMIC RATING OD GEN ONLY, 51%-220%G ONLY
1	TT01004AA	ALT: DIESEL GENERATOR (GENERAC)
1	TT01023AA	DEL: DELETE 20KVA/16KW UPS (QTY 2)

Qty.	Nomenclature	Description
1	DQ-462564-01	Valmont 2020 120-foot self-supported tower
1	DS500GTANKUPGB	500 GAL FUEL TANK OPTION (FOR 60-80KW) ADDER TO STANDLAONE GENSET
<b>Aeroflex Service Monitor Upgrades</b>		
1	DQTT05348AA	P25 CONTROL CHANNEL LOGGER / 390XOPT206 (REQUIRES 390XOPT200)
1	DQTT05359AA	P25 AES ENCRYPTION / 390XOPT240 / R2077A
1	DQTT05362AA	P25 PERFORMANCE TEST TRIGGERS / 390XOPT260
1	DS390XOPT644	MOTOROLA APX 8000 SERIES AUTOTEST/ALIGNMENT
1	DS390XOPT645	MOTOROLA APX "B" SERIES AUTOTEST/ALIGNMENT
1	DSTT05345AA	P25 CONVENTIONAL WITH DES OFB TYPE III / 390XOPT200 / R2075A
1	DSTT05356AA	AUTOTEST II FOR P25 RADIO SYSTEMS / 390XOPT218 / R2083A
1	DSTT05343AA	TRACKING GENERATOR / 390XOPT061 / R2020A
1	DQ390XOPT604	APX-7000 AUTOTEST & ALIGNMENT/ 390XOPT604
1	DDN9837	10 AMP CURRENT SHUNT 0.01 OHM / AC24011 / R1794A
1	DSTT05346AA	P25 TRUNKING VHF/UHF/700/800MHZ / 390XOPT201 (REQUIRES 390XOPT200)
1	DS390XOPT220	P25 PHASE 2 TWO-SLOT TDMA PHYSICAL LAYER/390XOPT220
1	DSTT05359AA	P25 AES ENCRYPTION / 390XOPT240 / R2077A
<b>DC Power Systems</b>		
1	DSL MHFX800ST	DC POWER SYS, 48V 800ADC 84X23X18 RELAY RACK, 1200 ADC DIST UNIT
8	DSL MHF7548VZE1T	48V, 75A LMHF RECTIFIER (T)
1	DSWL BG2088ST	BATTERY, 2088AH 48VDC STRING CONSISTING OF (24) 2V CELLS ST RATE VLRA
30	DSSP4KLMD C10B1A	LMDC BREAKER, 10A
1	DSL MHFX450ST	DC POWER SYS, 48V 450ADC, DIST MOD, LVLD, CONTROLLER, BATT DISC
4	DSL MHF7548VZE1T	48V, 75A LMHF RECTIFIER (T)
1	DSWL BG800ST	BATTERY, 800AH 48VDC STRING CONSISTING OF (24) 2V CELLS ST RATE VLRA
10	DSSP4KCDPD10B1	10 AMP BREAKER FOR TYPE CDPD
1	DSL MHFX450ST	DC POWER SYS, 48V 450ADC, DIST MOD, LVLD, CONTROLLER, BATT DISC
4	DSL MHF7548VZE1T	48V, 75A LMHF RECTIFIER (T)
1	DSWL BG800ST	BATTERY, 800AH 48VDC STRING CONSISTING OF (24) 2V CELLS ST RATE VLRA
10	DSSP4KCDPD10B1	10 AMP BREAKER FOR TYPE CDPD
1	DSL MHFX450ST	DC POWER SYS, 48V 450ADC, DIST MOD, LVLD, CONTROLLER, BATT DISC
4	DSL MHF7548VZE1T	48V, 75A LMHF RECTIFIER (T)
1	DSWL BG800ST	BATTERY, 800AH 48VDC STRING CONSISTING OF (24) 2V CELLS ST RATE VLRA

Qty.	Nomenclature	Description
10	DSSP4KCDPD10B1	10 AMP BREAKER FOR TYPE CDPD
1	DSL MHFX450ST	DC POWER SYS, 48V 450ADC, DIST MOD, LVLD, CONTROLLER, BATT DISC
4	DSL MHF7548VZE1T	48V, 75A LMHF RECTIFIER (T)
1	DSWL BG800ST	BATTERY, 800AH 48VDC STRING CONSISTING OF (24) 2V CELLS ST RATE VLRA
10	DSSP4KCDPD10B1	10 AMP BREAKER FOR TYPE CDPD
1	DSL MHFX450ST	DC POWER SYS, 48V 450ADC, DIST MOD, LVLD, CONTROLLER, BATT DISC
5	DSL MHF7548VZE1T	48V, 75A LMHF RECTIFIER (T)
1	DSWL BG1200ST	BATTERY, 1200AH 48VDC STRING CONSISTING OF (24) 2V CELLS ST RATE VLRA
10	DSSP4KCDPD10B1	10 AMP BREAKER FOR TYPE CDPD
1	DSL MHFX450ST	DC POWER SYS, 48V 450ADC, DIST MOD, LVLD, CONTROLLER, BATT DISC
5	DSL MHF7548VZE1T	48V, 75A LMHF RECTIFIER (T)
1	DSWL BG1200ST	BATTERY, 1200AH 48VDC STRING CONSISTING OF (24) 2V CELLS ST RATE VLRA
10	DSSP4KCDPD10B1	10 AMP BREAKER FOR TYPE CDPD
1	DSL MHFX450ST	DC POWER SYS, 48V 450ADC, DIST MOD, LVLD, CONTROLLER, BATT DISC
5	DSL MHF7548VZE1T	48V, 75A LMHF RECTIFIER (T)
1	DSWL BG1200ST	BATTERY, 1200AH 48VDC STRING CONSISTING OF (24) 2V CELLS ST RATE VLRA
30	DSSP4KCDPD10B1	10 AMP BREAKER FOR TYPE CDPD
<b>In-Building DAS</b>		
1	DS_POLA_NOKIA_MW_V1	CUSTOM NOKIA MICROWAVE QUOTE
1	DS_BDA_POLA_SPV	POLA BDA EQUIPMENT S PALOS VERDES ST.
1	DS_BDA_POLA_PD	POLA BDA EQUIPMENT PD BUILDING
<b>APX Subscriber Feature Upgrades</b>		
1	T8627	TDMA
320	QA03399AB	ADD: ENHANCED DATA
320	QA09008	ADD: GROUP SERVICES FLP

SECTION 5

# ACCEPTANCE TEST PLAN

## Port of Los Angeles - P25 Trunking Upgrade

ASTRO25 7.17 M-Core & Simulcast Trunking

Draft ATP – (Finalized in Design Review)



# 5.1 WIDE AREA TRUNKING - TDMA ONLY SITES

## 5.1.1 Auto Site Affiliation

### 1. DESCRIPTION

A Radio affiliation is a function that links a unique radio ID and unique talkgroup to a specific site. This information is stored in a affiliation table in the zone database.

Before resources are assigned, the affiliation table is accessed to know which sites need to be assigned to support the call. Only the sites that need to be assigned that have associated talkgroups will be assigned. If the site does not have that talkgroup affiliated to it will not be assigned. This allows for more calls to be processed with fewer resources.

### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 1  
RADIO-3 - TALKGROUP 2  
RADIO-3 - SITE - SITE 2  
RADIO-4 - TALKGROUP 2  
RADIO-4 - SITE - SITE 2

This test requires the ZoneWatch feature.

Note: There are system settings which could affect the assignment of resources, such as required site.

**VERSION #1.030**

### 2. TEST

- Step 1. Turn RADIO-1 off and on.
- Step 2. Verify via ZoneWatch that RADIO-1 sends in its affiliation.
- Step 3. Initiate a call using RADIO-1 on TALKGROUP 1.
- Step 4. Verify RADIO-2 can receive and respond to the call. Using ZoneWatch verify that no resources are assigned at SITE 2 as there are no subscribers affiliated to TALKGROUP 1 at SITE 2.
- Step 5. Initiate a call on TALKGROUP 2 using RADIO-3.
- Step 6. Verify that RADIO-4 can receive and respond to the call. Using ZoneWatch verify that no resources are assigned at SITE 1 as there are no subscribers affiliated to TALKGROUP 2 at SITE 1.

Pass \_\_\_\_ Fail \_\_\_\_

## Wide Area Trunking - TDMA Only Sites

### 5.1.2 Talkgroup Call

#### 1. DESCRIPTION

The Talkgroup is the primary level of organization for communications on a trunked radio system. Radios with Talkgroup call capability will be able to communicate with other members of the same Talkgroup. This provides the effect of a private channel down to the Talkgroup level.

This test will demonstrate that a Talkgroup transmission initiated by a radio user will only be heard by system users, which have, the same Talkgroup selected. As with other types of calls, Talkgroup calls can take place from anywhere in the system.

#### SETUP

RADIO-1 - SITE 1 - TALKGROUP 1  
RADIO-2 - SITE 2 - TALKGROUP 1  
RADIO-3 - SITE 1 - TALKGROUP 2  
RADIO-4 - SITE 2 - TALKGROUP 2

#### VERSION #1.040

#### 2. TEST

- Step 1. Initiate a Wide Area Call with RADIO-1 in TALKGROUP 1.
- Step 2. Observe that only RADIO-2 will be able to monitor and respond to the call.
- Step 3. Initiate a Wide Area Call with RADIO-3 in TALKGROUP 2.
- Step 4. Observe that only RADIO-4 will be able to monitor and respond the call.

Pass\_\_\_\_ Fail\_\_\_\_



## Wide Area Trunking - TDMA Only Sites

### 5.1.3 Recent User Priority (TDMA)

#### 1. DESCRIPTION

A recent user of the channel has priority over other users of equal priority of being assigned a channel when a busy queue exists. The maximum number of consecutive times that a user may be elevated to recent user priority is two.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 2  
RADIO-2 - SITE - SITE 1  
RADIO-3 - TALKGROUP 3  
RADIO-3 - SITE - SITE 1  
RADIO-5 - TALKGROUP 4  
RADIO-5 - SITE - SITE 1

#### VERSION #1.030

#### 2. TEST

- Step 1. Ensure that the priority level for all talkgroups is the same. Simulate a busy system by disabling all the physical channels at SITE 1 with the exception of the control channel and one voice channel. Press the PTT of RADIO-5 and keep this call in progress for the duration of the test
- Step 2. Press and hold the PTT switch of RADIO-1.
- Step 3. Press and hold the PTT switch on RADIO-2 and then press and hold the PTT switch on RADIO-3. Verify that both radios receive a busy tone.
- Step 4. Release the PTT switches on RADIO-2 and RADIO-3.
- Step 5. Release the PTT switch on RADIO-1.
- Step 6. As soon as RADIO-2 receives its callback tone, press and hold its PTT switch.
- Step 7. Within 2 seconds of callback, re-key RADIO-1. Verify that RADIO-1 receives a busy tone. Release the PTT switch on RADIO-1.
- Step 8. Release the PTT switch on RADIO-2. Verify that RADIO-1 receives a callback tone before RADIO-3.
- Step 9. Repeat Steps 2-8 for RADIO-1 and RADIO-2. Verify that the priority of RADIO-1 is once more elevated in the busy queue.
- Step 10. Repeat Steps 2-8 for RADIO-1 and RADIO-2 once more. Verify that in Step 9 that RADIO-3 receives the callback tone since RADIO-1 cannot be elevated in the busy queue more than two consecutive times. Release the PTT of RADIO-5.

Pass\_\_\_\_ Fail\_\_\_\_

## Wide Area Trunking - TDMA Only Sites

### 5.1.4 Continuous Assignment Updating

#### 1. DESCRIPTION

When a talkgroup is assigned a voice channel, the site controller continues to transmit the channel assignment on the control channel for the duration of the talkgroup call. Radios coming into use on the system are automatically sent to voice channels with conversations in progress involving their selected talkgroups.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 1  
RADIO-3 - TALKGROUP 1

VERSION #1.010

#### 2. TEST

- Step 1. Turn OFF RADIO-1.
- Step 2. Initiate a Talkgroup Call using RADIO-2 and verify RADIO-3 hears the audio.
- Step 3. While the Talkgroup Call is in progress, turn ON RADIO-1.
- Step 4. Observe RADIO-1, which was just brought back into service, joins the Talkgroup Call already in progress.
- Step 5. End the talkgroup call.
- Step 6. Switch RADIO-1 to another talkgroup.
- Step 7. Initiate a Talkgroup Call from RADIO-2 to RADIO-3.
- Step 8. While the Talkgroup Call is in progress, set RADIO-1 back to TALKGROUP 1.
- Step 9. Observe that RADIO-1 joins the Talkgroup Call already in progress.

Pass \_\_\_\_ Fail \_\_\_\_



## Wide Area Trunking - TDMA Only Sites

### 5.1.5 Call Alert

#### 1. DESCRIPTION

Call Alert is a tone page that allows a user to selectively alert another radio unit. The initiating radio will receive notification from the trunked system as to whether or not the page was received by the target radio. Units receiving a Call Alert will sound an alert tone. As with other types of calls, Call Alerts can take place from anywhere in the system.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 2  
RADIO-3 - TALKGROUP 3

VERSION #1.010

#### 2. TEST

- Step 1. Using RADIO-1, press the page button.
- Step 2. Enter the unit ID of RADIO-2 with the keypad, or scroll to the location where this ID is stored
- Step 3. Press the PTT to initiate the call alert. Verify that the RADIO-1 user receives audible indication that the Call Alert was sent.
- Step 4. Verify that RADIO-2 user receives an audible indication of an incoming Call Alert was sent but RADIO-3 does not.
- Step 5. Verify RADIO-1 gets an audible indication that the Call Alert was successfully received at the target radio.
- Step 6. Turn off RADIO-2. Send a Call Alert from RADIO-1 to RADIO-2.
- Step 7. Verify that the RADIO-1 user receives audible indication that the Call Alert was sent.
- Step 8. Verify RADIO-1 receives a "No Acknowledgement" indication that the Call Alert was not received at the target radio.

Pass \_\_\_\_ Fail \_\_\_\_

## Wide Area Trunking - TDMA Only Sites

### 5.1.6 Private Call

#### 1. DESCRIPTION

Private Call is a selective calling feature that allows a radio user to carry on one-to-one conversation that is only heard by the 2 parties involved. Subscriber units receiving a private call will sound an alert tone. As with other types of calls, Private Calls can take place from anywhere in the system.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 1  
RADIO-3 - TALKGROUP 1

#### VERSION #1.020

#### 2. TEST

- Step 1. Using RADIO-1, press the Private Call (Call) button.
- Step 2. Enter the unit ID of RADIO-2 with the keypad, or scroll to the location where this ID is stored.
- Step 3. Press the PTT to initiate the Private Call.
- Step 4. Verify that RADIO-2 hears tones and the display indicates that a Private Call has been received, but RADIO-3 receives no indications.
- Step 5. Answer the call at RADIO-2 by pressing the Private Call (Call)/Respond button. If RADIO-2 has a display, verify it shows the ID number or Alias of the calling unit.
- Step 6. Press the PTT switch on RADIO-2 and respond to the Private Call. Note that if you do not press the Private Call button before pressing PTT, your audio will be heard by all members of the talkgroup, and not just by the radio initiating the Private Call.
- Step 7. Verify that RADIO-2 can communicate with RADIO-1.
- Step 8. Verify that RADIO-3 does not monitor the Private Call.
- Step 9. End the Private Call by pressing the "home" key and return to normal talkgroup operation.

Pass\_\_\_\_ Fail\_\_\_\_

## Wide Area Trunking - TDMA Only Sites

### 5.1.7 Emergency Alarm and Call with Top of Queue (TDMA)

#### 1. DESCRIPTION

Users in life threatening situations can use the Emergency button on the radio to immediately send a signal to the dispatcher and be assigned the next available voice channel. An Emergency Call can be set to either Top of Queue or Ruthless Preemption operation. To accomplish this test, an Emergency Alarm and Call will be initiated from a subscriber which will be received by a subscriber affiliated at any site of any zone in the system.

NOTE: If the subscriber does not have the Display option, the Emergency ID will not be displayed.

NOTE: All radios and talkgroups should start with default priorities. Default is 10.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - Any Site  
RADIO-3 - TALKGROUP 2  
RADIO-3 - SITE - SITE 1  
RADIO-4 - TALKGROUP 3  
RADIO-4 - SITE - SITE 1  
RADIO-5 - TALKGROUP 4  
RADIO-5 - SITE - Any Site

VERSION #1.020

#### 2. TEST

- Step 1. Verify the emergency type for TALKGROUP 1's template to be set up as Top of Queue.
- Step 2. Simulate a busy system by disabling all channels at SITE 1 with the exception of the control channel and one physical voice channel. Press the PTT on RADIO-5 and hold until the completion of the test.
- Step 3. Press the PTT to initiate a call with RADIO-3 and hold the PTT switch until instructed to release.
- Step 4. Key RADIO-4 and verify the radio receives a busy tone. Release the PTT switch on RADIO-4.
- Step 5. Using RADIO-1, send an Emergency Call by depressing the emergency switch and then the PTT switch.
- Step 6. Observe that RADIO-1 cannot transmit due to the voice channel being busy.
- Step 7. Release the PTT switch on RADIO-3. Observe that RADIO-1 receives the call back before RADIO-4 and is able to proceed with the call.
- Step 8. Observe that the display on RADIO-2 denotes an emergency and the unit ID or alias of RADIO-1.
- Step 9. Dekey RADIO-1 and end the Emergency Call by holding down the Emergency button on RADIO-1 until an alert tone sounds. Verify RADIO-1 returns to normal operation.
- Step 10. Verify RADIO-4 receives a callback. Release the PTT on RADIO-5. Return the system to normal operation.

Pass\_\_\_\_ Fail\_\_\_\_

## Wide Area Trunking - TDMA Only Sites

### 5.1.8 Emergency Alarm and Call with Ruthless Preemption (TDMA)

#### 1. DESCRIPTION

Users in life threatening situations can use the Emergency button on the radio to immediately send a signal to the dispatcher and be assigned the next available voice channel. An Emergency Call can be set to either Top of Queue or Ruthless Preemption operation. To accomplish this test, an Emergency Alarm and Call will be initiated from a subscriber which will be received by a subscriber, on the same talkgroup, affiliated at any site of any zone in the system.

NOTE: If the subscriber does not have the Display option, the Emergency ID will not be displayed. This test is not recommended for single site systems as RF contention will occur.

#### SETUP

RADIO-1 - TALKGROUP 5  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 5  
RADIO-2 - SITE - SITE 2  
RADIO-3 - TALKGROUP 2  
RADIO-3 - SITE - SITE 1  
RADIO-4 - TALKGROUP 2  
RADIO-4 - SITE - SITE 1  
RADIO-5 - TALKGROUP 1  
RADIO-5 - SITE - SITE 1  
CONSOLE-1 - TALKGROUP 5

#### VERSION #1.020

#### 2. TEST

- Step 1. Verify the emergency type for TALKGROUP 5's template is configured as Ruthless Preemption.
- Step 2. Simulate a busy system by disabling all physical channels at SITE 1 with the exception of the control channel and one voice channel. Press the PTT on RADIO-4 and keep the call in progress for the duration of the test. Verify RADIO-3 receives the call.
- Step 3. Press the PTT to initiate a call with RADIO-5 and hold the PTT switch until instructed to release.
- Step 4. Key RADIO-1 and verify the radio receives a busy tone. Release the PTT switch on RADIO-1.
- Step 5. Using RADIO-1 send an Emergency Call by pressing the emergency switch and then the PTT switch.
- Step 6. Observe that RADIO-1 is granted the channel immediately and the Talkgroup Call is dropped for RADIO-4. Verify an Emergency Alarm is displayed at a console position monitoring TALKGROUP 5. Verify that CONSOLE-1 and RADIO-2 receive audio from RADIO-1. Dekey RADIO-4.
- Step 7. Key RADIO-3 and verify the radio receives a busy tone. Release the PTT switch on RADIO-3.
- Step 8. End the Emergency Call by holding down the Emergency button on RADIO-1 until an alert tone sounds. Verify RADIO-1 returns to normal operation and that RADIO-3 receives a callback after the emergency hang time expires.
- Step 9. Release the PTT on RADIO-5.
- Step 10. Enable the disabled channels at SITE 1 to return the system to normal operation.

Pass\_\_\_\_ Fail\_\_\_\_



## Wide Area Trunking - TDMA Only Sites

### 5.1.9 All Start Talkgroups (TDMA)

#### 1. DESCRIPTION

Talkgroups can be set up as either All Start or Fast Start.

"AllStart" is the default Talkgroup Call setup approach that requires that all sites with affiliated talkgroup members and other required resources be available before the call begins. Otherwise, the system returns a busy response to the subscriber who initiated the Talkgroup Call. Once the required resources become available, the call is granted. NOTE: This feature only works on a multi-site system.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 2  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 1  
RADIO-3 - TALKGROUP 2  
RADIO-3 - SITE - SITE 1  
RADIO-5 - TALKGROUP 4  
RADIO-5 - SITE - SITE 1

#### VERSION #1.020

#### 2. TEST

- Step 1. Verify TALKGROUP 1's template is setup as an All Start Talkgroup.
- Step 2. Simulate a busy system by disabling all channels at SITE 1 with the exception of the control channel and one physical voice channel.
- Step 3. Press the PTT on RADIO-5 and keep the call up for the duration of the test.
- Step 4. Key RADIO-3 and busy out the only remaining voice channel at SITE 1 where RADIO-2 and RADIO-3 are affiliated..
- Step 5. Initiate a Talkgroup call from RADIO-1 and observe a busy indication is received due to no available voice channel at SITE 1 where RADIO-2 is affiliated.
- Step 6. End the call from RADIO-3. Verify that the call from RADIO-1 is now granted and RADIO-2 can hear the audio.
- Step 7. Release the PTT on RADIO-5.

Pass\_\_\_\_ Fail\_\_\_\_

## Wide Area Trunking - TDMA Only Sites

### 5.1.10 Fast Start Talkgroup without Critical Site (TDMA)

#### 1. DESCRIPTION

Talkgroups can be set up as either All Start or Fast Start.

A "FastStart" configuration for the Talkgroup Call allows a group call setup whether or not all affiliated Talkgroup members are available. This "Automatic Busy Override by Talkgroup" call setup method still requires the participation of all affiliated consoles, LOMIs (i.e. logging recorders) and critical sites before the call can begin. As channels at the affiliated talkgroup members' sites become available, they are added to the call in progress.

NOTE: This feature only works on a multi-site system.

#### SETUP

RADIO-1 - TALKGROUP 4  
RADIO-1 - SITE - SITE 2  
RADIO-2 - TALKGROUP 4  
RADIO-2 - SITE - SITE 1  
RADIO-3 - TALKGROUP 2  
RADIO-3 - SITE - SITE 1  
RADIO-5 - TALKGROUP 1  
RADIO-5 - SITE - SITE 1

#### VERSION #1.010

#### 2. TEST

- Step 1. Verify that TALKGROUP 4's template is set up as Fast Start with no critical sites specified.
- Step 2. Simulate a busy system by disabling all physical channels at SITE 1 with the exception of the control channel and one voice channel. Press the PTT on RADIO-5 and keep this call in progress for the duration of the test.
- Step 3. Key RADIO-3 and busy out the only remaining voice channel available at SITE 1.
- Step 4. Initiate a Talkgroup Call from RADIO-1 and observe the call is granted even with no voice channel available at SITE 1 for RADIO-2.
- Step 5. Dekey RADIO-3. Verify that RADIO-2 can now hear RADIO-1. Release the PTT on RADIO-5.

Pass \_\_\_\_ Fail \_\_\_\_

## Wide Area Trunking - TDMA Only Sites

### 5.1.11 Priority Monitor/Non-Priority Scan

#### 1. DESCRIPTION

This test will demonstrate that a subscriber unit can scan a pre-programmed list to find any Priority and Non-priority Talkgroups with assigned voice channels at that site. To demonstrate this, a call will be initiated from a subscriber at a remote site on a talkgroup monitored by a subscriber at the same site as the scanning radio. The scanning radio will scan from its selected talkgroup to the active talkgroup.

Note: Subscribers must be capable of supporting the Talkgroup scan.

#### SETUP

RADIO-1 - TALKGROUP 1 (SCANNING)  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 2  
RADIO-2 - SITE - SITE 1  
RADIO-3 - TALKGROUP 3  
RADIO-3 - SITE - SITE 1  
RADIO-4 - TALKGROUP 3  
RADIO-4 - SITE - SITE 2

\* RADIO-1 needs to be set to a dial position configured to scan.

#### VERSION #1.010

#### 2. TEST

- Step 1. Verify that RADIO-1 is set to TALKGROUP 1 and in the scan mode of operation and programmed to scan TALKGROUP 1, TALKGROUP 2, and TALKGROUP 3.
- Step 2. Initiate a Talkgroup Call with RADIO-4 and observe that RADIO-1 scans to the talkgroup and receives the call. Keep the call in progress until completion of the following step.
- Step 3. Initiate a Talkgroup Call with RADIO-2 and observe that RADIO-1 does not receive the call since RADIO-1 is listening to TALKGROUP 3.

Pass\_\_\_\_ Fail\_\_\_\_

## Wide Area Trunking - TDMA Only Sites

### 5.1.12 Alias Download to a Talkgroup

#### 1. DESCRIPTION

When alias download is enabled in the radio, the infrastructure will deliver the Radio Alias of the transmitting radio as defined in the provisioning manager to all members of a talkgroup at the end of a group call during hang time. Updated radio aliases are displayed on the next PTT.

#### SETUP

RADIO-1 - TALKGROUP 1 (Must be equipped with a display and affiliated to the TALKGROUP)

RADIO-2 - TALKGROUP 1 (Must be equipped with a display and affiliated to the TALKGROUP)

#### VERSION #1.000

#### 2. TEST

- Step 1. From RADIO-1, initiate a voice call to TALKGROUP 1.
- Step 2. Verify that audio is received at RADIO-2 and that RADIO-1's alias is displayed on RADIO-2's display.
- Step 3. In the Provisioning Manager, open the radio record for RADIO-1 and change the alias. Distribute the changes to the infrastructure.
- Step 4. From RADIO-1, initiate two to three voice calls to TALKGROUP 1 spaced 10 seconds apart.
- Step 5. Verify that audio is received at RADIO-2 and that RADIO-1's updated alias is eventually displayed on RADIO-2's display.

Pass\_\_\_\_ Fail\_\_\_\_



## 5.2 MCC 7100/7500 TRUNKED RESOURCES

### 5.2.1 Instant Transmit

#### 1. DESCRIPTION

The instant transmit switch provides immediate operator access to a channel, independent of its select status (selected or unselected). It provides priority over other dispatcher transmit bars or optional footswitches.

#### SETUP

RADIO-1 - TALKGROUP 1  
CONSOLE-1 – TALKGROUP 1 (Selected),  
TALKGROUP 2 (Unselect mode)

#### VERSION #1.010

#### 2. TEST

- Step 1. Using CONSOLE-1, press the Instant Transmit button on TALKGROUP 1.
- Step 2. Verify that the Transmit indicator is lit.
- Step 3. Verify RADIO-1 can monitor and respond to the call on TALKGROUP 1.
- Step 4. On RADIO-1 change to TALKGROUP 2.
- Step 5. Using CONSOLE-1, press the Instant Transmit button on the TALKGROUP 2 radio resource.
- Step 6. Verify RADIO-1 can monitor and respond to the call on TALKGROUP 2.

Pass\_\_\_\_ Fail\_\_\_\_

## MCC 7100/7500 Trunked Resources

### 5.2.2 Talkgroup Selection and Call

#### 1. DESCRIPTION

The Talkgroup Call is the primary level of organization for communications on a trunked radio system. Dispatchers with Talkgroup Call capability will be able to communicate with other members of the same talkgroup. This provides the effect of an assigned channel down to the talkgroup level. When a Talkgroup Call is initiated from a subscriber unit, the call is indicated on each dispatch operator position that has a channel control resource associated with the unit's channel/talkgroup.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 2  
RADIO-3 - TALKGROUP 1  
RADIO-4 - TALKGROUP 2  
CONSOLE-1 - TALKGROUP 1  
CONSOLE-2 - TALKGROUP 2

VERSION #1.010

#### 2. TEST

- Step 1. Initiate a wide area call from CONSOLE-1 on TALKGROUP 1.
- Step 2. Observe that RADIO-1 and RADIO-3 will be able to monitor the call. Dekey the console and have either radio respond to the call.
- Step 3. Observe that all consoles with TALKGROUP 1 can monitor both sides of the conversation.
- Step 4. Initiate a wide area call from CONSOLE-2 on TALKGROUP 2.
- Step 5. Observe that RADIO-2 and RADIO-4 will be able to monitor the call. Dekey the console and have either radio respond to the call.
- Step 6. Observe that all consoles with TALKGROUP 2 can monitor both sides of the conversation.

Pass \_\_\_\_ Fail \_\_\_\_



## MCC 7100/7500 Trunked Resources

### 5.2.3 PTT Unit ID/Alias Display

#### 1. DESCRIPTION

Console operator positions contain various resources such as talkgroup, multigroup, Private Call which enables the dispatcher to communicate with the subscriber units. If activity occurs on one of these operator position resources, the unit ID or associated alias of the initiating radio appears at the console resource.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 1  
CONSOLE-1 - TALKGROUP 1  
CONSOLE-2 - TALKGROUP 1

#### VERSION #1.010

#### 2. TEST

- Step 1. Select the resource for TALKGROUP 1 on CONSOLE-1.
- Step 2. Initiate a call on TALKGROUP 1 from RADIO-2 and observe that the alias is seen at CONSOLE-1 in the resource window as well as in the Activity Log window.
- Step 3. Initiate a call from RADIO-1 and observe that the alias of RADIO-1 is seen at CONSOLE-1 in the resource window as well as in the Activity Log window.
- Step 4. Modify RADIO-2's alias. Make sure to give enough time for the alias change to propagate to the Zone Controller.
- Step 5. Initiate a call from RADIO-2 and observe the new alias of RADIO-2 is seen at CONSOLE-1 in the list in the resource window as well as in the Activity Log window.
- Step 6. Return RADIO-2's alias to its original state.

Pass \_\_\_\_ Fail \_\_\_\_

## MCC 7100/7500 Trunked Resources

### 5.2.4 Emergency Alarm and Call Display Description

#### 1. DESCRIPTION

Users in life threatening situations can use the emergency button on the radio to send an audible alarm and a visual alarm signal to a console operator in order to request immediate system access to a voice channel for an emergency call. An emergency alarm begins after the radio user presses the radio's emergency button. Pressing the emergency button places the radio in "emergency mode". To begin an emergency call, the radio user must press the radio's PTT button while in "emergency mode." The assigned voice channel will be dedicated to the emergency caller's talkgroup for an extended period of time, equal to the Message Hang Time plus the Emergency Hang Time. As with other call types, emergency calls can operate across sites as well as within the same site.

#### SETUP

RADIO-1 - TALKGROUP 1  
CONSOLE-1 - TALKGROUP 1  
CONSOLE-2 - TALKGROUP 1

#### VERSION #1.010

#### 2. TEST

- Step 1. Initiate an Emergency Alarm from RADIO-1.
- Step 2. Observe the Emergency from RADIO-1 is received at CONSOLE-1 for TALKGROUP 1.
- Step 3. Acknowledge the Emergency at the operator position. Verify CONSOLE-2 receives notification that the call has been acknowledged.
- Step 4. Initiate a call with RADIO-1 to initiate an Emergency call.
- Step 5. Observe CONSOLE-1 and CONSOLE-2 can monitor RADIO-1
- Step 6. Clear the Emergency from CONSOLE-1 on TALKGROUP 1.
- Step 7. End the Emergency Alarm from RADIO-1.

Pass \_\_\_\_\_ Fail \_\_\_\_\_

## MCC 7100/7500 Trunked Resources

### 5.2.5 Multi-Select Operation

#### 1. DESCRIPTION

Multi-Select (Msel) allows the console operator to group a number of channels/talkgroups together such that when the general transmit bar is depressed, all of the multi-selected channels/talkgroups will transmit at the same time with the same information. Multi-Select is one way communication call. If a radio user responds to a Multi-Select call the talkgroup the user is affiliated to will be the only one to hear the call. There is no super-group formed, so radio communication is still at the single talkgroup level. Multi-Select is utilized to send an APB to several channels/talkgroups. A Multi-Select has a limit of twenty (20) trunking/conventional resources

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 2  
CONSOLE-1 - TALKGROUP 1, TALKGROUP 2

#### VERSION #1.010

#### 2. TEST

- Step 1. From CONSOLE-1, create an Msel group with TALKGROUP 1 and TALKGROUP 2.
- Step 2. Transmit on the Msel using the Msel instant transmit button.
- Step 3. Verify that RADIO-1 and RADIO-2 hear the call.
- Step 4. Initiate a call with RADIO-1.
- Step 5. Verify the call is heard on CONSOLE-1 but not on RADIO-2.
- Step 6. Initiate a call with RADIO-2.
- Step 7. Verify the call is heard on CONSOLE-1 but not on RADIO-1.
- Step 8. On CONSOLE-1 dissolve the Msel.

Pass\_\_\_\_ Fail\_\_\_\_

## MCC 7100/7500 Trunked Resources

### 5.2.6 Talkgroup Patch

#### 1. DESCRIPTION

Talkgroup Patch allows a dispatcher to merge several talkgroups together on one voice channel to participate in a single conversation. This can be used for situations involving two or more talkgroups that need to communicate with each other. Using the Patch feature, the console operator can talk and listen to all of the selected talkgroups grouped; in addition, the members of the individual talkgroups can also talk or listen to members of other talkgroups. Patched talkgroups can communicate with the console dispatcher and other members of different talkgroups because of the "supergroup" nature of the Patch feature.

NOTE : If "secure" and "clear" resources are patched together, one repeater for each mode may be assigned per site.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 2  
RADIO-3 - TALKGROUP 1  
RADIO-4 - TALKGROUP 2  
CONSOLE-1 - TALKGROUP 1 and TALKGROUP 2

Note: All 4 Radios must have the same home zone.

#### VERSION #1.010

#### 2. TEST

- Step 1. Using CONSOLE-1 create a patch between TALKGROUP 1 and TALKGROUP 2.
- Step 2. Initiate a patch call from CONSOLE-1.
- Step 3. Verify RADIO-1, RADIO-2, RADIO-3, and RADIO-4 can monitor the call.
- Step 4. Initiate several calls between the radios and verify successful communication.
- Step 5. Dissolve the patch created in step 1.

Pass \_\_\_\_ Fail \_\_\_\_

---

## 5.2.7 Talkgroup Patch - Secure

---

### 1. DESCRIPTION

Talkgroup Patch allows a dispatcher to merge several talkgroups together on one voice channel to participate in a single conversation. This can be used for situations involving two or more talkgroups that need to communicate with each other. Using the Patch feature, the console operator can talk and listen to all of the selected talkgroups grouped; in addition, the members of the individual talkgroups can also talk or listen to members of other talkgroups. Patched talkgroups can communicate with the console dispatcher and other members of different talkgroups because of the "supergroup" nature of the Patch feature.

### SETUP

RADIO-1 - TALKGROUP 1 (Secure TX Mode)  
RADIO-2 - TALKGROUP 2 (Secure TX Mode)  
RADIO-3 - TALKGROUP 1 (No secure keys loaded)  
RADIO-4 - TALKGROUP 2 (Clear TX Mode with keys loaded)  
CONSOLE-1 - TALKGROUP 1 and TALKGROUP 2 (Secure TX Mode)

Note: All 4 Radios must have the same home zone.

### VERSION #1.010

### 2. TEST

- Step 1. Using CONSOLE-1 create a secure patch between TALKGROUP 1 and TALKGROUP 2.
- Step 2. Initiate a patch call from CONSOLE-1.
- Step 3. Verify RADIO-1, RADIO-2 and RADIO-4 can monitor the call.
- Step 4. Initiate a talkgroup call on TALKGROUP 1 from RADIO-1.
- Step 5. Observe that all radios are able to hear RADIO-1 except RADIO-3.
- Step 6. Dissolve the patch.

Pass \_\_\_\_ Fail \_\_\_\_

---

## 5.2.8 Talkgroup Patch with Conventional

---

### 1. DESCRIPTION

Talkgroup Patch allows a dispatcher to merge several talkgroups together on one voice channel to participate in a single conversation. This can be used for situations involving two or more channels or talkgroups that need to communicate with each other.

Using the Patch feature, the console operator can talk and listen to all of the selected talkgroups grouped; in addition, the members of the individual channels/talkgroups can also talk or listen to members of other channels/talkgroups. Patched resources can communicate with the console dispatcher and other members of different channels/talkgroups because of the "supergroup" nature of the Patch feature.

NOTE : If "secure" and "clear" resources are patched together, one repeater for each mode may be assigned per site.

### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - CONVENTIONAL CHANNEL 1  
RADIO-3 - TALKGROUP 1  
RADIO-4 - CONVENTIONAL CHANNEL 1  
CONSOLE-1 - TALKGROUP 1 and  
CONVENTIONAL CHANNEL 1

### VERSION #1.010

### 2. TEST

- Step 1. Using CONSOLE-1 create a patch between TALKGROUP 1 and CONVENTIONAL CHANNEL 1.
- Step 2. Initiate a patch call from CONSOLE-1.
- Step 3. Verify RADIO-1, RADIO-2, RADIO-3, and RADIO-4 can monitor the call
- Step 4. Initiate several calls between the radios and verify successful communication
- Step 5. Dissolve the patch created in step 1.

Pass \_\_\_\_ Fail \_\_\_\_

## MCC 7100/7500 Trunked Resources

### 5.2.9 Call Alert

#### 1. DESCRIPTION

Call Alert Page allows a subscriber/dispatcher to selectively alert another radio unit. The initiating subscriber/console will receive notification as to whether or not the call alert was received. Units receiving a Call Alert will sound an alert tone and show a visual alert indication. The display will also show the individual ID of the initiating subscriber/console unit.

#### SETUP

RADIO-1 - TALKGROUP 1  
CONSOLE-1 - TALKGROUP 1

VERSION #1.030

#### 2. TEST

- Step 1. Using CONSOLE-1, select the call alert button in the "Private Call" resource window.
- Step 2. Enter the ID of RADIO-1 and send the call alert to RADIO-1.
- Step 3. Verify that RADIO-1 receives the alert and that the ID or alias of the console is shown.
- Step 4. Turn off RADIO-1.
- Step 5. Using CONSOLE-1, send the call alert to RADIO-1 again.
- Step 6. Verify that after trying to page RADIO-1, the console displays "Can not send call alert - target not found" in the summary/status list.

Pass\_\_\_\_ Fail\_\_\_\_

## MCC 7100/7500 Trunked Resources

### 5.2.10 Console Initiated Private Call to Subscriber

#### 1. DESCRIPTION

Private Conversation is a selective calling feature which allows a dispatcher or radio user to carry on one-to-one conversation that is heard only by the two parties involved. Subscriber units receiving a private call will sound an alert tone. As with other call types, Private Calls operate across sites as well as within the same site.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 1  
CONSOLE-1 - TALKGROUP 1

VERSION #1.020

#### 2. TEST

- Step 1. Using CONSOLE-1, select the "PRIVATE-CALL" tile and click the Private Call function.
- Step 2. Select the unit to be Private Called, in this case RADIO-1. (or select the numeric keypad and enter the Unit ID to be Private Called.)
- Step 3. Click the Send button.
- Step 4. Answer the Private Call with RADIO-1 and respond to the console.
- Step 5. Verify RADIO-2 does not hear the private conversation.
- Step 6. After completing the Private Call, return to the normal talkgroup mode.

Pass\_\_\_\_ Fail\_\_\_\_



## MCC 7100/7500 Trunked Resources

### 5.2.11 Console Priority

#### 1. DESCRIPTION

Console Operator Positions have ultimate control of transmitted audio on an assigned voice channel resource. The Console Position has the capability to take control of an assigned voice channel for a talkgroup call so that the operator's audio overrides any subscriber audio. Console priority is a feature that enables dispatchers to gain immediate access to an assigned voice channel so that a central point of audio control exists.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 1  
CONSOLE-1 - TALKGROUP 1

VERSION #1.020

#### 2. TEST

- Step 1. Initiate a Talkgroup call from RADIO-1 on TALKGROUP 1. Keep this call in progress until the test has completed.
- Step 2. Observe that RADIO-2 receives the call.
- Step 3. While the call is in progress, key up CONSOLE-1 on TALKGROUP 1.
- Step 4. Observe that RADIO-2 is now receiving audio from CONSOLE-1 on TALKGROUP 1.
- Step 5. De-key CONSOLE-1.
- Step 6. Verify RADIO-2 now receives RADIO-1 audio.
- Step 7. End the TALKGROUP 1 call from RADIO-1.

Pass\_\_\_\_ Fail\_\_\_\_

## MCC 7100/7500 Trunked Resources

### 5.2.12 Remote Monitor

#### 1. DESCRIPTION

Remote Monitor from Console is a call type in which the console operator can select and remotely key a subscriber unit. This allows the dispatcher to monitor the transmit audio remotely and without detection. This feature is useful in situations where the subscriber unit has been stolen, or there is a need to determine if the radio user is incapacitated and cannot activate a PTT (i.e. an officer has been injured or is under duress). The radio being monitored will not show any sign of being keyed up. This test can be run in secure or clear mode on a trunked 9600 or 3600 site.

#### SETUP

RADIO-1 - TALKGROUP 1

CONSOLE-1 - TALKGROUP 1

**VERSION #1.020**

#### 2. TEST

- Step 1. Put RADIO-1 into Remote Monitor via the Remote Monitor tile on the CONSOLE-1.
- Step 2. Verify that RADIO-1 keys up without any transmit indication.
- Step 3. Verify any audio is heard by RADIO-2 and CONSOLE-1.
- Step 4. Wait 30 seconds and verify that RADIO-1 dekeys.

Pass \_\_\_\_\_ Fail \_\_\_\_\_

## MCC 7100/7500 Trunked Resources

### 5.2.13 Instant Recall Recorder (IRR) Operation

#### 1. DESCRIPTION

The Instant Recall Recorder (IRR) allows for audio from a phone call or a radio call to be played back at the MCC 7500 or MCC 7100 Console position. Thirty minutes of audio is saved for radio and an additional thirty minutes for telephone. The audio is saved on the positions hard disk in the form of a .wav file.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 1

CONSOLE-1 - TALKGROUP 1 running IRR application.

#### VERSION #1.020

#### 2. TEST

- Step 1. Select a radio channel on the CONSOLE-1 application window.
- Step 2. Select IRR from the CONSOLE-1 toolbar.
- Step 3. Initiate radio communication between RADIO-1 and RADIO-2.
- Step 4. Verify a new entry appears in the IRR log window.
- Step 5. Select the new entry from the list.
- Step 6. Press play and verify conversation replay.

Pass \_\_\_\_ Fail \_\_\_\_

---

## 5.2.14 Text Message to a Talkgroup

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### 1. DESCRIPTION

The dispatch console operator can send a text message to a talkgroup from the Dispatch Console. The text message can be up to 160 characters in length and is sent on the voice channel during hangtime.

### SETUP

RADIO-1 - TALKGROUP 1 (Must be equipped with a display and affiliated to the TALKGROUP)

VERSION #1.040

### 2. TEST

- Step 1. Open the group text messaging window from the dispatch console.
- Step 2. Select TALKGROUP 1 under the resource drop down list.
- Step 3. In the text message entry box, type a text message up to 160 characters.
- Step 4. Send the text message.
- Step 5. On RADIO-1 verify that the text message was received from the Dispatch Console.

Pass\_\_\_\_ Fail\_\_\_\_

## 5.3 RADIO CONTROL MANAGER (RCM) FEATURES

### 5.3.1 Radio Check

#### 1. DESCRIPTION

Radio Check is a RCM command used to verify that a radio is active in the trunking system. The Radio Check command causes the Zone Controller to poll for the radio requesting that the radio re-affiliate. When the radio re-affiliates, the RCM then has the knowledge that the radio is powered on and within system range. If the radio is involved in a conversation, whether group or interconnect, the RCM application displays a message to that effect.

The information displayed by the RCM in response to the Radio Check command is: current talkgroup affiliation, the multigroup that the talkgroup is attached to (assuming the talkgroup belongs to a multigroup), and the site where the radio is affiliated. If the radio does not respond to the Radio Check command, a message to that effect displays.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 2

#### VERSION #1.030

#### 2. TEST

- Step 1. Select the Status menu and then select the Radio Check item to open the Radio Check window.
- Step 2. Enter the ID or alias of RADIO-2 into the entry box and click the Apply button.
- Step 3. Observe the radio is polled and the current radio information is displayed on the RCM.
- Step 4. Turn off RADIO-1.
- Step 5. Enter the ID or alias of the RADIO-1 into the entry box and click the Apply button.
- Step 6. Observe that the RCM displays "Radio Not Found."
- Step 7. Depress and hold the PTT button of RADIO-2 until instructed to release.
- Step 8. Enter the ID or alias of RADIO-2 into the entry box and click the Apply button. Observe that a busy for the radio is displayed on the RCM.
- Step 9. Release the PTT button on RADIO-2.
- Step 10. Observe the radio is polled and the current radio information is displayed on the RCM.

Pass \_\_\_\_ Fail \_\_\_\_

## Radio Control Manager (RCM) Features

### 5.3.2 Selective Radio Inhibit

#### 1. DESCRIPTION

The INHIBIT command issued by the Radio Control Manager (RCM) disables a radio, preventing it from transmitting or receiving any audio. All of the radio's functionality ceases while a radio is inhibited by the RCM. Once inhibited, the radio cannot be used to monitor voice channels or for any other radio user initiated activity. Note that an inhibited radio still monitors the control channel so that it can be re-enabled with the Cancel Inhibit command. Upon receiving the Cancel Inhibit command from the RCM, the radio returns to its normal operation.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1

#### VERSION #1.030

#### 2. TEST

- Step 1. With the RCM open from the main Command tab click on the "+" button .
- Step 2. Enter the IDs or aliases of RADIO-1.
- Step 3. Select "Selective Inhibit" button.
- Step 4. Once all desired radio information is entered and appears in the command window click the submit to initiate the command.
- Step 5. Observe RADIO-1 is inhibited and appears to be dead.
- Step 6. Observe that the Inhibit task appears in the Command tab.
- Step 7. Cancel the Inhibit by selecting the task in the Command tab and clicking the Revert button to submit the task.
- Step 8. Observe that the Cancel Inhibit task appears in the Command tab and that RADIO-1 is returned to normal operation.

Pass\_\_\_\_ Fail\_\_\_\_

## Radio Control Manager (RCM) Features

### 5.3.3 Emergency Alarm Display

#### 1. DESCRIPTION

The emergency call information that is displayed on the Radio Control Manager (RCM) includes the radio alias of the radio that initiated the Emergency Alarm, the talkgroup that the radio was affiliated to at the time the alarm was sent, and the time the alarm was received.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 2

One RCM which has TALKGROUP 1 attached is required.

#### VERSION #1.030

#### 2. TEST

- Step 1. With the Radio Control Manager (RCM) open select the Event tab and verify that the Emergency Alarm window is visible. If it is not, select the the Emergency Alarm check box to bring it to the RCM viewable area.
- Step 2. Initiate an Emergency Alarm from RADIO-1.
- Step 3. Observe that the RCM receives the Emergency Alarm.
- Step 4. Acknowledge the Emergency by selecting the Emergency in the window and clicking on the Respond button.
- Step 5. Verify the window displays the radio alias, the talkgroup, and the time the alarm was received.
- Step 6. Again, select the displayed Emergency and click the Delete button to clear the emergency.
- Step 7. Reset the radio by holding the Emergency button until the radio clears.
- Step 8. Repeat Steps 1-7 using RADIO-2.

Pass\_\_\_\_ Fail\_\_\_\_

## 5.4 FAULT MANAGEMENT

### 5.4.1 Unified Event Manager - Base Views

#### 1. DESCRIPTION

The Unified Event Manager (UEM) in its base configuration provides a number of views. The purpose of this test is to demonstrate the key views available from the UEM.

The Physical Summary and Detail View (Physical Map) and Service Summary and Detail View (Service Map) in previous releases are deprecated and are replaced by the Zone Map. Custom views can be saved and retrieved by other NM Client users.

#### SETUP

NMclient01 - UEM session up and running.

#### VERSION #1.010

#### 2. TEST

Step 1. Alarms View: In the navigation pane expand Fault Management and select Alarms. The view displays active alarms for managed resources, displaying impacted managed resources and specific objects on the managed resource along with selected alarm properties.

Step 2. Alarm View Search: Customize the Active Alarms display by selecting the View option from the menu bar, then select Search. Perform a Managed Resource search for channels, site controllers and routers by entering "Contains" and ch, sc, and z00 respectively in the search fields to perform the three separate searches. For each of the three searches a filtered alarm view is displayed that contains alarms for the appropriate device in the search.

Step 3. Network Events View: In the navigation pane expand Fault Management and select Network Events. The view displays recent events reported for managed resources, displaying impacted managed resources and specific object on the managed resource along with selected event properties. Alarming events are base for creating alarm objects.

Step 4. Physical Summary View: In the navigation pane expand Zone Views and Physical, then select Physical Summary View. The Physical Summary View provides an aggregated alarm severity status of the devices located at all subnets in the Zone.

Step 5. Service Summary View: In the navigation pane expand Zone Views and Service, then select Service Summary View. The Service Summary View provides a quick summary of the service status of sites in a Zone, including access to Channel status.

Step 6. Zone Map: In the navigation pane, expand Zone Views and select Zone Map. The Zone Map view provides an aggregated alarm severity status of the devices located at discovered sites in the Zone.

Step 7. Network Database: In the navigation pane select Network Database. The Network Database displays a list of all discovered Managed Resources and Sites. The display includes properties of each resource as well as overall severity of all objects and/or sub resources

Pass\_\_\_\_ Fail\_\_\_\_



## Fault Management

### 5.4.2 Site Path Failure (Ethernet) Reports to the Unified Event Manager

#### 1. DESCRIPTION

This test will demonstrate that the Unified Event Manager (UEM) alarms view is able to capture information about various failures at the system and zone level.

This test simulates a microwave/transport failure by removing a customer selected site data link and monitoring the alerts.

Note: If using a Simulcast site, this test refers to the Prime Site links. While failures would be seen at the subsite level if a Subsite link were failed, the site would not drop into Site Trunking.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
NMclient01 - UEM session up and running.

\* RADIO-1 should be "Site Locked"

#### VERSION #1.030

#### 2. TEST

- Step 1. Remove the Ethernet cable(s) to the SITE 1 router(s) (If Simulcast, this refers to the Prime Site router(s)) at the site where RADIO-1 is affiliated. Be certain to remove the Ethernet cable from both routers if redundant site links are being utilized.
- Step 2. Observe the UEM reports CommFailure alarms for the devices at the affected site.
- Step 3. In addition, observe that the site is now in the Site Trunking mode.
- Step 4. Reconnect the Ethernet cable(s) disconnected in Step 1.
- Step 5. Observe the site returns to the Wide Area Trunking mode.
- Step 6. Observe the topology and alarms/events that appear in the UEM, indicating the site is in recovery and after a period of time has recovered.

Pass\_\_\_\_ Fail\_\_\_\_

## Fault Management

### 5.4.3 Console PC - Voice Processing Module Link Failure Reports to the Unified Event Manager

#### 1. DESCRIPTION

This test will demonstrate that the Unified Event Manager (UEM) alarms view is able to capture information about various failures at the system and zone level.

This test simulates a Console PC to Voice Processing Module (VPM) link failure.

#### SETUP

RADIO-1 - TALKGROUP 1

CONSOLE-1 - TALKGROUP 1 (VPM Based console)

VERSION #1.020

#### 2. TEST

- Step 1. Initiate a call from RADIO-1 to CONSOLE-1 to verify communication.
- Step 2. Remove the Ethernet cable from the VPM to the Console Site Ethernet Switch.
- Step 3. Observe the UEM reports CommFailure alarms for the VPM.
- Step 4. In addition, observe that CONSOLE-1 reports the link to the VPM as Down.
- Step 5. Reconnect the VPM to the Console Site Ethernet Switch.
- Step 6. Observe that UEM regains communication with the VPM and the Console PC to VPM link recovers.
- Step 7. Initiate a call from RADIO-1 to CONSOLE-1 to verify communication.

Pass\_\_\_\_ Fail\_\_\_\_



## 5.5 SYSTEM RELIABILITY FEATURES

### 5.5.1 Base Station Identification

#### 1. DESCRIPTION

This test will demonstrate that the repeater(s) programmed for Base Station Identification (BSI) operation at every site broadcasts the FCC BSI at predefined intervals (usually 30 minutes). To accomplish this, a service monitor will be set up to monitor the BSI channel of a random site and note that the Base Station Identification is heard.

#### SETUP

A service monitor will be required to perform this test.

Note: A properly configured subscriber can be used to monitor the frequency for the BSI tones in place of a service monitor.

VERSION #1.030

#### 2. TEST

- Step 1. Choose one site to test for Base Station Identification (BSI).
- Step 2. Setup the service monitor or subscriber to receive the frequency of the BSI channel for the particular site.
- Step 3. Monitor the service monitor until the Base Station Identification is broadcast. Verify that the BSI tones are heard on the monitored frequency.

Pass\_\_\_\_ Fail\_\_\_\_

## System Reliability Features

### 5.5.2 Multiple Control Channels

#### 1. DESCRIPTION

A maximum of four channels are eligible for assignment as control channel at each site. In the event that the assigned control channel fails at any remote site, the Zone Controller automatically selects one of the other control capable channels as the active control channel for that site. A Control Channel Preference Level can be used to rank the control capable channels where 1 is the highest ranking and 4 the lowest.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 1  
RADIO-3 - TALKGROUP 2  
RADIO-3 - SITE - SITE 1  
RADIO-4 - TALKGROUP 2  
RADIO-4 - SITE - SITE 1

VERSION #1.020

#### 2. TEST

- Step 1. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1.
- Step 2. Observe that only RADIO-2 will be able to monitor and respond to the call.
- Step 3. Initiate a Talkgroup Call with RADIO-3 on TALKGROUP 2.
- Step 4. Observe that only RADIO-4 will be able to monitor and respond to the call.
- Step 5. Power off the control channel at SITE 1.
- Step 6. Observe that the control channel rotates to the next available channel capable of acting as a control channel.
- Step 7. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1.
- Step 8. Observe that only RADIO-2 will be able to monitor and respond to the call.
- Step 9. Initiate a Talkgroup Call with RADIO-3 on TALKGROUP 2.
- Step 10. Observe that only RADIO-4 will be able to monitor and respond to the call. Power up the channel previously powered off to return the system to normal operation.

Pass\_\_\_\_ Fail\_\_\_\_



## System Reliability Features

### 5.5.3 Redundant Site Controller Switching - Automatic Switchover

#### 1. DESCRIPTION

The Site Controller subsystem uses two Site Controllers in a redundant configuration. The backup Site Controller is made active either upon the loss of communication to the active Site Controller or upon a user initiated command from the Site Control Manager.

This test will demonstrate that on the loss of the active site controller the standby controller will become active and carry on the site operations.

#### SETUP

RADIO-1 – TALKGROUP 1  
RADIO-1 – SITE – SITE 1  
RADIO-2 – TALKGROUP 1  
RADIO-2 – SITE – SITE 1  
RADIO-3 – TALKGROUP 1  
RADIO-3 – SITE – SITE 1

All Radios should be "Site Locked".

#### VERSION #1.020

#### 2. TEST

- Step 1. Verify both Site Controllers are available and in the "Normal" state.
- Step 2. Power off the active Site Controller (or in the ESS configuration connect to the Active Site controller using CSS and perform a "reset") and verify the backup becomes the new active Site Controller (note events in the event viewer).
- Step 3. Key RADIO-1 and verify that RADIO-2 and RADIO-3 hear the audio.
- Step 4. End the call from RADIO-1.
- Step 5. Power up the Site Controller (if it was powered off). Verify the Site Controller returns to the normal state.

Pass\_\_\_\_ Fail\_\_\_\_

## System Reliability Features

### 5.5.4 Redundant Zone Controller Switching/Automatic Switchover

#### 1. DESCRIPTION

In a non-DSR configuration the Zone Controller subsystem uses two Zone Controllers in a redundant configuration. The backup Zone Controller is made active either upon the loss of the active ZC or upon a user command from the Unified Network Configurator (UNC). In a DSR configuration there are 4 Zone Controllers in a redundant configuration. Any one of the 4 could be active to keep the Zone Sites in Wide Area Trunking. If using the Dynamic Resilience Zone configuration the Unified Event Manager will report the Zone Controller switchover in both Unified Event Managers (UEM).

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 2  
RADIO-3 - TALKGROUP 1  
RADIO-3 - SITE - Site3 (Site3 should be in another Zone if applicable.)

\* The Zone Controllers should be successfully synchronized before performing this procedure.

#### VERSION #1.030

#### 2. TEST

- Step 1. Verify the state of the current Zone Controllers is Active or Standby in the Unified Network Configurator (UNC). (There will be 2 Zone Controllers in single Zone or 4 in the case of DSR zones.)
- Step 2. Reset the active Zone Controller application via the Unified Event Manager (UEM) diagnostic.
- Step 3. Verify using UNC, UEM and ZoneWatch (if applicable) that the standby Zone Controller becomes active and brings all sites back wide. Wait for the Radios to settle out the site affiliations.
- Step 4. Key RADIO-1 and verify that RADIO-2 and RADIO-3 hear the audio.
- Step 5. End the call from RADIO-1.
- Step 6. Verify that Zone Controller that was reset comes back up to a "Standby" state.

Pass\_\_\_\_ Fail\_\_\_\_



## System Reliability Features

### 5.5.5 Continued Operation Upon Loss of Prime Site Switch

#### 1. DESCRIPTION

The Simulcast Prime Site High Availability feature enhances current operation by increasing the number of channels available following a LAN switch failure. These sites are configured with four LAN switches rather than the standard two LAN switch configuration. When the same site resources are spread across four LAN switches, the failure of a single switch removes fewer resources hence improving the general availability of resources as well as improving the likelihood of preserving redundancy.

Per current operation, these sites are expected to preserve wide area operation upon failure of any of the switches (assumes redundant WAN links are utilized between the master site and prime site). This test case will demonstrate continued wide area operation upon a single switch failure. It also demonstrates increased channel availability over the standard 2 LAN switch configuration.

#### SETUP

RADIO-1 TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 TALKGROUP 1  
RADIO-2 - SITE - SITE 2  
RADIO-3 TALKGROUP 1  
RADIO-3 - SITE - SITE 1

Channel 2 (on switch 2) is set as the preferred control channel. Channel 4 is the next preferred.

Redundant WAN links are configured between the master site and prime site.

Ensure Zone Watch is setup to monitor the sites and the Unified Event Manager (UEM) is available for viewing faults.

Note: Switch failures may be simulated by pulling power on the switch.

#### VERSION #1.010

#### 2. TEST

- Step 1. Verify that the SITE 1 is in wide area trunking. (Normal Operation)
- Step 2. Fail switch 2 and verify that the Site remains in wide area trunking.
- Step 3. Verify that the UEM reports the failure of switch 2.
- Step 4. Verify in ZoneWatch that channels on switches 1, 3 and 4 are available.
- Step 5. Key-up RADIO-1 on a channel connected to switch 1 and verify that RADIO-2 and RADIO-3 receive RADIO-1 audio. Repeat this step for channels connected to switch 3 and 4 also.

Pass \_\_\_\_ Fail \_\_\_\_

## System Reliability Features

### 5.5.6 Continued Operation Upon Loss of Reference Distribution Module

#### 1. DESCRIPTION

Dual LAN subsites are equipped with new hardware that enable all of the Multisite Base Radios (MsBRs) to communicate over an active or redundant LAN, thus lessening the impacts of a single point of failure. Two modules ("GPB 8000 Reference Distribution Modules (RDM)") are added to the primary GTR8000 Expandable Site Subsystem (ESS) to facilitate the switching and time reference distribution functions at the remote sites. In addition, the expansion cabinets are equipped with two Expansion HUBs (XHUBs). A failure of an RDM or XHUB will result in the MsBRs automatically reverting to the LAN served by the other active RDM/XHUB thus allowing continued wide area operation by all MsBRs.

This test case will demonstrate continued wide area operation upon a single point of failure associated with an RDM failure.

#### SETUP

RADIO-1 TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 TALKGROUP 1  
RADIO-2 - SITE - SITE 2  
RADIO-3 TALKGROUP 1  
RADIO-3 - SITE - SITE 1

Ensure ZoneWatch is setup to monitor the sites and the Unified Event Manager (UEM) is available for viewing faults.

Note: An RDM/XHUB failure can be simulated by pulling the RDM/XHUB out of the ESS.

#### VERSION #1.020

#### 2. TEST

- Step 1. Using RADIO-1, key-up on a channel residing on SITE 1's primary Expandable Site Subsystem (ESS). While RADIO-1 is keyed, fail RDM 1.
- Step 2. Verify RADIO-1 operation on ZoneWatch. RADIO-1 stays on the same channel and the Site remains in wide area trunking.
- Step 3. Verify that RADIO-2 and RADIO-3 receive RADIO-1 audio.
- Step 4. Verify that the UEM reports the failure of RDM 1.
- Step 5. Dekey RADIO-1, key-up RADIO-3 on a channel residing on the primary ESS. While RADIO-3 is keyed, restore RDM 1.
- Step 6. Verify RADIO-3 operation on ZoneWatch. RADIO-3 stays on the same channel and the Site remains in wide area trunking.
- Step 7. Verify that RADIO-1 and RADIO-2 receive RADIO-3 audio.
- Step 8. Verify that the UEM reports the recovery of RDM 1.

Pass \_\_\_\_ Fail \_\_\_\_



## System Reliability Features

### 5.5.7 Redundant Comparator Switching – Comparator Failure

#### 1. DESCRIPTION

IP Simulcast Trunking subsystem can use two comparators for each channel in a redundant configuration at the Prime Site. The standby comparator is made active upon the loss of the active comparator.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 1

Channel-1 – Control Channel  
CSS Status Panel or UNC command can be used to verify the current redundancy state of the comparator (Active or Standby).

VERSION #1.030

#### 2. TEST

- Step 1. Verify the system is in Wide Trunking Mode with Channel-1 as the control channel and Channel-2 in service.
- Step 2. Key RADIO-1 and verify that RADIO-2 hears the audio. Verify Channel-2 is used.
- Step 3. Power off or Disable the Active comparator (i.e. Comparator 2) for Channel-2. Verify Channel-2 is out of service and RADIO-1's call ended.
- Step 4. DeKey RADIO-1
- Step 5. Verify the Standby comparator (i.e. CM2b) for Channel-2 becomes Active and Channel-2 is back in service (note the event in UEM event viewer).
- Step 6. Re-key RADIO-1 and verify that RADIO-2 hears the audio. Verify Channel-2 is used.
- Step 7. Power on or restore Comparator-2. Verify Comparator-2 is in the Enabled state.

Pass\_\_\_\_ Fail\_\_\_\_

## 5.6 AUDIO IP LOGGING

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### 5.6.1 Logging Trunking Talkgroup Call

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#### 1. DESCRIPTION

This test will demonstrate how the Archiving Interface Server (AIS) can be used to log trunking talkgroup call audio/events on a given talkgroup. The audio is archived in a vocoded format (IMBE for Trunking Talkgroup Calls).

#### SETUP

The AIS at MCC 7500 Console site affiliated to TALKGROUP 1.  
RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE 1  
CONSOLE-1 - TALKGROUP 1  
CONSOLE-1 - CONSOLE SITE 1

#### VERSION #1.020

#### 2. TEST

- Step 1. Initiate a talkgroup call from RADIO-1 on TALKGROUP 1.
- Step 2. Observe that the call events/audio are being sent to the logging system by the AIS.
- Step 3. Using the playback application, verify the logged audio/events correspond to steps 1 and 2.
- Step 4. Initiate a talkgroup call from CONSOLE-1 on TALKGROUP 1.
- Step 5. Observe that the call events/audio are being sent to the logging system by the AIS.
- Step 6. Using the playback application, verify the audio/events logged correspond to steps 4 and 5.

Pass \_\_\_ Fail \_\_\_

## Audio IP Logging

### 5.6.2 Logging Secure Trunking Talkgroup Call

#### 1. DESCRIPTION

This test will demonstrate the Archiving Interface Server (AIS) can be used to log trunking talkgroup call audio for call in a secure transmit mode on a given talkgroup. The audio is archived in a vocoded decrypted format (IMBE for Trunking Talkgroup Call) only when the logging system user requested coded audio to be logged.

#### SETUP

The AIS at MCC7500 Console site is affiliated to TALKGROUP 1 and has the appropriate secure keys loaded.

RADIO-1 - TALKGROUP 1

RADIO-1 - SITE - SITE 1

CONSOLE-1 - TALKGROUP 1

**VERSION #1.020**

#### 2. TEST

- Step 1. Initiate PTT from RADIO-1 on TALKGROUP 1 in a secure transmit mode.
- Step 2. Observe that the call audio is being sent to the logging system by the playback application.
- Step 3. If TALKGROUP 1 is marked to receive coded audio verify the coded audio can be played back via the application.
- Step 4. Observe that the events for the TALKGROUP 1 call is logged even if the TALKGROUP 1 is not marked to receive coded audio.

Pass\_\_\_\_ Fail\_\_\_\_

## 5.7 INTEGRATED VOICE AND DATA (IV & D)

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### 5.7.1 Context Activation

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#### 1. DESCRIPTION

Context Activation covers the process a Radio uses to register for packet data service on the trunked system. For this test, the Radio is configured to initiate a context request with the system upon power-on.

#### SETUP

RADIO-1 - TALKGROUP 1 (Powered-off)

Note: RADIO-1 must have data capabilities enabled in the network manager.

**VERSION #1.020**

#### 2. TEST

- Step 1. Power-on RADIO-1.
- Step 2. Observer radio context activation and can be identified by the icon in the upper right-hand corner of the radio if equipped with a display.

Pass \_\_\_\_ Fail \_\_\_\_

## Integrated Voice and Data (IV & D)

### 5.7.2 Over the Air Programming (PoP25)

#### 1. DESCRIPTION

The feature Programming Over P25 (POP25) allows a user to configure a radio remotely from the enterprise network by sending a sequence of commands over-the-air via the ASTRO 25® IV&D system. It is expected that the POP25 will significantly reduce the operational costs of IV&D radios by configuring personalities, talkgroups, channels, sites, etc in a radio without physically touching the radio.

This test will demonstrate the ability to perform a subscriber update using Customer Programming Software (CPS) over the air.

NOTE: There are subscriber programming options that will affect the test. The subscriber can be programmed to Approve the update, implement the update on next power cycle or disregard the update.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 1

PC loaded with Customer Programming Software (CPS) and the System Key Dongle. The PC must be connected to the ASTRO 25® network via the CEN. RADIO-1 must be data capable and context activated for data service.

#### VERSION #1.010

#### 2. TEST

- Step 1. Locate IP address for RADIO-1
- Step 2. From the CPS computer on the Customer Enterprise Network (CEN), connect to RADIO-1 over the network and read the subscriber.
- Step 3. Make a change to the archived program file and write to RADIO-1.
- Step 4. Once the new archive is received at RADIO-1 the radio user will have to approve the new configuration.
- Step 5. Once the new configuration has been received and the load is complete, verify the configuration change has been implemented.
- Step 6. On the CPS PC return the archive feature to the original state.
- Step 7. Send the program update to RADIO-1. Verify the progress bar is shown in the CPS status bar.
- Step 8. Begin a talkgroup call by keying RADIO-2. Verify RADIO-1 hears the audio.
- Step 9. While the call is in progress dekey and key RADIO-2 several times with various pauses to interrupt the data transfer to RADIO-1.
- Step 10. Dekey RADIO-2 and verify the data transfer completes. Once the programming update has completed accept the configuration change on RADIO-1. Verify RADIO-1 configuration has returned to its original state.

Pass \_\_\_\_ Fail \_\_\_\_

## 5.8 ENHANCED DATA

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### 5.8.1 Enhanced Data Context Activation

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#### 1. DESCRIPTION

Context Activation refers to the process a Radio uses to register for packet data service on the trunked system. For this test, the Radio is configured to initiate a context request with the system upon power-on.

#### SETUP

RADIO-1 - TALKGROUP 1 (Must be equipped with a display and initially Powered-off)

Note: RADIO-1 must have data capabilities enabled in the network manager.

**VERSION #1.050**

#### 2. TEST

- Step 1. Power-on RADIO-1.
- Step 2. After a period of 10 seconds, observe that the radio is enabled for data services by the presence of a data icon on the radio display.
- Step 3. Using the menu buttons below the radio display, observe that the radio has a valid IP address

Pass \_\_\_\_\_ Fail \_\_\_\_\_



## 5.9 OVER THE AIR REKEYING (OTAR)

### 5.9.1 Clear Hello

#### 1. DESCRIPTION

The KMF operator can send a message to any radio to confirm that the radio is on the system.

Note: The devices under test must have a valid air address registered with the KMF and must be accessible on the data system.

#### SETUP

RADIO-1 TALKGROUP 1

RADIO-1 must not be configured for enhanced security mode in either radio programming or the KMF.

**VERSION #1.020**

#### 2. TEST

- Step 1. Go to the Radio Management page of the KMF
- Step 2. Initiate a Clear Hello operation
- Step 3. Click the 'Clear Hello' button, or right-click and choose 'Clear Hello.'
- Step 4. Go to the Operation Status page of KMF verify that the RADIO-1's Clear Hello operation is shown. The operation is complete when the Operation Status is 100% completed.

Pass \_\_\_\_ Fail \_\_\_\_

## Over The Air Rekeying (OTAR)

### 5.9.2 Encrypted Hello

#### 1. DESCRIPTION

The KMF operator can send an encrypted message to any radio to confirm that radio is on the system and that its encryption services are functioning.

Note: The devices under test must have a valid air address registered with the KMF and must be accessible on the data system.

#### SETUP

RADIO-1 - TALKGROUP 1

Note: The radio must be current in the KMF

#### VERSION #1.020

#### 2. TEST

- Step 1. Go to the Radio Management page of the KMF
- Step 2. Select RADIO-1 from the list.
- Step 3. Initiate an Encrypted Hello operation
- Step 4. Go to the Operation Status page of KMF, verify that RADIO-1's Encrypted Hello operation is shown. The operation is complete when the Operation Status is completed.

Pass \_\_\_\_ Fail \_\_\_\_



## Over The Air Rekeying (OTAR)

### 5.9.3 Full Update to Subscriber

#### 1. DESCRIPTION

The entire set of encryption keys (in addition to other state parameters) are sent to a radio using the Full Unit Update command.

Note: The devices under test must have a valid air address registered with the KMF and must be accessible on the data system.

#### SETUP

RADIO-1 - TALKGROUP 1 (Secure Mode)  
RADIO-2 - TALKGROUP 1 (Secure Mode)  
RADIO-2 will be a reference radio.

Note: It is assumed that both radios under test are current with the KMF.

**VERSION #1.030**

#### 2. TEST

- Step 1. Delete both TEKs from the CKR assigned to the talkgroup under test, from RADIO-1.
- Step 2. Using RADIO-1, verify when the subscriber is set to secure mode, the radio indicates a key fail.
- Step 3. Go to the Radio Management page of the KMF.
- Step 4. Select RADIO-1 from the list.
- Step 5. Initiate an Full Update operation.
- Step 6. Go to the Operation Status page of KMF, verify that RADIO-1's Full Update operation is shown. The operation is complete when the Operation Status is "Completed." Note that a warmstart operation will occur if the TEK selected for the OTAR session is one of the TEKs assigned to CKR.
- Step 7. Now that RADIO-1 contains the keys in the CKR, verify secure communications between RADIO-1 and RADIO-2.

Pass\_\_\_\_ Fail\_\_\_\_

## 5.10 OVER THE ETHERNET KEYING (OTEK)

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### 5.10.1 Clear Hello using over the Ethernet Keying (OTEK)

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#### 1. DESCRIPTION

The KMF operator can send a message to any console to confirm that console is on the system.

Note: If the console has just been powered up, make sure to let it stabilize and to login via the console user interface to make sure the console registers with the KMF. Verify KMF registration by observing the KMF's Operations Status page to see that the test console has registered.

#### SETUP

This test will require one console (CONSOLE-1).

**VERSION #1.020**

#### 2. TEST

- Step 1. Go to the Console Management page of the KMF.
- Step 2. Select CONSOLE-1 from the list
- Step 3. Initiate a Clear Hello operation.
- Step 4. Go to the Operation Status page of KMF, verify that CONSOLE-1's Clear Hello operation is shown. The operation is complete when the Operation Status is "Completed."

Pass\_\_\_\_ Fail\_\_\_\_



## Over the Ethernet Keying (OTEK)

### 5.10.2 Encrypted Hello using over the Ethernet Keying (OTEK)

#### 1. DESCRIPTION

The KMF operator can send an encrypted message to any console to confirm that console is on the system and that its encryption services are functioning.

Note: If the console has just been powered up, make sure to let it stabilize and to login via the console user interface to make sure the console registers with the KMF. Verify KMF registration by observing the KMF's Operations Status page to see that the test console has registered.

#### SETUP

CONSOLE-1 - TALKGROUP 1

Note: The console must be current in the KMF.

VERSION #1.020

#### 2. TEST

- Step 1. Go to the Console Management page of the KMF.
- Step 2. Select CONSOLE-1 from the list.
- Step 3. Initiate a Encrypted Hello operation
- Step 4. Go to the Operation Status page of KMF, verify that RADIO-1's Clear Hello operation is shown. The operation is complete when the Operation Status is "Completed."

Pass \_\_\_\_\_ Fail \_\_\_\_\_

## Over the Ethernet Keying (OTEK)

### 5.10.3 Full Update to Console using Over The Ethernet Keying (OTEK)

#### 1. DESCRIPTION

The entire set of encryption keys (in addition to other state parameters) are sent to a console using the Full Unit Update command.

Note: If the console has just been powered up, make sure to let it stabilize and to login via the console user interface to make sure the console registers with the KMF. Verify KMF registration by observing the KMF event viewer to see that the test console has registered.

#### SETUP

CONSOLE-1 - TALKGROUP 3 (Reference console)  
CONSOLE-3 - TALKGROUP 3 (test console that will be used for OTEK operation)  
It is assumed that CONSOLE-3 initially does not have any traffic keys but does have a UKEK.

Note: It is assumed that this test will occur after all OTEK configurations are completed.

Note: This can be done with a VPM based console or a secure card based console.

#### VERSION #1.020

#### 2. TEST

- Step 1. Initiate a secure call on TALKGROUP 3 from CONSOLE-1 to CONSOLE-3
- Step 2. Verify that no audio is received on CONSOLE-3 because the console does not have a key or has the incorrect key.
- Step 3. Go to the Console Management page of the KMF
- Step 4. Select CONSOLE-3 from the list
- Step 5. Initiate a Full Update operation.
- Step 6. Go to the Operation Status page of KMF, verify that CONSOLE-3's Clear Hello operation is shown. The operation is complete when the Operation Status is "Completed."
- Step 7. The console will now have the current keys. Go to the Console Management page of the KMF and verify that CONSOLE-3's currency state is marked as "Current."
- Step 8. Now that CONSOLE-3 is current, verify secure communications between CONSOLE-1 and CONSOLE-3.

Pass\_\_\_\_\_ Fail\_\_\_\_\_

## 5.11 SYSTEM MANAGEMENT TESTS

### 5.11.1 ZoneWatch

#### 1. DESCRIPTION

ZoneWatch is an administration tool for monitoring radio traffic on a system. A system manager can use ZoneWatch to analyze traffic patterns for load distribution and troubleshoot radio and site problems. ZoneWatch is used to view current radio traffic activity for the system. This activity is displayed in graphical format, color-coded for easy identification of the type of activity occurring on the system.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 2  
RADIO-3 - TALKGROUP 1  
RADIO-3 - SITE - SITE 3  
RADIO-4 - TALKGROUP 1  
RADIO-4 - SITE - SITE 4

VERSION #1.010

#### 2. TEST

- Step 1. Verify that ZoneWatch has been configured for the Grid and Multi Site Scroll windows to display system activity.
- Step 2. From the PC Application Launcher, select a zone folder.
- Step 3. From within that zone, select ZoneWatch.
- Step 4. Select the appropriate profile to be able to view the channel usage on the system.
- Step 5. Initiate several calls with the radios and observe that the appropriate channel usage information is displayed.

Pass\_\_\_\_ Fail\_\_\_\_

## System Management Tests

### 5.11.2 Affiliation Display

#### 1. DESCRIPTION

Affiliation Display is a Private Radio Network Management (PRNM) application that monitors the mobility of radios for a particular zone. Mobility describes how radio users travel between different sites in a zone and how they communicate with other members of their assigned talkgroup or even with members outside of their talkgroup. A radio can be viewed in more than one zone. As a radio roams from one site to another or changes talkgroups, Affiliation Display updates and displays the affiliation and de-affiliation information for a monitored radio. This information can be useful for the troubleshooting and tracking of radios in the system and for monitoring the movement of traffic within a zone.

The Affiliation Display is divided into three sections: Site Viewer, Talkgroup Viewer, and Radio Viewer.

- The Site Viewer displays the number of talkgroups and number of radios affiliated to that site.

- The Talkgroup Viewer displays how many radios are affiliated to that talkgroup and the number of sites at which the talkgroup has radios affiliated.

- The Radio Viewer window displays affiliation information for a custom list of radios.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 1  
RADIO-3 - TALKGROUP 2  
RADIO-3 - SITE - SITE 2  
RADIO-4 - TALKGROUP 2  
RADIO-4 - SITE - SITE 2

#### VERSION #1.010

#### 2. TEST

- Step 1. Add RADIO-1, RADIO-2, RADIO-3, and RADIO-4 to the Affiliation Display.
- Step 2. Verify that RADIO-1 and RADIO-2 show they are affiliated to SITE 1 and TALKGROUP 1.
- Step 3. Verify that RADIO-3 and RADIO-4 show they are affiliated to SITE 2 and TALKGROUP 2.
- Step 4. Change the talkgroup of RADIO-1 and RADIO-2 to TALKGROUP 2.
- Step 5. Verify that RADIO-1 and RADIO-2's affiliated talkgroup changes to TALKGROUP 2 on the Affiliation Display.
- Step 6. Change the site of RADIO-3 and RADIO-4 to SITE 1.
- Step 7. Verify that RADIO-3 and RADIO-4's affiliated site changes to SITE 1 on the Affiliation Display.

Pass \_\_\_\_\_ Fail \_\_\_\_\_



## System Management Tests

### 5.11.3 Unified Event Manager - Force Synchronization - Core Router

#### 1. DESCRIPTION

Synchronization is the process where the status of a device is periodically checked. There could be situations where a user may not want to wait for the minimum period to view the synchronization results. Therefore, the user can initiate a synchronization request for the device with the manager called Force Synchronization. Force Synchronization interrupts the normal synchronization process and checks the status of a particular device.

The purpose of this test is to demonstrate the ability to manually synchronize the state with agents within the system using the Unified Event Manager (UEM).

Manual synchronization provides a fallback to obtain object status after a network interruption.

NOTE: This test can be run on a standalone Core Router/Gateway or a combined Core/Exit Router/Gateway.

#### SETUP

NMclient01 - UEM session up and running.

#### VERSION #1.030

#### 2. TEST

- Step 1. On a UEM client session, click on the Network Database node tree in the navigation window.
- Step 2. Right click on a Core Router, then select Synchronize.
- Step 3. The Synchronization Job Status window appears with the Job Status ID.
- Step 4. Click on the View Job Status button.
- Step 5. The Job Status View window opens providing the Job ID, Status, Owner, Type, Target, Submit Time, End Time, and Additional Info for all the jobs.
- Step 6. Locate the Synchronization job initiated in step 2 and click on the job. Verify the Synchronization job is listed with a status of Success.
- Step 7. Click on the View Log button. A summary of the Synchronization job details is provided in the job log.
- Step 8. Locate the Core Router in the Network Database View. The correct Severity property of the device is displayed.

Pass\_\_\_\_ Fail\_\_\_\_

## System Management Tests

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### 5.11.4 Unified Event Manager - Force Synchronization - Site Controller

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#### 1. DESCRIPTION

Synchronization is the process where the status of a device is periodically checked. There could be situations where the user may not want to wait for the minimum period to view the synchronization results. Therefore, the user can initiate a synchronization request for the device with the manager called Force Synchronization. Force Synchronization interrupts the normal synchronization process and checks the status of a particular device.

The purpose of this test is to demonstrate the force synchronize state with agents within the system using the Unified Event Manager (UEM).

Force synchronization provides a fallback to obtain object status after a network interruption.

#### SETUP

NMclient01 - UEM session up and running.

**VERSION #1.030**

#### 2. TEST

- Step 1. On the UEM client session, click on the Network Database node tree in the navigation window.
- Step 2. Right click on a Site Controller, then select Synchronize.
- Step 3. The Synchronization Job Status window appears with the Job Status ID.
- Step 4. Click on the View Job Status button.
- Step 5. The Job Status View window opens providing the Job ID, Status, Owner, Type, Target, Submit Time, End Time, and Additional Information for all the jobs.
- Step 6. Locate the Synchronization job initiated in step 2 and click on the job. Verify the Synchronization job is listed with a status of Success.
- Step 7. Click on the View Log button. A summary of the Synchronization job details is provided in the job log.
- Step 8. Locate the Site Controller in the Network Database View. The correct Severity property of the device is displayed.

Pass \_\_\_\_ Fail \_\_\_\_

## 5.12 DYNAMIC SYSTEM RESILIENCE

### 5.12.1 Primary Core Failure - Switchover to Back-up Core (Voice and Data Services)

#### 1. DESCRIPTION

Dynamic System Resilience (DSR) allows a system to continue to function with minimal loss of voice and/or Data communications due to the failure of any controlling master site.

This test will demonstrate in the event of a complete Primary Core failure, the Backup Core takes over in order to return the system back to wide area trunking. Some of the Backup Core equipment automatically takes over while the Network Management servers like the Provisioning Manager Server and Unified Network Configurator require manual switchover.

Note: This test case applies to the following data services - Trunking IV&D, HPD and Conventional IV&D data. The test case can be executed with any or all of the supported data services and should include the appropriate packet data gateways, sites and the radio personalities in the setup of the test case.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-1 - SITE - SITE 1  
RADIO-2 - TALKGROUP 1  
RADIO-2 - SITE - SITE 1  
RADIO-5 - TALKGROUP 1  
Mobile Data Terminal (MDT) connected to RADIO-5  
UDP Tool installed on both the MDT and Host computers  
Zone Controller 1: Active  
Zone Controller 2: Standby  
Zone Controller 3: Standby  
Zone Controller 4: Standby  
Packet Data Gateway 1: Active  
Packet Data Gateway 2: Standby  
Unified Network Configurator 1: Active

Unified Network Configurator 2: Standby  
User Configuration Manager: Active  
User Configuration Manager 2: Standby  
System Statistics Server 1: Active  
System Statistics Server 2: Active

#### VERSION #1.040

#### 2. TEST

- Step 1. Initiate a TALKGROUP 1 call from RADIO-1. Verify that RADIO-2 receives the audio.
- Step 2. Using RADIO-5 MDT, configure the data application for periodic inbound data messages. (1 message every 30 seconds) Observe at the Host PC that data messages are received.
- Step 3. Pull the power cords to the Primary Core LAN Switches 1 & 2. (Also the redundant power supply (RPS) if equipped.)
- Step 4. In the Unified Network Configurator (UNC), select Zone Controllers 1 through 4 and check the redundancy state using the Quick Command feature. (Note: In a single Zone system or when the test is run on the Zone with the primary core system servers the backup UNC will need to be manually enabled to run the quick command.)
- Step 5. Verify that Zone Controller (ZC) 3 is Active. (Note that the transition of ZC 3 to the "Active" state causes the currently active ZC to reset and the sites will temporarily lose Wide Area Trunking while the connection to ZC 3 is established.)
- Step 6. In the Unified Network Configurator, select any of the Packet Data Gateways 1 and 2 and check the redundancy state using the Quick Command feature.
- Step 7. Verify that Packet Data Gateway 2 is Active.
- Step 8. Initiate a TALKGROUP 1 call from RADIO-1. Verify that RADIO-2 receives the audio.
- Step 9. Observe at the Host PC that received data messages have continued.

Step 10. If the backup servers were enabled for the test, they should now be disabled. Return the system to normal by powering up the core switches. Verify once the Zone Controllers start to communicate only 1 Zone Controller will be active.

**Pass**\_\_\_\_ **Fail**\_\_\_\_

## 5.13 ISSI 8000

### 5.13.1 Automatic Roaming - Talkgroup Call for Home Talkgroup

#### 1. DESCRIPTION

This test will demonstrate that a group call initiated from a home radio/console in the local system that is affiliated to a home talkgroup can be heard by a home radio that has roamed to a foreign system and is affiliated to the home talkgroup.

This test will also demonstrate that a group call initiated from a home radio that has roamed to a foreign system and is affiliated to a talkgroup home to the local system can be heard by home radio and console affiliated to the home talkgroup in the local system.

#### SETUP

SYSTEM 1 (home of TALKGROUP 1)

RADIO-1 (home radio on SYSTEM 1, has roamed to  
SYSTEM 2) - TALKGROUP 1  
RADIO-2 - TALKGROUP 1  
CONSOLE-1 - TALKGROUP 1

RADIO-2 and CONSOLE-1 (home to SYSTEM 1,  
located in SYSTEM 1) - TALKGROUP 1

SYSTEM 2  
RADIO-1 - TALKGROUP 1

VERSION #1.020

#### 2. TEST

- Step 1. Initiate a group call from RADIO-2 on TALKGROUP 1.
- Step 2. Observe that RADIO-1 and CONSOLE-1 are able to monitor and respond to the call on TALKGROUP 1.
- Step 3. Initiate a group call from CONSOLE-1 on TALKGROUP 1.
- Step 4. Observe that RADIO-1 and RADIO-2 are able to monitor and respond to the call on TALKGROUP 1.
- Step 5. Initiate a group call from RADIO-1 on TALKGROUP 1.
- Step 6. Observe that RADIO-2 and CONSOLE-1 are able to monitor and respond to the call on TALKGROUP 1.

Pass\_\_\_\_ Fail\_\_\_\_

---

## 5.13.2 Automatic Roaming - Emergency Alarm and Call for Home Talkgroup

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### 1. DESCRIPTION

This test will demonstrate that emergency alarm and call initiated from a home radio that has roamed to a foreign system and is affiliated to a talkgroup home to the local system can be heard by a console that is affiliated to the home talkgroup in the local system. This test also verifies that the emergency can be acknowledged and knocked down by the console in the local system.

### SETUP

SYSTEM 1 (home of TALKGROUP 1)  
CONSOLE-1 - TALKGROUP 1

SYSTEM 2  
RADIO-1 - TALKGROUP 1

RADIO-1 is a home radio on SYSTEM 1, has roamed to SYSTEM 2 and is affiliated to TALKGROUP 1.  
CONSOLE-1 is home to SYSTEM 1, located in System 1 and affiliated to TALKGROUP 1.

VERSION #1.020

### 2. TEST

- Step 1. Initiate an emergency alarm from RADIO-1 on TALKGROUP 1 by holding the emergency button.
- Step 2. Observe that CONSOLE-1 is able to hear and see the emergency alarm on TALKGROUP 1.
- Step 3. Acknowledge the emergency alarm on TALKGROUP 1 from CONSOLE-1.
- Step 4. Key RADIO-1 to initiate an emergency call on TALKGROUP 1.
- Step 5. Observe that CONSOLE-1 is able to monitor and respond to the emergency call on TALKGROUP 1.
- Step 6. Knock down the emergency from CONSOLE-1 on TALKGROUP 1.
- Step 7. Exit emergency mode on RADIO-1 by holding the emergency button on the radio.

Pass\_\_\_\_ Fail\_\_\_\_

## 5.14 LOCATION SERVICE

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### 5.14.1 Location Updates

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#### 1. DESCRIPTION

The Location Service send updates at configured time intervals. These intervals can be updated which will send a message to the subscriber updating the reporting parameters.

Note: Location requires reception of a clear GPS signal which may not always be possible in the CCSi environment. Location tests are not recommended for staging but rather for the final destination when it is possible to perform outdoor tests more easily.

#### SETUP

MotoMapping Client installed

RADIO-1 - GPS enabled and provisioned on the Location Service

Note: It is possible that an external GPS antenna may be required if testing inside CCSi.

VERSION #1.020

#### 2. TEST

- Step 1. From the device list on the mapping client, expand the device details for RADIO-1. This will display the Latitude, Longitude and the update time.
- Step 2. Select RADIO-1 on the map and right click to bring up a pop up box.
- Step 3. Select the option "Set Location Update Frequency" and update the parameter "Delta Time to Min=30 seconds. Verify that RADIO-1 is updating every 30 seconds by looking at the device list.

Pass \_\_\_\_ Fail \_\_\_\_

## 5.15 LOCATION ON PTT

### 5.15.1 Location on PTT - Enabled for All Calls

#### 1. DESCRIPTION

The test will demonstrate Location on PTT capability when enabled for all calls. The dispatcher will see updated locations a subscriber transmitting in a group call and transmitting in an emergency call.

#### SETUP

RADIO-1 - TALKGROUP 1  
CONSOLE-1 – TALKGROUP 1  
MAPPING-1 – RADIO-1

RADIO-1 is configured in the UNS for Location on PTT - Enabled for All Calls.  
Subscribers must have GPS coverage.

#### VERSION #1.040

#### 2. TEST

- Step 1. Using RADIO-1 transmit on TALKGROUP 1.
- Step 2. Will demonstrate that CONSOLE-1 hears RADIO-1 and a little more than 2 seconds after audio starts MAPPING-1 shows an updated location for RADIO-1 not indicating emergency.
- Step 3. Dekey RADIO-1.
- Step 4. Using RADIO-1 press and release emergency button and then transmit on TALKGROUP 1.
- Step 5. Will demonstrate that CONSOLE-1 hears RADIO-1 and a little more than 2 seconds after audio starts MAPPING-1 shows an updated location for RADIO-1 indicating emergency.
- Step 6. Dekey RADIO-1 and press and release emergency button to exit emergency.
- Step 7. Using CONSOLE-1, knockdown the emergency call.
- Step 8. Will demonstrate no more locations are updated for RADIO-1 at MAPPING-1.

Pass\_\_\_\_\_ Fail\_\_\_\_\_



## Location On PTT

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### 5.15.2 Location on PTT - Enabled for Emergency Calls

---

#### 1. DESCRIPTION

The test will demonstrate Location on PTT capability when enabled for emergency calls. The dispatcher will see updated locations for subscribers transmitting in emergency mode and subscribers transmitting not in emergency mode that are in the emergency call.

#### SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 – TALKGROUP 1  
CONSOLE-1 – TALKGROUP 1  
MAPPING-1 – RADIO-1 and RADIO-2

RADIO-1 and RADIO-2 are configured in the UNS for Location on PTT - Enabled for Emergency Calls. Subscribers must have GPS coverage.

**VERSION #1.030**

#### 2. TEST

- Step 1. Using RADIO-1 transmit on TALKGROUP 1.
- Step 2. Will demonstrate that CONSOLE-1 hears RADIO-1 and MAPPING-1 does not show an updated location for RADIO-1.
- Step 3. Dekey RADIO-1 and press and release emergency button and then transmit on TALKGROUP 1.
- Step 4. Will demonstrate that CONSOLE-1 hears RADIO-1 and a little more than 2 seconds after audio starts MAPPING-1 shows an updated location for RADIO-1 indicating emergency.
- Step 5. Dekey RADIO-1.
- Step 6. Using RADIO-2 transmit on TALKGROUP 1.
- Step 7. Will demonstrate that CONSOLE-1 hears RADIO-2 and a little more than 2 seconds after audio starts MAPPING-1 shows an updated location for RADIO-2 not indicating emergency.
- Step 8. Dekey RADIO-2.
- Step 9. Using RADIO-1, press and release emergency button to exit emergency.
- Step 10. Using CONSOLE-1, knockdown the emergency call.

Pass \_\_\_\_ Fail \_\_\_\_

## 5.16 WAVE

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### 5.16.1 WAVE - ISSI Talkgroup Call

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#### 1. DESCRIPTION

The WAVE Talkgroup represents a call to a group of WAVE users associated and defined as part of WAVE "Channel(s)" in the WAVE System. Talkgroups ( or as referred to in the WAVE System as "Channels") is the most basic communication element in WAVE and are used to create communication streams to join multiple users. WAVE has the capability to tie Talkgroups in an Astro P25 System to their profiles. WAVE ties talkgroups with Astro P25 Systems via ISSI. The Astro P25 System sees WAVE as a foreign system. This test will demonstrate that a Talkgroup transmission initiated by a radio user will only be heard by system users, which have, the same Talkgroup selected in their Smartphone App. The same thing applies vice versa between the SMARTPHONE and radio user.

#### SETUP

Smartphone-1 - Astro TG01  
Radio-1 - Astro TG01  
Radio-2 - Astro TG02

Note: The WAVE System must be preconfigured to allow the use of its system via Internet and/or Cellular Data.

Astro TG01 must be tied from the WAVE System with the same Talkgroup ID as Astro TG01 in the Astro System.

#### VERSION #1.020

#### 2. TEST

- Step 1. Login to the WAVE Mobile Communicator PTT App on the Smartphone with the correct credentials.
- Step 2. Initiate a Talkgroup Call with Radio-1 on Astro TG01.
- Step 3. Observe that Smartphone-1 will be able to monitor and respond to the call.
- Step 4. Verify that the Radio-1 receives the audio on Astro TG 01 from Smartphone-1.
- Step 5. Respond with RADIO-1 and verify that Smartphone-1 receives the response audio but Radio-2 cannot since it is on a different Talkgroup.
- Step 6. Verify that both Radio-1's and Smartphone WAVE User ID's are displayed correctly on both devices during communication.

Pass \_\_\_\_ Fail \_\_\_\_



## Wave

# 5.16.2 Talkgroup Call

## 1. DESCRIPTION

The Talkgroup Call is the primary level of organization for communications on a trunked radio system. Dispatchers with Talkgroup Call capability will be able to communicate with other members of the same talkgroup. This provides the effect of an assigned channel down to the talkgroup level. When a Talkgroup Call is initiated from a subscriber unit, the call is indicated on each Mototrbo Anywhere subscriber that is associated with that particular Talkgroup.

## SETUP

RADIO-1 - TALKGROUP 1  
RADIO-2 - TALKGROUP 2  
RADIO-3 - TALKGROUP 1  
RADIO-4 - TALKGROUP 2  
MTA-User-1 - TALKGROUP 1

## VERSION #1.020

## 2. TEST

- Step 1. Initiate a wide area call from MTA-User-1 on TALKGROUP 1.
- Step 2. Observe that RADIO-1 and RADIO-3 will be able to monitor the call. Dekey MTA-User-1 and have either radio respond to the call.
- Step 3. Observe that MTA-User-1 as well as other Radios with TALKGROUP 1 can monitor both sides of the conversation.

Pass\_\_\_\_ Fail\_\_\_\_

## 5.17 WAVE MOBILE COMMUNICATOR

### 5.17.1 Log In and Channel (Talk Group) Access

#### 1. DESCRIPTION

The WAVE Mobile Communicator provides WAVE Thin Client (WTC) access to the WAVE Channels via a mobile carrier's network once the user logs in. The WTC access's WAVE Channels assigned to that specific logon users' profile through the Proxy Server.

This test will verify that WTC users can log in to the application, transmit and receive audio signal on the assigned WAVE Channels.

#### SETUP

Access to an Android or Apple iOS device.

WAVE Mobile Communicator PTT needs to be installed from the Google Play Store or Apple App Store.

Access to a WAVE Proxy Server from a WTC via mobile carrier network

User with a profile assignment needs to previously created on the WAVE system

Successfully logged into WAVE Mobile Communicator.

**VERSION #1.000**

#### 2. TEST

- Step 1. Launch the WAVE Mobile Communicator application from your Smart device
- Step 2. Enter a WAVE username in the "User Name:" field
- Step 3. Enter the user's password in the "Password:" field
- Step 4. Enter the Public IP Address of the WAVE Management Server in the "Server:" field
- Step 5. Toggle/Check the "Secure Connection" option
- Step 6. Click the [Sign In] button
- Step 7. Select a Profile... if you only have access to a single profile or have already chosen a profile previously, please proceed to step 9
- Step 8. Click the [Next] button
- Step 9. (Conditional) A message window may appear requesting location access: click the [Allow] button
- Step 10. Verify the correct channels are listed... if you only have logged in and chosen channels previously, you may need to access all of the user's channels through settings

Pass \_\_\_\_ Fail \_\_\_\_



## 5.18 RADIO ALIAS UPDATE

### 5.18.1 Alias Update on User Login

#### 1. DESCRIPTION

This test is to demonstrate updates to radio aliases as different users login to a subscriber unit. The customer is assumed to have a Unified Network Server (UNS) and have purchased a license for the Radio Alias Update feature.

#### SETUP

- Radio Alias Update is enabled for the security group to which the radio under test belongs
- UNS is provisioned with 2 or more users
- UNS is provisioned with a group that contains the radio under test
- Radio is provisioned to allow login from the radio
- RAM is provisioned to talk to the UNS, talk to the PM, and is subscribed to the UNS Group

VERSION #1.080

#### 2. TEST

- Step 1. "User 1" is logged into the Radio
- Step 2. Key up on Radio. Verify "User 1 Alias" shows up as the person talking on the other radios involved in the call
- Step 3. Logout of Radio. "User 2" Logs into the Radio
- Step 4. Key up on the Radio (2-3 times). Verify that "User 2 Alias" shows up as the person talking on the other radios involved in the call

Pass \_\_\_\_ Fail \_\_\_\_

# COVERAGE ACCEPTANCE TEST PLAN

This Coverage Acceptance Test Plan is based up on the design proposed in this document. This is considered a draft and will be finalized based up the design review and final installation.

## 6.1 OVERVIEW

This Coverage Acceptance Test Plan (CATP) is designed to verify that the voice radio system implemented by Motorola Solutions for Port of Los Angeles, CA meets or exceeds the required reliability as shown on Motorola Solutions' maps. The CATP defines the coverage testing method and procedure, the coverage acceptance criterion, the test documentation, and the responsibilities of both Motorola Solutions and Port of Los Angeles, CA.

Coverage Acceptance Testing is based upon a coverage prediction that accurately represents the implemented infrastructure and parameters that are consistent with the contract agreements. To characterize system performance accurately, the actual user equipment radio series deployed for Port of Los Angeles, CA will be used to conduct the coverage test.

Subsequent sections define the coverage acceptance test configuration(s) and test criteria.

## 6.2 CATP DEFINITIONS

Several definitions are needed to accurately describe the coverage acceptance test method and criteria. Where cited, these terms or methods are defined in TIA TSB-88.1-D<sup>1</sup> or TSB-88.3-D<sup>2</sup>.

### 6.2.1 Defined Test Area

The defined test area is the geographical area in which communications will be provided that meet or exceed the specified Channel Performance Criterion (CPC) at the specified reliability for the specified equipment configuration(s). The defined test area(s) are listed in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary, along with names of the corresponding Motorola Solutions map(s) which show the defined test areas.

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<sup>1</sup> Wireless Communications Systems --- Performance in Noise- and Interference-Limited Situations --- Part 1: Recommended Methods for Technology Independent Performance Modeling Technical Service Bulletin TSB-88.1-D, Telecommunications Industry Association (TIA), Arlington VA, 2012.

<sup>2</sup> *Wireless Communications Systems --- Performance in Noise- and Interference-Limited Situations --- Part 3: Recommended Methods for Technology Independent Performance Verification*, Technical Service Bulletin TSB-88.3-D, Telecommunications Industry Association (TIA), Arlington VA, 2013.



For the defined test areas the coverage reliability commitment is only on-roads. The roads included in the on-road commitment are defined by the US Census Bureau TIGER streets that are accessible by 2-wheel drive vehicles.

For coverage testing, each defined test area will be divided into a grid pattern by Motorola Solutions to produce at least the number of uniformly sized test locations (or tiles) required by the Estimate of Proportions formula. [TSB-88.3-D, §5.2.1, equation 2] The minimum number of test tiles required varies, from a hundred to many thousands, depending on the size of the defined test area, desired confidence in results, type of coverage test, and the predicted versus required reliability.

## 6.2.2 Channel Performance Criterion (CPC)

The CPC is the specified minimum design performance level in a faded channel. [TSB-88.1-D, §5.2] For this system, the CPC is the Delivered Audio Quality (DAQ) as stated in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary, the DAQ definitions are provided in Table 6-1: DAQ Definitions.

Table 6-1: DAQ Definitions

DAQ	Subjective Performance Description
1	Unusable, speech present but unreadable.
2	Understandable with considerable effort. Frequent repetition due to noise/distortion.
3	Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
3.4	Speech understandable with repetition only rarely required. Some noise/distortion.
4	Speech easily understood. Occasional noise/distortion.
4.5	Speech easily understood. Infrequent noise/distortion.
5	Speech easily understood.

The CPC pass/fail criterion is the faded performance threshold, plus any adjustments for antenna performance, external noise, and in-building or in-vehicle losses. [TSB-88.1-D, §5.4.2, Figure 5] The faded performance threshold for the specified CPC is determined using the receiver's static reference sensitivity adjusted by the projected CPC parameters for the applicable Modulation Type and DAQ as listed in the current version of TSB-88.1, Annex A, Table A-1. For coverage testing of digital voice radio systems, the faded performance threshold is the applicable Bit Error Rate (BER) from the projected CPC parameters.

## 6.2.3 Reliability

The Covered Area reliability is the percentage of locations within the defined test area that are predicted to meet or exceed the specified CPC. The Motorola Solutions map(s) indicate the Covered Area(s) within which this system is predicted to provide at least the reliability of meeting or exceeding the CPC as stated in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary.

For the defined test area(s) guaranteed for Covered Area reliability, only the painted covered area on Motorola Solutions' maps will be tested for coverage acceptance. No acceptance testing will be performed in locations predicted on Motorola Solutions' maps to be below the required Covered Area reliability.

After all accessible tiles in the defined test area have been tested, the Covered Area reliability will be determined by dividing the number of tiles tested that meet or exceed the CPC pass/fail criterion by the total number of tiles tested. [TSB-88.3-D, §5.1, equation 1]

## 6.2.4 Direction(s) of Test

The direction(s) of test in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary, defines the direction(s) which will be tested for coverage acceptance. Outbound (also called forward link, downlink, or talk-out) is the path from the fixed equipment outward to the mobile or portable radios. Inbound (also called reverse link, uplink, or talk-in) is the path from the mobile or portable radios inward to the fixed equipment. Both Outbound and Inbound directions will be evaluated as a separate independent test.

## 6.2.5 Equipment Configurations

This section defines the equipment configurations and infrastructure design parameters upon which the coverage guarantee and the coverage acceptance test are based. The equipment configurations are defined in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary, and include user equipment, outdoor/in-building definition, defined test area, number of test tiles, reliability, CPC, CPC pass/fail, and direction(s) of test. The infrastructure design parameters are defined in Table 6-3: Port of Los Angeles, CA Infrastructure Design Parameters, and include site names, site locations, and antenna system parameters. If the implemented system equipment configuration and/or infrastructure design parameters vary from these configurations and/or parameters, a revised coverage map will be used to define the test configuration and potential areas from which test tiles will be included in the revised coverage acceptance test.

Coverage testing will be conducted with equipment installed per the configurations in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary, and with the mobile antennas in unobstructed locations that are not adjacent to other large objects or metallic items which would distort the antenna patterns.



**Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary**

User Equipment	Outdoor / In-Building	Defined Test Area & Map Name	Number of Test Tiles	Reliability	CPC	CPC Pass/Fail	Direction(s) of Test
ASTRO P25 700MHz							
APX Portable with dual band antenna in swivel case with remote speaker microphone for transmit and in swivel case with remote speaker microphone for receive	Outdoor	TBD – Based Upon As Built Design	TBD – Based Upon As Built Design	95%	DAQ-3,4	2.4% BER Outbound with Subjective DAQ Re-Test Allowed. 2.6% BER Inbound with Subjective DAQ Re-Test Allowed	Outbound and Inbound Independently

Table 6-3: Port of Los Angeles, CA Infrastructure Design Parameters

Site Name	Latitude	Longitude	Transmit Antenna System		Receive Antenna System		External Noise assumed <small>(relative to KToB)</small>
			Mount Height	Antenna Model	Mount Height	Antenna Model	
<b>Trunking Simulcast Subsystem</b>							
Black Jack Mtn	33° 23' 12.53" N	118° 24' 3.66" W	65 ft	*RDEAntRF Industries Pty Ltd\YB715-99 @757 V2.0_CCDT.adf	85 ft	*RDEAntRF Industries Pty Ltd\CC807-06-T3 @808 V1.0_CCDT.adf	N/A
Marine Exchange	33° 42' 43.1" N	118° 17' 38.1" W	269 ft	*RDEAntRF Industries Pty Ltd\CC807-06-T3 @808 V1.0_CCDT.adf	289 ft	*RDEAntRF Industries Pty Ltd\CC807-06-T3 @808 V1.0_CCDT.adf	N/A
MLETC	33° 45' 58" N	118° 15' 19" W	100 ft	*RDEAntRF Industries Pty Ltd\CC807-06-T3 @808 V1.0_CCDT.adf	120 ft	*RDEAntRF Industries Pty Ltd\CC807-06-T3 @808 V1.0_CCDT.adf	N/A
Knoll Hill	33° 45' 3.7" N	118° 17' 9.2" W	62 ft	*RDEAntRF Industries Pty Ltd\CC807-06-T3 @808 V1.0_CCDT.adf	82 ft	*RDEAntRF Industries Pty Ltd\CC807-06-T3 @808 V1.0_CCDT.adf	N/A
Long Beach Water	33° 51' 29" N	118° 13' 27" W	120 ft	*RDEAntRF Industries Pty Ltd\BPA7496-60-13_2 @853 V1.0_CCDT.adf	140 ft	*RDEAntRF Industries Pty Ltd\CC807-06-T3 @808 V1.0_CCDT.adf	N/A

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## 6.2.6 In-Building Coverage

### 6.2.6.1 Outdoor Only Coverage

Motorola Solutions' portable coverage prediction is for outdoor locations only. Portable coverage inside buildings and vehicles is not a design requirement of this system and is, therefore, not guaranteed.

## 6.2.7 CPC Pass/Fail Criterion for a Test Tile

For each equipment configuration, the CPC pass/fail criterion for a test tile is stated in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary. Each equipment configuration will have only one CPC pass/fail criterion for a test tile.

To measure BER, the coverage test will be performed with the appropriate attenuator value installed in the test radio antenna line, to establish an equivalent signal level performance for each equipment configuration.

Any tile that fails the objective BER test described above will be re-tested using a subjective DAQ test. Any tile that fails the objective BER test, but passes a subjective DAQ re-test will be declared passed.

Coverage for the portable outdoor equipment configurations will be verified for acceptance by attenuation of the test radio for BER and DAQ tests. The attenuation will be the difference between the test radio's antenna system and the additional loss used in Motorola Solutions' coverage prediction to account for portable antenna performance. The attenuator values are provided in Table 6-4: Attenuator Values to Evaluate Each Equipment Configuration.

This provides a method of verifying that the radio system provides the required BER or DAQ for the specified CPC for each of the defined equipment configurations.

Below are the attenuator values required to evaluate each equipment configuration. The methodology to determine the attenuator value is demonstrated in TSB-88.1-D §5.4.2, Figure 5. The attenuator value includes the proper values for the equipment configuration requirement plus adjustments for the test equipment setup. Should the test equipment setup losses (e.g. cable length) vary, an adjustment to the attenuator value may be required to represent the required equipment configuration accurately.

**Table 6-4: Attenuator Values to Evaluate Each Equipment Configuration**

User Equipment Configuration and Outdoor / In-Building	Attenuator Value
Portable Outdoors	TBD (Based Upon As-Built Design)

## 6.2.8 Required Number of Test Tiles in the Defined Test Area

The method used to test coverage is a statistical sampling of the defined test area to verify that the CPC is met or exceeded at the required reliability for each of the defined equipment configurations. It is impossible to verify every point within a defined test area, because there are



infinite points; therefore, coverage reliability will be verified by sampling a statistically significant number of randomly selected locations, quasi-uniformly distributed throughout the defined test area. There is one test sample per test tile, where a sample consists of multiple sub-samples.

Coverage acceptance testing will be performed in the defined test area as indicated on Motorola Solutions-provided maps. To verify that the reliability requirement is met, the defined test area indicated on Motorola Solutions' maps will be divided into uniformly sized test tiles, with at least the number of test tiles indicated in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary. The number of test tiles indicated in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary is at least the minimum required by the Estimate of Proportions formula as stated in section 1.2.1 (Defined Test Area) of this document.

Per TSB-88.3-D, the stated minimum outdoor tile size is 100 by 100 wavelengths; however, the minimum *practical* test tile size is typically about 400 by 400 meters (about 0.25 by 0.25 miles). The minimum practical tile size for any system is determined by the distance traveled at the speed of the test vehicle while sampling, GPS error margin, and availability of road access within very small test tiles. A related consideration is the time, resources, and cost involved in testing very large numbers of very small tiles. For a given defined test area, all test tiles must be of equal size. The maximum test tile size is 2 by 2 km (1.24 by 1.24 miles) [TSB-88.3-D, §5.5.1]. In some wide-area systems, this constraint on maximum tile size may dictate a greater number of test tiles than the minimum number required by the Estimate of Proportions formula.

No acceptance testing will be performed in locations outside the defined test area as indicated on the Motorola Solutions-provided maps. Motorola Solutions and Port of Los Angeles, CA may agree to perform "information only" tests in locations outside the defined test area; however, these "information only" test results will not be used for coverage acceptance. Any "information only" test locations must be defined before starting the test. If the added locations require significant additional time and resources to test, a change order will be required and Motorola Solutions may charge Port of Los Angeles, CA on a time-and-materials basis.

## 6.2.9 Accessibility to Test Tiles

Prior to testing, Motorola Solutions and Port of Los Angeles, CA will plan the route for the test vehicle(s) through the defined test area, to ensure that at least the minimum required number of tiles is tested. While planning the route (if possible) or during the test, Motorola Solutions and Port of Los Angeles, CA will identify any test tiles that are inaccessible for the coverage test (due to lack of roads, restricted land, etc.). Inaccessible tiles will be eliminated from the acceptance test calculation. [TSB-88.3-D, §5.5.4]

If elimination of inaccessible test tiles results in less than a statistically significant number of test tiles or substantially alters the defined test area, Motorola Solutions reserves the right to adjust the committed reliability based on the reduced number of accessible test tiles within the altered test area and the Estimate of Proportions formula. [TSB-88.3-D, §5.2.1, equation 2]

## 6.2.10 Random Selection of a Test Location in Each Tile

This CATP provides an objective method of randomly selecting and tracking test locations using Motorola Solutions' Voyager<sup>SM</sup> coverage testing tool. The method has direct correlation with Motorola Solutions' coverage prediction methodology.

Using Voyager, the actual test location within each test tile will be randomly selected by the test vehicle crossing into the tile at an arbitrary point, with an arbitrary speed and direction. If the

selected test location is in a shielded area such as a tunnel or underground parking garage, the data from that test location must be eliminated and a replacement test location must be used.

### 6.2.11 CPC Measurements in Each Tile

For Outbound and Inbound BER testing, complementary timing profiles will be used by Voyager and the Voyager Fixed Network application, VFNE-2, to interleave the inbound and outbound testing. VFNE-2 will be used to gather inbound test statistics. The mobile application, Voyager, will gather outbound test statistics and will send an inbound test pattern to VFNE-2.

## 6.3 RESPONSIBILITIES AND PREPARATION

This section identifies the responsibilities of Port of Los Angeles, CA and Motorola Solutions regarding requirements for equipment, personnel, and time during the coverage test.

Port of Los Angeles, CA will provide the following for the duration of the coverage test:

- At least test vehicle(s) that is representative of the vehicles to be installed with radios, and will provide the driver(s).
- Exclusive use of the test channels required by Motorola Solutions during the test.

Motorola Solutions will provide the following for the duration of the coverage test:

- At least one Motorola Solutions Voyager coverage testing tool.
- One or more computers equipped with Motorola Solutions VFNE-2 software, and connected to the radio network for collecting inbound signal statistics.
- A timing profile to allow the test radio to transmit and receive at regular intervals will be established to facilitate automatic inbound and outbound BER statistics gathering.

As required, Motorola Solutions will provide a receiver signal strength calibration file for the test radio(s) used with the Voyager coverage testing tool.

Before starting the test, Port of Los Angeles, CA and Motorola Solutions will agree upon the time frame for Motorola Solutions' submission of a report containing the coverage test results.

## 6.4 CATP PROCEDURES

A coverage acceptance test will be performed using Motorola Solutions' Voyager tool to randomly select test locations, and to manage BER data collection.

Voyager consists of the following:

- A voice test radio connected to an antenna installed in a representative location on the test vehicle. The test radio will monitor transmissions from the fixed network radio site(s).
- A Global Positioning System (GPS) receiver, which will provide the computer with the location and speed of the test vehicle.
- A laptop computer with Voyager software and a mapping database, which includes highways, local streets, political boundaries, rivers, and railroads.
- A computer with the Voyager Fixed Network (VFNE-2) application, connected to the system network to retrieve inbound BER statistics and to initiate the outbound test pattern.

The procedure for the objective BER coverage test will be as follows:

- The Voyager tool will be installed in a test vehicle, which will be driven over a route planned to cover the accessible tiles within the defined test area.
- During the coverage test, the laptop computer screen will display the vehicle's location on a map of the defined test area overlaid with the grid of test tiles. Voyager will automatically initiate outbound measurements and inbound transmissions based on the defined timing profile. The computer will provide a visual indication that a measurement has been completed. Voyager will manage the coverage test data collection, and will store the outbound measurements for each tested tile for later analysis. Voyager will use the information collected by the VFNE-2 fixed end application for the inbound tests. Voyager will use its merge and export feature to match the inbound measurements to a test tile and display the BER statistics.
- For TDMA System Inbound/Outbound BER/SSI Coverage Testing, one channel is required. The TDMA inbound and outbound test will use a 1031Hz test pattern. A single TDMA channel can be used for both the inbound and outbound testing. The TDMA base stations must be put into test mode to gather inbound signal strength and BER information and to transmit the outbound test pattern. The outbound test will send the 1031 Hz pattern on both TDMA logical channel 0 and 1 at the same time. The inbound test from the mobile can use either TDMA logical channel 0 or TDMA logical channel 1. The Voyager Fixed Network (VFNE-2) application will connect to the system test port to establish an IP session to each base station to gather inbound signal statistics and initiate the outbound signal. The outbound test pattern, once initiated, will send a continuous O.153 test pattern over the air to allow the radio in the Voyager test vehicle to gather signal statistics whenever a test is initiated.
- Any tile that fails the objective BER test described above will be re-tested using a subjective DAQ test. Any tile that fails the objective BER test, but passes the subjective DAQ re-test will be declared passed.

The procedure for the subjective DAQ re-test of failed BER tiles (if needed) will be as follows:

- A subjective listening re-test will be performed on tiles that fail the objective BER test, to verify undefined DAQ performance of those tiles.
- Talk-out and talk-in will be evaluated independently
- To perform a statistically valid subjective DAQ test, a large group of people is required to ensure high confidence in the results. However, obtaining a large group of people for a subjective listening test is usually impractical; therefore, several (three to seven) people in a car or van must be used for the test. Since a group this small cannot provide statistically significant results, it is very important that the personnel participating in the subjective test be familiar with the sound of radio conversations. Before subjectively testing, all personnel who will evaluate audio quality must be "calibrated" by listening to examples of audio that pass and fail the subjective DAQ test.
- A fixed dispatch location will be established. Prior to testing, Port of Los Angeles, CA and Motorola Solutions will agree upon a procedure to allow each audio transmission to be evaluated for approximately five seconds.
- The test participants will be divided into teams, each consisting of personnel from both Port of Los Angeles, CA and Motorola Solutions. Each team will have members that operate a portable radio in the field, and members that are stationed at the fixed dispatch location.
- As the field test team(s) drive through the coverage area, test locations within each re-test tile will be selected randomly by Voyager's GPS location indication. Voyager will be used to log the talk-in and talk-out pass/fail result as well as any pertinent notes for the location.
- At each re-test tile location, each field test team member will listen to a talk-out audio transmission, and will record his or her subjective pass/fail evaluation of the DAQ for the tile. Team members stationed at the dispatch location will evaluate talk-in audio quality of

transmissions from the test radio(s) in that tile. Each team member will maintain a test log to record date, time, and subjective pass/fail evaluation for each re-test tile location. Subjective pass/fail evaluation will be based on the DAQ descriptions in Table 6-1: DAQ Definitions. The determination of whether each re-test tile passes or fails the required DAQ value will be the majority vote of all team members' pass/fail subjective evaluations for that tile. An odd number of team members are required to avoid ties for the pass/fail majority vote.

Should any subjective DAQ re-test tile fail, a retry of the transmission will occur. Should the retry pass, the re-test tile will be considered a pass. If a retry should occur, it will be noted in the test log notes for that test tile

## 6.5 CATP DOCUMENTATION AND COVERAGE ACCEPTANCE

During the coverage acceptance test, Voyager generates computer files that include the raw test data. A copy of this data will be provided to Port of Los Angeles, CA at the conclusion of the coverage test. Motorola Solutions will process this data to produce a map detailing the coverage test results, and to determine whether the coverage test was passed for each user equipment configuration.

The coverage acceptance criterion for a user equipment configuration will be that the voice radio system implemented by Motorola Solutions for Port of Los Angeles, CA meets or exceeds the reliability stated in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary, for that user equipment configuration. The system coverage acceptance criterion will be the successful passing of each of the user equipment configurations defined in Table 6-2: Port of Los Angeles, CA Coverage Acceptance Test Summary.

Motorola Solutions reserves the right to review any test tiles that fail. If a coverage test, or a portion thereof, is suspected by Motorola Solutions to have failed due to external interference, those tiles suspected of being affected by an interferer may be re-tested. If the test tiles re-tested are confirmed to have failed due to interference or external noise, those test tiles will be excluded from all acceptance calculations and Motorola Solutions will work with Port of Los Angeles, CA to identify potential solutions to the interference issues.

Motorola Solutions will conduct this Coverage Acceptance Test only once. If any portion of the test is determined to be affected by proven equipment malfunctions or failures, Motorola Solutions will repeat the portion of the test affected by the equipment malfunction or failure. Port of Los Angeles, CA will have the option to accept the coverage at any time prior to completion of the coverage test or documentation process.

Motorola Solutions will submit to Port of Los Angeles, CA a report detailing the coverage test results. This report will include a document, which is to be signed by both Port of Los Angeles, CA and Motorola Solutions, indicating the test was performed in accordance with this CATP and the results of the test indicate the acceptance or non-acceptance of the coverage portion of the system.



SECTION 7

# STATEMENT OF WORK

## 7.1 STATEMENT OF WORK

Motorola Solutions will install and configure the proposed equipment. The following table describes the tasks involved with installation and configuration.

Tasks	Motorola Solutions	Customer
<b>PROJECT INITIATION</b>		
<b>Contract Finalization and Team Creation</b>		
Execute contract and distribute contract documents.	X	X
Furnish a performance bond in the full amount of the contract price as security for the faithful performance of Motorola Solutions' contractual obligations.	X	
Assign a Project Manager as a single point of contact.	X	X
Assign resources.	X	X
Schedule project kickoff meeting.	X	X
Deliverable: Signed contract, defined project team, and scheduled project kickoff meeting.		
<b>Project Administration</b>		
Ensure that project team members attend all meetings relevant to their role on the project.	X	X
Set up the project in the Motorola Solutions information system.	X	
Record and distribute project status meeting minutes.	X	
Maintain responsibility for third-party services contracted by Motorola Solutions.	X	
Complete assigned project tasks according to the project schedule.	X	X
Submit project milestone completion documents.	X	
Upon completion of tasks, approve project milestone completion documents.		X
Conduct all project work Monday thru Friday, 7:30 a.m. to 5:00 p.m.).	X	X
Deliverable: Completed and approved project milestones throughout the project.		
<b>Project Kickoff</b>		
Introduce team, review roles, and decision authority.	X	X
Present project scope and objectives.	X	

Tasks	Motorola Solutions	Customer
Review SOW responsibilities and project schedule.	X	X
Schedule Design Review.	X	X
Deliverable: Completed project kickoff and scheduled Design Review.		
<b>Design Review</b>		
Review the Customer's operational requirements.	X	X
Present the system design and operational requirements for the solution.	X	
Present installation plan.	X	
Present preliminary cutover plan and methods to document final cutover process.	X	
Present configuration and details of sites required by system design.	X	
Validate that Customer sites can accommodate proposed equipment.	X	X
Provide approvals required to add equipment to proposed existing sites.		X
Review safety, security, and site access procedures.	X	
Finalize site acquisition and development plan.	X	
Present equipment layout plans and system design drawings.	X	
Provide backhaul performance specifications and demarcation points.		X
Provide heat load and power requirements for new equipment.	X	
Provide information on existing system interfaces.		X
Provide frequency and radio information for each site.		X
Assume liability and responsibility for proving all information necessary for complete installation.		X
Assume responsibility for issues outside of Motorola Solutions' control.		X
Complete the required forms required for frequency coordination and licensing.	X	
Ensure that frequency availability and licensing meet project requirements, and pay licensing and frequency coordination fees.		X
Review and update design documents, including System Description, Statement of Work, Project Schedule, and Acceptance Test Plan, based on Design Review agreements.	X	
Provide minimum acceptable performance specifications for any customer provided hardware, software, LAN, WAN and internet connectivity.	X	
Execute Change Order in accordance with all material changes to the Contract resulting from the Design Review.	X	
Deliverable: Finalized design documentation based upon "frozen" design, along with any relevant Change Order documentation.		

Tasks	Motorola Solutions	Customer
<b>SITE PREPARATION AND DEVELOPMENT</b>		
<b>Site Access</b>		
Provide site owners/managers with written notice to provide entry to sites identified in the project design documentation.		X
Maintain access roads in order to provide clear and stable entry to sites for heavy-duty construction vehicles, cement trucks and cranes. Ensure that sufficient space is available at the site for these vehicles to maneuver under their own power, without assistance from other equipment.		X
Obtain site licensing and permitting, including site lease/ownership, zoning, permits, regulatory approvals, easements, power, and telco connections.		X
Deliverable: Access, permitting, and licensing necessary to install system equipment at each site.		
<b>Site Planning</b>		
Provide necessary buildings, equipment shelters, and towers for installation of system equipment.		X
Provide the R56 requirements for space, power, grounding, HVAC, and connectivity requirements at each site.	X	
Provide adequate electrical power in proper phase and voltage at sites.		X
Provide as-built structural and foundation drawings of the structures and site locations, along with geotechnical reports, in order to facilitate a structural analysis.		X
If necessary, perform structural analysis of towers, rooftops, or other structures to confirm that they are capable of supporting proposed and future antenna loads.		X
Confirm that there is adequate utility service to support the new equipment and ancillary equipment.	X	
Provide cost estimates to rectify identified utility power, HVAC, grounding, and tower issues identified.	X	
Modify towers or other structures, or relocate sites in the system, to ensure that they are capable of supporting proposed and future antenna loads.		X
Conduct site walks to collect pertinent information (e.g. location of telco, power, structures, etc.)	X	
Ensure that each site meets the R56 standards for space, grounding, power, HVAC, and connectivity requirements.		X
Conduct one three-point ground resistance test of each site.	X	
Prepare and submit Electromagnetic Energy (EME) plans for the site (as licensee) to demonstrate compliance with FCC RF Exposure Guidelines.		X
Obtain the permits needed to complete site development, including electrical, building, and construction permits.	X	
Pay for application fees, taxes, and recurring payments for lease/ownership of property.		X
Ensure that required rack space is available for installation of the new equipment.		X
Deliverable: Information and permitting requirements completed at each site.		



Tasks	Motorola Solutions	Customer
<b>General Facility Improvements</b>		
Provide adequate HVAC, grounding, lighting, cable routing, and surge protection based upon Motorola Solutions' Standards and Guidelines for Communication Sites (R56)		X
Ensure the resolution of environmental and hazardous material issues at each site including, but not limited to, asbestos, structural integrity (tower, rooftop, water tank, etc.), and other building risks.		X
Ensure that electrical service will accommodate installation of system equipment, including isolation transformers, circuit breakers, surge protectors, and cabling.		X
Provide obstruction-free area for the cable run between the demarcation point and system equipment.		X
Provide structure penetrations (wall or roof) for transmission equipment (e.g. antennas, microwave radios, etc.).		X
Supply interior building cable trays, raceways, conduits, and wire supports.		X
Pay for usage costs of power and generator fueling, both during the construction and installation effort, and on an ongoing basis.		X
Provide one-time mobilization of construction crews.	X	
Transport removed site equipment to a location designated by Customer and within Customer's jurisdiction.	X	
Deliverable: Sites meet physical requirements for equipment installation.		
<b>SYSTEM INSTALLATION</b>		
<b>Equipment Order and Manufacturing</b>		
Create equipment order and reconcile to contract.	X	
Manufacture Motorola Solutions-provided equipment necessary for system based on equipment order.	X	
Procure non-Motorola Solutions equipment necessary for the system.	X	
Deliverable: Equipment procured and ready for shipment.		
<b>System Staging</b>		
Ship all equipment needed for staging to Motorola Solutions' Customer Center for Solutions Integration (CCSi).	X	
Provide information on existing system interfaces, room layouts, or other information necessary for the assembly to meet field conditions.		X
Set up and rack the solution equipment on a site-by-site basis, as it will be configured in the field at each of the sites.	X	
Cut and label the cables with to/from information to specify interconnection for field installation and future servicing needs.	X	
Complete the cabling/connecting of the subsystems to each other ("connectorization" of the subsystems).	X	
Assemble required subsystems to assure system functionality.	X	
Power up, load application parameters, program, and test all staged equipment.	X	

Tasks	Motorola Solutions	Customer
Confirm system configuration and software compatibility with the existing system.	X	
Inventory the equipment with serial numbers and installation references.	X	
Pay for travel and accommodations for up to five (5) Customer attendees.	X	
Pay for travel and accommodations for additional Customer attendees.		X
Review and approve proposed Factory Acceptance Test Plan.		X
Pay for travel, lodging, meals, and all incidental expenses for Customer personnel and representatives to witness the Factory Acceptance Testing.		X
Perform factory functional acceptance tests of system features	X	
Conduct site and system level testing.	X	
Perform system burn-in 24 hours a day during staging to isolate and capture any defects.	X	
Deliverable: System staged and ready for shipment.		
<b>Equipment Shipment and Storage</b>		
Provide secure location for solution equipment.		X
Pack and ship solution equipment to the identified, or site locations.	X	
Receive solution equipment.		X
Inventory solution equipment.	X	
Deliverable: Solution equipment received and ready for installation		
<b>General Installation</b>		
Deliver solution equipment to installation location.	X	
Coordinate receipt of and inventory solution equipment with designated contact.	X	
Install all proposed fixed equipment as outlined in the System Description based upon the agreed-upon floor plans, connecting audio, control, and radio transmission cables to connect equipment to the power panels or receptacles, and audio/control line connection points. Installation performed in accordance with R56 standards and state/local codes.	X	
Provide system interconnections that are not specifically outlined in the system design, including dedicated phone circuits, microwave links, or other types of connectivity.		X
Install and terminate all network cables between site routers and network demarcation points, including microwave, leased lines, and Ethernet.	X	
Ensure that Type 1 and Type 2 AC suppression is installed to protect installed equipment.		X

Tasks	Motorola Solutions	Customer
Connect installed equipment to the provided ground system.	X	
Label equipment, racks, and cables.	X	
Perform preliminary audit of installed equipment to ensure compliance with requirements and R56 standards.	X	
Note any required changes to the installation for inclusion in the "as-built" system documentation.	X	
Remove, transport, and dispose of old radio and Microwave equipment at the sites included in this proposal. This includes de-commissioning Microwave equipment located at Badger Bridge.	X	
Deliverable: Equipment installed.		
<b>Antenna and Transmission Line Installation</b>		
Install antennas, including supplying and installing new side arm mounts	X	
Install tower top amplifiers as required by the coverage design.	X	
Install transmission lines required for system.	X	
Provide structure penetrations for transmission equipment (e.g. antennas & microwave line.).	X	
Install microwave waveguide and lines, as applicable.	X	
Perform sweep tests on transmission lines.	X	
Provide and install attachment hardware for supporting transmission lines on antenna support structure.	X	
Supply and install ground buss bar at the bottom of each antenna support structure.	X	
Deliverable: Antenna and Transmission Line installed.		
<b>ASTRO 25 Core and Remote Site Installation and Configuration</b>		
Install fixed equipment contained in the equipment list and system description.	X	
Provide backhaul connectivity and associated equipment for all sites to meet latency, jitter and capacity requirements. Excluding all Microwave and MPLS connectivity included in the Motorola proposal.		X
Configure ASTRO 25 system to support the new RF sites.	X	
Verify site link performance, prior to the interconnection of the solution equipment to the link equipment.	X	
Provide list of subscriber IDs for loading into the Zone Controller.		X
Load subscriber IDs in the Zone Controller.	X	
Provide required radio ID and alias information to enable alias database setup for interface to consoles.		X
Integrate the RF sites into the system to ensure proper operation.	X	

Tasks	Motorola Solutions	Customer
Deliverable: ASTRO 25 core and remote site equipment installation completed.		
<b>Console Installation and Configuration</b>		
Identify circuits for connection to console and a demarcation point located within 25 feet of the console interface.		X
Connect console to circuit demarcation points.	X	
Install PC workstation w/ keyboard and mouse, and monitor.	X	
Install a Voice Processor Module (VPM) and purchased peripheral console equipment in accordance with R56 standards and state/local codes.	X	
Develop templates for console programming.	X	
Perform console programming and configuration.	X	
Deliverable: Console equipment installation completed.		
<b>Control Station Installation and Configuration</b>		
Provide the locations of control stations and desk sets at each site.		X
Survey mounting locations and develop control station installation plan.	X	
Provide adequate space, grounding, and power for the control station installation.		X
Properly connectorize and ground the cabling, which will be run to the outdoor antenna location using the least obtrusive method.	X	
Provide an elevated antenna mounting location, and adequate feed-line routing and support.		X
Install line (not greater than 100 feet in length) and antenna system (connectors, coax grounding kit, antenna, and surge protection).		X
Install RF local control stations identified in the equipment list.	X	
Perform control station programming.	X	
Deliverable: Control station equipment installation completed.		
<b>Logging Equipment Installation and Configuration</b>		
Supply logging equipment.		X
Provide interface to logging equipment.	X	
Deliverable: Logging equipment installation completed.		
<b>WAVE System Installation and Configuration</b>		
Install WAVE Server in allocated rack space.	X	
Install InterSystem Gateway at the ASTRO25 Master Site.	X	
Install desktop computers at the allocated workspaces.	X	

Tasks	Motorola Solutions	Customer
Install networking equipment at the relevant sites.	X	
Validate servers and network are ready for software load.	X	
Install software for WAVE Management, Media, Proxy, and WRG Server.	X	
Install and configure TLS Certificates.		X
Install up to five of each of the WAVE client applications and train the customer how to install the remaining.	X	
Configure up to ten WAVE Users and WAVE Profiles and train the customer how to configure the remaining.	X	
Configure WAVE Communication Groups.	X	
Configure WAVE Interfaces for radio gateways.	X	
Provide knowledge transfer to end user.	X	
Deliverable: WAVE system installed and configured.		
<b>Develop Console and User Radio Fleetmap</b>		
Review and determine modifications to existing fleetmap.		X
Review fleetmapping requirements with Customer, including user ID and talkgroup structures.	X	
Designate user group representatives for the user groups, to make timely decisions on their behalf.		X
Provide advisory input during fleetmap development.	X	
Develop templates.		X
Participate in a meeting to finalize any changes among user groups.	X	X
Review and approve fleetmap templates.		X
Program the approved templates into a radio-programming template tool.	X	
Program sample radios with approved templates and deliver for evaluation by Customer.	X	
Program approved templates into console.		X
Evaluate sample radios and provide feedback.		X
Approve templates.		X
Deliverable: Fleetmap plan completed and approved by Customer.		
<b>SYSTEM OPTIMIZATION AND TESTING</b>		
<b>R56 Site Audit</b>		
Perform R56 site-installation quality-audits, verifying proper physical installation and operational configurations.	X	

Tasks	Motorola Solutions	Customer
Create site evaluation report to verify site meets or exceeds requirements, as defined in Motorola Solutions' R56 Standards and Guidelines for Communication Sites.	X	
Deliverable: R56 Standards and Guidelines for Communication Sites audits completed successfully.		
<b>Electromagnetic Interference (EMI) Analysis</b>		
Perform EMI analysis for the Motorola Solutions-supplied equipment. Note: Motorola Solutions is only responsible for interference caused by Motorola Solutions-provided transmitters to the Motorola Solutions-provided receivers. Should the proposed equipment experience interference, Motorola Solutions can be contracted to investigate the source and recommend solutions to mitigate the issue.	X	
Resolve any interference caused by equipment not supplied by Motorola Solutions.		X
Deliverable: EMI analysis completed.		
<b>Solution Optimization</b>		
Verify that all equipment is operating properly and that all electrical and signal levels are set accurately.	X	
Verify that all audio and data levels are at factory settings.	X	
Verify communication interfaces between devices for proper operation.	X	
Ensure that functionality meets manufacturers' specifications and complies with the final configuration established during design review or system staging.	X	
Deliverable: Completion of System Optimization.		
<b>Functional Acceptance Testing</b>		
Verify the operational functionality and features of the solution supplied by Motorola Solutions, as contracted.	X	
Witness the functional testing.		X
Document all issues that arise during the acceptance tests.	X	
If any major task for the system as contractually described fails during the Customer acceptance testing or beneficial use, repeat that particular task after Motorola Solutions determines that corrective action has been taken.	X	
Resolve any minor task failures before Final System Acceptance.	X	
Document the results of the acceptance tests and present for review.	X	
Review and approve final acceptance test results.		X
If any major task as contractually described fails, repeat that particular task after Motorola Solutions determines that corrective action has been taken.	X	
Document all issues that arise during the acceptance tests.	X	



Tasks	Motorola Solutions	Customer
Document the results of the acceptance tests and present to the Customer for review.	X	
Resolve any minor task failures before Final System Acceptance.	X	
Deliverable: Completion of functional testing and approval by Customer.		
<b>Coverage Testing</b>		
Determine the required number of test vehicles for simultaneous testing of multiple service areas.	X	X
Perform coverage testing according to the Coverage Acceptance Test Plan (CATP), Submit test reports within the agreed period.	X	
For any area that fails, take corrective action.	X	
Retest any areas for which corrective action has been taken.	X	
Document all issues that arise during the coverage testing.	X	
Submit final test reports, according to the agreed period.	X	
Provide the required number of test vehicles, drivers, and resources to witness the coverage testing.		X
Review and approve test results.		X
Deliverable: Completion of coverage testing and approval by Customer.		
<b>PROJECT TRANSITION</b>		
<b>Training</b>		
Finalize schedule for training coursework.	X	
Provide training facility.		X
Ensure that the training participants fulfill course prerequisites.		X
Conduct the training classes outlined in the Training Plan.	X	
Attend proposed training classes.		X
Deliverable: Training coursework completed.		
<b>Cutover</b>		
Finalize Cutover Plan.	X	X
Calibrate and tune existing mobile and portable radios to ensure good working order.		X
Provide Motorola Solutions with user radio information for input into the system database and activation, as required.		X
Provide programming of user radios and related services (i.e. template building, re-tuning, testing and installations), as needed, during cutover period.		X
Conduct cutover meeting with relevant personnel to address both how to mitigate technical and communication problem impacts to	X	

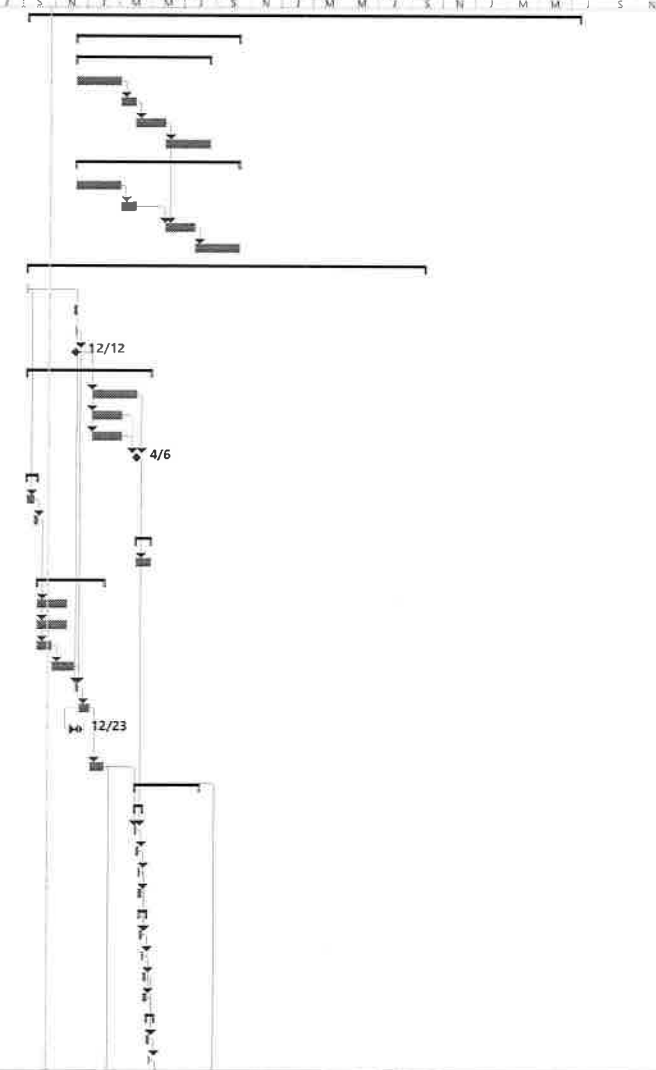
Tasks	Motorola Solutions	Customer
the users during cutover and during the general operation of the system.		
Notify the personnel affected by the cutover of the date and time planned for cutover.		X
Provide ongoing communication with users regarding the project and schedule.	X	X
Cut over users and ensure that user radios are operating on system.		X
Resolve punchlist items, documented during the Acceptance Testing phase, in order to meet all the criteria for final system acceptance.	X	
Assist Motorola Solutions with resolution of identified punchlist items by providing support, such as access to the sites, equipment and system, and approval of the resolved punchlist items.		X
Deliverable: Migration to new system completed, and punchlist items resolved.		
<b>Transition to Warranty</b>		
Review the items necessary for transitioning the project to warranty support and service.	X	
Motorola Solutions to provide services during year 1 warranty which align with the proposed services.	X	
Provide a Customer Support Plan detailing the warranty support associated with the contract equipment.	X	
Participate in the Transition Service/Project Transition Certificate (PTC) process.		X
Deliverable: Service information delivered and approved by Customer		
<b>Finalize Documentation and System Acceptance</b>		
Provide manufacturer's installation material, part list and other related material to Customer upon project completion.	X	
Provide an electronic as-built system manual on CD or other Customer preferred electronic media. The documentation will include the following: <ul style="list-style-type: none"> <li>- Site Block Diagrams.</li> <li>- Site Floor Plans.</li> <li>- Site Equipment Rack Configurations.</li> <li>- Antenna Network Drawings for RF Sites (where applicable).</li> <li>- ATP Test Checklists.</li> <li>- Functional Acceptance Test Plan Test Sheets and Results.</li> <li>- Equipment Inventory List.</li> <li>- Console Programming Template (where applicable).</li> <li>- Maintenance Manuals (where applicable).</li> <li>- Technical Service Manuals (where applicable).</li> </ul> Drawings will be delivered in Adobe PDF format.	X	
Receive and approve documentation.		X
Execute Final Project Acceptance.	X	X
Deliverable: All required documents are provided and approved. Final Project Acceptance.		

SECTION 8

# IMPLEMENTATION SCHEDULE

## 8.1 DETAILED PROJECT SCHEDULE

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Successors	Qtr 2, 2018	Qtr 1, 2019	Qtr 3, 2019	Qtr 1, 2020	Qtr 3, 2020	Qtr 1, 2021	Qtr 3, 2021	Qtr 1, 2022
1	Summary	<b>POLA P25 Radio System Upgrade</b>	744 days	Thu 9/12/19	Tue 7/19/22										
2	Summary	Phase 0 - Non-UASI Funded Projects	220 days	Thu 12/12/19	Wed 10/14/20										
3	Summary	New Site Construction (Port Projects)	180 days	Thu 12/12/19	Wed 8/19/20										
4	Summary	Site Acquisition / Leasing	60 days	Thu 12/12/19	Wed 3/4/20		5								
5	Summary	Site Clearing	20 days	Thu 3/5/20	Wed 4/1/20	4	6								
6	Summary	MSB Shelter Installation	40 days	Thu 4/2/20	Wed 5/27/20	5	7,11								
7	Summary	Tower Installation	60 days	Thu 5/28/20	Wed 8/19/20	6									
8	Summary	New Site Construction (Knoll Hill)	220 days	Thu 12/12/19	Wed 10/14/20										
9	Summary	Site Acquisition / Leasing	60 days	Thu 12/12/19	Wed 3/4/20		10								
10	Summary	Site Clearing	20 days	Thu 3/5/20	Wed 4/1/20	9	11								
11	Summary	MSB Shelter Installation	40 days	Thu 5/28/20	Wed 7/22/20	10,6	12								
12	Summary	Tower Installation	60 days	Thu 7/23/20	Wed 10/14/20	11									
13	Summary	Phase 1 - UASI 2018 Funding	537 days	Thu 9/12/19	Fri 10/1/21										
14	Summary	Pre-Contract Design Review (for Staging)	1 day	Thu 9/12/19	Thu 9/12/19		24,33								
15	Summary	Contract	1 day	Thu 12/12/19	Thu 12/12/19										
16	Summary	Contract Execution	1 day	Thu 12/12/19	Thu 12/12/19		17,33								
17	Summary	Phase 0 + Phase 1 - Payment Milestone 1 (25% due upon contract execution)	0 days	Thu 12/12/19	Thu 12/12/19	16	19FS+22 days, 20FS+								
18	Summary	Contract Design Review	167 days	Fri 9/13/19	Mon 5/4/20										
19	Summary	P25 Infrastructure Design Review	60 days	Tue 1/14/20	Mon 4/6/20	17FS+22 days	22								
20	Summary	Microwave & MPLS Design Review	40 days	Tue 1/14/20	Mon 3/9/20	17FS+22 days	22								
21	Summary	3rd Party Subsystems Design Review	40 days	Tue 1/14/20	Mon 3/9/20	17FS+22 days	22								
22	Summary	Design Approval	0 days	Mon 4/6/20	Mon 4/6/20	19,20,21	27,39								
23	Summary	Infrastructure Order Processing	15 days	Fri 9/13/19	Thu 10/3/19										
24	Summary	Process Equipment List	10 days	Fri 9/13/19	Thu 9/26/19	14	25								
25	Summary	Order Bridged	5 days	Fri 9/27/19	Thu 10/3/19	24	29,30,31								
26	Summary	Fleetmapping & Subscribers Template Dev.	20 days	Tue 4/7/20	Mon 5/4/20										
27	Summary	Construct APX Radio Templates	20 days	Tue 4/7/20	Mon 5/4/20	22									
28	Summary	Infrastructure Manufacturing & Staging	91 days	Fri 10/4/19	Fri 2/7/20										
29	Summary	Manufacture Motorola FNE	40 days	Fri 10/4/19	Thu 11/28/19	25									
30	Summary	Manufacture Non-Motorola Equipment	40 days	Fri 10/4/19	Thu 11/28/19	25									
31	Summary	Develop CCSi Configurations	20 days	Fri 10/4/19	Thu 10/31/19	25	32								
32	Summary	Stage FNE Equipment	30 days	Fri 11/1/19	Thu 12/12/19	31	33								
33	Summary	CCSi Factory Acceptance Test Plan (FATP)	5 days	Mon 12/16/19	Fri 12/20/19	32,14,16	34								
34	Summary	Ship FNE Equipment to Field	15 days	Mon 12/23/19	Fri 1/10/20	33	35SS,36								
35	Summary	Phase 0 + Phase 1 - Payment Milestone 2 (60% due upon shipment from CCSi)	0 days	Mon 12/23/19	Mon 12/23/19	34SS									
36	Summary	Receive & Inventory Equipment	20 days	Mon 1/13/20	Fri 2/7/20	34	39,86								
37	Summary	Microwave & MPLS Installation	88 days	Tue 4/7/20	Thu 8/6/20		104								
38	Summary	300 Water St.	10 days	Tue 4/7/20	Mon 4/20/20										
39	Summary	Deliver & Bolt Racks	3 days	Tue 4/7/20	Thu 4/9/20	36,22	40								
40	Summary	Cable Equipment	2 days	Fri 4/10/20	Mon 4/13/20	39	42,41,44								
41	Summary	Antenna Installation	3 days	Tue 4/14/20	Thu 4/16/20	40	44								
42	Summary	MPLS Router Installation	5 days	Tue 4/14/20	Mon 4/20/20	40									
43	Summary	Gaffey St.	10 days	Fri 4/17/20	Thu 4/30/20										
44	Summary	Deliver & Bolt Racks	3 days	Fri 4/17/20	Tue 4/21/20	40,41	45								
45	Summary	Cable Equipment	2 days	Wed 4/22/20	Thu 4/23/20	44	47,46								
46	Summary	Antenna Installation	3 days	Fri 4/24/20	Tue 4/28/20	45	49								
47	Summary	MPLS Router Installation	5 days	Fri 4/24/20	Thu 4/30/20	45	49								
48	Summary	San Pedro Hill	10 days	Fri 5/1/20	Thu 5/14/20										
49	Summary	Deliver & Bolt Racks	3 days	Fri 5/1/20	Tue 5/5/20	46,47	50								
50	Summary	Cable Equipment	2 days	Wed 5/6/20	Thu 5/7/20	49	52,51								



Project: POLA P25 Radio System  
Date: Thu 10/24/19

Task: Summary (solid bar), Inactive Milestone (dashed bar), Duration-only (thin bar), Start-only (bar with start cap), External Milestone (bar with diamond), Manual Progress (bar with diagonal lines)

Split: Project Summary (dashed bar), Inactive Summary (dashed bar), Manual Summary Rollup (bar with diagonal lines), Finish-only (bar with finish cap), Deadline (bar with vertical line), Progress (bar with diagonal lines)

Milestone: Inactive Task (dashed bar), Manual Task (solid bar), Manual Summary (bar with diagonal lines), External Tasks (bar with vertical line), Progress (bar with diagonal lines)

ID	Task Name	Duration	Start	Finish	Predecessors	Successors	Qtr 3, 2018	Qtr 1, 2019	Qtr 3, 2019	Qtr 1, 2020	Qtr 3, 2020	Qtr 1, 2021	Qtr 3, 2021	Qtr 1, 2022
51	Antenna Installation	3 days	Fri 5/8/20	Tue 5/12/20	50	54								
52	MPLS Router Installation	5 days	Fri 5/8/20	Thu 5/14/20	50	54								
53	Mt. Lukens	10 days	Fri 5/15/20	Thu 5/28/20										
54	Deliver & Bolt Racks	3 days	Fri 5/15/20	Tue 5/19/20	51,52	55								
55	Cable Equipment	2 days	Wed 5/20/20	Thu 5/21/20	54	57,56								
56	Antenna Installation	3 days	Fri 5/22/20	Tue 5/26/20	55	59								
57	MPLS Router Installation	5 days	Fri 5/22/20	Thu 5/28/20	55	59								
58	Saddle Peak	10 days	Fri 5/29/20	Thu 6/11/20										
59	Deliver & Bolt Racks	3 days	Fri 5/29/20	Tue 6/2/20	56,57	60								
60	Cable Equipment	2 days	Wed 6/3/20	Thu 6/4/20	59	62,61								
61	Antenna Installation	3 days	Fri 6/5/20	Tue 6/9/20	60	64								
62	MPLS Router Installation	5 days	Fri 6/5/20	Thu 6/11/20	60	64								
63	Sierra Peak	10 days	Fri 6/12/20	Thu 6/25/20										
64	Deliver & Bolt Racks	3 days	Fri 6/12/20	Tue 6/16/20	61,62	65								
65	Cable Equipment	2 days	Wed 6/17/20	Thu 6/18/20	64	67,66								
66	Antenna Installation	3 days	Fri 6/19/20	Tue 6/23/20	65	69								
67	MPLS Router Installation	5 days	Fri 6/19/20	Thu 6/25/20	65	69								
68	Catalina Island	10 days	Fri 6/26/20	Thu 7/9/20										
69	Deliver & Bolt Racks	3 days	Fri 6/26/20	Tue 6/30/20	66,67	70								
70	Cable Equipment	2 days	Wed 7/1/20	Thu 7/2/20	69	72,71								
71	Antenna Installation	3 days	Fri 7/3/20	Tue 7/7/20	70									
72	MPLS Router Installation	5 days	Fri 7/3/20	Thu 7/9/20	70	74								
73	330 Centre Street	10 days	Fri 7/10/20	Thu 7/23/20										
74	Deliver & Bolt Racks	3 days	Fri 7/10/20	Tue 7/14/20	72	75								
75	Cable Equipment	2 days	Wed 7/15/20	Thu 7/16/20	74	77,76								
76	Antenna Installation	3 days	Fri 7/17/20	Tue 7/21/20	75	79								
77	MPLS Router Installation	5 days	Fri 7/17/20	Thu 7/23/20	75	79								
78	Badger Bridge	10 days	Fri 7/24/20	Thu 8/6/20										
79	Deliver & Bolt Racks	3 days	Fri 7/24/20	Tue 7/28/20	76,77	80								
80	Cable Equipment	2 days	Wed 7/29/20	Thu 7/30/20	79	82,81								
81	Antenna Installation	3 days	Fri 7/31/20	Tue 8/4/20	80									
82	MPLS Router Installation	5 days	Fri 7/31/20	Thu 8/6/20	80	95								
83	P25 Radio Site Installation	155 days	Mon 2/10/20	Fri 9/11/20		104								
84	Master & DSR Installation	22 days	Mon 2/10/20	Tue 3/10/20										
85	Master Site Installation	11 days	Mon 2/10/20	Mon 2/24/20										
86	Deliver & Bolt Racks	5 days	Mon 2/10/20	Fri 2/14/20	36	87								
87	Cable Equipment	3 days	Mon 2/17/20	Wed 2/19/20	86	88								
88	Antenna Installation	3 days	Thu 2/20/20	Mon 2/24/20	87	90								
89	Backup Master Site Installation	11 days	Tue 2/25/20	Tue 3/10/20										
90	Deliver & Bolt Racks	5 days	Tue 2/25/20	Mon 3/2/20	88	91								
91	Cable Equipment	3 days	Tue 3/3/20	Thu 3/5/20	90	92								
92	Antenna Installation	3 days	Fri 3/6/20	Tue 3/10/20	91	95								
93	Dispatch Center Installation	26 days	Fri 8/7/20	Fri 9/11/20										
94	Primary Dispatch Center	14 days	Fri 8/7/20	Wed 8/26/20										
95	Test Site Connectivity	2 days	Fri 8/7/20	Mon 8/10/20	92,82	96,100SS								
96	Equipment Room Rack Install	2 days	Tue 8/11/20	Wed 8/12/20	95	97,98								
97	Dispatch Consol Install	5 days	Thu 8/13/20	Wed 8/19/20	96	98								
98	Control Station Install	5 days	Thu 8/20/20	Wed 8/26/20	96,97	103,101								
99	Backup Dispatch Center	26 days	Fri 8/7/20	Fri 9/11/20										
100	Test Site Connectivity	2 days	Fri 8/7/20	Mon 8/10/20	95SS									
101	Equipment Room Rack Install	2 days	Thu 8/27/20	Fri 8/28/20	98	102								

Project: POLA P25 Radio System  
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Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Manual Progress
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline	
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Progress	

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Successors	Qtr 3, 2018	Qtr 1, 2019	Qtr 3, 2019	Qtr 1, 2020	Qtr 3, 2020	Qtr 1, 2021	Qtr 3, 2021	Qtr 1, 2022
102		Dispatch Consol Install	5 days	Mon 8/31/20	Fri 9/4/20	101	103								
103		Control Station Install	5 days	Mon 9/7/20	Fri 9/11/20	98,102	106								
104		Phase 0 + Phase 1 - Payment Milestone 3 (10% due upon installation)	0 days	Fri 9/11/20	Fri 9/11/20	37,83									
105		<b>Software Configuration</b>	100 days	Mon 9/14/20	Fri 1/29/21										
106		Configure Master / DSR Sync	20 days	Mon 9/14/20	Fri 10/9/20	103	107								
107		Configure OTAR / OTEK	20 days	Mon 10/12/20	Fri 11/6/20	106	108								
108		Configure WAVE PTT	20 days	Mon 11/9/20	Fri 12/4/20	107	109								
109		Configure ISSI for Future Connection	20 days	Mon 12/7/20	Fri 1/1/21	108	110								
110		Configure GPS / LoPTT Interface	20 days	Mon 1/4/21	Fri 1/29/21	109	114								
111		<b>Site Optimization</b>	20 days	Mon 2/1/21	Fri 2/26/21										
112		Master & DSR Optimization	8 days	Mon 2/1/21	Wed 2/10/21										
113		Master Site Optimization	4 days	Mon 2/1/21	Thu 2/4/21										
114		Site Link Verification	2 days	Mon 2/1/21	Tue 2/2/21	110	115								
115		Site Optimization	2 days	Wed 2/3/21	Thu 2/4/21	114	117								
116		Backup Master Site Optimization	4 days	Fri 2/5/21	Wed 2/10/21										
117		Site Link Verification	2 days	Fri 2/5/21	Mon 2/8/21	115	118								
118		Site Optimization	2 days	Tue 2/9/21	Wed 2/10/21	117	120								
119		Dispatch Center Optimization	12 days	Thu 2/11/21	Fri 2/26/21										
120		Dispatch Center Optimization	12 days	Thu 2/11/21	Fri 2/26/21	118	122,126								
121		<b>Site Installation Audit</b>	75 days	Mon 3/1/21	Fri 6/11/21										
122		Master & DSR Core Sites	45 days	Mon 3/1/21	Fri 4/30/21	120	123								
123		Dispatch Centers	10 days	Mon 5/3/21	Fri 5/14/21	122	124								
124		Punchlist Resolution	20 days	Mon 5/17/21	Fri 6/11/21	123	128								
125		<b>Training</b>	60 days	Mon 3/1/21	Fri 5/21/21										
126		POLA Selected Training Bank Classes	60 days	Mon 3/1/21	Fri 5/21/21	120	133								
127		<b>Acceptance Test</b>	5 days	Mon 6/14/21	Fri 6/18/21										
128		Functional Acceptance Testing (Dispatch)	5 days	Mon 6/14/21	Fri 6/18/21	124	130								
129		<b>System Cutover</b>	35 days	Mon 6/21/21	Fri 8/6/21										
130		Cutover Conventional System	25 days	Mon 6/21/21	Fri 7/23/21	128	131								
131		Cutover Dispatch	10 days	Mon 7/26/21	Fri 8/6/21	130	133								
132		<b>Project Finalization</b>	40 days	Mon 8/9/21	Fri 10/1/21										
133		Final Documentation	20 days	Mon 8/9/21	Fri 9/3/21	131,126	134								
134		Puchlist Resolution	20 days	Mon 9/6/21	Fri 10/1/21	133	135								
135		Service Transition	0 days	Fri 10/1/21	Fri 10/1/21	134	136								
136		Final System Acceptance	0 days	Fri 10/1/21	Fri 10/1/21	135	137								
137		Phase 0 + Phase 1 - Payment Milestone 4 (5% due upon final acceptance)	0 days	Fri 10/1/21	Fri 10/1/21	136									
138		<b>Phase 2 - UASI 2019 Funding</b>	642 days	Mon 2/3/20	Tue 7/19/22										
139		Contract	1 day	Mon 2/3/20	Mon 2/3/20										
140		Contract Execution	1 day	Mon 2/3/20	Mon 2/3/20		143FS+22 days,144FS								
141		Phase 2 - Payment Milestone 1 (25% due upon contract execution)	0 days	Mon 2/3/20	Mon 2/3/20	140									
142		Contract Design Review	60 days	Thu 3/5/20	Wed 5/27/20										
143		P2S Infrastructure Design Review	60 days	Thu 3/5/20	Wed 5/27/20	140FS+22 days	145								
144		3rd Party Subsystems Design Review	40 days	Thu 3/5/20	Wed 4/29/20	140FS+22 days	145								
145		Design Approval	0 days	Wed 5/27/20	Wed 5/27/20	143,144	147								
146		<b>Infrastructure Order Processing</b>	15 days	Thu 5/28/20	Wed 6/17/20										
147		Process Equipment List	10 days	Thu 5/28/20	Wed 6/10/20	145	148								
148		Order Bridged	5 days	Thu 6/11/20	Wed 6/17/20	147	150,151,152								
149		<b>Infrastructure Manufacturing &amp; Staging</b>	160 days	Thu 6/18/20	Wed 1/27/21										
150		Manufacture Motorola FNE	60 days	Thu 6/18/20	Wed 9/9/20	148	153								
151		Manufacture Non-Motorola Equipment	90 days	Thu 6/18/20	Wed 10/21/20	148	154								
152		Develop CCSI Configurations	20 days	Thu 6/18/20	Wed 7/15/20	148	154								

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Task Summary Inactive Milestone Duration-only Start-only External Milestone Manual Progress  
Split: Project Summary Inactive Summary Manual Summary Rollup Finish-only Deadline  
Milestone Inactive Task Manual Task Manual Summary External Tasks Progress

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Successors	Qtr 1, 2018		Qtr 1, 2019		Qtr 1, 2020		Qtr 3, 2020		Qtr 1, 2021		Qtr 1, 2022	
								N	J	M	M	I	S	N	I	M	M	J	N
153		Ship FNE to CCSi	15 days	Thu 9/10/20	Wed 9/30/20	150	154												
154		Stage FNE Equipment	30 days	Thu 10/22/20	Wed 12/2/20	153,151,152	155												
155		CCSI Factory Acceptance Test Plan (FATP)	10 days	Thu 12/3/20	Wed 12/16/20	154	156												
156		Ship FNE Equipment to Field	10 days	Thu 12/17/20	Wed 12/30/20	155	158,157SS												
157		Phase 2 - Payment Milestone 2 (60% due upon shipment from CCSi)	0 days	Thu 12/17/20	Thu 12/17/20	156SS													
158		Receive & Inventory Equipment	20 days	Thu 12/31/20	Wed 1/27/21	156	163,218												
159		P25 Radio Site Installation	127 days	Thu 1/28/21	Fri 7/23/21		225												
160		RF Sites Installation	127 days	Thu 1/28/21	Fri 7/23/21														
161		7/800MHz Simulcast Cell	37 days	Thu 1/28/21	Fri 3/19/21														
162		300 Water St.	10 days	Thu 1/28/21	Wed 2/10/21														
163		Deliver & Bolt Racks	5 days	Thu 1/28/21	Wed 2/3/21	158	164												
164		Cable Equipment	2 days	Thu 2/4/21	Fri 2/5/21	163	165												
165		Antenna Installation	3 days	Mon 2/8/21	Wed 2/10/21	164	167												
166		Gaffey St.	9 days	Thu 2/11/21	Tue 2/23/21														
167		Deliver & Bolt Racks	5 days	Thu 2/11/21	Wed 2/17/21	165	168												
168		Cable Equipment	2 days	Thu 2/18/21	Fri 2/19/21	167	169												
169		Antenna Installation	2 days	Mon 2/22/21	Tue 2/23/21	168	171												
170		San Pedro Hill	9 days	Wed 2/24/21	Mon 3/8/21														
171		Deliver & Bolt Racks	5 days	Wed 2/24/21	Tue 3/2/21	169	172												
172		Cable Equipment	2 days	Wed 3/3/21	Thu 3/4/21	171	173												
173		Antenna Installation	2 days	Fri 3/5/21	Mon 3/8/21	172	175												
174		Catalina Island	9 days	Tue 3/9/21	Fri 3/19/21														
175		Deliver & Bolt Racks	5 days	Tue 3/9/21	Mon 3/15/21	173	176												
176		Cable Equipment	2 days	Tue 3/16/21	Wed 3/17/21	175	177												
177		Antenna Installation	2 days	Thu 3/18/21	Fri 3/19/21	176	180												
178		UHF Backup Simulcast Cell	60 days	Mon 3/22/21	Fri 6/11/21														
179		300 Water St.	10 days	Mon 3/22/21	Fri 4/2/21														
180		Deliver & Bolt Racks	5 days	Mon 3/22/21	Fri 3/26/21	177	181												
181		Cable Equipment	2 days	Mon 3/29/21	Tue 3/30/21	180	182												
182		Antenna Installation	3 days	Wed 3/31/21	Fri 4/2/21	181	184												
183		Gaffey St.	10 days	Mon 4/5/21	Fri 4/16/21														
184		Deliver & Bolt Racks	5 days	Mon 4/5/21	Fri 4/9/21	182	185												
185		Cable Equipment	2 days	Mon 4/12/21	Tue 4/13/21	184	186												
186		Antenna Installation	3 days	Wed 4/14/21	Fri 4/16/21	185	188												
187		San Pedro Hill	10 days	Mon 4/19/21	Fri 4/30/21														
188		Deliver & Bolt Racks	5 days	Mon 4/19/21	Fri 4/23/21	186	189												
189		Cable Equipment	2 days	Mon 4/26/21	Tue 4/27/21	188	190												
190		Antenna Installation	3 days	Wed 4/28/21	Fri 4/30/21	189	192												
191		Mt. Lukens	10 days	Mon 5/3/21	Fri 5/14/21														
192		Deliver & Bolt Racks	5 days	Mon 5/3/21	Fri 5/7/21	190	193												
193		Cable Equipment	2 days	Mon 5/10/21	Tue 5/11/21	192	194												
194		Antenna Installation	3 days	Wed 5/12/21	Fri 5/14/21	193	196												
195		Saddle Peak	10 days	Mon 5/17/21	Fri 5/28/21														
196		Deliver & Bolt Racks	5 days	Mon 5/17/21	Fri 5/21/21	194	197												
197		Cable Equipment	2 days	Mon 5/24/21	Tue 5/25/21	196	198												
198		Antenna Installation	3 days	Wed 5/26/21	Fri 5/28/21	197	200												
199		Catalina Island	10 days	Mon 5/31/21	Fri 6/11/21														
200		Deliver & Bolt Racks	5 days	Mon 5/31/21	Fri 6/4/21	198	201												
201		Cable Equipment	2 days	Mon 6/7/21	Tue 6/8/21	200	202												
202		Antenna Installation	3 days	Wed 6/9/21	Fri 6/11/21	201	205												
203		VHF Marine Repeater Sites Installation	30 days	Mon 6/14/21	Fri 7/23/21														

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Date: Thu 10/24/19

Task  Summary  Inactive Milestone  Duration-only  Start-only  External Milestone  Manual Progress  
 Split  Project Summary  Inactive Summary  Manual Summary Rollup  Finish-only  Deadline  
 Milestone  Inactive Task  Manual Task  Manual Summary  External Tasks  Progress


















ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Successors	Gantt Chart												
								Qtr 3, 2018	Qtr 1, 2019	Qtr 3, 2019	Qtr 1, 2020	Qtr 3, 2020	Qtr 1, 2021	Qtr 3, 2021	Qtr 1, 2022					
204	WBS	300 Water St.	10 days	Mon 6/14/21	Fri 6/25/21															
205	WBS	Deliver & Bolt Racks	5 days	Mon 6/14/21	Fri 6/18/21	202	206													
206	WBS	Cable Equipment	2 days	Mon 6/21/21	Tue 6/22/21	205	207													
207	WBS	Antenna Installation	3 days	Wed 6/23/21	Fri 6/25/21	206	209													
208	WBS	Gaffey St.	10 days	Mon 6/28/21	Fri 7/9/21															
209	WBS	Deliver & Bolt Racks	5 days	Mon 6/28/21	Fri 7/2/21	207	210													
210	WBS	Cable Equipment	2 days	Mon 7/5/21	Tue 7/6/21	209	211													
211	WBS	Antenna Installation	3 days	Wed 7/7/21	Fri 7/9/21	210	213													
212	WBS	330 Centre St.	10 days	Mon 7/12/21	Fri 7/23/21															
213	WBS	Deliver & Bolt Racks	5 days	Mon 7/12/21	Fri 7/16/21	211	214													
214	WBS	Cable Equipment	2 days	Mon 7/19/21	Tue 7/20/21	213	215													
215	WBS	Antenna Installation	3 days	Wed 7/21/21	Fri 7/23/21	214	230,279,280													
216	WBS	BDA Installation	50 days	Thu 1/28/21	Wed 4/7/21		225													
217	WBS	BDA Location #1	30 days	Thu 1/28/21	Wed 3/10/21															
218	WBS	Install BDA Equipment	10 days	Thu 1/28/21	Wed 2/10/21	158	219													
219	WBS	Install BDA Transmission Line & Antennas	10 days	Thu 2/11/21	Wed 2/24/21	218	220,222													
220	WBS	Conduct BDA Acceptance Test	10 days	Thu 2/25/21	Wed 3/10/21	219														
221	WBS	BDA Location #2	30 days	Thu 2/25/21	Wed 4/7/21															
222	WBS	Install BDA Equipment	10 days	Thu 2/25/21	Wed 3/10/21	219	223													
223	WBS	Install BDA Transmission Line & Antennas	10 days	Thu 3/11/21	Wed 3/24/21	222	224													
224	WBS	Conduct BDA Acceptance Test	10 days	Thu 3/25/21	Wed 4/7/21	223														
225	WBS	Phase 2 Payment Milestone 3 (10% due upon installation)	0 days	Fri 7/23/21	Fri 7/23/21	159,216														
226	WBS	Site Optimization	52 days	Mon 7/26/21	Tue 10/5/21															
227	WBS	RF Sites Optimization	52 days	Mon 7/26/21	Tue 10/5/21															
228	WBS	7/800MHz Simulcast Cell	16 days	Mon 7/26/21	Mon 8/16/21															
229	WBS	300 Water St.	4 days	Mon 7/26/21	Thu 7/29/21															
230	WBS	Site Link Verification	2 days	Mon 7/26/21	Tue 7/27/21	215	231													
231	WBS	Site Optimization	2 days	Wed 7/28/21	Thu 7/29/21	230	233													
232	WBS	Gaffey St.	4 days	Fri 7/30/21	Wed 8/4/21															
233	WBS	Site Link Verification	2 days	Fri 7/30/21	Mon 8/2/21	231	234													
234	WBS	Site Optimization	2 days	Tue 8/3/21	Wed 8/4/21	233	236													
235	WBS	San Pedro Hill	4 days	Thu 8/5/21	Tue 8/10/21															
236	WBS	Site Link Verification	2 days	Thu 8/5/21	Fri 8/6/21	234	237													
237	WBS	Site Optimization	2 days	Mon 8/9/21	Tue 8/10/21	236	239													
238	WBS	Catalina Island	4 days	Wed 8/11/21	Mon 8/16/21															
239	WBS	Site Link Verification	2 days	Wed 8/11/21	Thu 8/12/21	237	240													
240	WBS	Site Optimization	2 days	Fri 8/13/21	Mon 8/16/21	239	243													
241	WBS	UHF Backup Simulcast Cell	24 days	Tue 8/17/21	Fri 9/17/21															
242	WBS	300 Water St.	4 days	Tue 8/17/21	Fri 8/20/21															
243	WBS	Site Link Verification	2 days	Tue 8/17/21	Wed 8/18/21	240	244													
244	WBS	Site Optimization	2 days	Thu 8/19/21	Fri 8/20/21	243	246													
245	WBS	Gaffey St.	4 days	Mon 8/23/21	Thu 8/26/21															
246	WBS	Site Link Verification	2 days	Mon 8/23/21	Tue 8/24/21	244	247													
247	WBS	Site Optimization	2 days	Wed 8/25/21	Thu 8/26/21	246	249													
248	WBS	San Pedro Hill	4 days	Fri 8/27/21	Wed 9/1/21															
249	WBS	Site Link Verification	2 days	Fri 8/27/21	Mon 8/30/21	247	250													
250	WBS	Site Optimization	2 days	Tue 8/31/21	Wed 9/1/21	249	252													
251	WBS	Mt. Lukens	4 days	Thu 9/2/21	Tue 9/7/21															
252	WBS	Site Link Verification	2 days	Thu 9/2/21	Fri 9/3/21	250	253													
253	WBS	Site Optimization	2 days	Mon 9/6/21	Tue 9/7/21	252	255													
254	WBS	Saddle Peak	4 days	Wed 9/8/21	Mon 9/13/21															

Project: POLA P25 Radio System  
Date: Thu 10/24/19

Task Summary Inactive Milestone Duration-only Start-only External Milestone Manual Progress  
Split Project Summary Inactive Summary Manual Summary Rollup Finish-only Deadline  
Milestone Inactive Task Manual Task Manual Summary External Tasks Progress

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Successors	Qtr 1, 2018			Qtr 1, 2019			Qtr 1, 2020			Qtr 1, 2021			Qtr 3, 2021			Qtr 1, 2022			
								N	J	M	M	J	S	N	J	M	M	J	S	N	J	M	M	J	S	N
255		Site Link Verification	2 days	Wed 9/8/21	Thu 9/9/21	253	256																			
256		Site Optimization	2 days	Fri 9/10/21	Mon 9/13/21	255	258																			
257		Catalina Island	4 days	Tue 9/14/21	Fri 9/17/21																					
258		Site Link Verification	2 days	Tue 9/14/21	Wed 9/15/21	256	259																			
259		Site Optimization	2 days	Thu 9/16/21	Fri 9/17/21	258	262																			
260		VHF Marine Repeater Sites Installation	12 days	Mon 9/20/21	Tue 10/5/21																					
261		300 Water St.	4 days	Mon 9/20/21	Thu 9/23/21																					
262		Site Link Verification	2 days	Mon 9/20/21	Tue 9/21/21	259	263																			
263		Site Optimization	2 days	Wed 9/22/21	Thu 9/23/21	262	265																			
264		Gaffey St.	4 days	Fri 9/24/21	Wed 9/29/21																					
265		Site Link Verification	2 days	Fri 9/24/21	Mon 9/27/21	263	266																			
266		Site Optimization	2 days	Tue 9/28/21	Wed 9/29/21	265	268																			
267		330 Centre St.	4 days	Thu 9/30/21	Tue 10/5/21																					
268		Site Link Verification	2 days	Thu 9/30/21	Fri 10/1/21	266	269																			
269		Site Optimization	2 days	Mon 10/4/21	Tue 10/5/21	268	271																			
270		Site Installation Audit	75 days	Wed 10/6/21	Tue 1/18/22																					
271		RF Sites & Sub-Systems	45 days	Wed 10/6/21	Tue 12/7/21	269	272																			
272		Dispatch Centers	10 days	Wed 12/8/21	Tue 12/21/21	271	273																			
273		Punchlist Resolution	20 days	Wed 12/22/21	Tue 1/18/22	272	275																			
274		Acceptance Test	80 days	Wed 1/19/22	Tue 5/10/22																					
275		Coverage Acceptance Test	45 days	Wed 1/19/22	Tue 3/22/22	273	276																			
276		Functional Acceptance Testing (RF)	5 days	Wed 3/23/22	Tue 3/29/22	275	277																			
277		30 Day Operational Test	30 days	Wed 3/30/22	Tue 5/10/22	276	282																			
278		Subscribers	90 days	Mon 7/26/21	Fri 11/26/21																					
279		Program APX Mobiles	90 days	Mon 7/26/21	Fri 11/26/21	215	282																			
280		Program APX Portables	90 days	Mon 7/26/21	Fri 11/26/21	215	282																			
281		System Cutover	10 days	Wed 5/11/22	Tue 5/24/22		289																			
282		Cutover Radio Users	10 days	Wed 5/11/22	Tue 5/24/22	277,279,280	284																			
283		Project Finalization	40 days	Wed 5/25/22	Tue 7/19/22																					
284		Final Documentation	20 days	Wed 5/25/22	Tue 6/21/22	282	285																			
285		Puchlist Resolution	20 days	Wed 6/22/22	Tue 7/19/22	284	287,286																			
286		Service Transition	0 days	Tue 7/19/22	Tue 7/19/22	285	290																			
287		Final System Acceptance	0 days	Tue 7/19/22	Tue 7/19/22	285	288,290																			
288		Phase 2 - Payment Milestone 4 (5% due upon final acceptance)	0 days	Tue 7/19/22	Tue 7/19/22	287																				
289		POLA P25 System Warranty & Maintenance	260 days	Wed 7/20/22	Tue 7/18/23	281																				
290		Warranty Period	260 days	Wed 7/20/22	Tue 7/18/23	286,287																				

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Date: Thu 10/24/19

<b>Task</b>		Summary		Inactive Milestone		Duration-only		Start-only		External Milestone		Manual Progress
<b>Split</b>		Project Summary		Inactive Summary		Manual Summary Rollup		Finish-only		Deadline		Progress
<b>Milestone</b>		Inactive Task		Manual Task		Manual Summary		External Tasks		Progress		

SECTION 9

# SYSTEM WARRANTY & EXTENDED MAINTENANCE

## 9.1 ABOVE WARRANTY MAINTENANCE PLAN

### 9.1.1 Advanced Plus Services Overview

In order to ensure the continuity of the Port's network and reduce system downtime Motorola Solutions proposes our Advanced Plus Services offering to the the Port of LA. Appropriate for customers who wish to leverage Motorola Solutions' experienced personnel to maintain mission-critical communications for their first responders, Advanced Plus Services focuses on monitoring the network on an ongoing basis, proactively mitigating potential functionality and security issues, and providing both remote and on-site support. The proposed offering consists of the following specific services:

- Service Desk.
- Technical Support.
- Network Event Monitoring.
- On-site Support.
- Annual Preventative Maintenance.
- Network Hardware Repair.
- Remote Security Patch Installation.
- Security Monitoring.
- Network Updates.

These services will be delivered to the Port through the combination of local service personnel either dedicated to the network or engaged as needed; a centralized team within our Solutions Support Center (SSC), which operates on a 24 x 7 x 365 basis; and our Repair Depot, which will ensure that equipment is repaired to the highest quality standards. The collaboration between these service resources, all of who are experienced in the maintenance of mission-critical networks, will enable a swift analysis of any network issues, an accurate diagnosis of root causes, and a timely resolution and return to normal network operation.

### 9.1.2 Advanced Plus Services Descriptions

#### 9.1.2.1 Centralized Service Delivery

Centralized support will be provided by Motorola Solutions' support staff, located at our Service Desk and Solutions Support Center (SSC). These experienced personnel will provide direct service and technical support through a combination of Service Desk telephone support,



technical consultation and troubleshooting through the SSC, and ongoing network monitoring of the Port's system.

Motorola Solutions will provide **Service Desk** response as a single point of contact for all support issues, including communications between the Port, third-party subcontractors and manufacturers, and Motorola Solutions. When the Port's personnel call for support, the Service Desk will record, track, and update all Service Requests, Change Requests, Dispatch Requests, and Service Incidents using our Customer Relationship Management (CRM) system. The Service Desk is responsible for documenting the Port's inquiries, requests, concerns, and related tickets; tracking and resolving issues; and ensuring timely communications with all stakeholders based on the nature of the incident.

As tickets are opened by the Service Desk, issues that require specific technical expertise and support will be routed to our Solutions Support Center (SSC) system technologists for **Technical Support**, who will provide telephone consultation and troubleshooting capabilities to diagnose and resolve infrastructure performance and operational issues. Motorola Solutions' recording, escalating, and reporting process applies ISO 90001 and TL 9000-certified standards to the Technical Support calls from our contracted customers, reflecting our focus on maintaining mission-critical communications for the users of our systems.

The same SSC staff that provide direct telephone support to the Port will also provide **Network Event Monitoring** to the Port's network in real-time, ensuring continuous management of the system's operational functionality. The SSC's technicians will utilize sophisticated tools to remotely monitor the Port's system, often identifying and resolving anomalous events before they might affect user communications.

### 9.1.2.2 Field Service Delivery

On-site repairs and network preventative maintenance will be provided by authorized local field services delivery personnel, who will be dispatched from and managed by the Solutions Support Center.

**On-Site Support** provides local, trained and qualified technicians who will arrive at the Port's location upon a dispatch service call to diagnose and restore the communications network. This involves running diagnostics on the hardware or Field Replacement Unit (FRU) in order to identify defective elements, and replacing those elements with functioning ones. The system technician will respond to the the Port's location in order to remedy equipment issues based on the impact of the issue to overall system function.

**Annual Preventive Maintenance Service** provides proactive, regularly scheduled operational testing and alignment of infrastructure and network components to ensure that they continually meet original manufacturer specifications. Certified field technicians perform hands-on examination and diagnostics of network equipment on a routine and prescribed basis.

### 9.1.2.3 Network Hardware Repair

Motorola Solutions' authorized Repair Depot will repair the equipment provided by Motorola Solutions, as well as select third-party infrastructure equipment supplied as part of the proposed solution. The Repair Depot will manage the logistics of equipment repair (including shipment and return of repaired equipment), repair Motorola Solutions equipment, and coordinate the repair of third-party solution components.

#### 9.1.2.4 Security Management Operations

The proposed **Remote Security Patch Installation Service** will provide the Port with pre-tested security updates, pre-tested and remotely installed by Motorola Solutions on the Port's system. When appropriate, Motorola Solutions will make these updates available to outside vendors in order to enable them to test each patch, and will incorporate the results of those third-party tests into the updates before installation on the Port's network. Once an update is fully tested and ready for deployment in the Port's system, Motorola Solutions will remotely install it onto the Port's system, and notify the Port that the patch has been successfully installed. If there are any recommended configuration changes, warnings, or workarounds, Motorola Solutions will provide detailed documentation along with the updates on the website.

**Security Monitoring** provides 24x7x365 monitoring of the radio network's security elements by specialized security technologists with years of experience working with ASTRO 25 mission-critical networks. For highly complex or unusual security events, our technologists have direct and immediate access to Motorola Solutions engineers for rapid resolution.

#### 9.1.2.5 Network Updates

With our proposed **Network Updates Service**, Motorola Solutions commits to sustain the Port's ASTRO 25 system through a program of software and hardware updates aligned with the ASTRO 25 platform lifecycle. This comprehensive approach to technology sustainment will ensure that the Port has access to the latest available standard features, as well as the opportunity to incorporate optional features through the purchase of hardware and/or software licenses. Updates and expansion of system components will optimize the availability of repair services, and will enable the Port to add RF sites, dispatch positions, data subsystems, network management positions, and other elements to increase capacity and processing capability. Motorola Solutions will minimize any interruption to system operation during each network update, with minimal reliance on the Port's personnel.

### 9.1.3 Motorola Solutions' Services Capabilities

Our focus on the needs of our public safety partners has led us to recognize that an integrated implementation and service delivery team that takes a new system from system installation, to acceptance, to warranty, and all the way through extended maintenance, is the best way to ensure that public safety communications systems meet the needs of first responders. Motorola Solutions' team of experts, have developed refined processes and sophisticated tools through our experience in delivering mission-critical communications.

#### 9.1.3.1 On-Call Support through the Solutions Support Center (SSC)

The cornerstone of our customer care process, our Solution Support Center (SSC) is staffed 24x7x365 by experienced system technologists. This TL 9000/ISO 9001-certified center responds to over 5000 public safety, utility, and enterprise customers. With over 100,000 phone and email interactions with Motorola Solutions customers per month, the SSC provides our customers with a centralized contact point for service requests.

#### 9.1.3.2 On-Site Service through a Field Service Team

On-site maintenance and repair of the Port's system will be provided by Motorola Solutions' local team of service personnel. Motorola Solutions will provide the Port with a Customer

Support Plan (CSP) that outlines the details of each service, provides escalation paths for special issues, and any other information specific to the Port's service agreement. Some of these details will include items such as access to sites, response time requirements, severity level definitions, and parts department access information.

Local technicians will be dispatched for on-site service by the SSC, who will inform the technician of the reason for dispatch. This will enable the technician to determine if a certain component or Field Replacement Unit (FRU) will be needed from inventory to restore the system. Once on site, the field technician will notify the SSC and begin to work on the issue. The technician will review the case notes to determine the status of the issue, and begin the troubleshooting and restoration process. Once the system is restored to normal operation, the field technician will notify the SSC that the system is restored. The SSC, in turn, will notify the Port that the system is restored to normal operation and request approval to close the case.

### 9.1.3.3 Centralized Repair Management through Motorola Solutions' Repair Depot

Our repair management depot coordinates component repair through a central location, eliminating the need to send system equipment to multiple vendor locations for repair. Once equipment is at the depot, technicians will replicate the Port's network configuration in our comprehensive test labs in order to reproduce and analyze the issue. Technicians will then restore the equipment to working order. After repairs are completed, equipment will be tested to its original performance specifications and, if appropriate, configured for return to use in the Port's system. All components being repaired are tracked throughout the process, from shipment by the Port to return through a case management system where users can view the repair status of the equipment via a web portal.

### 9.1.3.4 Direct Access to System Information through MyView Portal

Supplementing Motorola Solutions' proposed services plan for the Port is access to MyView Portal, the Motorola Solutions' online system information tool (see the figure titled "MyView Portal"). MyView Portal provides our customers with real-time visibility to critical system and services information, all through an easy-to-use, graphical interface. With just a few clicks, the Port's administrators will gain instant access to system and support compliance, case reporting, ability to update and create cases, have visibility to when the system will be updated, and receive pro-active notifications regarding system updates. Available 24x7x365 from any web-enabled device, the information provided by MyView will be based on your needs and user access permissions, ensuring that the information displayed is secure and pertinent to your operations.



Figure 9-1: MyView Portal offers real-time, role-based access to critical system and services information.

SECTION 10

# PRICING SUMMARY

## 10.1 PRICING SUMMARY

Phase	Objective & Descriptions	Implementation Services Pricing	Equipment Pricing	Subtotal
1 Non UASI	<b>Backhaul &amp; UHF Overlay</b>	\$ 3,244,449.83	\$ 2,092,971.55	\$ 5,337,421.38
	Aviat Microwave System MPLS Rotuers & Networking PPHQ & HAB In-Building Amplifiers VHF Receive Layer APX Portable & Mobile Upgrades & Programming Port Area UHF Overlay Simulcast Cell			
1	<b>Site Construction</b> Knoll Hill Greenfield Site	\$ 466,056.55	\$ 254,294.00	\$ 720,350.55
<b>Phase 1 Discount Packages</b>				
	<b>Combined Discount Packages</b>	\$ (322,443.00)	\$ (203,977.38)	\$ (526,420.38)
<b>Phase 1 Sub Totals</b>				
	System Total	\$ 3,388,063.37	\$ 2,143,288.17	\$ 5,531,351.54
	9.5% Equipment Sales Tax Est.	\$ -	\$ 203,612.38	\$ 203,612.38
	<b>Phase 1 Total with Discounts A-C and est. Sales Tax</b>	<b>\$ 3,388,063.37</b>	<b>\$ 2,346,900.55</b>	<b>\$ 5,734,963.92</b>
2 UASI 2018	<b>Trunking Radio System Controller</b>	\$ 1,780,761.14	\$ 3,008,524.32	\$ 4,789,285.46
	Master Trunking Core Backup Trunking Core Upgraded Dispatch Consoles WAVE5000 (PTT over Cellular) Regional ISSI Connection Hardware & Software			
<b>Phase 2 Discount Packages</b>				
	<b>Combined Discount Packages</b>	\$ (579,097.56)	\$ (978,362.04)	\$ (1,557,459.60)
<b>Phase 2 Sub Totals</b>				
	System Total	\$ 1,201,663.58	\$ 2,030,162.28	\$ 3,231,825.86
	9.5% Equipment Sales Tax Est.	\$ -	\$ 192,865.42	\$ 192,865.42
	<b>Phase 2 Total with Discounts A-C and est. Sales Tax</b>	<b>\$ 1,201,663.58</b>	<b>\$ 2,223,027.70</b>	<b>\$ 3,424,691.28</b>
3 UASI 2019	<b>P25 Radio System &amp; Citywide UHF System</b>	\$ 1,750,473.75	\$ 3,049,679.80	\$ 4,800,153.55
	Prime & Redundant Prime Site 700MHz Trunking Sites Citywide UHF Overlay System Backup Control Stations			
<b>Phase 3 Discount Packages</b>				
	<b>Combined Discount Packages</b>	\$ (573,071.00)	\$ (998,405.74)	\$ (1,571,476.73)
<b>Phase 3 Sub Totals</b>				
	System Total	\$ 1,177,402.75	\$ 2,051,274.06	\$ 3,228,676.82
	9.5% Equipment Sales Tax Est.	\$ -	\$ 194,871.04	\$ 194,871.04
	<b>Phase 3 Total with Discounts A-C and est. Sales Tax</b>	<b>\$ 1,177,402.75</b>	<b>\$ 2,246,145.10</b>	<b>\$ 3,423,547.85</b>
<b>Standard &amp; Extended Warranty Options</b>				
<b>Year</b>			<b>Extended Maintenance</b>	<b>System Upgrade</b>
1	Year 1 Standard Product Warranty & SUA		Incl.	Incl.
2	Year 2 Extended ASTRO System Equipment Warranty & SUA		\$ 783,342.58	\$ 519,667.55
3	Year 3 Extended ASTRO System Equipment Warranty & SUA		\$ 806,842.85	\$ 522,452.59
4	Year 4 Extended ASTRO System Equipment Warranty & SUA		\$ 831,048.14	\$ 525,321.94
	<b>4-Year Standard Warranty, Extended Warranty &amp; Upgrade Totals</b>		<b>\$ 2,421,233.57</b>	<b>\$ 1,567,442.08</b>

SECTION 11

# PAYMENT TERMS

## 11.1 PAYMENT TERMS

Except for a payment that is due on the Effective Date, Customer will make payments to Motorola within thirty (30) days after the date of each invoice. Customer will make payments when due in the form of a check, cashier's check, or wire transfer drawn on a U.S. financial institution. If Customer has purchased additional Professional or Subscription services, payment will be in accordance with the applicable addenda. Payment for the System purchase will be in accordance with the following milestones.

**System Purchase (excluding Subscribers, if applicable)**

1. **25% of the Contract Price due upon contract execution (due upon effective date);**
2. **60% of the Contract Price due upon shipment of equipment from Staging;**
3. **10% of the Contract Price due upon installation of equipment; and**
4. **5% of the Contract Price due upon Final Acceptance.**

**If Subscribers are purchased, 100% of the Subscriber Contract Price will be invoiced upon shipment (as shipped).**

Motorola shall make partial shipments of equipment and will request payment upon shipment of such equipment. In addition, Motorola shall invoice for installations completed on a site-by-site basis or when professional services are completed, when applicable. The value of the equipment shipped/services performed will be determined by the value shipped/services performed as a percentage of the total milestone value. Unless otherwise specified, contract discounts are based upon all items proposed and overall system package. For invoicing purposes only, discounts will be applied proportionately to the FNE and Subscriber equipment values to total contract price. Overdue invoices will bear simple interest at the maximum allowable rate by state law.

**For Lifecycle Support Plan and Subscription Based Services:  
Motorola will invoice Customer annually in advance of each year of the plan.**

The chart below outlines the hourly labor rates for Motorola System Integration resources to be used. The staffing requirements shall be multiplied by the appropriate rate per resource in the table below. The hourly labor rates are fully burdened. The hourly rates per resource type and level are listed in Table 1.

Levels	Resource Types			
	Project Management	System Engineering	System Technologist	Project Administration
4	\$ 290.00	\$ 300.00	\$ 280.00	\$ 200.00
3	\$ 240.00	\$ 250.00	\$ 240.00	\$ 180.00
2	\$ 220.00	\$ 220.00	\$ 220.00	\$ 170.00
1	\$ 190.00	\$ 210.00	\$ 210.00	\$ 160.00

Table 1 - Hourly Rates



These rates apply to ordinary days and times (Monday to Friday during the hours 8am to 5pm). Additional surcharges may apply to work done outside these timeframes. The minimum charge for any resource will be 4 hours. Travel expenses are not included in these rates and may be charged separately.

The qualifications of each type and level of resource are defined in the tables found at Motorola Solutions Inc.'s website. All Motorola System Integration personnel assigned to this project will be classified according these levels. Project Administrative roles are varied and their specific duties and qualifications will be determined by the complexity and requirements of each project.

SECTION 12

# TERMS & CONDITIONS

## 12.1 TERMS & CONDITIONS

The City of Los Angeles (the "City") and Motorola Solutions, Inc. ("Motorola") have two master agreements that are relevant to this Motorola Proposal. Concerning Radio Communications Equipment, the City and Motorola have previously entered into Contract No. 59456 (the "Master Equipment Agreement"). Concerning services and systems, the City and Motorola have previously entered into a Master Services Agreement identified as City Contract No. C-123897 and Motorola Contract No. 1000409608 (the "Master Services Agreement").

The Master Services Agreement contains a Communications System Agreement, including its exhibits, as Exhibit C (referred to as the "Communications System Agreement"). In accordance with the last paragraph of Section 2.2 of the Master Services Agreement, the proposed transaction is a "system transaction" and, as such, this Motorola Proposal is based upon the Communications System Agreement, the other applicable provisions of the Master Services Agreement, and the Master Equipment Agreement (to the extent necessary, applicable and not covered by the Communications System Agreement and the Master Services Agreement).

Pricing for the Equipment offered in the Motorola Proposal is based off of the Master Equipment Agreement and pricing for the services offered in the Motorola Proposal is based off of the Master Services Agreement, although the Motorola Proposal does contain additional discounts in favor of the City as permitted by Section 2.2 of the Master Services Agreement. Further, this Motorola Proposal is a "Proposal" as that term is used in Section 2.2 of the Master Services Agreement and contains various additional documents (e.g., System Description, Equipment List, Statement of Work, Performance Schedule, Acceptance Test Plan, and Payment Schedule showing the payment milestones, etc.).

The City prefers to issue a Purchase Order for the equipment and a Contract Amendment for the services. Therefore, the City may accept this Proposal by issuing (i) a Purchase Order for the equipment that specifically refers to City Contract No. 59456 and incorporates by reference the Proposal by date and general description, and (ii) a Contract Amendment that specifically refers to City Contract No. C-123897 and Motorola Contract No. 1000409608 and incorporates by reference the Proposal by date and general description.



SECTION 13

# SPECIFICATION SHEETS & ATTACHMENTS

## 13.1 SPECIFICATIONS SHEETS

## Nokia 9500 Microwave Packet Radio

Microwave Service Switch | Release 7.1 (ANSI)

The Nokia 9500 Microwave Packet Radio (MPR) family includes a flexible range of Microwave Service Switch (MSS) indoor units that provide advanced Carrier Ethernet networking, aggregation and demarcation functions. Optimized to reduce space and power consumption, the MSS exists in different form factors to address all network sizes and locations, including tail, hub and backbone. The entire MSS family uses the same software and management systems, enabling consistent operations across end-to-end packet microwave networks. Combined with the 9500 MPR Microwave Packet Transport (MPT), the MSS sets the standard for delivering fast, efficient wireless transmission links with flexible networking and simple operations.



	MSS-0	MSS-1	MSS-4	MSS-8
Chassis	<ul style="list-style-type: none"> <li>• Fixed</li> <li>• Pole/Wall mount</li> <li>• Environmentally hardened for outdoor usage</li> <li>• IP67 compliant</li> </ul>	<ul style="list-style-type: none"> <li>• Fixed</li> <li>• Fanless</li> </ul>	<ul style="list-style-type: none"> <li>• Modular: four slots</li> <li>• Two core slots (1+1)</li> <li>• Two interface slots</li> </ul>	<ul style="list-style-type: none"> <li>• Modular: Eight slots</li> <li>• Two core slots</li> <li>• Six interface slots</li> </ul>
Dimensions	345 mm x 190 mm x 65 mm (13.6 in. x 7.5 in. x 2.6 in.)	½ RU	1 RU	2 RU
Nodal capability	Three radios	Six radios	Twelve radios	Twenty-four radios
Switching capability	16 Gb/s	16 Gb/s	100 Gb/s	100 Gb/s
Weight	4.2 kg (9.3 lb)	2 kg (4.4 lb)	Chassis: 2.8 kg (6.2 lb)	Chassis: 3.6 kg (7.9 lb)
Interfaces	<ul style="list-style-type: none"> <li>• 2 x 10/100/1000 RJ-45 with PoE support</li> <li>• 1 x 10/100/1000 RJ-45</li> <li>• 1 x SFP</li> </ul>	<ul style="list-style-type: none"> <li>• 16 DS1</li> <li>• 4 x 10/100/1000 RJ-45</li> <li>• 2 x SFP</li> </ul>	<ul style="list-style-type: none"> <li>• Up to 64 E1, 22 GE, 2 E3, 4 STM-1</li> <li>• 2 x 10 Gb/s SFP+ ports</li> </ul>	<ul style="list-style-type: none"> <li>• Up to 192 DS1, 12 DS3, 12 OC-3, 54 GE</li> <li>• 2 x 10 Gb/s SFP+ ports</li> </ul>
Power supply	AC: 110 V to 230 V nominal DC: 48 V nominal	Dual feeds -48 V, optional external +24 V	-48 V DC or optional integrated +24 V DC	Dual feeds: -48 V DC or optional integrated +24 V DC
Temperature	-40°C to +46°C (-40°F to +115°F) with Solar Loading (per GR-3108 Class 4)	-40°C to +65°C (-40°F to +149°F)	-40°C to +50°C (-40°F to +122 °F)	-40°C to +65°C (-40°F to +149°F)

## Technical specifications

### Indoor/outdoor connections

- GE electrical or optical cable

### Synchronization

- Performance according to ITU-T G.813, G.823, G.8264
- Clock distribution options
  - DS1/OC-3
  - External reference sync-in/ sync-out (2 MHz, 5 MHz, 10 MHz)
  - Sync E + SSM
  - ITU-T G.8264
  - Built-in Stratum 3 clock
  - OC-3 line clock
  - 1588 T-TC and T-BC on path support

### Standards compliance

#### Environmental

- Telcordia® GR-63, GR-1089
- GR-3108
  - MSS-O: Class 4
  - MSS-1, MSS-8: Class 2
- EMC: EN 55022 Class B, EN 301 489-1, EN 301 489-4

#### Safety

- EN 60950-1, UL

#### Ecological

- ECMA TR/70

#### Networking and services

- IEEE 802.1p, 802.1Q: VLAN tagging
- IEEE 802.3: Ethernet
- IEEE 802.3u: 100Base-TX
- IEEE 802.3z: 1000Base-SX/LX
- IEEE 802.3ab: 1000Base-T
- IEEE 802.3x: Flow control
- IEEE 802.1D: MAC bridges
- IEEE 802.1AX-2008: Link aggregation
- IEEE 802.1ag: Ethernet OAM
- MEF CE 2.0: Carrier Ethernet
- MEF 8, MEF 9, MEF 14, MEF 22
- ITU-T G.7041: GFP
- ITU-T G.8032v2: ERPS
- ITU-T G.813: Timing characteristics
- ITU-T G.823: Control of jitter
- ITU-T G.8273.2: Timing characteristics
- ITU-T Y.1731: OAM functions

#### Traffic management and QoS

- Marking based on:
  - Layer 2 (IEEE 802.1p)
  - Layer 3 (DiffServ)

#### Network and element management

- Console, management, alarm
- Optional 256-bit AES Encryption compliant with FIPS PUB 140-2

- Secure FTP for software download and backup
- IPv4/IPv6 management
- Integrated network management in a Microsoft® Windows® environment
- Embedded web browser for network element supervision
- PC software-based configuration
- Intuitive supervision systems
- SNMP agent with TCP/IP rerouting capability
- Nokia 5620 Service Aware Manager
- Nokia TSM-8000 Fault Management System

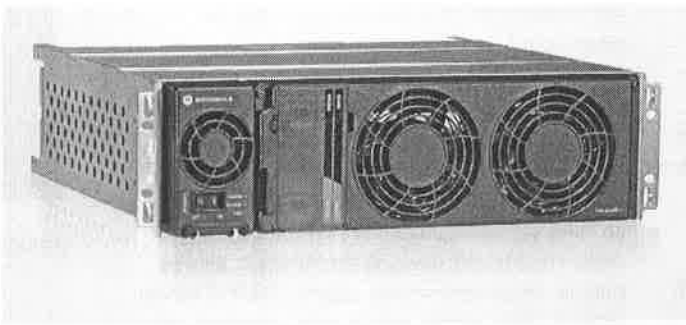
#### Services

- Architecture and design
- Equipment and site engineering
- Installation services
- Integration services
- Performance analysis, network assessment, DCN, synchronization and QoS assessment
- Migration to packet microwave management
- Maintenance
  - 24x7 technical support
  - Return for repair or advanced exchange

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Product code: SR1610001474 (November)



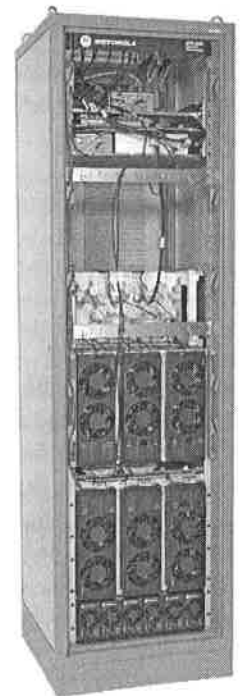
**FLEXIBLE DESIGN – SOFTWARE CONFIGURABLE**

# G-SERIES SITE EQUIPMENT FOR ASTRO<sup>®</sup> 25 SYSTEMS

Motorola's ASTRO 25 networks are designed to meet the current and future requirements for Project 25 (P25) solutions. Our G-series portfolio of RF stations, receivers, site controllers and comparators is designed to maximize channel up-time, simplify system technology refresh, enable smaller, more efficient site design and minimize the cost of ownership.

Our G-series equipment is designed so that many upgrades, migrations, and conversions can be completed with only software installations, allowing new features to be quickly added to your existing system with a simple download. You can easily add P25 TDMA and Dynamic Channel Assignment; Information Assurance, Network Security and system release updates. Furthermore, you can migrate from conventional to trunking, 3600 to P25 trunking and from 12.5 kHz P25 FDMA to 6.25e kHz P25 TDMA.

Designed to carry your needs into the future, the G-series hardware platform has built-in functionality and flexibility with an AC/DC - 48VDC power supply and two-branch receive diversity capacity, as well as a linear power amplifier for improved coverage in P25 FDMA Simulcast systems.



GTR 8000 Expandable Site Subsystem

## SIMULCAST

Motorola is an industry leader in simulcast system solutions with more mission critical systems fully operational in the field than any other LMR systems provider. The G-series site equipment is designed with simulcast system design and functionality in mind. GTR 8000 Base Radios feature a linear modulation (LSM) that provides industry-leading P25 coverage in VHF, UHF, 700/800 MHz and 900 MHz. LSM enables simulcast systems to be deployed with greater site spacing without sacrificing coverage or capability, resulting in fewer sites to build and maintain. It also allows current systems to deploy IP-based simulcast without the need to add fill-in sites.

## SERVICING MADE EASY

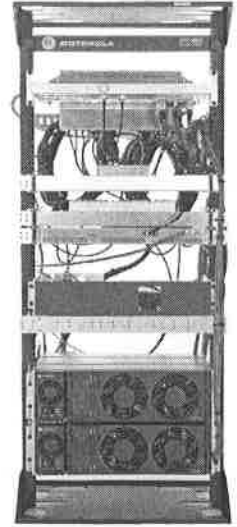
G-series site equipment has many features built in to support ease of service. Six basic modules create the entire G-series platform resulting in reduced spare parts inventory. Modules have front access to improve serviceability with hot-swap support to ensure channels are back on the air in minimum possible time. Standard Battery Revert and Charging capability is built into every G-series power supply. Integrating these capability eliminates the need for a large uninterrupted power supply and saves valuable site space.

A built-in GPS with frequency reference distribution is optionally available on the GTR 8000 Expandable Site Subsystem, which can significantly reduce or eliminate site visits.

Software upgrades are more stable and performed with less downtime in the GTR 8000 base radio. One version of software can run actively while another version is downloading. Using a remote IP connection, the user can decide when to switch between the two versions of software allowing the system manager to prepare for software downloads.

## OPTIMIZED NETWORK SECURITY

Information Assurance capabilities are standard with G-series equipment and can be configured or disabled depending on your specific system maintenance and security requirements. G-series products provide the necessary boundary defense capabilities required in mission critical infrastructure today including local user accounts and password controls, user privilege model support (two levels), local and remote access services controls, secure shell services support, SNMPv3, central authentication, general operating system and network services hardening, and device test services controls.



GTR 8000 Site Subsystem

# SYSTEM CONFIGURATIONS

## ASTRO 25 TRUNKING

GTR 8000 Base Radios, GPW 8000 Receivers, GCP 8000 Site Controllers, and GCM 8000 Comparators are the building blocks of an ASTRO® 25 trunking system. Site repeater and simulcast system architectures in P25 FDMA and P25 TDMA offer the flexibility to deliver communications that fit user requirements.

G-series equipment is capable of both Project 25 FDMA and Project 25 TDMA in ASTRO 25 trunking systems. Dynamic Channel Assignment is optional for GTR 8000 Base Radios as part of the ASTRO 25 Dynamic Dual Mode system option, and offers seamless interoperability between P25 FDMA and P25 TDMA users, dynamically allocating a call based on available resources without any user intervention or awareness. The P25 TDMA trunking features are offered across the complete trunking portfolio to address the needs of users ranging from single site to statewide radio systems.

ASTRO 25 trunking is a fully scalable solution from as small as a single trunking site to large statewide systems that include a mix of site repeater and simulcast operation as well as additional data and mutual aid overlays. G-series equipment configured for trunking supports both V.24 circuit-based architectures as well as state-of-the-art IP-based system designs. GPW 8000 Receivers and GCM 8000 Comparators improve the in-bound subscriber signal coverage and re-broadcast a quality improved composite signal respectively in simulcast or receiver voting systems.

Motorola offers industry-leading channel resiliency in trunking systems with the GTR 8000 Expandable Site Subsystem. The architecture ensures that no single point of failure can remove more than one channel from service at the RF sites. Plus, the sites are simultaneously simplified through the integration of base station frequency references, Ethernet LAN switches and network gateways.

Motorola also offers a turn-key P25 trunking site with the ASTRO 25 Express system, a GTR 8000 Expandable Site Subsystem designed to operate as a single-site solution. Stations, site controllers, Ethernet switches, RF combiners and multicouplers are all integrated into a single rack or cabinet. If more capacity is required, additional cabinets can be added to the site.

## ASTRO 25 CONVENTIONAL

ASTRO® 25 Conventional is a feature-rich conventional system solution on the common-hardware G-series platform. The GTR 8000 Base Radios, GPW 8000 Receivers, and GCM 8000 Comparators can be used together or separately to build everything from a small, single repeater site to a large, countywide or statewide receiver-voting or simulcast conventional system.

The hardware will support IP-only circuit system design while connectivity with consoles can be either IP-based or 4-wire depending on migration plans and system specific operational requirements. GTR 8000 can be configured for either base station or standalone repeater operation. GPW

8000 Receivers and GCM 8000 Comparators improve the inbound subscriber signal coverage and re-broadcast a quality improved composite signal respectively in simulcast or receiver voting systems.

Sixteen configurable channel personalities enable the station to change channel bandwidth and frequency setting via IP or v.24 commands. General purpose I/O offers 12 logic inputs and 12 logic outputs that can be programmed via the user-friendly GTR 8000 Configuration Service Software (Windows® application) for a highly customized alarm reporting solution and station operation.

ASTRO 25 Conventional can also be deployed as a system overlay with ASTRO 25 Trunking systems by adding a GTR 8000 Base Radio configured for conventional operation to an existing trunking GTR 8000 Expandable Site Subsystem and sharing the common wide-area network connections as well as RF cavity combiners and receiver multicouplers.

### **ANALOG CONVENTIONAL**

The GTR 8000 and GPW 8000 products support analog conventional operation in 800 MHz, UHF 380-524 MHz and VHF 136-174 MHz. Analog standalone repeater, receiver voting and simulcast capabilities are available and include a 100 ppb/2 year internal frequency reference for optimal audio performance on 12.5 KHz analog channels.

The G-series equipment provides full support for analog 4-wire circuit connectivity. Over an IP network, technicians can remotely adjust line level settings and tone remote operational modes. 16 configurable analog personalities enable the station to change channel bandwidth and frequency settings via TRC (tone remote control) or WildCard general purpose I/O. The general purpose I/O offers 12 logic inputs and 12 logic outputs, which can be programmed via the user friendly Configuration Service Software (Windows® application) for a highly customized alarm-reporting solution and station operation.

### **MIXED ANALOG/DIGITAL CONVENTIONAL**

G-Series site equipment can be configured to simultaneously support both analog and digital communication. This mixed mode form of operation allows the system to support a

mixed fleet of analog and digital subscribers as a flexible long term solution, or as part of a gradual migration path from analog to digital. Mixed mode operation is supported on conventional standalone repeaters, receiver voting and simulcast systems.

### **ASTRO 25 DATA**

ASTRO 25 trunking and conventional systems can be enabled with P25 Integrated Data functionality so users can leverage their investment in voice infrastructure for basic data needs. Enhanced Data is a software feature in systems with Integrated Data. Enhanced Data optimizes the data channels in an ASTRO 25 system for data applications that require short inbound data messages like location, telemetry and biometrics, and can improve data efficiency by 12x. For example, with Enhanced Data, customers can set quicker location polling rates for a larger number of users on their system, therefore providing better real-time view to resource locations. Based on customer requirements, ASTRO 25 Enhanced Data allows for data to be prioritized over voice, protecting channels for data use and enabling agency shared data channels. If higher data throughput is a requirement, Motorola offers HPD as an overlay on ASTRO 25 trunking systems to provide the same coverage footprint for both systems.

### **3600 TRUNKING**

The GTR 8000 base radio supports 3600 trunking operation, enabling new future-ready base radios to be added to existing SmartZone systems with SmartX. The GTR 8000 is software upgradeable to P25 trunking when the time is right to migrate to P25. 3600 trunking operation is available on both simulcast and intellirepeater systems, in either analog or digital mode.

The GTR 8000 supports WildCard general purpose I/O with 12 logic inputs and 12 logic outputs, which can be programmed via the user friendly Configuration Service Software (Windows application) for a highly customized alarm-reporting solution and station operation.

Using an IP connection, the GTR 8000 can be monitored, configured and software updated from a convenient, remote location.

## **G-SERIES SITE EQUIPMENT PRODUCTS**

### **GTR 8000 EXPANDABLE SITE SUBSYSTEM**

A space-efficient, single rack design, the GTR 8000 Expandable Site Subsystem (ESS) integrates up to six GTR 8000 Base Radios, redundant GCP 8000 Site Controllers or GPB 8000 Reference Distribution Modules, redundant Ethernet LAN switches, redundant network gateways, transmit combiners, and receiver multicouplers. This enables

a highly resilient architecture that provides industry-leading protection against single points of failure at the RF sites while providing a turn-key site solution that minimizes site cabling connections and installation effort.

It supports ASTRO 25 simulcast and site repeater trunking operation, 3600 simulcast and intellirepeater trunking operation with SmartX, HPD, and P25 digital and analog conventional operation. When ordered as an ASTRO 25

Express System, the GTR 8000 Expandable Site Subsystem is the industry's only turn-key, single-site Project 25 trunking solution.

### GTR 8000 BASE RADIO

Designed to support ASTRO 25 trunking simulcast, 3600 trunking simulcast with SmartX, HPD, and P25 and analog conventional operation, GTR 8000 Base Radios offer additional design flexibility for infrastructure sites where equipment may have to be interchanged individually during a technology refresh or when used as a station replacement for QUANTAR™ or STR 3000 stations.

### GPW 8000 RECEIVER

In conventional and trunking voting or simulcast voting applications, the GPW 8000 Receiver increases in-bound signal coverage for subscribers. Physical space is optimized at receive-only sites with the GPW 8000 space efficient dual receive module design.

### GTR 8000 SITE SUBSYSTEM

This configuration supports HPD with the redundant site controllers and GTR 8000 Base Radio configured for data operation. The specially designed low-loss RF system ensures that HPD signal coverage equals the coverage available from the integrated voice and data

solution allowing complete data coverage in an ASTRO® 25 system without the inconvenience of fill-in sites for coverage holes.

### GCP 8000 SITE CONTROLLER

The GCP 8000 Site Controller is used at an ASTRO 25 trunking site to assign voice and data channels, manage and report alarms on site resources, provide Ethernet switching capability, and provide a frequency reference to GTR 8000 Base Radios. The frequency reference is provided either via a GPS receiver or an ultra high stability oscillator. The nature of these frequency references eliminates or minimizes site visits for frequency tuning servicing.

### GCM 8000 AND GRV 8000 COMPARATORS

Used in voting and simulcast networks, G-Series Comparators increase the talk-in coverage of a radio in the field. The comparators pick up audio from multiple sites and perform a frame-by-frame analysis to build a high quality composite audio package for transmission. The GCM 8000 supports P25 digital conventional and P25 trunking systems. The GRV 8000 supports analog conventional and P25 digital conventional systems.

## GTR 8000 EXPANDABLE SITE SUBSYSTEM (SQM01SUM7054A)

### GENERAL PERFORMANCE

	HPD	INTEGRATED VOICE & DATA				
	700/800 MHz	900 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Number of Channels	1-5	1-6	1-6	1-6	1-6	2-6
Height with 7.5 ft Rack	90.4 in (230 cm)	90.4 in (230 cm)	90.4 in (230 cm)	90.4 in (230 cm)	90.4 in (230 cm)	90.4 in (230 cm)
Footprint (W x D) with 7.5 ft Rack	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)
Weight (fully configured) with 7.5 ft Rack	520 lbs (235 kg)	575 lbs (260 kg)	520 lbs (235 kg)	UHF 380-435 MHz: 475 lbs (215 kg) UHF 450-512 MHz: 565 lbs (260 kg)	475 lbs (215 kg)	538 lbs (246 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption (fully configured)						
Power Efficiency Package	2200 W	C4FM: 3700 W LSM, H-DQPSK: 4100 W	C4FM, FM: 2755 W LSM, H-DQPSK: 2900 W	C4FM, FM: 2325 W LSM, H-DQPSK: 2500 W	C4FM, FM: 2500 W LSM, H-DQPSK: 2100 W	C4FM, FM: 4310 W
Standard	2400 W	C4FM: 3700 W LSM, H-DQPSK: 4100 W	C4FM, FM: 2900 W LSM, H-DQPSK: 3100 W	C4FM, FM: 2500 W LSM, H-DQPSK: 2700 W	C4FM, FM: 2650 W LSM, H-DQPSK: 2200 W	C4FM, FM: 4580 W
Antenna Connectors	TX: 7/16 Female RX: N Female	TX: 7/16 or N Female RX: N Female	TX: 7/16 Female RX: N Female	TX: 7/16 Female RX: N Female	TX: N Female RX: BNC Female	TX: N Female RX: N Female
Channel Spacing	25 kHz	12.5 kHz	12.5/25 kHz	12.5/25 kHz	12.5/15/25/30 KHz	12.5/25 kHz
Transmit Combiner Spacing	150 kHz	12.5 kHz (Hybrid) 150 kHz (Cavity)	150 kHz	150 kHz (450 - 512 MHz) N/A (380-450, 512-524 MHz)	N/A	N/A
Modulation	TX: 64QAM, 16QAM, QPSK RX: 64QAM, 16QAM, QPSK	TX: C4FM, LSM, H-DQPSK RX: C4FM, H-CPM	TX: C4FM, LSM, H-DQPSK, FM RX: C4FM, H-CPM, FM	TX: C4FM, LSM, H-DQPSK, FM RX: C4FM, H-CPM, FM	TX: C4FM, LSM, H-DQPSK, FM RX: C4FM, H-CPM, FM	TX: FM, C4FM RX: C4FM, H-CPM, FM
Frequency Stability	GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized

Specifications subject to change without notice.

## GTR 8000 EXPANDABLE SITE SUBSYSTEM (SQM01SUM7054A) CONTINUED

### TRANSMITTER (CABINET OUTPUT)\*

	HPD					
	700/800 MHz	900 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Frequency Range	764-776, 851-870 MHz	935-941 MHz	764-776, 851-870 MHz	380-435, 435-524 MHz	136-174 MHz	851-870 MHz
Average Power output per channel	1-20 W	2-way Hybrid: 1-37 W 3-way Hybrid: 1-22 W 4-way Hybrid: 1-17 W 5-way Hybrid: 1-12 W 6-way Hybrid: 1-10 W	1-40 W	C4FM, FM: 2-110 W (380-450, 512-524 MHz) LSM, H-QPSK: 2-100 W (380-450, 512-524 MHz) C4FM, FM: 1-33 W (450-512 MHz) LSM, H-QPSK: 1-30 W (450-512 MHz)	C4FM, FM: 2-100 W LSM, H-QPSK: 2-60 W	13-134 W
Modulation Fidelity	N/A	5%	5%	5%	5%	5%
EVM	10%	N/A	N/A	N/A	N/A	N/A
Intermodulation Attenuation	80 dB	80 dB	80 dB	80 dB (450-512 MHz) 65 dB (380-450, 512-524 MHz)	55 dB	55 dB
Spurious and Harmonic Emissions Attenuation	90 dB	90 dB	90 dB	90 dB	90 dB	90 dB
Analog FM Hum and Noise						
12.5 kHz	N/A	N/A	45 dB	45 dB	45 dB	
25 kHz	N/A	N/A	50 dB	50 dB	50 dB	
Analog Audio Distortion	N/A	N/A	Less than 2% at 1000 Hz	Less than 2% (1% typical) at 1000 Hz	Less than 2% (1% typical) at 1000 Hz	Less than 2% at 1000 Hz
Emissions Designators	17K7D7D	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D 9K80D7W, 10K0F1D 11K0F3E, 16K0F1D 16K0F3E	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 10K0F1E, 10K0F1D 10K0F1W, 9K80D7E 9K80D7D, 9K80D7W 17K7D7D, 16K0F1D 16K0F3E, 11K0F3E 14K0F1D, 14K0F3E 21K7D7E, 21K7D7D 21K7D7W	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D 9K80D7W, 10K0F1D 11K0F3E, 16K0F1D 16K0F3E	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D 9K80D7W, 10K0F1D 11K0F3E, 16K0F1D 16K0F3E	8K10F1E, 8K10F1D, 8K10F1W, 10K0F1E, 10K0F1D, 10K0F1W, 16K0F1D, 16K0F3E, 11K0F3E, 14K0F1D, 14K0F3E

### RECEIVER (TOP OF CABINET)

	HPD					
	700/800 MHz	900 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Frequency Range	792-825 MHz	896-902 MHz	792-825 MHz	380-435, 435-524 MHz	136-174 MHz	806-825 MHz
Analog Sensitivity 12 dB SINAD	N/A	N/A	12.5 kHz: -123 dBm 25 kHz: -122 dBm	12.5 kHz: -117 dBm (380-450, 512-524 MHz) 12.5 kHz: -121.5 dBm (450-512 MHz) 25 kHz: -116 dBm (380-450, 512-524 MHz) 25 kHz: -120.5 dBm (450-512 MHz)	12.5/15 kHz: -118 dBm 25/30 kHz: -117 dBm	12.5 kHz: -123 dBm 25 kHz: -122 dBm
Digital Sensitivity 1% Bit Error Rate Static (BER)						
64 QAM	-101 dBm	N/A	N/A	N/A	N/A	N/A
16 QAM	-108 dBm	N/A	N/A	N/A	N/A	N/A
QPSK	-115 dBm	N/A	N/A	N/A	N/A	N/A
Digital Sensitivity 5% Bit Error Rate Static (BER)						
C4FM	N/A	-123 dBm	-123 dBm	-117 dBm (380-450, 512-524 MHz) -121.5 dBm (450-512 MHz)	-118 dBm	-123 dBm
H-CPM	N/A	-118.5 dBm	-121 dBm	-115 dBm (380-450, 512-524 MHz) -119.5 dBm (450-512 MHz)	-116 dBm	N/A
Intermodulation Rejection	75 dB**	80 dB	80 dB	80 dB	80 dB	80 dB
Digital Adjacent Channel Rejection	50 dB**	60 dB	60 dB	60 dB	60 dB	60 dB

\* Includes Transmitter RF Distribution System for 900 MHz, 700/800 MHz, and UHF 450-512 MHz. Does not include Transmitter RF Distribution System for VHF, UHF 380-450, 512-524 MHz and High Power 800 MHz

\*\* Reference signal is QPSK

Specifications subject to change without notice.

## GTR 8000 EXPANDABLE SITE SUBSYSTEM (SQM01SUM7054A) CONTINUED

### RECEIVER (TOP OF CABINET)

HPD		INTEGRATED VOICE & DATA				
700/800 MHz		900 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Analog Adjacent Channel Rejection (EIA603) Analog 12.5 kHz	N/A	N/A	75 dB	75 dB	75 dB	75 dB
Analog Adjacent Channel Rejection (TIA603D) Analog 12.5 kHz	N/A	N/A	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)
Analog 25 kHz	N/A	N/A	80 dB	80 dB	80 dB	80 dB
Spurious and Image Response Rejection	90 dB**	100 dB	100 dB	85 dB (380-435 MHz) 100 dB (450-512 MHz)	90 dB	100 dB
Analog Audio Response	N/A	N/A	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	N/A	N/A	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)
Analog FM Hum and Noise 12.5 kHz	N/A	N/A	45 dB	45 dB	45 dB	45 dB
25 kHz	N/A	N/A	50 dB	50 dB	50 dB	50 dB
Intermediate Frequency	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 44.85 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz

### TRANSMITTER RF DISTRIBUTION SYSTEM

	700/800 MHz Cavity	900 MHz Hybrid	UHF: 450-512 MHz Cavity
Frequency Range	764-776, 851-870 MHz	935-941 MHz	450-512 MHz
Insertion Loss (150 kHz spacing)	3.1 dB typ	2-way loss: 4.4 dB typ 3-way loss: 6.3 dB typ 4-way loss: 7.6 dB typ 5-way loss: 8.8 dB typ 6-way loss: 9.7 dB typ	4.5 dB typ
Tx-Tx Isolation (150 kHz spacing)	32 dB	20 dB	32 dB

### RECEIVER RF DISTRIBUTION SYSTEM

	700/800/900 MHz		UHF: 450-512 MHz	
Frequency Range	792-825 MHz or 896-902 MHz		450-512 MHz	
	Typical	Limit	Typical	Limit
Noise Figure	3.8 dB	5 dB	4.6 dB	5.5 dB
Gain	13 dB	-16 to 24 dB adjustable	10 dB	-16 to 24 dB adjustable
3rd Order Output Intercept	21 dBm		19 dBm	
Amplifier Intercept	35 dBm		40 dBm	
Preselector Bandwidth	792-825 MHz or 896-902 MHz		2 or 3.5 MHz	
RF Input Connector Type	N		N	
RF Output Connector Type	BNC		BNC	

\* Includes Transmitter RF Distribution System for 900 MHz, 700/800 MHz, and UHF 450-512 MHz. Does not include Transmitter RF Distribution System for VHF, UHF 380-450, 512-524 MHz and High Power 800 MHz.

\*\* Reference signal is QPSK

Specifications subject to change without notice.

## GCP 8000 SITE CONTROLLER (T7038A)

### GENERAL PERFORMANCE

	HPD	INTEGRATED VOICE & DATA
Channel Capacity	5	Repeater Site: 28 Simulcast (Multicast): 30
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	40 lbs (18 kg)	40 lbs (18 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)
Rack Option	19 in standard rack mountable	19 in standard rack mountable
Frequency Stability	GPS Synchronized	Simulcast (Multisite): External
<b>ELECTRICAL</b>		
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption	AC: 160 W DC: 80 W	AC: 130 W DC: 60 W

## GCM 8000 COMPARATOR (T7321A)

### GENERAL PERFORMANCE

	INTEGRATED VOICE & DATA
Channel Capacity	1 or 2
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	40 lbs (18 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)
Rack Option	19 in standard rack mountable
Time Stability	External Reference
<b>ELECTRICAL</b>	
Power Requirements	AC: 90-264 VAC 47-63Hz DC: 43.2-60 VDC
Power Consumption	AC: 1 module 130 W AC: 2 modules 160 W DC: 1 module 60 W DC: 2 modules 80 W

## G-SERIES COMPACT SITE

### GENERAL PERFORMANCE

Frequency Band	700 MHz, 800 MHz
Channel Capacity	3
Size (HxWxD)	51.2 x 27.2 x 36.5 in (Pole Mount) 59.5 x 27.2 x 36.5 in (Pad Mount) 55.3 x 27.2 x 36.5 in (Wall Mount)
Weight	230 lbs (empty), 460 lbs (fully loaded)
Temperature Range	-30 to 50°C (External to Cabinet)
Rack Option	Pole, Pad, or Wall Mountable

## GRV 8000 COMPARATOR (T8341A)

### GENERAL PERFORMANCE

OPERATION	ANALOG CONVENTIONAL DIGITAL CONVENTIONAL
Channel Capacity	1 or 2
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	36 lbs (16 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)
Rack Option	19 in standard rack mountable
Frequency Stability	External Reference
<b>ELECTRICAL</b>	
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption	AC: 1 module 80 W AC: 2 modules 105 W DC: 1 module 50 W DC: 2 modules 75 W

Specifications subject to change without notice.

# GTR 8000 BASE RADIO (T7039A)

## GENERAL PERFORMANCE

	HPD	INTEGRATED VOICE & DATA			
	700/800 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	46 lbs (21 kg)	46 lbs (21 kg)	46 lbs (21 kg)	46 lbs (21 kg)	48 lbs (22 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption Power Efficiency Package	325 W	C4FM, FM: 405 W LSM, H-DPOSK: 425 W	C4FM, FM: 410 W LSM, H-DPOSK: 445 W	C4FM, FM: 405 W LSM, H-DPOSK: 315 W	C4FM, FM: 700 W
Standard	325 W	C4FM, FM: 430W LSM, H-DPOSK: 470 W	C4FM, FM: 435 W LSM, H-DPOSK: 455 W	C4FM, FM: 435 W LSM, H-DPOSK: 345 W	C4FM, FM: 725 W
Antenna Connectors TX	N female	N female	N female	N female	N female
Antenna Connectors RX	BNC female	BNC female N female **	BNC female N female **	BNC female N female **	BNC female N female **
Channel Spacing	25 kHz	12.5/25 kHz	12.5/25 kHz	12.5/15/25/30 kHz	12.5/25 kHz
Modulation	TX: 64QAM, 16QAM, QPSK RX: 64QAM, 16QAM, QPSK	TX: C4FM, LSM, H-DPOSK, FM RX: C4FM, H-CPM, FM	TX: C4FM, LSM, H-DPOSK, FM RX: C4FM, H-CPM, FM	TX: C4FM, LSM, H-DPOSK, FM RX: C4FM, H-CPM, FM	TX: FM, C4FM RX: C4FM, H-CPM, FM
Frequency Stability	External Reference	100 ppb/2 yr or External Reference	100 ppb/2 yr or External Reference	100 ppb/2 yr or External Reference	100 ppb/2 yr or External Reference

## TRANSMITTER

	700/800 MHz	700/800 MHz	UHF: 380-435 MHz UHF: 435-524 MHz	VHF: 136-174 MHz	800 MHz: High Power & Low Power unless indicated
Frequency Range	764-776, 851-870 MHz	764-776, 851-870 MHz	380-435, 435-524 MHz	136-174 MHz	851-870 MHz
Power Output	2-50 W	2-100 W	C4FM, FM: 2-110 W H-DPOSK, LSM: 2-100 W	C4FM, FM: 2-100 W H-DPOSK, LSM: 2-60 W	High Power: 15-150 W Low Power: 2-30 W
Electronic Bandwidth	Full Bandwidth	Full Bandwidth	Full Bandwidth	Full Bandwidth	Full Bandwidth
Modulation Fidelity	N/A	5%	5%	5%	5%
EVM	10%	N/A	N/A	N/A	N/A
Intermodulation Attenuation	80 dB	80 dB	65 dB	55 dB	55 dB
Spurious and Harmonic Emissions Attenuation	90 dB	90 dB	90 dB	90 dB	90 dB
Analog FM Hum and Noise 12.5 kHz 25 kHz	N/A N/A	45 dB 50 dB	45 dB 50 dB	45 dB 50 dB	45 dB 50 dB
Analog Audio Distortion	N/A	Less than 2% at 1000 Hz	Less than 2% (1% typical) at 1000 Hz	Less than 2% (1% typical) at 1000 Hz	Less than 2% at 1000 Hz
Emissions Designators	17K7D7D	8K70D1E, 8K70D1D, 8K70D1W 8K10F1E, 8K10F1D, 8K10F1W 10K0F1E, 10K0F1D, 10K0F1W 9K80D7E, 9K80D7D, 9K80D7W 17K7D7D, 16K0F1D, 16K0F3E 11K0F3E, 14K0F1D, 14K0F3E 21K7D7E, 21K7D7D, 21K7D7W	8K70D1E, 8K70D1D, 8K70D1W 8K10F1E, 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D, 9K80D7W 10K0F1D, 11K0F3E, 16K0F1D 16K0F3E	8K70D1E, 8K70D1D, 8K70D1W 8K10F1E, 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D, 9K80D7W 10K0F1D, 11K0F3E, 16K0F1D 16K0F3E	High Power: 8K10F1E, 8K10F1D, 8K10F1W 16K0F1D, 16K0F3E, 11K0F3E 14K0F1D, 14K0F3E  Low Power: 8K10F1D, 8K10F1E, 8K10F7W 8K70D1W, 8K70D7W, 9K80D7W 10K0F1D, 11K0F3E, 16K0F3E 16K0F1D

## RECEIVER

	700/800 MHz	700/800 MHz	UHF: 380-435 MHz UHF: 435-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Frequency Range	792-825 MHz	792-825 MHz	380-435, 435-524 MHz	136-174 MHz	806-825 MHz
Analog Sensitivity (12 dB SINAD)	N/A	12.5 kHz: -118 dBm 25 kHz: -117 dBm	12.5 kHz: -118 dBm 25 kHz: -117 dBm	12.5 kHz: -119 dBm 25/30 kHz: -118 dBm	12.5 kHz: -118 dBm 25 kHz: -117 dBm
Digital Sensitivity 1% Bit Error Rate Static (BER)					
64 QAM	-98 dBm	N/A	N/A	N/A	N/A
16 QAM	-104 dBm	N/A	N/A	N/A	N/A
QPSK	-111 dBm	N/A	N/A	N/A	N/A
Digital Sensitivity 5% Bit Error Rate Static (BER)					
C4FM	N/A	-118 dBm	-118 dBm	-119 dBm	-118 dBm
H-CPM	N/A	-116 dBm	-116 dBm	-117 dBm	-116 dBm

\* Reference signal is QPSK \*\* Optional Preselector  
Specifications subject to change without notice.

## GTR 8000 BASE RADIO (T7039A) CONTINUED

### RECEIVER

	HPD	INTEGRATED VOICE & DATA			
	700/800 MHz	700/800 MHz	UHF: 380-435 MHz UHF: 435-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Intermodulation Rejection	75 dB*	85 dB	85 dB	85 dB	85 dB
Digital Adjacent Channel Rejection	50 dB*	60 dB	60 dB	60 dB	60 dB
Analog Adjacent Channel Rejection (EIA603) Analog 12.5 kHz	N/A	75 dB	75 dB	75 dB	75 dB
Analog Adjacent Channel Rejection (TIA603D) Analog 12.5 kHz Analog 25 kHz	N/A N/A	50 or 60 dB (adjustable) 80 dB	50 or 60 dB (adjustable) 80 dB	50 or 60 dB (adjustable) 80 dB	50 or 60 dB (adjustable) 80 dB
Spurious and Image Response Rejection	85 dB*	85 dB 100 dB**	85 dB 100 dB**	90 dB 95 dB**	85 dB 100 dB**
Analog Audio Response	N/A	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	N/A	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)
Analog FM Hum and Noise 12.5 kHz 25 kHz	N/A N/A	45 dB 50 dB	45 dB 50 dB	45 dB 50 dB	45 dB 50 dB
Intermediate Frequency	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 44.85 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz

## GPW 8000 RECEIVER (T7540A)

### GENERAL PERFORMANCE

	INTEGRATED VOICE & DATA					
	700/800 MHz		UHF: 380-435 MHz UHF: 435-524 MHz		VHF: 136-174 MHz	
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)		5.25 x 19 x 18 in (133 x 483 x 457 mm)		5.25 x 19 x 18 in (133 x 483 x 457 mm)	
Weight	36 lbs (16 kg)		36 lbs (16 kg)		36 lbs (16 kg)	
Temperature Range	-22 to 140°F (-30 to 60°C)		-22 to 140°F (-30 to 60°C)		-22 to 140°F (-30 to 60°C)	
Power Requirements						
AC	90-264 VAC, 47-63 Hz		90-264 VAC, 47-63 Hz		90-264 VAC, 47-63 Hz	
DC	43.2-60 VDC		43.2-60 VDC		43.2-60 VDC	
Power Consumption	1 Module	2 Module	1 Module	2 Module	1 Module	2 Module
AC – Power Efficiency Package	40 W	65 W	40 W	65 W	40 W	65 W
DC – Power Efficiency Package	30 W	50 W	30 W	50 W	30 W	50 W
AC	80 W	105 W	80 W	105 W	80 W	105 W
DC	50 W	75 W	50 W	75 W	50 W	75 W
Antenna Connectors RX	BNC female N female **		BNC female N female **		BNC female N female **	
Channel Spacing	12.5/25 kHz		12.5/25 kHz		12.5/15/25/30 kHz	
Modulation	C4FM, FM		C4FM, FM		C4FM, FM	
Frequency Stability	Conventional: 100 ppb/2 yr		Conventional: 100 ppb/2 yr		Conventional: 100 ppb/2 yr	

\* Reference signal is QPSK \*\* Optional Preselector  
Specifications subject to change without notice

# GPW 8000 RECEIVER (T7540A) CONTINUED

## RECEIVER

INTEGRATED VOICE & DATA - CONVENTIONAL			
	700/800 MHz	UHF: 380-435 MHz UHF: 435-524 MHz	VHF: 136-174 MHz
Frequency Range	792-825 MHz	380-435 MHz, 435-524 MHz	136-174 MHz
Analog Sensitivity 12 dB SINAD	12.5 kHz: -118 dBm 25 kHz: -117 dBm	12.5 kHz: -118 dBm 25 kHz: -117 dBm	12.5/15 kHz: -119 dBm 25/30 kHz: -118 dBm
Digital Sensitivity 5% Bit Error Rate Static (BER)			
C4FM	-118 dBm	-118 dBm	-119 dBm
H-CPM	-116 dBm	-116 dBm	-117 dBm
Intermodulation Rejection	85 dB	85 dB	85 dB
Digital Adjacent Channel Rejection	60 dB	60 dB	60 dB
Analog Adjacent Channel Rejection (EIA603)			
Analog 12.5 kHz	75 dB	75 dB	75 dB
Analog 25 kHz			
Analog Adjacent Channel Rejection (TIA603D)			
Analog 12.5 kHz	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)
Analog 25 kHz	80 dB	80 dB	80 dB
Spurious and Image Response Rejection	85 dB 100 dB*	85 dB 100 dB*	90 dB 95 dB*
Analog Audio Response	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)
Analog FM Hum and Noise			
Analog 12.5 kHz	45 dB	45 dB	45 dB
Analog 25 kHz	50 dB	50 dB	50 dB
Intermediate Frequency	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 44.85 MHz 2nd: 2.16 MHz

\* Optional Preselector

Specifications subject to change without notice.

# GTR 8000 SITE SUBSYSTEM (T7133A)

## GENERAL PERFORMANCE

<b>HPD</b>	
<b>700/800 MHz</b>	
Number of Channels	1
Height	27 RU, 50.4 in (128 cm)
Footprint (W x D)	20.9 x 25.4 in (53 x 64.5 cm)
Weight	225 lbs (102 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption (fully configured)	AC: 615 W DC: 495 W
Antenna Connectors TX	N Female
Antenna Connectors RX	N Female
Channel Spacing	25 kHz
Modulation	TX: 64QAM, 16QAM, QPSK RX: 64QAM, 16QAM, QPSK
Frequency Stability	GPS synchronized

## TRANSMITTER INCLUDING RFDS

<b>HPD</b>	
<b>700/800 MHz</b>	
Frequency Range	764-776, 851-870 MHz
Average Power output per channel	1-27 W
Electronic Bandwidth	Full Bandwidth
Error Vector Magnitude	10%
Spurious and Harmonic Emissions Attenuation	90 dB
Emissions Designators	17K7D7D

## RECEIVER INCLUDING RFDS

<b>HPD</b>	
<b>700/800 MHz</b>	
Frequency Range	792-825 MHz
Sensitivity 1% Bit Error Rate Static (BER)	
64 QAM	-101 dBm
16 QAM	-108 dBm
QPSK	-115 dBm
Intermodulation Rejection	75 dB*
Adjacent Channel Rejection	50 dB*
Spurious and Image Response Rejection	90 dB*
Intermediate Frequency	
1st	73.35 MHz
2nd	2.16 MHz
Preselector Bandwidth	792-825 MHz

\* Reference signal is QPSK.  
Specifications subject to change without notice.

## FCC TYPE ACCEPTANCE

### FCC DESIGNATION

Frequency Range	Type	Power Output	Type Acceptance Number
136-174 MHz	Transmitter	2-100 W	ABZ89FC3790B, ABZ89FC3799B
136-174 MHz	Receiver	N/A	ABZ89FR3791B
406-435 MHz	Transmitter	2-110 W	ABZ89FC4821B
406-435 MHz	Receiver	N/A	ABZ89FR4822B
435-512 MHz	Transmitter	2-110 W	ABZ89FC4819B
435-512 MHz	Receiver	N/A	ABZ89FR4820B
764-776 MHz	Transmitter	2-100 W 2-50 W (HPD)	ABZ89FC5812B
851-870 MHz	Transmitter	2-100 W 2-50 W (HPD)	ABZ89FC5810B
792-825 MHz	Receiver	N/A	ABZ89FR5811B
935-941 MHz	Transmitter	2-120 W	ABZ89FC5823B
896-902 MHz	Receiver	N/A	ABZ89FR5824B
851-870 MHz	Transmitter	15-150W	ABZ89FC5825B

## EU REGULATORY COMPLIANCE

CE mark is available on the GTR 8000 Base Radio (T7039A) and GPW 8000 Receiver (T7540A) in the following frequency ranges: UHF 380-525 MHz and VHF 136-174 MHz. Specifications subject to change without notice.



**MOTOROLA SOLUTIONS**

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# MCC 7500E IP DISPATCH CONSOLE

## THE CONTINUAL PURSUIT FOR OPERATIONAL EFFICIENCY

Better manage the flow of critical information and be the pipeline of intelligence to those who need it most with the MCC 7500E IP Dispatch Console. The ultra small form factor makes deployment simple and easy across dispatch centers where space is at a premium. Additionally, the MCC 7500E offers dual Ethernet connections minimizing the risk of a lost connection.

### TAKE IT WITH YOU

The MCC 7500E IP Dispatch Console provides a full console interface experience anywhere inside or outside of your radio network. It can operate as a permanent, back up or mobile solution, with full console functionality. Whether for a planned event or immediate emergency response, command a wealth of information for high-impact results. Connect to responders with voice, Talkgroup Text Message and tone communication on ASTRO® 25 trunked and conventional systems.

#### NEW SMALL FORM FACTOR

CONTINUAL REDUCTION IN PHYSICAL SPACE REQUIREMENTS FOR THE HARDWARE

REDUNDANCY IN ETHERNET CONNECTIONS HELPING TO ENSURE HIGH AVAILABILITY OF THE SYSTEM

### DISPATCH APPLICATION ECOSYSTEM

The ability to integrate Motorola Solutions and other third party dispatch applications with the MCC 7500E console API creates a dispatch environment that helps you meet the needs of your first responders.

#### Motorola Solutions Certified Logging Recorders

The Motorola Solutions certified NICE and Verint Logging Recorders provide seamless dedicated recording for the MCC 7500E console to improve productivity and offer post incident insights to your operations. They are the only recording solutions that meet all of the extensive Motorola Solutions performance specifications required to be implemented on the ASTRO 25 IP network.

#### PremierOne™ Computer Aided Dispatch

PremierOne CAD integrates with the MCC 7500E console to streamline workflows, minimize key strokes and reduce input error for more dispatch efficiency. Your personnel can operate within a single interface and from one mouse and keyboard to receive 9-1-1 calls, manage an incident response and communicate critical information to responders in the field.



### Advanced Messaging Solution

The Advanced Messaging Solution builds upon the Talkgroup Text Messaging capability of the MCC 7500E IP Dispatch Console, further enhancing responder decision-making abilities by facilitating two-way texting between dispatch and users in the field. When voice communication is not an option, Advanced Messaging Solution provides responders with critical information, right at their fingertips, on portable radios or broadband devices.

### APX Personnel Accountability

Streamline on-scene roll calls and gain the confidence to make critical decisions with an easy to use single screen view showing the status of all on-scene personnel. Rapidly execute evacuation orders to quickly alert your team to changing situations and see that everyone acknowledges.

### EASE OF USE MAKES FOR MORE EFFECTIVE SUPPORT

First responders don't know or care where your dispatchers are. Yet, they need the same high level of responsiveness in each and every emergency. The MCC 7500E leverages a graphical user interface (GUI) that has been continuously improved upon based on user feedback for over 10 years. Examples of enhancements range from various color choices for resource backgrounds, buttons, or on screen text to fully customizable sizes of resources. The continual pursuit of operational efficiency enables your dispatchers to quickly adapt to a new system with a short learning curve and minimal training allowing them to feel right at home.

The customizable GUI design helps your dispatchers become more efficient and productive using purpose-designed workflows with minimal click-throughs, critical resource information displays and contextual right-click menus. It is also beneficial for switching seamlessly between the MCC 7500E, MCC 7500 and MCC 7100 IP Dispatch Consoles. enabling dispatchers to provide the same level

of service every time, with no additional training. Extra features are designed specifically to enable a smooth transition. The Enhanced Integrated Instant Recall Recorder helps maintain typical dispatch operation without extra equipment or installations. It can provide your dispatchers with access to the audio and associated call information across all call on their dispatch consoles. With flexible configuration options the Enhanced Integrated Instant Recall Recorder can be easily customized to meet the needs of individual dispatchers. The optional Audio Interface Module (AIM) facilitates use of purpose-built dispatch accessories if desired in place of commercial off-the-shelf USB accessories. With the MCC 7500E, you'll maximize your effectiveness in coordinating and informing first responders, from anywhere.

### THE INTELLIGENCE YOU NEED, EVERY TIME, ALL THE TIME

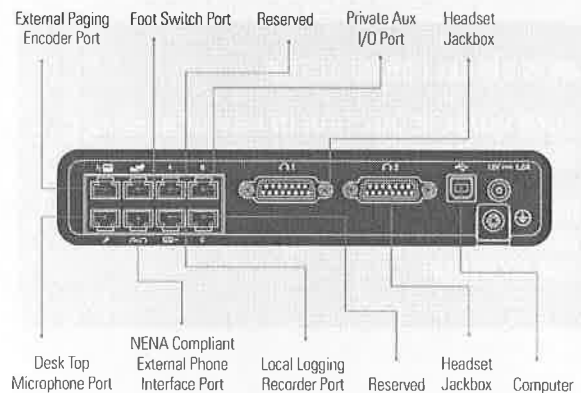
First responders rely heavily on dispatch for support. They need to be confident that your team can always offer the right information and coordination when an emergency arises. The inherent reliability and security of the ASTRO 25 system ensures first responders and dispatchers stay connected with best-in-class audio quality. Redundant Ethernet connections provide dispatchers with continued access to their dispatch consoles even during failures in the IP network LAN switches. For peace of mind that the right information always gets through, rely on the MCC 7500E IP Dispatch Console's smart voice prioritization and intelligent audio routing capabilities at your dispatch positions. Furthermore, continuous link and resource polling gives your dispatchers the confidence that once connected they stay connected.

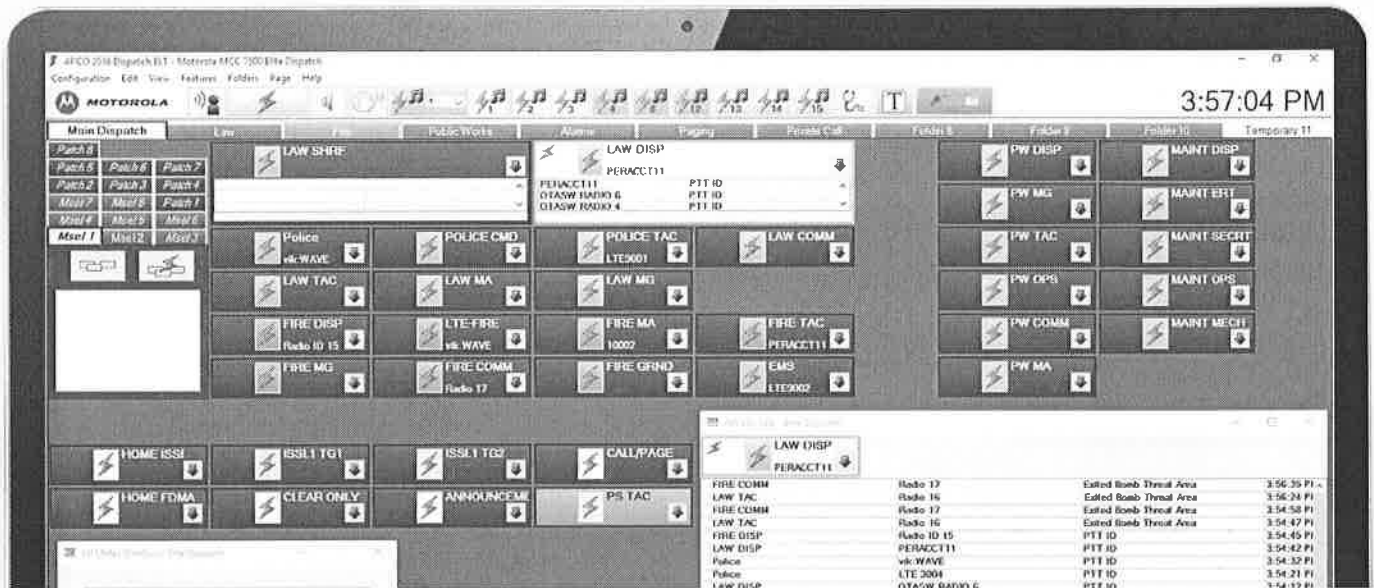
### SCALE UP YOUR SYSTEM NOT YOUR COST

If your public safety agency is like most others, money is tight for you right now.



Enhanced Integrated Instant Recall Recorder





Tailor the MCC 7500E IP Dispatch Console to your needs with the customizable user interface

The MCC 7500E console is a cost effective, completely software-based solution. Flexible deployment options reduce physical space requirements and system management does not require specialized hardware knowledge. New functionality and expanded capacity arrive via software updates – upgradeable from a centralized, single point of contact. This cuts down on the time, expense and inconvenience of growing or managing your system.

Scale to the needs of your organization now and into the future with licensed capacity of 15, 30, 45, 60, 100, or 160 Radio Resources. Deploy the MCC 7500E console incrementally with interoperation with the MCC 7500, for even more installation flexibility.

## SOLUTION COMPONENTS

### MCC 7500E Console Positions

The MCC 7500E console connects directly to the radio system's IP transport network without gateways or interface boxes. Vocoding and encryption are performed within each software-based operator position. MCC 7500E consoles functions as an integrated component of the total radio system without additional centralized electronics.

The MCC 7500E console position can be comprised of a desktop workstation with just a headset, or operate with a small formfactor computer and monitor with a keyboard, mouse/trackball/touchscreen, up to 8 assignable speakers, and a range of audio accessories. The MCC 7500E is designed for the workspace of the future. At 2.3 inches tall, the HP Z2 Mini is perfectly suited for dispatch operations where space is limited.

### Audio Accessories

Both Mission-Critical Audio Accessories are available including goose neck microphone, foot-switch and headset jack-box. Additionally, commercially available USB connected accessories can be used if desired.

## Compatibility

For dispatch users who need to conduct dispatching activities and other tasks on a single computer, the following applications are supported for such installation:

- K Core Configuration Manager
- ASTRO 25 Advanced Messaging Solution
- MKM 7000 Console Alias Manager Server
- MKM 7000 Console Alias Manager Client
- PRX 7000 Console Proxy Server
- Voting Control and Display Client
- Personnel Accountability Client
- PremierOne Text Messaging Client.

## Radio Resource Capacity Licenses

Radio Resource Capacity Licenses are available for 15, 30, 45, 60, 100, or 160 radio resources.

Capacity licenses are issued for the life of the product and continue in force when the system is upgraded.

## Remote Operation

Full dispatch capability is provided when operating outside of the ASTRO 25 Network. The MCC 7500E console supports firewall controlled access for up to 160 channels into the secure ASTRO 25 network from the Customer Enterprise Network (CEN). For remote access with additional security, virtual private network (VPN) access is also supported through the CEN.

## SPECIFICATIONS

System Compatibility	ASTRO® 25 System
Vocoder Algorithms Supported	AMBE, (IMBE is compatible with AMBE), G.728 (for Analog Conventional), G.711 (Telephony)
Encryption Algorithms Supported	AES (256 bit), DES-OFB, ADP (Advanced Digital Privacy)

### MCC 7500E IP DISPATCH CONSOLE CAPACITIES

Assignable Radio Resource Capacities	15, 30, 45, 60, 100, 160
Simultaneous Audio Sessions per Console	60
Bandwidth Requirement per Channel	35 kbps
Simultaneous Encryption/ Decryption Sessions per Secure Capable Console	60
Multi-Select Groups per Dispatch Console	Up to 16 (with up to 20 Members per Multi-Select group)
Patch Groups per Dispatch Console	Up to 16 (with 20 members per patch group)

## USB AUDIO INTERFACE MODULE SPECIFICATIONS

Before you mount and install the USB Audio Interface device (AIM), verify that you meet the environmental requirements necessary for the device to operate.

	Connector type	Device
Audio Interface Module (AIM)	RJ45	One desktop gooseneck microphone, one local logging recorder, one external telephone headset, one external paging encoder, one footswitch, and support for four private Aux I/O's.
	DB15	Two headset jacks connectors.
Dimensions (H x D x W)	1.69 x 5.23 x 8.39 in (43 x 133 x 213 mm)	
Weight	1.43 lbs (0.65 kg)	
AC Operating Voltage for the USB AIM Power Supply	90 VAC - 264 VAC	
Minimum Input Voltage	90 VAC with 57-63 Hz	
Maximum Input Voltage	264 VAC with 47-53 Hz	
Typical Input Voltages	115 VAC and 230 VAC	
DC Operating Voltage for the USB AIM Device	12 VDC (nominal)	
Maximum Power Consumption	0.5 A at 12 VDC (6 Watt)	
Operating Temperature	5°C (41°F) – 40°C (104°F)	
Storage Temperature	-25°C (-13°F) – 70°C (158°F)	
Relative Humidity Operating	0% – 90% relative humidity at 40°C non-condensing	
Certifications	CE CMM EPUF 50 EAC Safety CSA 60950-1-07 2011-12 UL 60950-1 2011 IEC 60950-1 2005	EMC Emissions & Immunity FCC part15B Class B ICES-003 EN 60950 - 1 : 2006 + A11 : 2009 + A1 : 2010 + A12: 2011 EN55022 :2010 EN55024 :2010 EN 61000-3-2:2006 +A1:2009 +A2:2009 EN 61000-3-3:2008 Energy Efficiency International Energy Efficiency Level V (AIM power supply only)



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**POWERFUL AND FLEXIBLE VOIP COMMUNICATIONS**

# MCD 5000 DESKSET SYSTEM

Expand your communications with VoIP technology. Scalable from small operations to complex control centers and geographically disbursed operations, you can depend on the new modular MCD 5000 Deskset System with VoIP technology for your conventional and trunked communications. Whether used in dispatch environments, back-up sites, special events or call monitoring, you can easily expand communication capabilities throughout your organization using your IP network. This easy-to-deploy solution enables communications across your network

when and where you need it most, increasing safety, awareness and coordination.

## **MCD 5000 DESKSET**

A flexible desktop console, the MCD 5000 Deskset provides digital control for a variety of Motorola two-way radios, and can connect directly to a radio or over an IP network using the MCD 5000 Radio Gateway Unit (RGU).

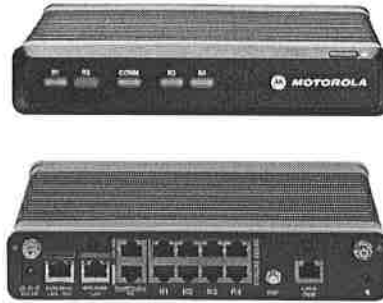
The MCD 5000 Deskset digital control link emulates the buttons and display of the connected radio and performs all the functions of the radio control head.

And with a large and easy-to-read color LCD screen, intuitive layout and an adjustable viewing angle, the MCD 5000 Deskset is ergonomically designed for both occasional and constant everyday use.

**PRODUCT SPEC SHEET**  
MCD 5000 DESKSET SYSTEM

**MCD 5000 RADIO GATEWAY UNIT**

Connect the MCD 5000 Deskset to radios over your IP network using the MCD 5000 RGU. The MCD 5000 Deskset allows users to dynamically switch between MCD 5000 RGUs, giving access to additional radios across the network and expanding communications. Each MCD 5000 RGU can connect up to four radios, and each MCD 5000 Deskset can connect to one radio at a time.



The MCD 5000 RGU connects radios to the MCD 5000 Deskset over your IP network

**DESKSET AUDIO ACCESSORIES**

With flexible communication options, you can use the handset, Push-To-Talk (PTT) switch and built-in condenser microphone, or add the optional headset, footswitch and desk microphone accessories for user convenience.

**IP NETWORK**

Take full advantage of VoIP technology and deploy the MCD 5000 Deskset when and where you need it on your IP network.

**CONFIGURATION AND REPORTING TOOLS**

Our configuration tool offers the convenience of remote use from anywhere on the network or local use with an Ethernet connection. And you can provide timely support and save travel time when you remotely access your system to configure the MCD 5000 Deskset and MCD 5000 RGU. You can also remotely run reports and perform queries for information you need to make real-time decisions. Additional supervisor reporting tools allow monitoring of each MCD 5000 Deskset System devices (MCD 5000 Deskset/MCD 5000 RGU) to enhance training and operational efficiencies.

**OPERATIONS MANAGEMENT CENTER (OMC) SERVER**

An optional main management server for the MCD 5000 Deskset System, the Operations Management Center (OMC) enables system operation, maintenance, provisioning, and control for larger installations, as well as for customers with information assurance (IA) needs.

This central repository stores registration for all system users, MCD 5000 Desksets and radio resources, along with system-wide information including alarms, logs and audits. The OMC server runs on the Red Hat® LINUX® operating system.

Providing user-level interface to the OMC, the Administrator Control Panel Client (ACP) PC allows local and remote administration access for system management activities. The ACP runs on Microsoft Windows 10 (64-bit) and is required for systems with an OMC..

**PRODUCT SPEC SHEET**  
MCD 5000 DESKSET SYSTEM

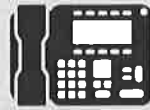
**EXAMPLE MCD 5000 DESKSET SYSTEM SHOWING 3 OPERATOR POSITIONS CONTROLLING UP TO 8 RADIOS**

The MCD 5000 Deskset system allows multiple desksets to dynamically switch to different MCD 5000 RGUs, giving you access to additional radios for expanded communications. Each MCD 5000 Deskset can connect to one radio at a time.

EACH DESKSET CAN SELECT ANY ONE OF THE 8 RADIOS BELOW



MCD 5000 DESKSET



MCD 5000 DESKSET



MCD 5000 DESKSET

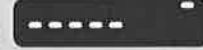
IP NETWORK  
WAN / LAN

MCD 5000 RGU

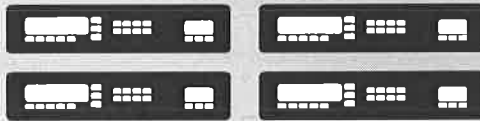


EACH MCD 5000 RGU  
SUPPORTS UP TO 4 RADIOS

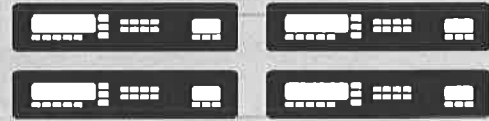
MCD 5000 RGU



TWO-WAY RADIO DEVICES



TWO-WAY RADIO DEVICES



CONVENTIONAL/TRUNKING/DIGITAL/ANALOG



**TWO-WAY RADIO DEVICES**

The MCD 5000 Deskset lets you control a wide variety of digital radios:

**APX™ 7500 Multiband Console**

**ASTRO® Console (W9):**

- ASTRO® Spectra™
- ASTRO® Spectra Plus™
- ASTRO® XTL™ 5000

**CDM Series Radios:**

- CDM 1550™
- CDM 1550 LS™
- CDM 1550 LS+™

**Dimetra TETRA Mobile Radios:**

- MTM5400
- MTM800E

**MCS 2000™ Model III Control Station**

**TRC Radios/Base-Station/Adaptors**

**4-Wire E&M Radios**

**MOTOTRBO XPR5550e**

**PRODUCT SPEC SHEET**  
MCD 5000 DESKSET

**SPECIFICATIONS**

**MCD 5000 DESKSET**

Dimensions	Height: 4.17 in (106 mm) Width: 10.35 in (263 mm) Depth: 8.27 in (210 mm) Weight: 3.97 lbs (1.8 kg)
Environmental	Operating temperature: 0 °C to 50 °C (32 °F to 122 °F) Storage temperature: -40 °C to 80 °C (-40 °F to 176 °F) Humidity: 5% to 95% @ +50° C (122° F), Non-Condensing
Power	Input power: +10.8 to +13.2VDC, (+12 V nominal) Dissipation: 12.5W Max. 37VDC to 57VDC. Powered via POE-PD; meeting 802.3af Standard for Powered Deskssets class 0
Audio	The end-to-end distortion is no more than 3% THD The generated audio is no more than -50 dBm of Hum and Noise below the rate audio output The crosstalk between any audio signals is no more than -65 dBm at 0 dBm transmit audio power
Supported Radio Protocols	RS-232 TTL using RJ-45 connector, SB9600, IP, 4W-E&M, TRC
Regulatory-EMC	FCC part 15 class A
Safety	EN60950-1
Green Product	RoHS, WEEE Mark
Certified Standard Compliance Requirements	CE Mark, FCC part 15 A Mark, UL Mark (for P.S. only) US federal government Environmentally Preferable Specification (EPP) Program
Non-certified Standard Compliance Requirements	CSA, UL, MOTOROLA W18 certification, CMM
Vocoders	G.711 and G.729

**MCD 5000 DESKSET SYSTEM CAPACITIES**

Maximum Number of Radio Resources	512
Maximum Number of MCD 5000 Radio Gateway Units (RGUs)	128
Maximum Number of Radios per MCD 5000 Radio Gateway Unit (RGU)	4
Maximum Number of MCD 5000 Desksets	100
Maximum Number of Groups per MCD 5000 Deskset	20
Maximum Number of Users per MCD 5000 Deskset	8 (Non-OMC System) 1,000 (OMC System)

**MCD 5000 RADIO GATEWAY UNIT**

Dimensions	Height: 1.65 in (42 mm) Width: 8.58 in (218 mm) Depth: 10.39 in (264 mm) Weight: 5.73 lbs (2.6 kg)
Environmental	Operating temperature: -30 °C to 60 °C (-22 °F to 140 °F) Storage temperature: -40 °C to 80 °C (-40 °F to 176 °F) Humidity: 5% to 95% @ +50° C (122° F), Non-Condensing
Power	Input power:+10.8 to +14VDC, (+12 V nominal) Dissipation: 9W Max. 37VDC to 57VDC. Powered via POE-PD; meeting 802.3af Standard for Powered Deskssets class 0
Audio	The end-to-end distortion is no more than 3% THD The generated audio is no more than -50 dBm of Hum and Noise below the rate audio output The crosstalk between any audio signals is no more than -65 dBm at 0 dBm transmit audio power
Supported Radio Protocols	RS-232 TTL, SB9600, IP, 4W-E&M, TRC, XCMP
Regulatory-EMC	FCC part 15 class A
Safety	EN60950-1
Green Product	RoHS, WEEE Mark
Certified Standard Compliance Requirements	CE Mark, FCC part 15 A Mark, UL Mark (for P.S. only) US federal government Environmentally Preferable Specification (EPP) Program
Non-certified Standard Compliance Requirements	CSA, UL, MOTOROLA W18 certification, CMM
Vocoders	G.711 and G.729

To learn more about how the MCD 5000 Deskset System can help you implement powerful and flexible VoIP communications on your network, contact your Motorola representative or visit [motorolasolutions.com/dispatch](http://motorolasolutions.com/dispatch).

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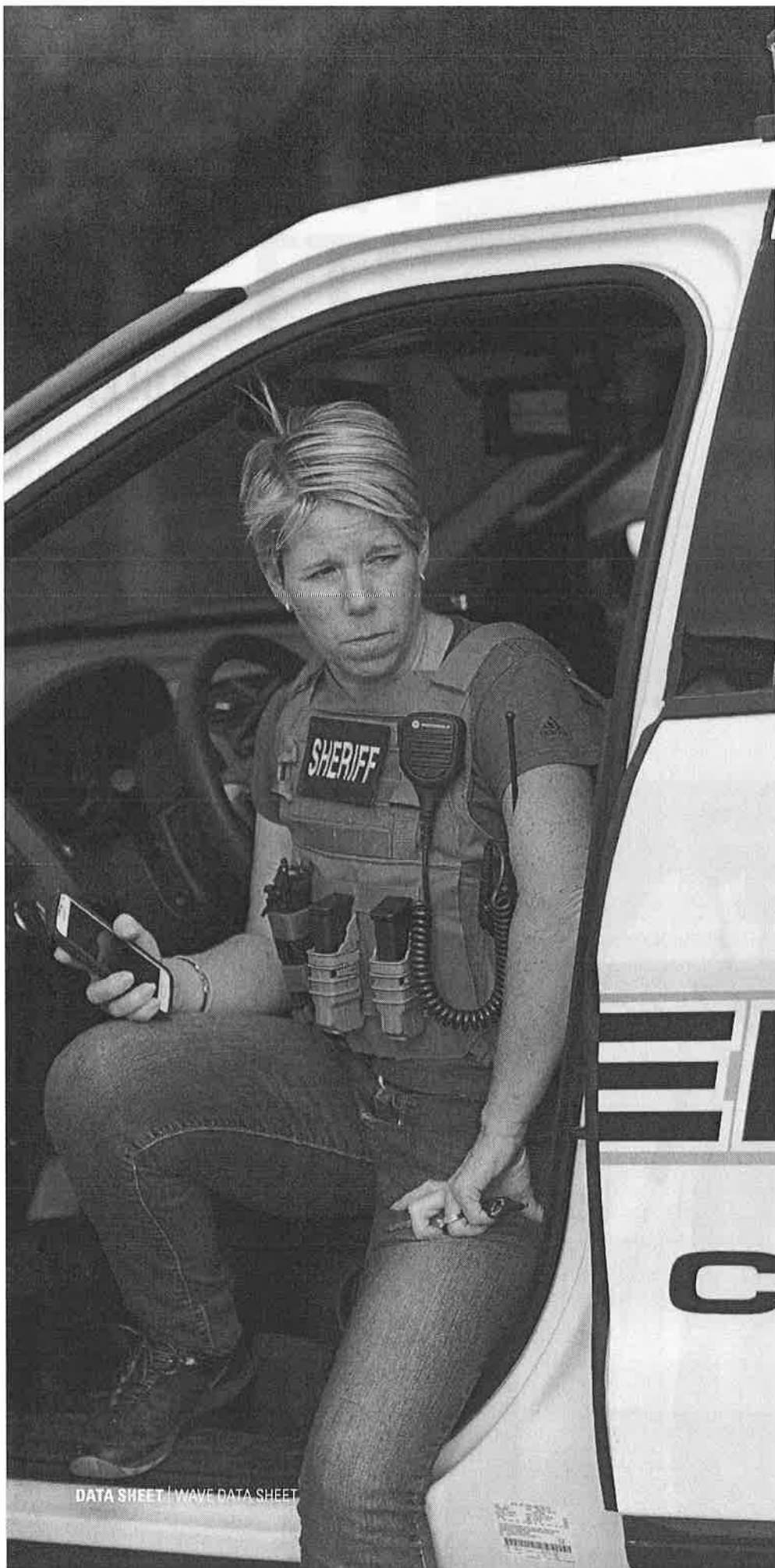
# WAVE™ PTT

**INTEROPERABLE,  
SECURE GROUP  
COMMUNICATION**



**MOTOROLA**  
SOLUTIONS





DATA SHEET | WAVE DATA SHEET

WAVE enables interoperable push-to-talk (PTT) communication across broadband and radio networks and devices so that critical, time-sensitive information flows quickly and securely between mobile workers and teams.

Whether on a smartphone, radio, computer or landline, your personnel can connect instantly and securely with WAVE.

## USE RIGHT DEVICE FOR THE JOB

Perhaps you're an executive traveling for a conference but you want to stay connected to your radio system.

Or, you use your radio for operational purposes and do not need to carry a ruggedized radio with you all of the time. Maybe you're a government agent working undercover. Your smartphone and ear buds would be ideal to connect to other tactical units while keeping you inconspicuous. For every police officer on the beat, agent on a job or worker on shift, there are many other personnel that can provide support, often life-saving assistance, with PTT communications using smartphones, tablets or PCs from any location. WAVE makes it possible.

## BRIDGE TWO-WAY RADIO WITH BROADBAND NETWORKS

With WAVE you can experience functionality that lets you build and operate secure, highly-scalable solutions for today's most demanding communications environments:

### Connect Radio to Radio

Connect multiple, disparate two-way radio systems and remove barriers to communication interoperability and workforce collaboration.

### Extend Radio To Broadband

Extend workforce communications beyond radio to include smart devices and broadband networks for seamless communications in any location.

### Embrace Broadband

Secure, 'over-the-top' PTT connecting smart devices over 3G, 4G LTE and Wi-Fi networks delivers greater choice and flexibility when choosing a non-radio, carrier-independent communications solution.

## WAVE CLIENT APPLICATIONS

Whatever the device or available network, WAVE has client applications that meet the needs of all types of users.

### MOBILE COMMUNICATOR



#### TURN YOUR MOBILE PHONE INTO A MULTI-CHANNEL PTT HANDSET

Not everyone needs or wants to carry a radio handset. But they do want instant, secure access to important, often mission-critical communications wherever they are located.

With a WAVE Mobile Communicator installed on a smartphone, tablet or custom handheld, any user can access PTT communications and collaborate with groups or other users as required. Mapping, presence and channel activity monitoring improve situational awareness for everyone.

Install WAVE Mobile Communicator on Android or iOS mobile phones and augment with remote speaker microphones and other accessories to create a radio-like user experience.

### WEB COMMUNICATOR



#### USE A WEB BROWSER TO ACCESS YOUR WAVE COMMUNICATIONS CHANNELS

You're a computer-based worker who would like to stay connected to your team from anywhere. WAVE Web Communicator provides device agnostic communications from your web browser.

Simply log in for instant access to your groups and contacts and start communicating via PTT or text. See communication history and the location of other team members.

### DESKTOP COMMUNICATOR

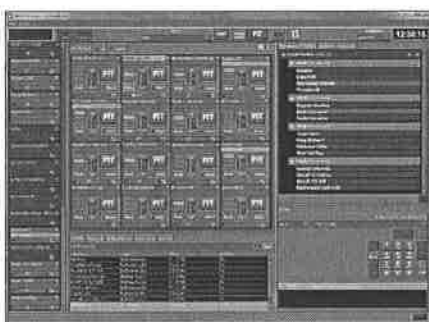


#### ACCESS PTT COMMUNICATIONS FROM YOUR DESKTOP PC

You're not a mobile worker in the field responding to events and service calls, but you're there to provide support from headquarters, a communications center or a remote location. Let's turn your desktop PC into a PTT communications hub.

WAVE Desktop Communicator is a software application that allows workers to use their desktop or laptop PC to monitor, transmit and receive audio from multiple communication systems such as two-way radio networks and telephones. With an intuitive and easy-to-use display, the Desktop Communicator runs on virtually any PC, from multiprocessor desktop machines to netbooks.

### ADVANCED DESKTOP COMMUNICATOR



#### FEATURE RICH COMMUNICATION CONSOLE

Designed for small to mid-sized organizations, the WAVE Advanced Desktop Communicator is an enterprise-grade communication console.

Advanced Desktop Communicator gives operators the ability to display and manage hundreds of communications channels that make up a complex and fluid communications environment. Multiple radio channels, telephone calls and other communications systems can be quickly patched together. Activity displays, audio recording and instant replay provides a complete session history for archiving and audit trail purposes.



## **WAVE SECURITY**

Multiple layers of security ensure your communication is heard only by those intended.

### **Broadband to Radio Encryption**

Because your voice and data communications are encrypted on both broadband and radio networks, you can be assured that it is only heard by those intended.

### **Standards-Based TLS 1.2 Support**

Transport Layer Security protects the privacy and data integrity of communication between the WAVE server and mobile client application. This is particularly important when operating on public broadband networks not completely in your control.

### **Device Authorization**

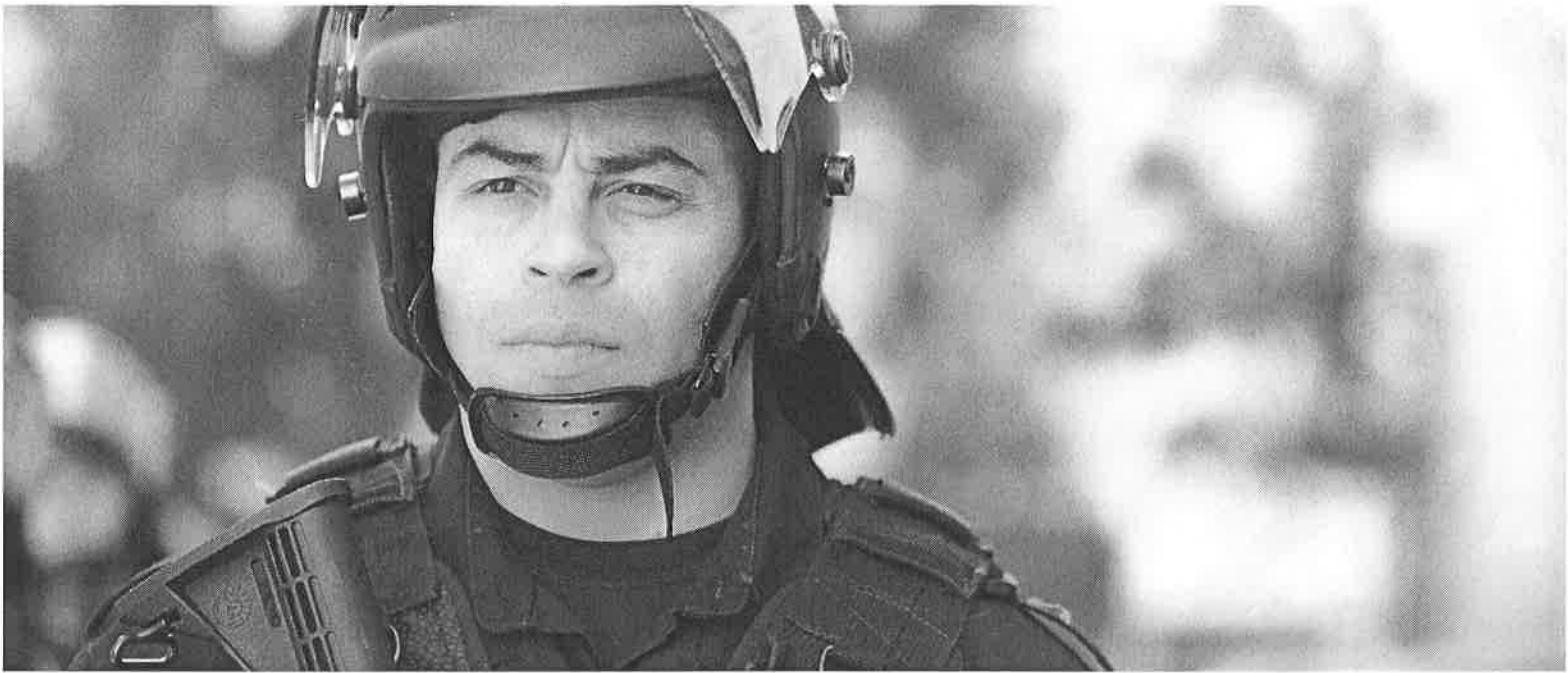
A unique identifier per device prevents unauthorized devices from accessing the system, even if account credentials are stolen. Only those with authorized devices and login credentials are able to gain access to your communications.

## **WAVE REDUNDANCY**

WAVE can be configured for either geographic or local redundancy of all WAVE core components. Upon failure or disconnection, the backup component will automatically take over to maintain broadband PTT service.

## **WIRELINE RADIO INTEGRATION**

Eliminate the donor radio for each interoperable talkgroup with a direct IP wireline interface. With wireline integration, talkgroups can be added or removed through software configuration, which translates to less hardware and maintenance costs. What's more, wireline interfaces can pass unit ID and other information not possible with donor radio configurations.



# WAVE FOR ASTRO 25

If you're one of the over two million users that rely on a Motorola Solutions P25 radio for daily communications as well as emergency response in the most demanding situations, you value the importance of staying connected with fellow first responders and supporting teams when it matters most.

And like the majority of your industry peers, you will have noted the wide availability of broadband data networks and smart mobile devices. You are asking how they can be used to improve public safety communications for everyone.

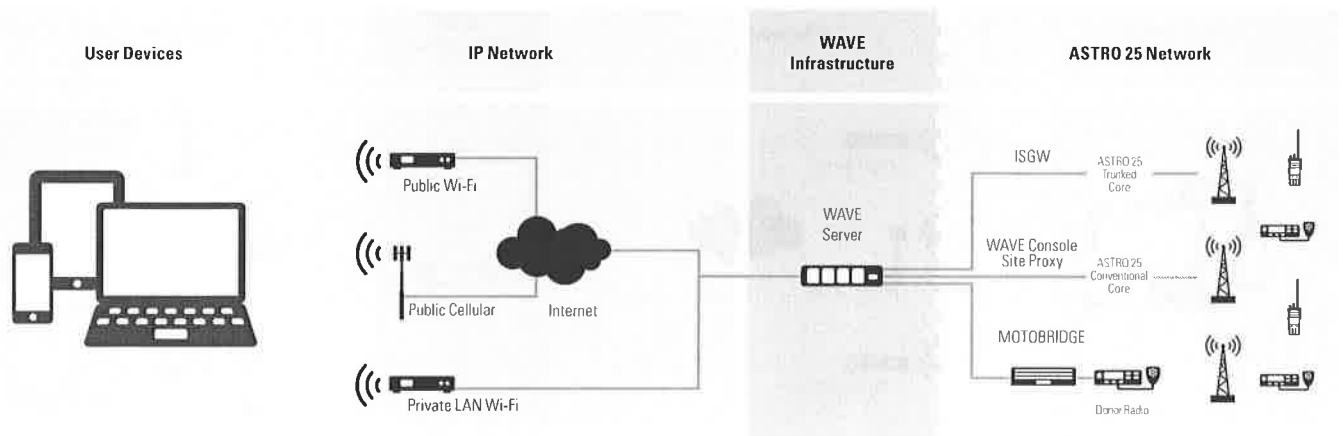
The answer lies with WAVE and its ability to add another performance-driven layer of capability to ASTRO® 25 systems by securely extending PTT communications to non-radio users over broadband networks, from any location.

WAVE redundancy for ASTRO 25 High Availability and DSR configurations means your broadband PTT interoperability service continues to perform in the event of an ASTRO 25 core switch.

## ASTRO 25 ENCRYPTED INTEROPERABILITY WITH WAVE

WAVE supports ASTRO 25 encrypted talkgroups and encrypted conventional channels with encryption keys securely stored in the WAVE CRYPTR device. With WAVE encrypted talkgroups, your mission-critical PTT communications stay secure from the radio core to the broadband edge.

## WAVE INTERFACES INTO ASTRO 25





# WAVE FOR DIMETRA

Motorola Solutions DIMETRA™ solution offers secure, reliable and efficient communications customized to meet the needs of different markets. With a large installed base and multiple vendor support, we offer a wide choice of products and applications so organizations can select exactly the right solution for their needs.

WAVE continues this system flexibility by enabling secure and scalable extension

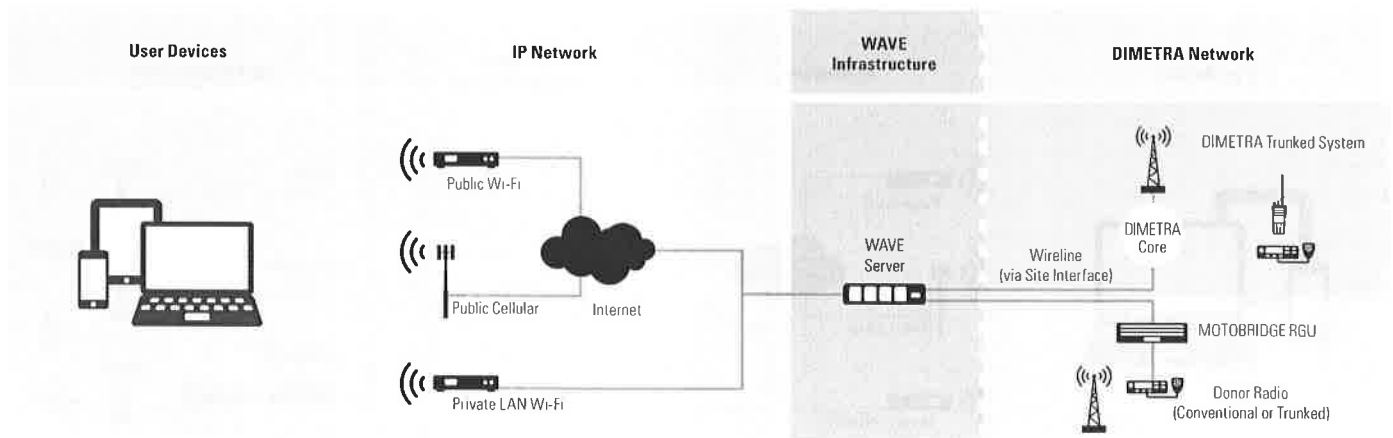
of DIMETRA networks to fixed and mobile broadband users and devices, enhancing team collaboration and effectiveness.

WAVE includes a wireline interface to DIMETRA networks, enabling greater system scalability and performance. WAVE's wireline interface supports up to 39 simultaneous DIMETRA to WAVE calls and the ability to provision up to 300 different DIMETRA talkgroups to interoperate with WAVE.

## DIMETRA ENCRYPTED TALKGROUP INTEROPERABILITY WITH WAVE

WAVE supports DIMETRA encrypted talkgroups to WAVE using a DIMETRA site interface wireline solution with the DIMETRA encryption keys securely stored in the WAVE CRYPTX device. With WAVE encrypted talkgroups, your mission-critical PTT communications stay secure from the radio core to the broadband edge.

## WAVE INTERFACE INTO DIMETRA

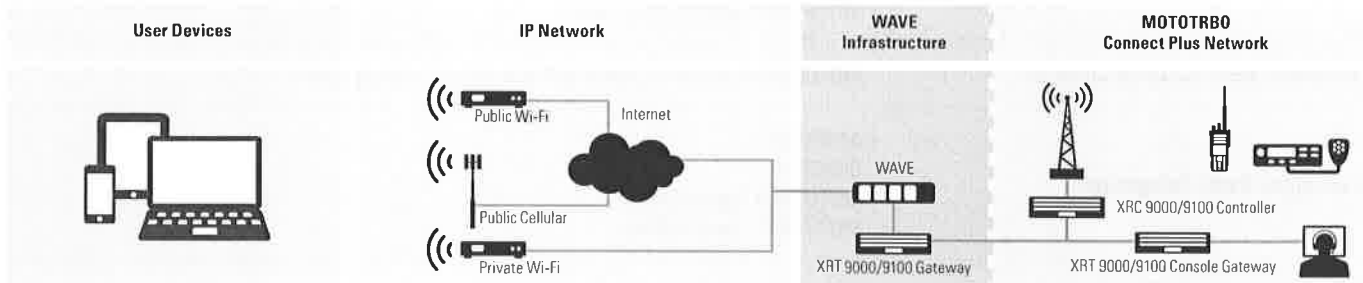


# WAVE FOR MOTOTRBO

WAVE uses a wireline interface to integrate with a MOTOTRBO™ Connect Plus, Capacity Plus and Capacity Max radio systems. The WAVE Server manages all communications between MOTOTRBO systems and broadband networks and devices, and maintains user credentials and configuration information for smartphone clients.

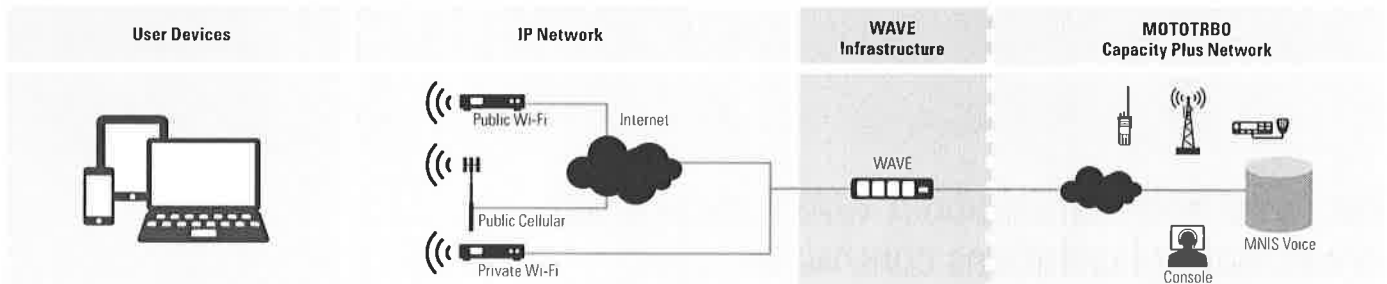
## EXTENDING A MOTOTRBO CONNECT PLUS SYSTEM

For MOTOTRBO Connect Plus systems, the WAVE Server integrates directly with an XRT 9000 or XRT 9100 Connect Plus Gateway. This interface provides an IP-based wireline connection to your Connect Plus system for a highly-scalable, reliable and secure broadband PTT integration.



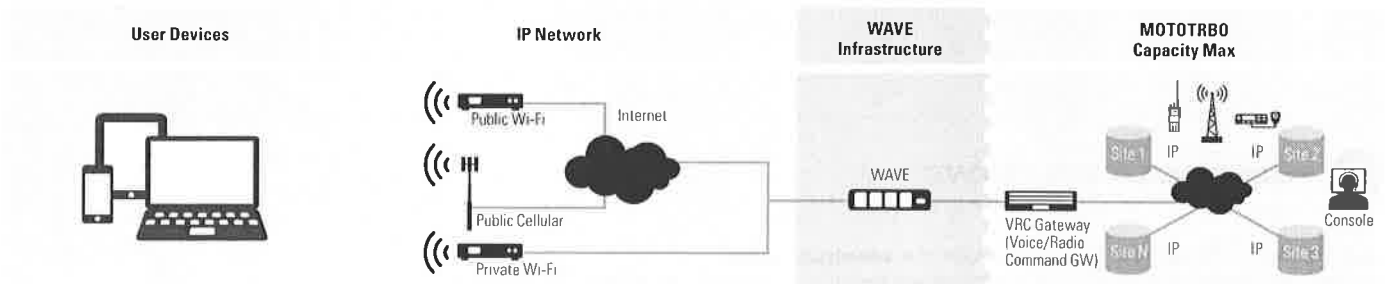
## EXTENDING A MOTOTRBO CAPACITY PLUS SYSTEM (SINGLE SITE / MULTISITE)

For MOTOTRBO Capacity Plus systems there is no requirement for an XRT gateway or donor radios as the WAVE Server integrates directly with the system using the IP-based MNIS voice interface. Repeaters that need connectivity to WAVE should have NAI voice licenses enabled.



## EXTENDING A MOTOTRBO CAPACITY MAX SYSTEM

For MOTOTRBO Capacity Max systems, the WAVE Server integrates directly using a MNIS VRC Gateway. No XRT or donor radios are needed. One VRC Gateway Talkpath license is required for each simultaneous call through to the WAVE server. These licenses are loaded on the CMSS.



## SPECIFICATIONS

<b>WAVE Clients Supported</b>	WAVE Mobile Communicator WAVE Web Communicator WAVE Desktop Communicator WAVE Advanced Desktop Communicator
<b>Wireline Radio Integration</b>	ASTRO 25 Trunked 7.13+ ASTRO 25 Digital Conventional (M Core) 7.17+ DIMETRA (DIPS/DIPC) 8.1+ DIMETRA (DIPM) R3 MOTOTRBO Connect Plus R01.05+ MOTOTRBO Capacity Plus R2.4+ MOTOTRBO Capacity Max R2.7+
<b>Wireless Donor Radio Integration</b>	MOTOBIDGE wireless interface to virtually any radio system
<b>Encrypted Radio Talkgroups</b>	ASTRO 25 DIMETRA MOTOTRBO Capacity Plus MOTOTRBO Capacity Max
<b>Provisioned WAVE Clients</b>	Up to 5000
<b>Provisioned Channels</b>	Up to 8000

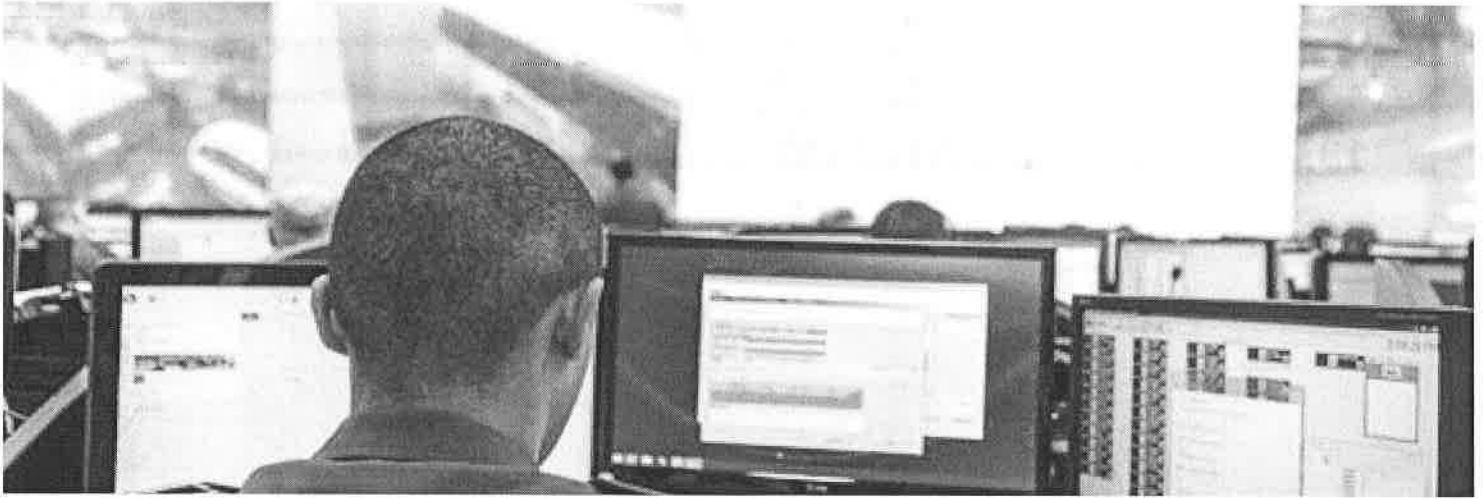
For more information about WAVE please visit  
[www.motorolasolutions.com/wave](http://www.motorolasolutions.com/wave)



Motorola Solutions, Inc. 500 West Monroe Street, Chicago, IL 60661 U.S.A. [motorolasolutions.com](http://motorolasolutions.com)

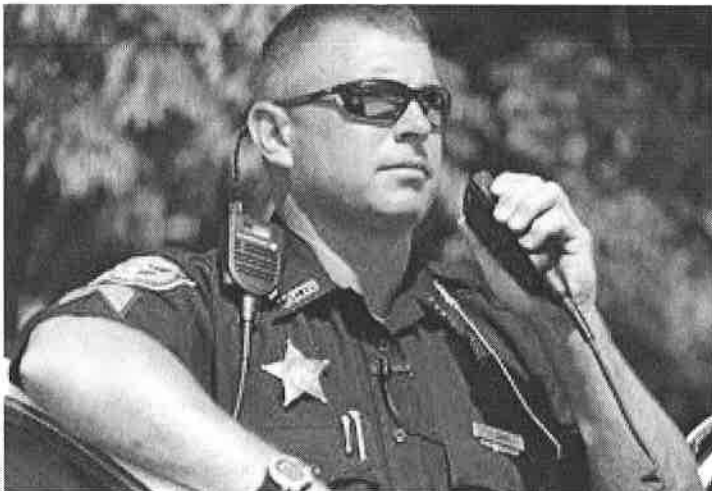
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## 13.2 TRAINING CATALOG



# 2018 PRODUCT AND SYSTEM TECHNICAL TRAINING COURSE CATALOG

MOTOROLA SOLUTIONS EDUCATION SERVICES  
NORTH AMERICA



# WELCOME

Choosing Motorola Solutions is only the beginning.

Next: Get trained on Motorola Solutions' latest innovations and improve your proficiency with our expanding training portfolio!

With versatile training solutions and best practices from our expert instructors and designers, you can increase the return on your technology investment throughout the product and system lifecycle.

Motorola Solutions Education Services provides your organization with one-stop shopping and end-to-end training support: from needs analysis and consultancy to course development, customization, delivery, and logistics.

Let us work with your team to ensure that your organization configures, operates and maintains your products and systems to effectively and efficiently meet your specific needs.

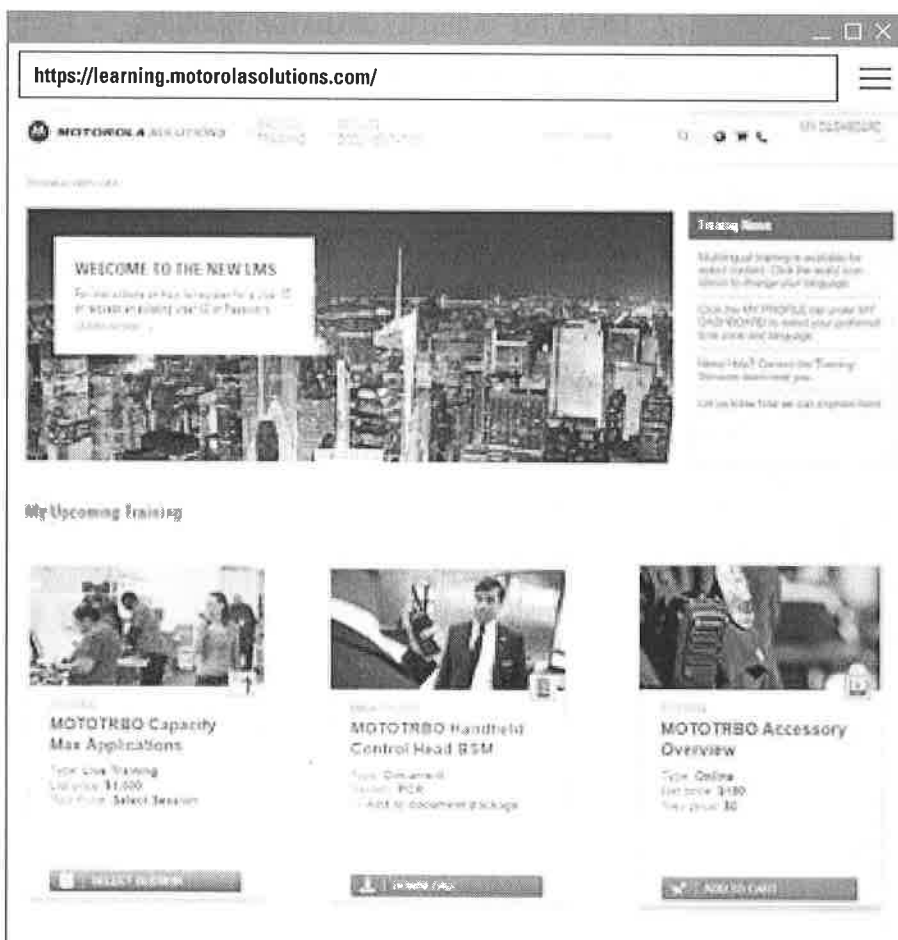
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# GENERAL INFORMATION

## A NEW INTERACTIVE LEARNING MANAGEMENT SYSTEM... DESIGNED FOR YOU!



**USE THE SEARCH BOX OR FILTERS FEATURE TO QUICKLY AND EASILY SEARCH FOR TRAINING OR DOCUMENTATION**

**VIEW YOUR HISTORY AND UPCOMING TRAINING ON YOUR PERSONALIZED DASHBOARD**

**RECEIVE REMINDER NOTIFICATIONS OF UPCOMING TRAINING OR CHANGES TO YOUR TRAINING**

**EASILY LOCATE AND DOWNLOAD DOCUMENTS**

**KEEP UP-TO-DATE WITH TRAINING NEWS AND ANNOUNCEMENTS**

## GENERAL INFORMATION

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](https://learning.motorolasolutions.com)

For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

# HOW TO REGISTER

## THE LEARNING MANAGEMENT SYSTEM (LMS)

The LMS is your valuable resource to see the latest courses, descriptions, requirements, dates and locations.

If you are a Motorola Solutions Customer who already has a Motorola Solutions Login ID, you can go to the **Enroll in a Course** section for further instructions.

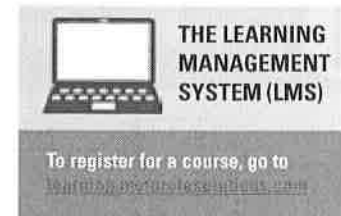


### SET UP A NEW USER ACCOUNT AND PASSWORD

#### CREATE A MOTOROLA SOLUTIONS LOGIN ID:

- Visit: <https://learning.motorolasolutions.com>
- Click **LOG IN**
- At the bottom of the dialog screen **Click Register**
- Complete the required information on the form
- Click **Submit**
- A confirmation email will be sent following your submission
- Additional instructions for activating your account will be provided by email in 1-3 business days

**LOOK FOR THIS ICON  
THROUGHOUT THE  
CATALOG FOR EASY  
ACCESS TO THE LMS**



### TO ENROLL IN A COURSE (ONCE YOU HAVE AN LMS ACCOUNT)

#### ENROLL IN A COURSE:

- Visit: <https://learning.motorolasolutions.com>
- Click on **LOG IN**
- Enter your Log In ID and Password and Click **LOG IN**
- If you have forgotten your User ID or Password, click **Forgot User ID** or **Forgot Password**
- Find a training course by clicking **Browse Training** at the top of the screen or use the **Search Catalog** feature

#### QUESTIONS ABOUT YOUR ACCOUNT OR A COURSE?

Your help desk information can be located in the top, right hand corner of the catalog pages. You can also **click here** to view the help desk contact information in your region.

## GENERAL INFORMATION

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLA.SOLUTIONS.COM](http://LEARNING.MOTOROLA.SOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (866) 247-2345, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

# TRAINING OPTIONS, POLICIES AND REQUIREMENTS

## TRAINING OPTIONS

### INSTRUCTOR-LED TRAINING


Resident training consists of regularly scheduled classes conducted at one of the Motorola Solutions Technical Training Centers. The centers are set up so students can immerse themselves in the subject matter, with limited distractions. They receive substantial time for hands on training that enables them to develop creative solutions for unique problems. Resident training includes a diverse customer base; therefore, the classroom equipment is modeled upon a standard configuration. In addition, some courses include media-based activities that are facilitated by the instructor. Advance registration is required.

### ON-SITE TRAINING AT YOUR LOCATION







All course titles can be delivered at your location, taught by our knowledgeable instructor staff. For more information on our on-site delivery options, contact your Account Manager.

### ONLINE SELF-PACED AND VIRTUAL CLASSROOM

Online Self-Paced learning allows you to gain foundational knowledge on a variety of topics using your own computer, at your own schedule. Virtual Classroom Learning offers scheduled instructor-led courses in an on-line virtual environment. Select courses from the recommendations listed in the Training Roadmaps from each product area of the catalog, or simply based upon your own personal need. Just look for courses with the Online Self-paced or Virtual Classroom icon.



### UNDERSTANDING THE ICONS

 <p><b>INSTRUCTOR-LED</b></p>	 <p><b>ONLINE, SELF-PACED</b></p>	 <p><b>OPTIONAL COURSE</b></p>
 <p><b>VIRTUAL CLASSROOM</b></p>	 <p><b>TEST</b></p>	 <p><b>NEW</b></p>

## POLICIES AND REQUIREMENTS

### CANCELLATION AND RESCHEDULING BY THE STUDENT

Customer cancellation or rescheduling made less than 30 days prior to the class start date will be subject to the full course tuition.

### CANCELLATION AND RESCHEDULING BY MOTOROLA SOLUTIONS

Motorola Solutions reserves the right to change or cancel classes up to 10 business days prior to the class start date. You will be notified at that time of such change or cancellation.

### PROFESSIONALISM

Students are expected to maintain professional conduct and dress at all times. Class dress is casual, but smart. For safety and security reasons, we cannot permit shorts, thong type sandals, or tank tops in the classroom.

### LAPTOP REQUIREMENTS

Some of our classes may require students to bring their laptops to the classroom so that they may utilize an electronic copy of the class material. Please review your enrollment confirmation email for specific requirements for your class.

### TRAINING CONTENT AND STRATEGY DISCLAIMER

All of Motorola Solutions training classes are designed to support and align with the Motorola Solutions Service strategy for each product. This strategy may include a combination of (but not limited to) processes, procedures, recommendations, and instructor experiential advice which may involve repair, replacement, and or recovery of hardware, software, or firmware of Motorola Solutions products. The repair, replacement, or recovery of these products may vary from product to product. Motorola Solutions reserves the right to change the structure and content of all courses at any time.

## GENERAL INFORMATION

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://learning.motorolasolutions.com)

For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

# PRICING AND HELPFUL INFORMATION

## FOR QUESTIONS AND ASSISTANCE

Call the Education Services help desk at:  
**800-247-2346**

Monday – Friday,  
8:00 a.m. – 5:00 p.m. Central Time

or email us at:  
[training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

## HOW TO MAKE PAYMENTS WHEN ENROLLING IN A COURSE

### HOW TO MAKE PAYMENTS WHEN REGISTERING

For your convenience we accept the following methods of payment:

- Credit Card
- Purchase Order
- Company Check
- Training Banks

If prepayment is required to secure your registration, it must be received by Motorola Solutions 30 days prior to your attendance.

Contact the help desk above for assistance with payments and P.O. specifications. All pricing listed is US dollars.



## DOWNLOAD THE NORTH AMERICA TRAINING SCHEDULE AND PRICE SHEET



## SCHEDULE AND PRICE SHEET

Click on the above download link to access the schedule and pricing file or visit: [www.motorolasolutions.com/nalearnschedule2018](http://www.motorolasolutions.com/nalearnschedule2018)

To view the most current details for any of our courses, please register for an account (see Page 4) and log into the Motorola Solutions Learning Management System (LMS) at: [learning.motorolasolutions.com](http://learning.motorolasolutions.com) or call us at (800) 247-2346, option 4.

## TRAINING BANKS

Whether you're a technician, system manager or radio user, you rely on Motorola Solutions Education Services to obtain the necessary knowledge to get the full potential out of your Motorola Solutions equipment. The Motorola Solutions Training Bank is a discounted, pre-paid, non-expiring debit account that allows you to budget up front for your training needs. Training Banks can be applied towards all training options including, Instructor-Led Tailored Field Courses.

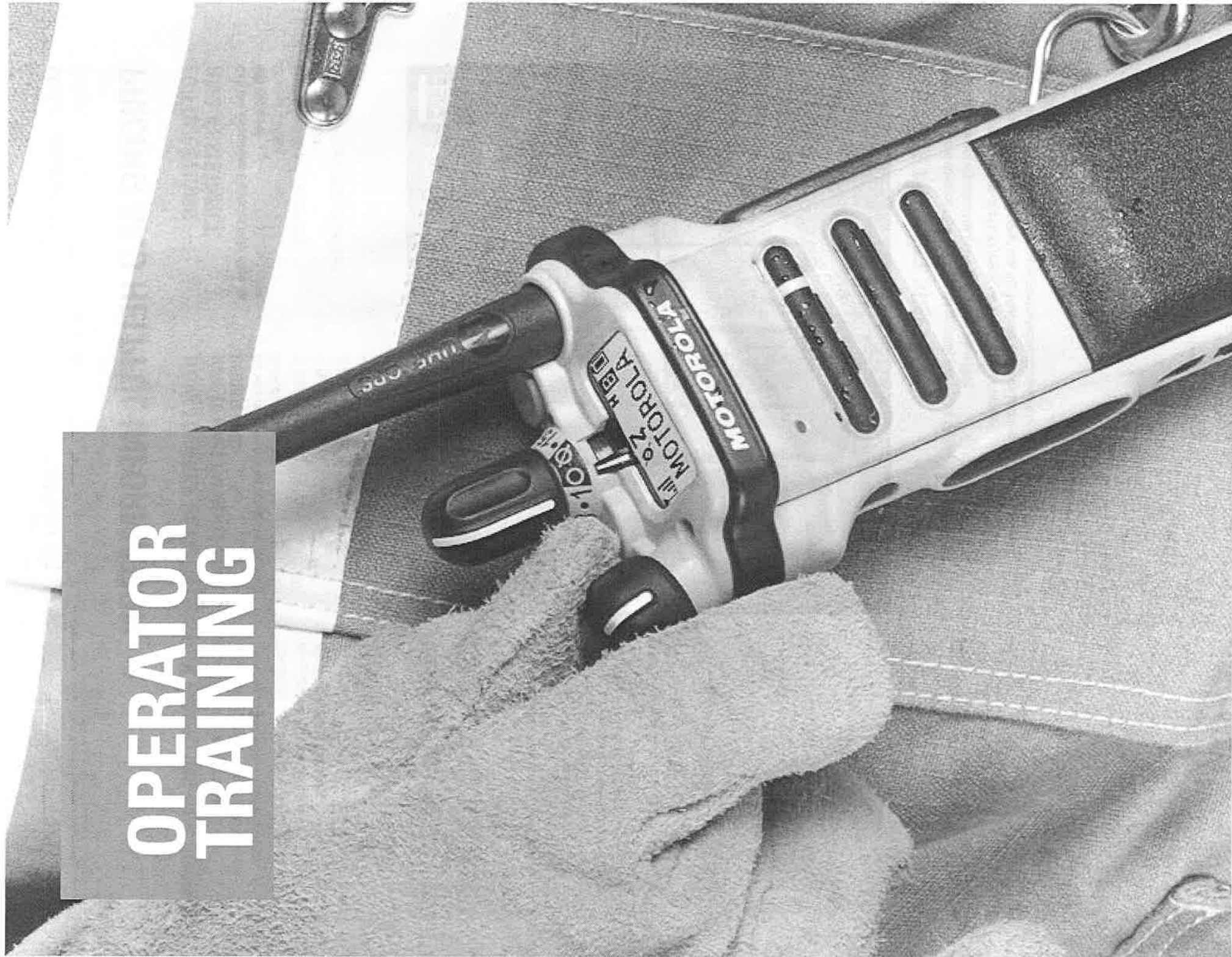
There are several benefits to Training Banks including:

- Allows you to budget up front for training needs
- Provides cost savings through discounted pricing tiers to maximize your training investment
- Does not require multiple POs, thus reducing internal approval cycle time and paperwork
- Training Banks do not expire

For more information, please visit us on the web at [motorolasolutions.com/amlearn](http://motorolasolutions.com/amlearn) or email us at [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com).

**Note:** Training Banks are only applicable to non-federal government customers.

# OPERATOR TRAINING



## OPERATOR TRAINING

For information on prerequisites and to register for courses visit the LMS at:  
[LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at:  
866.247.2346, option 6 or [training@motorolasolutions.com](mailto:training@motorolasolutions.com)

### THE SUCCESSFUL IMPLEMENTATION OF YOUR COMMUNICATIONS SYSTEM DEPENDS ON CONFIDENT USERS OF THE SYSTEM.

- Users of your mobile and portable radios require training on their units to understand its basic operation, features and functions
- Dispatchers of your consoles require training to understand basic operation, features and functions
- Management personnel require training on the Motorola Solutions applications

## TRAIN THE TRAINER

With this option, Motorola Solutions trains people you have identified as qualified instructors so that they in turn can train each individual user in your organization. These classes are typically done on site using your equipment. The interactive End User Tool Kit (iEUTK) and/or tailored end user materials can be utilized.

### AUDIENCE

This course is geared for customers who have an experienced, dedicated training staff in their organization. This course concentrates on specific product features and how it relates to the training process.

### COURSE OVERVIEW

This course provides the customer's identified training personnel knowledge and practice applying training techniques that will enable them to successfully train their students. Trainers will use simulation, facilitation and hands-on activities to facilitate learning events supported by tailored training materials and job aides. Students will become proficient in discussing common tasks associated with the operation of the customer's radios and consoles as identified by the customer's needs analysis. Note: This course is presented as customer specific and will cover pertinent information on customer equipment.

### REQUISITE KNOWLEDGE

Previous training experience and radio system knowledge is a must.

TO REQUEST FIELD TRAINING, PLEASE CONTACT YOUR ACCOUNT MANAGER.

**Note: The interactive End User Tool Kit (iEUTK) is not sold as a standalone product but included with our instructor-led, Train-The-Trainer or Operator Training.**

## OPERATOR TRAINING

With this option, the users within your organization are trained by a Motorola Solutions instructor. These classes are typically done on site using your equipment. The interactive End User Tool Kit (iEUTK) and/or tailored end user materials support this training option.

### CONSOLES TRAINING

These courses provide operators and supervisors with an introduction to the basic operation, administration and feature functionality of the Console Systems. Through facilitation and hands-on practice, users learn to perform tasks that are associated with their organization's particular system.

- Overview of console configuration
- Console dispatcher and supervisor operation
- Alias Management
- Messaging

### SUBSCRIBER TRAINING

These courses provide radio users with an introduction to their radios, a review of their radio's basic functionality by means of job aides tailored to exactly how they use their radios. Through facilitation and hands-on practice, users learn to perform common tasks associated with their radio configuration.

- Overview of radio configuration
- General radio operations

## COURSES FOR END USERS:

### CONSOLES:

- MCC 7000 Series Dispatch Console Administrator
- MCC 7000 Series Dispatch Console Operator
- MKM 7000 Console Alias Manager
- MOTOBRIDGE IP Dispatch Console Operator
- MOTOBRIDGE Administration Control Panel (ACP)
- MCD 5000 Operator

### MOBILES AND PORTABLES:


- APX™ Series
- MOTOTRBO™ Series
- XTL™/XTS Series
- SL Series
- LEX Series

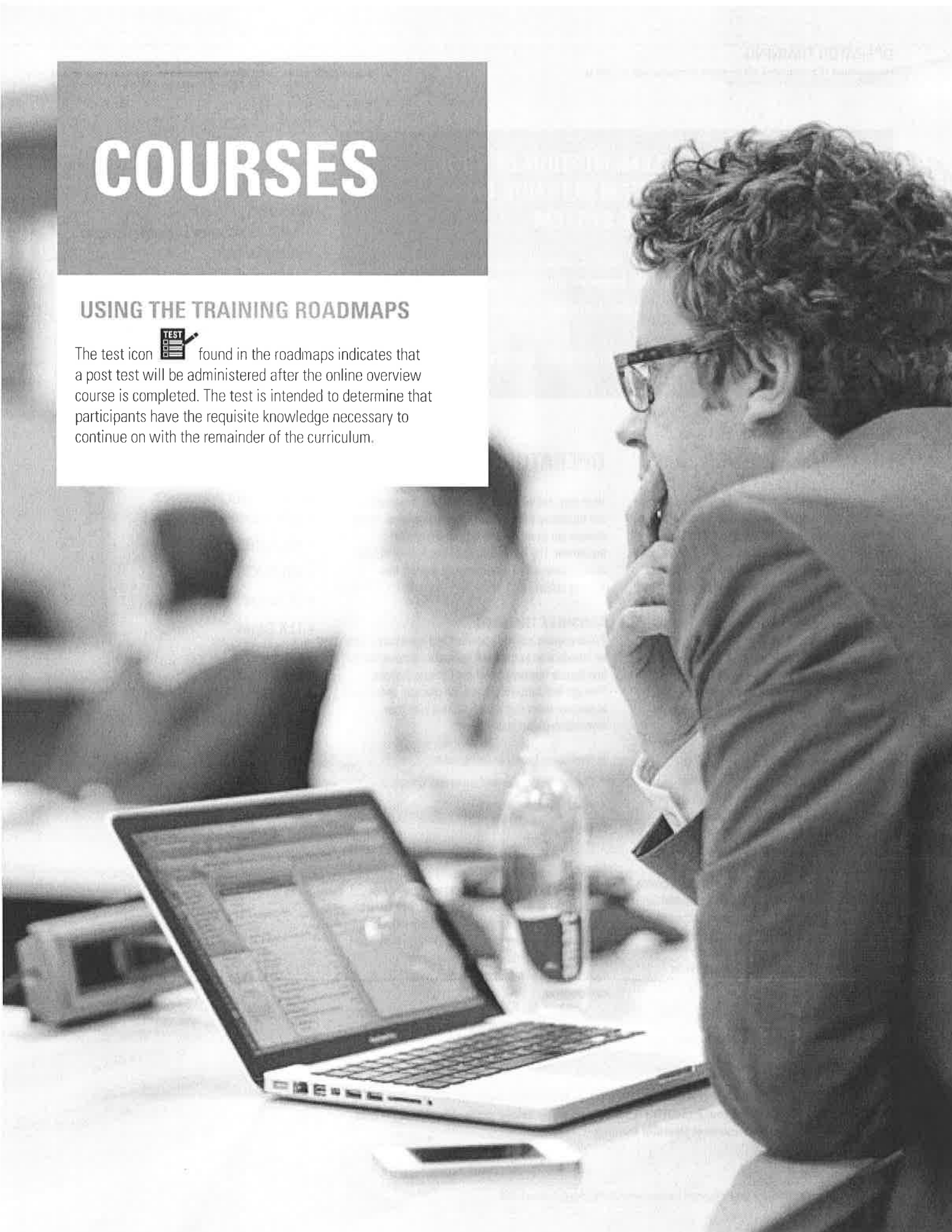
### OTHERS:

- Si500 Body Worn Camera
- Sr600 In-Vehicle Camera
- CommandCentral Vault
- WAVE

# COURSES

## USING THE TRAINING ROADMAPS

The test icon  found in the roadmaps indicates that a post test will be administered after the online overview course is completed. The test is intended to determine that participants have the requisite knowledge necessary to continue on with the remainder of the curriculum.





## FOUNDATIONAL COURSES

<b>BASIC RF</b> (RDS0002)	<b>13</b>
<b>BASIC RADIO</b> (RDS0004)	<b>13</b>
<b>BASIC NETWORKING</b> (RDS0003)	<b>13</b>
<b>RF FOR RADIO PROFESSIONALS</b> (RDS2012)	<b>14</b>
<b>INTRO TO R56</b> (NST9252)	<b>14</b>
<b>SITE INSTALLATION PRACTICES WORKSHOP</b> (NST925)	<b>14</b>
<b>R56 STANDARDS UPDATE</b> (NST9256)	<b>15</b>
<b>SERVER &amp; VIRTUALIZATION FOUNDATION</b> (SRV1010)	<b>15</b>
<b>COMMUNICATION SYSTEMS CONCEPTS</b> (NST021)	<b>15</b>
<b>NETWORKING ESSENTIALS IN MOTOROLA SOLUTIONS COMMUNICATIONS EQUIPMENT</b> (NST762)	<b>16</b>
<b>BRIDGING THE KNOWLEDGE GAP FOR ASTRO® 25 – TECHNICIAN</b> (ACT100E)	<b>16</b>
<b>BRIDGING THE KNOWLEDGE GAP FOR ASTRO® 25 – SYSTEM ADMINISTRATOR</b> (ACT101E)	<b>16</b>
<b>ASTRO® 25 SYSTEMS APPLIED NETWORKING</b> (NWT003)	<b>17</b>
<b>MOTOTRBO™ SYSTEMS APPLIED NETWORKING</b> (PCT2007)	<b>17</b>
<b>PUBLIC SAFETY LTE APPLIED NETWORKING</b> (LTE2007)	<b>17</b>



**THE LEARNING  
MANAGEMENT  
SYSTEM (LMS)**

To register for a course, go to  
[learning.motorolasolutions.com](http://learning.motorolasolutions.com)

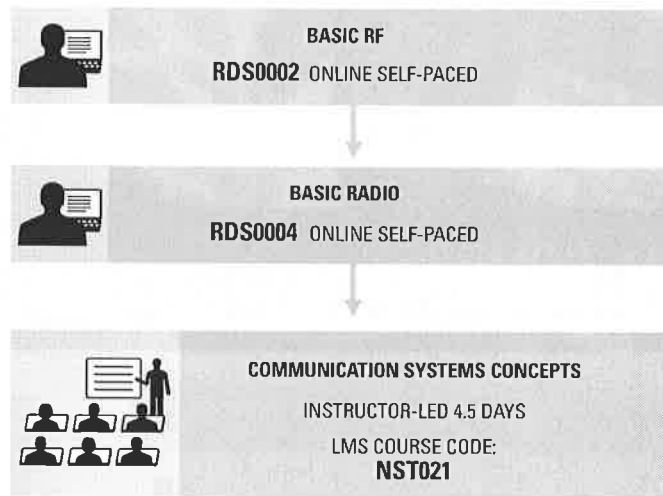
## RADIO SOLUTIONS FOUNDATIONAL

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

### RF FUNDAMENTALS

#### RF BASICS / RADIO SYSTEM BASICS



### CURRICULUM COMPLETE

PARTICIPANT HAS RF KNOWLEDGE REQUIRED FOR ADVANCING TO MORE COMPLEX TECHNICAL TRAINING COURSES.

## RADIO SOLUTIONS FOUNDATIONAL

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

## IP/NETWORKING FUNDAMENTALS



**BASIC NETWORKING**  
**RDS0003** ONLINE SELF-PACED



**NETWORKING ESSENTIALS IN  
MOTOROLA SOLUTIONS COMMUNICATIONS SYSTEM**  
INSTRUCTOR-LED 4.5 DAYS  
LMS COURSE CODE:  
**NST762**

**CHOOSE ONE OF THE FOLLOWING COURSES BELOW ACCORDING TO YOUR SOLUTION SYSTEM**

### ASTRO® 25 SYSTEM



**ASTRO® 25 SYSTEMS  
APPLIED NETWORKING**  
INSTRUCTOR-LED 4.5 DAYS  
LMS COURSE CODE:  
**NWT003**

OR

### MOTOTRBO™ SYSTEM



**MOTOTRBO™ SYSTEMS  
APPLIED NETWORKING**  
INSTRUCTOR-LED 3.5 DAYS  
LMS COURSE CODE:  
**PCT2007**

OR

### LTE SYSTEM



**PUBLIC SAFETY LTE APPLIED  
NETWORKING**  
INSTRUCTOR-LED 4.5 DAYS  
LMS COURSE CODE:  
**LTE2007**

## CURRICULUM COMPLETE

PARTICIPANT HAS IP PROTOCOLS AND NETWORKING SKILLS TO USE MOTOROLA SOLUTIONS SYSTEMS REQUIRING ADVANCED TECHNICAL TRAINING.

[CLICK HERE TO GO TO  
PAGE 19 FOR MORE  
DETAILS ON ASTRO® 25](#)

[CLICK HERE TO GO TO  
PAGE 48 FOR MORE  
DETAILS ON MOTOTRBO™.](#)

[CLICK HERE TO GO TO  
PAGE 57 FOR MORE  
DETAILS ON LTE](#)

# RADIO SOLUTIONS FOUNDATIONAL

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## BASIC RF

### COURSE OVERVIEW

This course emphasizes the concepts behind RF Systems theory and operation. Topics include basic radio transmitters and receivers, RF propagation, modulation, antenna systems, transmission lines and data-communications.

### AUDIENCE

Technical staff who need to understand Communication Systems Concepts including basic radio, RF propagation, modulation, antenna systems, transmission lines and data-communications.

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe electrical principles, including direct and alternating current.
- Describe the basic structure of radio transmitters and receivers.
- Describe the operation of the antenna system.
- Identify different types of transmission media.
- Describe RF propagation and understand system gains in a link budget.

### REQUISITE KNOWLEDGE

None



ONLINE, SELF-PACED  
LENGTH: 2 HOURS  
LMS COURSE CODE:  
RDS0002

## BASIC RADIO

### COURSE OVERVIEW

The purpose of this course is to provide the student with the basic, foundational land mobile two-way radio knowledge required when working with Motorola Solutions. This course is ideal for all people who sell or service land mobile two-way radios and it was especially designed to meet the needs of the MR Channel and Motorola Solutions employees.

### AUDIENCE

Technical staff who need to understand basic two-way radios

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Define what a two-way radio is.
- Describe two-way radio components.
- Describe communication types.
- List and describe ways of expanding coverage.
- Describe analog and digital solutions.
- Describe how transmit and receive processes work in conventional and trunked two-way radio.
- Define system scalability.
- Identify the considerations to implementing a two-way radio.
- List the characteristics of single-site, single-zone and multi-zone systems.
- Explain the concept of two-way radio security.
- Describe the open standards for the following technologies: APCO P25, TETRA and DMR.

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Basic RF (RDS0002)



ONLINE, SELF-PACED  
LENGTH: 4 HOURS  
LMS COURSE CODE:  
RDS0004

## BASIC NETWORKING

### COURSE OVERVIEW

This course provides a detailed description of the fundamentals of system networking. Topics include the OSI seven layer model, bridges and switches, IP and routing, applications and security.

### AUDIENCE

Engineers who need to understand the essentials of system networking.

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Identify the Elements and Interconnectivity of a basic network
- Define the OSI and TCP/IP Models
- Define the advantages of different Network Layout Options
- List the Physical and Data-Link Layers of the OSI and TCP/IP Models
- Define the Network and Transport Layers of the OSI and TCP/IP Models
- Identify the Service Layers within the OSI and TCP/IP Model
- Define the concept of Network Security.
- Identify standards organizations

### REQUISITE KNOWLEDGE

None



ONLINE, SELF-PACED  
LENGTH: 1 HOUR  
LMS COURSE CODE:  
RDS0003

 [CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET](#)

## RADIO SOLUTIONS FOUNDATIONAL

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (800) 237-2335, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

### RF FOR RADIO PROFESSIONALS

#### COURSE OVERVIEW

This course emphasizes the concepts behind RF Systems theory and operation. Topics include basic radio transmitters and receivers, RF propagation, modulation, antenna systems, transmission lines and data-communications.

#### AUDIENCE

Technical staff, who need to understand Communication Systems Concepts including basic radio, RF propagation, modulation, antenna systems, transmission lines and data-communications.

#### COURSE OBJECTIVES

Course consists of six modules: Advanced RF: Introduction, Transmission Lines, RF Hardware Filters, RF Performance, Test Equipment, and Troubleshooting. By the end of the course, you will be able to:

- Describe basic circuit-related phenomena and elements
- Describe the filtering process and types of RF filters List,
- Describe and compare digital modulation schemes
- List common frequency spectrum bands and describe their common uses
- Describe the transmission line theory
- Provide the rules for cable selection, routing and installation
- List advanced RF hardware filters, and provide their descriptions
- Discuss RF performance issues
- List and describe transmitter performance parameters
- List and describe receiver performance parameters
- List and describe common test equipment
- Describe the RF troubleshooting process

#### REQUISITE KNOWLEDGE

RF and radio basic knowledge or completion of RDS0002 and RDS0004 is highly recommended



ONLINE, SELF-PACED  
LENGTH: 3 HOURS  
LMS COURSE CODE:  
RDS2012

### INTRO TO R56

#### COURSE OVERVIEW

The purpose of this course is to present a high level overview of the RF site design and construction process, in line with the guidelines listed in Motorola Solutions' Standards and Guidelines for Communication Sites (R56) manual.

#### AUDIENCE

Technical Associates who need to use the R56 processes. Anyone who needs a technical introduction to the R56 processes.

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the site design and development tasks needed to meet R56 requirements.
- Describe the building and shelter design and installation tasks needed to meet R56 requirements.
- Identify the proper external and internal grounding tasks needed to meet R56 requirements.
- Identify transient voltage surge suppression needs that meet R56 requirements.
- Minimize the impact of RF Site Interference, in line with R56 requirements.
- Identify the equipment installation tasks needed to meet R56 requirements.

#### REQUISITE KNOWLEDGE

None



ONLINE, SELF-PACED  
LENGTH: 1 HOUR  
LMS COURSE CODE:  
NST9252

### SITE INSTALLATION PRACTICES WORKSHOP (R56)

#### COURSE OVERVIEW

The Site Installation Practices Workshop (R56) course is designed to present the standards and guidelines for installing a Motorola Solutions communication system. Participants will understand how a properly installed system can help to ensure a safe and efficient communications system, reducing system down time.

#### AUDIENCE

Technical System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- List the purposes of grounding and evaluate their importance in terms of personal safety and effective system installation and protection
- Apply principles of basic electronics to the installation standards found in the R56 manual
- Determine how an effectively installed ground system provides protection for a communication system from a lightning strike or electrical anomalies
- List the minimum requirements and specifications for the external and internal ground system
- List the minimum requirements and specifications for installation equipment, cables and documentation for a reliable communication system installation
- Investigate sources for possible solutions to various installation scenarios

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Graduate of a basic electronics course or equivalent experience.



INSTRUCTOR-LED  
LENGTH: 3.5 DAYS  
LMS COURSE CODE:  
NST925

## RADIO SOLUTIONS FOUNDATIONAL

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For general information, contact North America Education Services help desk at: (800) 247-2345, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

### R56 STANDARDS UPDATE

#### COURSE OVERVIEW

The R56 Standards and Guidelines for Communication Sites is in the process of being updated for 2017. This course will cover all updates and is intended for individuals who have recently completed, or recertified their R56 certification. It will provide insight and understanding on the changes and their impact on the documented standard.

#### AUDIENCE

Electronics Equipment Technicians who are responsible for the installation or inspection of communications equipment. Communication Site Installers (R56) and Communication Site Installation Inspectors (CSII)

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Be familiar with a current glossary of terms
- Understand changes and their relationship to the manual and certification
- Be aware of high level R56 Standards manual updates by chapter

#### REQUISITE KNOWLEDGE

Individuals must hold a valid R56 or CSII certification or have completed all necessary coursework prior to attending this course.



**INSTRUCTOR-LED**  
LENGTH: 1 DAY  
LMS COURSE CODE:  
NST9256

### SERVER & VIRTUALIZATION FOUNDATION

#### COURSE OVERVIEW

This course prepares students to configure a server hardware platform for virtualization. The course covers managing the hardware using BIOS and iLO, installing the ESXi 5.5 hypervisor, creating and provisioning virtual machines, installing client and server operating systems in the virtual machines, installing VMware Tools in the guest operating systems, and maintaining virtual machines using snapshots and OVF packages. Hands-on lab exercises provide experience with the entire installation and provisioning process.

#### AUDIENCE

Technical Personnel, Employees, Partners, Customers

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the relationship between virtualization and hardware resources
- Manage server hardware using BIOS and iLO
- Install ESXi on the server hardware
- Create and provision Virtual Machines using vSphere
- Install a guest operating systems in a Virtual Machine
- Install VMware Tools on the guest OS
- Configure VM startup and shutdown order
- Create and manage snapshots
- Migrate virtual machines using OVF packages

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Comp-TIA Server+ Certification or equivalent



**INSTRUCTOR-LED**  
LENGTH: 3 DAYS  
LMS COURSE CODE:  
SRV1010

### COMMUNICATION SYSTEMS CONCEPTS

#### COURSE OVERVIEW

The Communication Systems Concepts course emphasizes the concepts behind RF Systems theory and operation. Major topics covered include:

- RF System Operation, including talkaround, repeater operation, and types of signaling used in RF Systems
- A basic walkthrough of building a communication system from 'Simplex', to 'Half Duplex', 'Voting Systems', and 'Simulcast' is done, emphasizing the improvements in communication obtained with each step
- Trunking Operation, including Smartzone operation
- Types of modulation used in RF System operation, including ASTRO, Radio frequency path including the antenna and transmission line
- Decibels and their uses on the job. RF Propagation/ RF Interference
- Basic Troubleshooting practices from the system perspective

#### AUDIENCE

General

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Define terms commonly used in two-way communication systems
- Effectively use two-way radio communication systems knowledge to troubleshoot typical two-way communication radio systems
- Develop requirements for a two-way radio system by establishing programming and protocol requirements as requested
- Improve skills in the interpretation of typical two-way radio checks of the receiver, transmitter and the antenna system to troubleshoot a two-way radio communication system
- Use decibels to interpret the radio frequency path and antenna system to describe expected radio communication system performance and troubleshooting

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Knowledge of basic electronics
- Experience using standard communication test equipment



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
NST021

# RADIO SOLUTIONS FOUNDATIONAL

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## NETWORKING ESSENTIALS IN MOTOROLA SOLUTIONS COMMUNICATIONS EQUIPMENT

### COURSE OVERVIEW

The Networking Essentials in Motorola Solutions Communications Equipment course provides the technician with the essential elements of networking required for the installation and maintenance of most Motorola Solutions communications systems. The course includes ample hands-on and basic troubleshooting on network elements.

### AUDIENCE

System Technicians

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Recall basic network terminology
- Compare basic configuration types, both logical and physical
- Describe the basic OSI (Open System Interconnect) model compared with the TCP/IP model
- Construct a basic LAN with a Windows Server Domain Controller and workstations
- Examine the interaction between the routers through their configurations
- Use common network commands to simulate traffic and validate connectivity and routing

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- An understanding of the basic Motorola Solutions Communications Systems is highly recommended
- Basic familiarization with computer operating systems is required
- A basic knowledge of networking is helpful and recommended



**INSTRUCTOR-LED**  
**LENGTH: 4.5 DAYS**  
**LMS COURSE CODE:**  
**NS1762**

## BRIDGING THE KNOWLEDGE GAP FOR ASTRO® 25 – TECHNICIAN

### COURSE OVERVIEW

This seven-module course is designed to bring Technicians from different technical backgrounds and experience levels to a common starting point for the ASTRO® 25 curriculum. This course provides seven modules from the basic concepts of radio communication systems and computer networking features, through the evolution that led to the ASTRO® 25 trunking system's architecture.

### AUDIENCE

This course is intended for System Technicians, and other ASTRO® 25 system users who are new to trunked radio systems. Also those with experience in non-IP-based radio systems like SmartNet and SmartZone.

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Explain the different radio system concepts as applied to conventional and trunked systems
- Compare analog radio communication signaling to ASTRO® 25 radio communications signaling
- Identify different communication concepts using representative block diagrams of the respective systems
- Compare radio system communication concepts using representative block diagrams of the respective systems
- Compare how voice and data, information flow through different radio communication system types and how the signaling information controls that flow of information
- Describe the features of each radio communication system in terms of advantages and disadvantages

### REQUISITE KNOWLEDGE

None



**ONLINE, SELF-PACED**  
**LENGTH: 4 HOURS**  
**LMS COURSE CODE:**  
**ACT100E**

## BRIDGING THE KNOWLEDGE GAP FOR ASTRO® 25 – SYSTEM ADMINISTRATOR

### COURSE OVERVIEW

This five-module course is designed to bring Administrators from different technical backgrounds and experience levels to a common starting point for the ASTRO® 25 curriculum. This course provides seven modules from the basic concepts of radio communication systems and computer networking features, through the evolution that led to the ASTRO® 25 trunking system's architecture.

### AUDIENCE

System Administrators who are new to trunked radio systems. Also those with experience in non-IP-based radio systems like SmartNet and SmartZone.

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Identify different communication concepts using representative block diagrams of the respective systems
- Compare radio system communication concepts using representative block diagrams of the respective systems,
- Compare how voice and data information flows through different radio communication system types, and how the signaling information controls that flow of information
- Describe the features of each radio communication system in terms of advantages and disadvantages
- Explain the Trunked Radio System Concepts

### REQUISITE KNOWLEDGE

None



**ONLINE, SELF-PACED**  
**LENGTH: 4 HOURS**  
**LMS COURSE CODE:**  
**ACT101E**

## RADIO SOLUTIONS FOUNDATIONAL

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### ASTRO® 25 SYSTEMS APPLIED NETWORKING

#### COURSE OVERVIEW

The ASTRO® 25 Systems Applied Networking course provides technicians with the necessary networking information required for understanding the network components installed in modern Motorola Solutions communications systems. The course includes familiarization with basic networking concepts, and the networking components deployed in the ASTRO SmartZone System and ASTRO® 25 System..

#### AUDIENCE

Technical System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Recall basic network concepts
- Identify the various system network components
- Define the LAN topologies for each system
- Define the WAN topologies for each system
- Diagram SNMP deployment throughout the system
- Identify the HP switches and Motorola Solutions series routers
- Perform backup, restore, and recovery procedures of routers and LAN switches
- Identify network security components and concepts in an ASTRO® 25 system

#### REQUISITE KNOWLEDGE

Networking Essentials in Motorola Solutions Communications Equipment (NST762)

### MOTOTRBO™ SYSTEMS APPLIED NETWORKING

#### COURSE OVERVIEW

The MOTOTRBO™ Systems Applied Networking provides technicians with the necessary information required for understanding the typical networking requirements for implementing a variety of MOTOTRBO™ solutions. The course includes familiarization/review of basic networking concepts and MOTOTRBO™-specific networking requirements. This course will focus on specific configurations for IP Site Connect, Linked Capacity Plus, and Connect Plus trunking systems.

#### AUDIENCE

Technical System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Recall Basic Networking Concepts
- Identify recommended network components for MOTOTRBO™ systems
- Define LAN/WAN topologies for MOTOTRBO™ systems
- Perform backup, restore and recovery of recommended network components
- Identify network security concepts for MOTOTRBO™ systems

#### REQUISITE KNOWLEDGE

Networking Essentials in Motorola Solutions Communications Equipment (NST762)

### PUBLIC SAFETY LTE APPLIED NETWORKING

#### COURSE OVERVIEW

The Public Safety LTE Applied Networking course covers the operation and maintenance of Motorola Solutions-supplied network transport equipment used in a PS LTE network. Participants will learn the operation and replacement tasks required to maintain Layer 2 switches, Layer 3 switches, the NTP server, firewalls, and other devices which provide backhaul transport and connectivity services in the network. This lab-based course offers students practice with critical maintenance procedures on standalone equipment without impacting network operation.

#### AUDIENCE

Customer System Managers, Customer Network Transport Technical Staff, MSI employees

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Check and manage status of LTE network transport devices
- Upgrade and downgrade device firmware or operating system
- Backup and restore device configuration
- Replace device hardware
- Validate and troubleshoot device operation

#### REQUISITE KNOWLEDGE

none



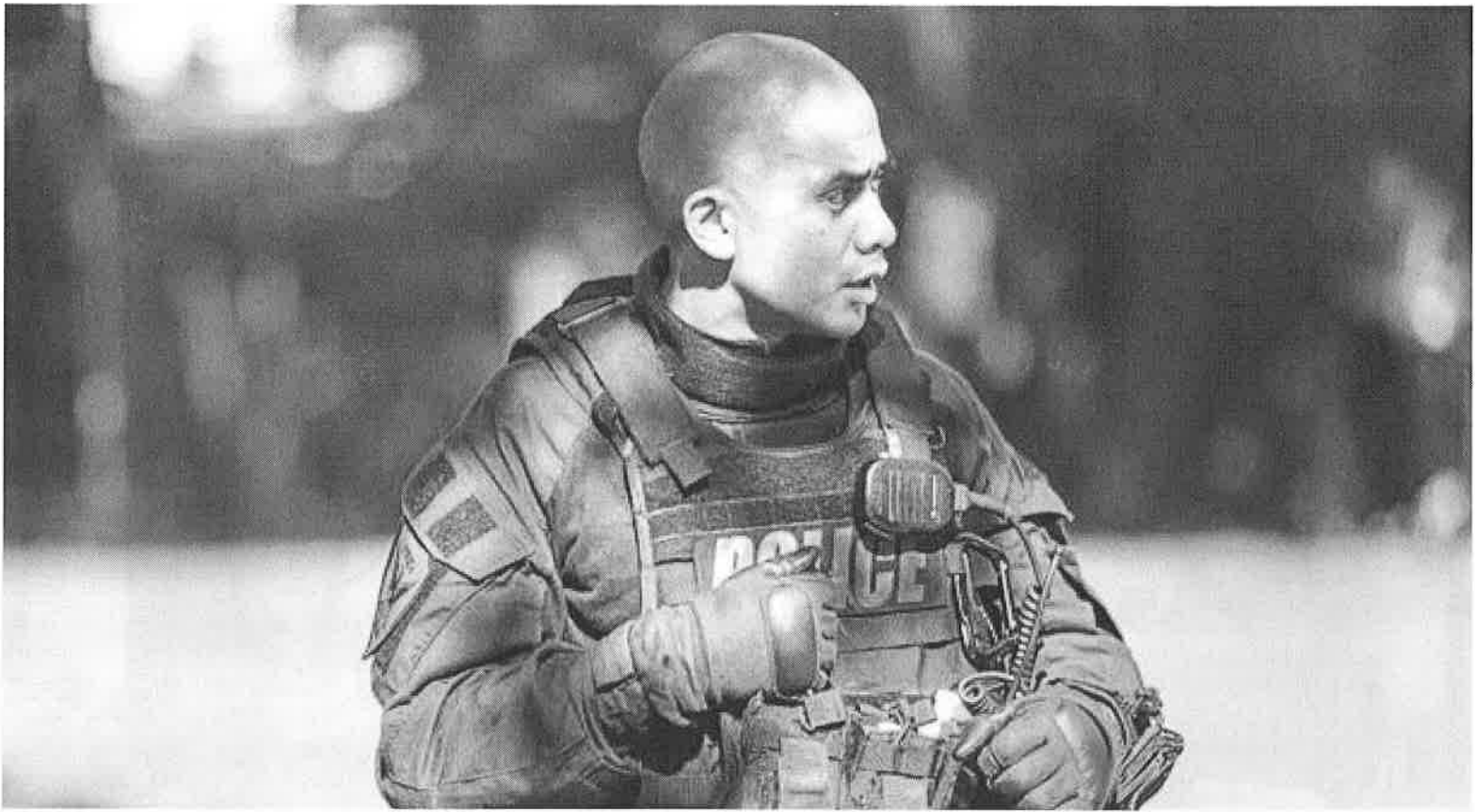
INSTRUCTOR-LED  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
NWT003



INSTRUCTOR-LED  
LENGTH: 3.5 DAYS  
LMS COURSE CODE:  
PCT2007




INSTRUCTOR-LED  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
LTE2007



# **ASTRO<sup>®</sup> 25 SYSTEMS PORTFOLIO**



<b>ASTRO® 25 IV&amp;D SYSTEM OVERVIEW (AST1038)</b>	<u>27</u>
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**THE LEARNING  
MANAGEMENT  
SYSTEM (LMS)**

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# ASTRO® 25 IV&D SYSTEM COURSES (CONTINUED)

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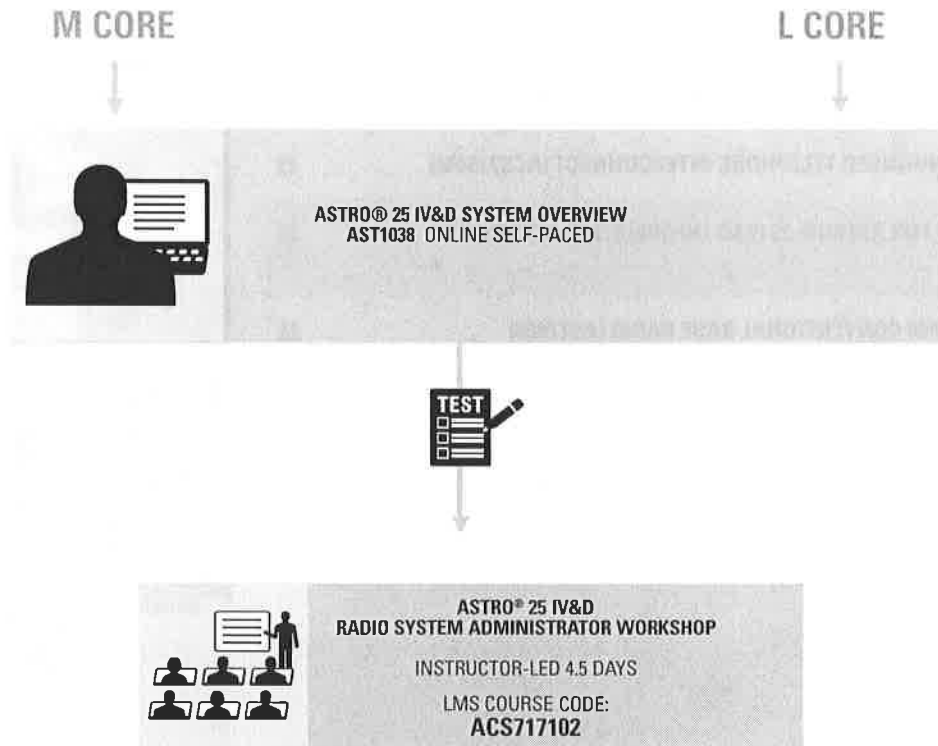


## RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLA.SOLUTIONS.COM](http://LEARNING.MOTOROLA.SOLUTIONS.COM)

For general information, contact North America Education Services help desk at: 1-800-247-2346, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

### ASTRO® 25 IV&D RADIO SYSTEM ADMINISTRATOR



### RECOMMENDED CURRICULUM IS COMPLETE

PARTICIPANT SHOULD BE ABLE TO CARRY OUT ADMINISTRATIVE TASKS IN THE ASTRO® 25 IV&D SYSTEM SUCH AS: PROVISIONING SUBSCRIBERS AND TALK GROUPS, GENERATING HISTORICAL REPORTS, CONTROLLING DEPLOYED SUBSCRIBERS AND MANAGING NETWORK ELEMENT CONFIGURATIONS. PARTICIPANT UNDERSTANDS FACTORS OF SYSTEM CONFIGURATION THAT IMPACT ASTRO® 25 SYSTEM MANAGEMENT.

 **OPTIONAL TRAINING ROADMAP AVAILABLE. CLICK ON THIS LINK TO GO TO PAGE 26 FOR ADDITIONAL DETAILS.**

# RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

For information on prerequisites and to register for courses visit the LMS at: [LEARNERS.MOTOROLA SOLUTIONS.COM](http://LEARNERS.MOTOROLA SOLUTIONS.COM)

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## ASTRO® 25 IV&D M/L CORE TECHNICIAN

M CORE


L CORE

 **ASTRO® 25 IV&D SYSTEM OVERVIEW**  
AST1038 ONLINE SELF-PACED




 **ASTRO® 25 IV&D**  
**M CORE WORKSHOP**  
INSTRUCTOR-LED 4.5 DAYS  
LMS COURSE CODE:  
**ACS717103**

## ASTRO® 25 IV&D K CORE TECHNICIAN

 **ASTRO® 25 IV&D SYSTEM OVERVIEW**  
AST1038 ONLINE SELF-PACED



 **ASTRO® 25 IV&D**  
**CONVENTIONAL K CORE WITH**  
**CONFIGURATION MANAGER**  
INSTRUCTOR-LED 3 DAYS  
LMS COURSE CODE:  
**ACS717410**

### RECOMMENDED CURRICULUM IS COMPLETE

PARTICIPANT SHOULD UNDERSTAND ASTRO® 25 M CORE COMPONENTS, VIRTUAL SERVERS AND SERVICE STRATEGY. PARTICIPANT CAN INTERPRET SYSTEM ALARMS, PROPOSE SOLUTIONS FOR SYSTEM FAILURES, AND AS WELL AS RESTORING EQUIPMENT TO PROPER FUNCTIONALITY.



OPTIONAL TRAINING  
ROADMAP AVAILABLE.  
CLICK ON THIS LINK TO  
GO TO PAGE 26 FOR  
ADDITIONAL DETAILS.

## RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

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For general information, contact North America Education Services help desk at:  
(800) 287-2546, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

### ASTRO® 25 IV&D REPEATER SITE TECHNICIAN (GTR)

M CORE

L CORE



**ASTRO® 25 IV&D SYSTEM OVERVIEW**  
AST1038 ONLINE SELF-PACED



**ASTRO® 25 IV&D  
GTR 8000 REPEATER SITE WORKSHOP**  
INSTRUCTOR-LED 3 DAYS  
LMS COURSE CODE:  
**ACS717208**

### RECOMMENDED CURRICULUM IS COMPLETE

PARTICIPANT CAN MAINTAIN AN ASTRO® 25 REPEATER SITE INCLUDING: GTR8000 BASE STATION, GCP8000 SITE CONTROLLER AND OTHER SITE EQUIPMENT.  
\*PARTICIPANT PERFORMS ALIGNMENTS THROUGH SHOOTING AND FIELD REPLACEMENT OF SITE DEVICES DURING COURSE.



**OPTIONAL TRAINING  
ROADMAP AVAILABLE.  
CLICK ON THIS LINK TO  
GO TO PAGE 26 FOR  
ADDITIONAL DETAILS.**

# RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

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For general information, contact North America Education Services help desk at:  
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## ASTRO® 25 IV&D IP SIMULCAST SITE TECHNICIAN

M CORE

L CORE



**ASTRO® 25 IV&D SYSTEM OVERVIEW**  
AST1038 ONLINE SELF-PACED



**ASTRO® 25 IV&D**  
**IP BASED DIGITAL SIMULCAST WORKSHOP**

INSTRUCTOR-LED 3 DAYS

LMS COURSE CODE:  
**ACS717217**

### **RECOMMENDED CURRICULUM IS COMPLETE**

PARTICIPANT SHOULD BE ABLE TO MAINTAIN AN ASTRO® 25 REPEATER SITE INCLUDING THE GTR8000 BASE STATION, GCP8000 SITE CONTROLLER, SITE COMPARATOR AND OTHER SITE EQUIPMENT.

 **OPTIONAL TRAINING ROADMAP AVAILABLE. CLICK ON THIS LINK TO GO TO PAGE 26 FOR ADDITIONAL DETAILS.**

## RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

For information on prerequisites and to register for courses visit the LMS at:  
[LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at:  
1-800-247-2346, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

### ASTRO® 25 IV&D CONVENTIONAL RF SITE TECHNICIAN

M CORE

K CORE



ASTRO® 25 IV&D SYSTEM OVERVIEW  
AST1038 ONLINE SELF-PACED



ASTRO® 25 IV&D  
CONVENTIONAL RF SITE WORKSHOP

INSTRUCTOR-LED 3 DAYS

LMS COURSE CODE:  
**ACS717440**

### RECOMMENDED CURRICULUM IS COMPLETE

PARTICIPANT SHOULD BE ABLE TO MAINTAIN AN ASTRO® 25 REPEATER SITE INCLUDING THE GTR8000 BASE STATION, GCP8000 SITE CONTROLLER, SITE COMPARATOR AND OTHER SITE EQUIPMENT.



OPTIONAL TRAINING  
ROADMAP AVAILABLE.  
[CLICK ON THIS LINK TO  
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## RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS










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### ASTRO® IV&D OPTIONAL TRAINING CURRICULUM

Motorola Solutions offers optional training for those participants who have completed their ASTRO® 25 curriculum and want to learn more about their system's infrastructure and/or features.

**Select the training course below applicable to your system.**

<p><b>DYNAMIC SYSTEM RESILIENCE</b></p> <p>ASTRO® 25 IV&amp;D DYNAMIC SYSTEM RESILIENCE ONLINE SELF-PACED</p> <p>ACS715023 </p>	<p><b>SMART X TO SUPPORT CIRCUIT-BASED RF SITES</b></p> <p>ASTRO® 25 IV&amp;D INTERFACING SMARTZONE 3600 SYSTEMS ONLINE SELF-PACED</p> <p>ACS713360 </p>	<p><b>NETWORK SECURITY</b></p> <p>ASTRO® 25 IV&amp;D INFORMATION ASSURANCE ONLINE SELF-PACED</p> <p>ACS713211 </p>	<p><b>TELEPHONE INTERCONNECTION</b></p> <p>ASTRO® 25 IV&amp;D ENHANCED TELEPHONE INTERCONNECT ONLINE SELF-PACED</p> <p>ACS715480 </p>	
<p><b>SECURITY PATCH MANAGEMENT</b></p> <p>ASTRO® 25 IV&amp;D SECURITY PATCH MANAGEMENT INSTRUCTOR-LED</p> <p>AST2001 </p>	<p><b>SYSTEMS FLEETMAPPING</b></p> <p>ASTRO® 25 IV&amp;D ISYSTEMS FLEETMAPPING INSTRUCTOR-LED</p> <p>RDS1017 </p>	<p><b>RADIO AUTHENTICATION</b></p> <p>ASTRO® 25 IV&amp;D RADIO AUTHENTICATION INSTRUCTOR-LED</p> <p>AST2038 </p>	<p><b>INFORMATION ASSURANCE WORKSHOP</b></p> <p>ASTRO® 25 IV&amp;D INFORMATION ASSURANCE WORKSHOP INSTRUCTOR-LED</p> <p>ASC716600 </p>	<p><b>DOMAIN CONTROLLER ADMINISTRATION</b></p> <p>ASTRO® 25 IV&amp;D DOMAIN CONTROLLER ADMINISTRATION INSTRUCTOR-LED</p> <p>AST2015 </p>

# RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

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## ASTRO® 25 IV&D SYSTEM OVERVIEW

### COURSE OVERVIEW

The ASTRO® 25 IV&D System Overview course will provide participants with knowledge and understanding of the ASTRO® 25 IV&D system. This course will address M, L and K Core systems. System architecture, components and features will be explained. In addition, RF and console sites and their architecture, features and components will be discussed. Finally, call processing for voice and mobile data applications will be covered, and an introduction to applications available in the ASTRO® 25 system will be provided.

### AUDIENCE

Core Technicians, Site Technicians, Console Technicians, Core Managers.

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Understand the general architecture of an ASTRO® 25 IV&D Radio System
- Understand key features of available in the ASTRO® 25 IV&D Radio System
- Understand the components of the ASTRO® 25 Zone Core
- Understand site components in the ASTRO® 25 system
- Understand the features, capabilities and components of the MCC7000 series dispatch consoles
- Understand concepts of Mobility and Call Processing in the ASTRO25
- Understand the applications for managing the ASTRO® 25 system

### REQUISITE KNOWLEDGE

None



ONLINE, SELF-PACED  
LENGTH: 4 HOURS  
LMS COURSE CODE:  
AST1038

## NEW FEATURES INTRODUCTION FOR ASTRO® 25 IV&D SYSTEMS

### COURSE OVERVIEW

This course describes the new features introduced in the ASTRO® 25 7.17 system release. These features are broadly classified into migration related features, efficiency and safety related features, resilience and reliability related features, network management and design related features, system capacity related features and inter-system communication related features. Optional features are introduced along with standard enhancements in this release.

### AUDIENCE

System Administrators, System Technicians, Field Technicians, Application Users

### COURSE OBJECTIVES

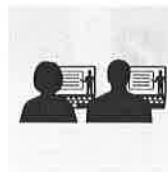
After completing this course, the student will be able to:

- Describe the standard enhancements in the ASTRO® 25 7.17 system release
- Describe optional enhancements in the ASTRO® 25 7.17 system release
- Describe the key optional features available in the ASTRO® 25 7.17 system release

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- ASTRO® 25 IV&D Curriculum (Release 7.9 or later) or equivalent knowledge for supported job role



VIRTUAL CLASSROOM  
LENGTH: 2 HOURS  
LMS COURSE CODE:  
AST1029

## ASTRO® 25 IV&D M CORE WORKSHOP

### COURSE OVERVIEW

The ASTRO® 25 IV&D with M Core course teaches troubleshooting skills and best practices for the Trunked Large Systems. The course also focuses on gathering and analyzing system information to implement appropriate action(s) that return a system to full operational status.

### AUDIENCE

M Core Master Site Technicians

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the ASTRO® 25 IV&D System architecture
- Identify the functional and radio subsystems that comprise the ASTRO® 25 IV&D System
- Explain and discuss call flow and data flow through ASTRO® 25 IV&D M Core devices and their subsystems
- Perform recommended routine maintenance procedures for ASTRO® 25 IV&D M Core
- Utilize the troubleshooting tools to diagnose a fault and restore the ASTRO® 25 IV&D M Core to the level of the Motorola Solutions-supported service strategy

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap for ASTRO® 25 – Technician (ACT100E)
- Networking Essentials in Communication Equipment (NST762)
- ASTRO® 25 Systems Applied Networking (NWT003)

### Required:

- ASTRO® 25 IV&D System Overview (AST1038)



INSTRUCTOR-LED  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
ACS717103

## RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

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### ASTRO® 25 IV&D CONVENTIONAL K CORE WITH CONFIGURATION MANAGER

#### COURSE OVERVIEW

The ASTRO® 25 IV&D Conventional with K Core and Configuration Manager course teaches advanced troubleshooting skills and best practices for the ASTRO® 25 IV&D Conventional K Core. It also focuses on administrator functions and how to use the ASTRO® 25 IV&D Configuration Manager applications. A technical **introduction** to the MCC 7000 series consoles as used within the ASTRO® 25 IV&D Conventional K Core, including some administrator functions, is also provided. Learning activities focus on gathering and analyzing system information to implement the appropriate actions that return a system to full operational status.

#### AUDIENCE

Master Site Technicians, System Administrators, Technical System Administrators, System Technicians and other Application Users

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Understand key physical and functional characteristics of K Core conventional system.
- Perform tasks necessary to install K Core conventional system components.
- Perform configuration steps for K Core conventional system components.
- Understand available maintenance tools and indicators in K Core conventional system.

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap – System Administrators (ACT101E)
- Networking Essentials in Communication Equipment (NST762)
- ASTRO® 25 Applied Networking (NWT003)
- ASTRO® 25 IV&D System Overview (AST1038)



**INSTRUCTOR-LED**  
LENGTH: 3 DAYS  
LMS COURSE CODE:  
**ACS717410**

### ASTRO® 25 IV&D RADIO SYSTEM ADMINISTRATOR WORKSHOP

#### COURSE OVERVIEW

This workshop covers administrator functions for an ASTRO® 25 IV&D System. Learning activities in this course focus on how to use the different ASTRO® 25 IV&D System Management applications. Participants will be provided with an opportunity to discuss how to structure their organization and personnel for optimal ASTRO® 25 IV&D system use.

#### AUDIENCE

System Administrators, Technical System Administrators, System Technicians, and other Application Users

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the relationship between radio programming, console administration and system management, and the impact of this relationship on system planning
- List the network management tools applicable at each phase of the system life cycle
- Use the report and real-time data to monitor performance and make adjustments necessary to maintain acceptable system performance levels
- Identify the advantages and disadvantages of options available for the configuration of system infrastructure and user parameters

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap – System Administrators (ACT101E)
- Networking Essentials in Communication Equipment (NST762)
- ASTRO® 25 Applied Networking (NWT003)
- ASTRO® 25 IV&D System Overview (AST1038)



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
**ACS717102**

### ASTRO® 25 SYSTEMS FLEETMAPPING

#### COURSE OVERVIEW

This workshop addresses topics necessary for the effective planning and mapping of an ASTRO® 25 IV&D radio system. During this course, the participants will learn about ASTRO® 25 features, capabilities, and restrictions in order to effectively plan and prepare for a new or upgraded ASTRO® 25 system.

#### AUDIENCE

Pre-sale customers, new system managers, system planning personnel

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Discuss what a fleetmap is and why one is needed.
- Discuss the methodologies used to configure radio users and groups with the goal of optimizing the system resources.
- Describe the content to assist with fleetmapping decisions.
- Discuss frequency band plan organization and management.
- Describe basic planning requirements and complete a simple Fleetmap information template.
- Complete worksheets required to create a Fleetmap based on sample operational requirement information.

#### REQUISITE KNOWLEDGE

None



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
**RDS1017**

## RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

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### ASTRO® 25 SECURITY PATCH MANAGEMENT

#### COURSE OVERVIEW

Provide Motorola Solutions ASTRO® 25 Land Mobile Radio (LMR) system administrators the information to access and patch their radio system infrastructure, update antivirus definitions, review log files and understand account management.

#### AUDIENCE

M Core Master Site Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Successfully access servers in the M-Core
- Successfully patch their radio system infrastructure
- Update Anti-virus (A/V) Definitions for their radiosystem infrastructure
- Perform basic review of UNIX logs
- Create user and group accounts
- Assist with basic tasks in Account Management on the LMR system

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- ASTRO® 25 IV&D M Core Workshop (ACS717103)



**INSTRUCTOR-LED**  
LENGTH: 4 DAYS  
LMS COURSE CODE:  
**AST2001**

### ASTRO® 25 RADIO AUTHENTICATION

#### COURSE OVERVIEW

This course describes the Radio Authentication feature and defines the HW/SW components in the Radio Authentication system. In addition the course describes the Radio Authentication process, discusses the various Keys uses in Radio Authentication. The students will understand how to provision and distribute relevant Keys using the AuC Client GUI to access the AuC Server. Students will understand how to enable Radio Authentication in the System via the AuC Client and how to configure the KVL 4000 for Radio Authentication and manage subscribers from the AuC Client.

#### AUDIENCE

Customer Administrators or Technicians.

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe Radio Authentication features and HW/SW components
- Describe the Radio Authentication process. Discuss the Keys used in Radio Authentication
- Provision and Distribute relevant Keys. Describe the AuC Client GUI
- Enable Radio Authentication in the System. Configure the KVL 4000 for Radio Authentication
- Manage Subscribers from the AuC Client. Discuss Radio Authentication functionality in a DSR system

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- AAE1400 - Radio Authentication e-learning course.
- Radio System Administration or equivalent knowledge of the Provisioning Manager, ZoneWatch, Historical Reports, ATIA Log Viewer, Unified Event Manager (UEM), Unified Network Configurator (UNC).

#### Required:

Access to customer ASTRO25 Radio System, AuC Server/Client is required. Customer to provide working Motorola Solutions' portable radio(s) capable of placing calls on the System, access to working AuC client/server along with admin login credentials, access to a working KVL4000 key loader that can upload keys to the AuC server.



**INSTRUCTOR-LED**  
LENGTH: 2 DAYS  
LMS COURSE CODE:  
**AST2038**

### ASTRO® 25 INFORMATION ASSURANCE WORKSHOP

#### COURSE OVERVIEW

Information Assurance (IA) refers to securing radio network access, protecting the privacy of network traffic using encryption, and assuring the integrity of data sent through the radio network or stored in the radio network. IA procedures and protocols offer FIPS-compliant techniques designed to harden the network. In this lab-based class, IA features are applied to network transport equipment by configuring HP switches, Motorola Solutions network routers, and firewalls in the classroom. Site level and zone core IA features are illustrated on the customer system or, by remotely accessing the Motorola Solutions Solutions OneLE ASTRO @ 25 system.

#### AUDIENCE

System Technician and Managers.

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Identify and describe the various Information Assurance (IA) features available in the
- ASTRO® 25 IV&D network.
- Identify the system locations and scope of protection offered by IA features in the network.
- Harden ASTRO @ 25 networks using Information Assurance (IA) features.
- Configure and restore IA features on HP switches and Motorola Solutions network routers.
- Configure site level IA features using the CSS or UNC.
- Manage zone core level IA features.
- Manage and check the configuration of firewalls in the ASTRO @ 25 network.

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- NST762 Networking Essentials in Communications Equipment
- NWT003 ASTRO @ 25 Applied Networking
- ACS71X103 ASTRO @ 25 M-Core Workshop



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
**ASC716600**

 [CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET](#)

## RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

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### ASTRO® 25 IV&D SECURE COMMUNICATIONS WORKSHOP

#### COURSE OVERVIEW

This workshop describes planning, installation, configuration, operations, and troubleshooting of Secure Communications within the ASTRO® 25 IV&D System.

#### AUDIENCE

System Technicians, System Administrators, Technical System Managers

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Plan, organize, and implement Secure Communications in an ASTRO® 25 IV&D system
- Install and configure a Key Management Facility (KMF) system and related components
- Demonstrate centralized key management using Over-the-Air-Rekeying (OTAR)
- Perform System Administrator functions using the KMF server and KMF client
- Troubleshoot installation and configuration problems for the KMF server, KMF client, and KMF database
- Implement end-to-end encryption using the MCC 7500 console subsystem

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap for ASTRO® 25 (ACT100E or ACT101E)
- Networking Essentials in Communication Equipment (NST762)



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
ACS717207

### ASTRO® 25 IV&D IP BASED DIGITAL SIMULCAST WORKSHOP

#### COURSE OVERVIEW

The ASTRO® 25 IV&D IP Based Digital Simulcast workshop provides an understanding of the components that comprise the ASTRO® 25 IV&D IP Simulcast subsystem, and how they operate in conjunction with each other. The workshop also explains the tools and methods available for troubleshooting components within the IP Based Simulcast subsystem.

#### AUDIENCE

Simulcast Site Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Recognize the flow of message and control data within an ASTRO® 25 IV&D IP Digital Simulcast subsystem
- Identify the major components and connections within an ASTRO® 25 IV&D IP Digital Simulcast subsystem prime and remote sites
- Recognize how calls are processed within an ASTRO® 25 IV&D IP Digital Simulcast subsystem
- Perform maintenance and troubleshooting of select components in an ASTRO® 25 IV&D IP Digital Simulcast subsystem

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap for ASTRO® 25 – Technician (ACT100E)
- Networking Essentials in Communication Equipment (NST762)
- ASTRO® 25 Systems Applied Networking (NWT003)

#### Required:

- ASTRO® 25 IV&D System Overview (AST1038)



**INSTRUCTOR-LED**  
LENGTH: 3 DAYS  
LMS COURSE CODE:  
ACS717217

### ASTRO® 25 IV&D GTR 8000 REPEATER SITE WORKSHOP

#### COURSE OVERVIEW

This workshop describes the components in the ASTRO® 25 IV&D System Repeater Site with GTR 8000 expandable site subsystem. This course also presents how the GTR 8000 expandable site subsystem operates and explains the tools and methods available for troubleshooting components within the subsystem.

#### AUDIENCE

GTR 8000 Site Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the ASTRO® 25 IV&D Repeater Site with GTR 8000 Expandable Site Subsystem configurations and components
- Identify the GCP 8000 Site Controller functions and configuration requirements
- Describe the connections and interfaces to the GCP 8000
- Diagnose and troubleshoot the GCP 8000
- Describe the functionality of the GTR 8000 Expandable Site Subsystem
- Configure and troubleshoot the ASTRO® 25 Repeater Site with GTR 8000 Expandable Site Subsystem
- Configure and troubleshoot the Network Transport subsystem

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap for ASTRO® 25 – Technician (ACT100E)
- Networking Essentials in Communication Equipment (NST762)
- ASTRO® 25 Systems Applied Networking (NWT003)

#### Required:

- ASTRO® 25 IV&D System Overview (AST1038)



**INSTRUCTOR-LED**  
LENGTH: 3 DAYS  
LMS COURSE CODE:  
ACS717208

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## ASTRO® 25 IV&D CONVENTIONAL RF SITE WORKSHOP

### COURSE OVERVIEW

The ASTRO® 25 IV&D Conventional RF Site workshop describes the components in the different ASTRO® 25 IV&D Conventional RF Sites topologies. This course also presents how the different ASTRO® 25 IV&D Conventional RF Sites topologies operate and explains the tools and methods available for troubleshooting components within the different ASTRO® 25 IV&D Conventional RF Sites topologies.

### AUDIENCE

Site Technicians

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Understand key physical and functional characteristics of conventional site.
- Perform tasks necessary to install conventional site components.
- Perform configuration steps for conventional site components.
- Understand available maintenance tools and indicators in conventional site.

### REQUISITE KNOWLEDGE

Completion of the following courses or equivalent knowledge:

- Bridging the Knowledge Gap – System Administrators (ACT101)
- Networking Essentials in Communication Equipment (NST762)
- ASTRO® 25 Applied Networking (NWT003)
- ASTRO® 25 IV&D System Overview (AST1038)



**INSTRUCTOR-LED**  
LENGTH: 3 DAYS  
LMS COURSE CODE:  
**ACS717440**

## ASTRO® 25 DOMAIN CONTROLLER ADMINISTRATION

### COURSE OVERVIEW

This workshop covers the administrator and management functions in the ASTRO® 25 Domain Controller and how these functions affect both users and computers in the ASTRO® 25 system. Learning activities in this course focus on how to use the Domain Controllers to authenticate, administer, and authorize users and devices in the ASTRO® 25 System. Group Policies and Organizational Units, RADIUS, and DNS structure will be addressed during this course.

### AUDIENCE

Console Technicians, System Managers

### COURSE OBJECTIVES


After completing this course, the student will be able to:

- Understand the Domain Controller server platform
- Understand the DNS Hierarchy in the ASTRO® 25 system
- Implement RADIUS authentication in applicable devices in an ASTRO® 25 system.
- Use Active Directory to control users in the ASTRO® 25 system.
- Understand Group Policy objects and how they impact users in the ASTRO® 25 Domain.

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- ASTRO® 25 IV&D System Overview (AST1038)



**INSTRUCTOR-LED**  
LENGTH: 3 DAYS  
LMS COURSE CODE:  
**AST2015**

## INTELLIGENT MIDDLEWARE 5.2 OPERATION AND ADMINISTRATION

### COURSE OVERVIEW

The purpose of this course is to provide the steps to operate and maintain a customer's IMW system within their Motorola Solutions system (ASTRO, Dimetra, LTE).

### AUDIENCE

Partners/Resellers and customers who would be responsible for the operation and maintenance of a customer's IMW system within their Motorola Solutions systems (ASTRO, Dimetra, LTE).

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe IMW features.
- Perform installation of IMW.
- Configure an IMW system.
- Identify the IMW tools to administer the system.
- Perform routine administration.
- Perform troubleshooting.
- Understand system-specific considerations.

### REQUISITE KNOWLEDGE

None



**INSTRUCTOR-LED**  
LENGTH: 2 DAYS  
LMS COURSE CODE:  
**RDS2025**



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# RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

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## ASTRO® 25 ISSI 8000 / CSSI 8000 FEATURE OVERVIEW

### COURSE OVERVIEW

The ISSI 8000 / CSSI 8000 Feature Overview self-paced course describes the optional Inter-RF Subsystem Interface available in an ASTRO® 25 IV&D System. It presents a description of the feature, its benefits and components, call processing scenarios, and an overview of the installation process.

### AUDIENCE

System Managers, Technical System Managers, System Technicians, Application Users

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the ISSI 8000 / CSSI 8000 feature
- Describe the components of the ISSI 8000 / CSSI 8000 feature
- Describe the communication scenarios if this feature is enabled
- Follow the installation and configuration process if this feature is added to an ASTRO system

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap for ASTRO® 25 – Technician (ACT100E)

### Required:

- ASTRO® 25 IV&D System Overview (AST1038)



ONLINE, SELF-PACED  
LENGTH: 4 HOURS  
LMS COURSE CODE:  
AST2005

## ASTRO® 25 IV&D DYNAMIC SYSTEM RESILIENCE

### COURSE OVERVIEW

The ASTRO® 25 IV&D Dynamic System Resilience (DSR) Overview is a self-study training course intended to provide a technical overview of DSR. The course describes how DSR adds a geographically separate backup for the Master Site to protect against a catastrophic failure.

### AUDIENCE

System Administrators, System Technicians, Field Technicians

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Differentiate between a non-DSR Master Site and a DSR Master Site

Describe the DSR components, operation and functionality of each of the following services:

- Voice
- Data
- Network Management
- Network Transport
- IP Services
- MOSCAD

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- ASTRO® 25 IV&D System Overview (AST1038)



ONLINE, SELF-PACED  
LENGTH: 2 HOURS  
LMS COURSE CODE:  
ACS715023

## ASTRO® 25 IV&D INTERFACING SMARTZONE 3600 SYSTEMS

### COURSE OVERVIEW

ASTRO® 25 IV&D Trunked System - Interfacing SmartZone 3600 Systems with SmartX is designed to allow communication between subscriber radios at existing 3600 RF sites and an ASTRO® 25 IV&D system. It is based on the Voice Processor Module hardware platform and enables the continued use of 3600 RF sites and subscriber radios with the release of ASTRO® 25 7.7 or higher. This self-study training course is intended to provide information related to the installation and functionality of, including the hardware and software associated with, the SmartX Site Converter in the ASTRO® 25 IV&D.

### AUDIENCE

System Administrators, System Technicians, Field Technicians

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the SmartX Site Converter and its operation within the system
- Identify the major components and functionality.
- Know the requirements and components necessary to install a SmartX Site Converter

### REQUISITE KNOWLEDGE

None



ONLINE, SELF-PACED  
LENGTH: 1 HOUR  
LMS COURSE CODE:  
ACS713360

 [CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET](#)

# RADIO SOLUTIONS ASTRO® 25 IV&D SYSTEMS

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services Help desk at: (866) 247-2345, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

## ASTRO® 25 IV&D ENHANCED TELEPHONE INTERCONNECT

### COURSE OVERVIEW

This web based course describes the functionality and the hardware and software associated with the Enhanced Telephone Interconnect feature in the ASTRO® 25 IV&D System.

### AUDIENCE

System Technicians, System Administrators

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Identify the function and major components for the Enhanced Telephone Interconnect feature
- Define the operation of the Enhanced Telephone Interconnect feature within the system
- Configure the Enhanced Telephone Interconnect equipment
- Troubleshoot the Enhanced Telephone Interconnect equipment

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap for ASTRO® 25 (ACT100E or ACT101E)
- Networking Essentials in Communication Equipment (NST762)



ONLINE, SELF-PACED  
LENGTH: 2 HOURS  
LMS COURSE CODE:  
**ACS715480**

## SYSTEM OVERVIEW FOR ASTRO® 25 IV&D INFORMATION ASSURANCE

### COURSE OVERVIEW

This web based course describes the functionality and the hardware and software associated CNI Network Security in the ASTRO® 25 IV&D System.

### AUDIENCE

System Administrators, System Technicians, Field Technicians

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Define network security and its functions
- List the network security components of an ASTRO® 25 IV&D system
- Define the functions, components and operation of the Core Server Management Server (CSMS)
- Identify the functions, components and operation of the Interface Barrier (NIB)
- Identify the functions, components and operation of the border router and the peripheral network router

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap for ASTRO® 25 (ACT100E or ACT101E)
- Networking Essentials in Communication Equipment (NST762)
- ASTRO® 25 Systems Applied Networking (NWT003)

### Required:

Take one of the following depending on system supporting:

- ASTRO®25 IV&D with M Core System Overview (ACS11200-E)
- ASTRO®25 IV&D Conventional with M Core Overview (ACS11420-E)
- ASTRO®25 IV&D with L Core System Overview (ACS11430-E)
- ASTRO®25 IV&D Conventional with K Core System Overview (ACS11400-E)



ONLINE, SELF-PACED  
LENGTH: 2 HOURS  
LMS COURSE CODE:  
**ACS713211**

## STANDALONE GTR8000 CONVENTIONAL BASE RADIO

### COURSE OVERVIEW

This course is designed to give the participants the ability to align, troubleshoot and repair the Standalone GTR8000 Base Station/Repeater to Motorola Solutions recommended service levels.

Emphasis is placed on the use of Configuration Service Software (CSS) and its role in configuration, maintenance, diagnostics, alignments, and optimization of the Standalone GTR8000 Base Radio/ Repeater

### AUDIENCE

Maintenance Technicians

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Understand basic concepts of the various radio systems supported by the GTR8000 Conventional Base Radio
- Identify the equipment modules of the GTR8000 Conventional Base Radio
- Operate and perform routine maintenance on the GTR8000 Conventional Base Radio
- Understand basic operational theory of GTR8000 Conventional Base Radio components
- Configure the GTR8000 Conventional Base Radio using Configuration Service Software (CSS)
- Identify the different backplane connections on the GTR8000 Conventional Base Radio
- Perform calibration and alignment adjustments for the GTR8000 Conventional Base Radio
- Troubleshoot problems and identify/replace faulty modules in the GTR8000 Conventional Base Radio

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- General RF Knowledge and Skills
- Basic Knowledge of Two-Way Radio systems



ONLINE, SELF-PACED  
LENGTH: 2 HOURS  
LMS COURSE CODE:  
**AST2006**

**HELPING**



**PEOPLE**

**BE THEIR**



**BEST**

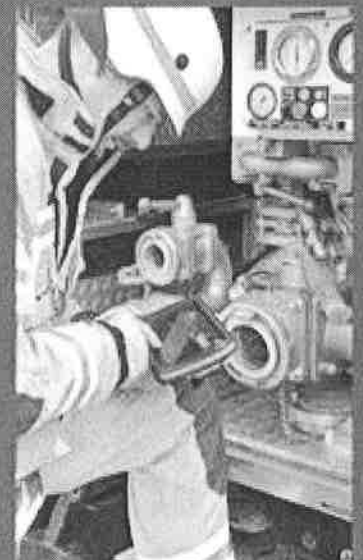


**IN THE**



**MOMENTS**

**THAT MATTER**





# DISPATCH CONSOLE PORTFOLIO

OPERATIONAL COMMAND AND CONTROL FROM  
MULTIPLE POINTS, AT MULTIPLE LEVELS

MCC 7100



MCC 7500

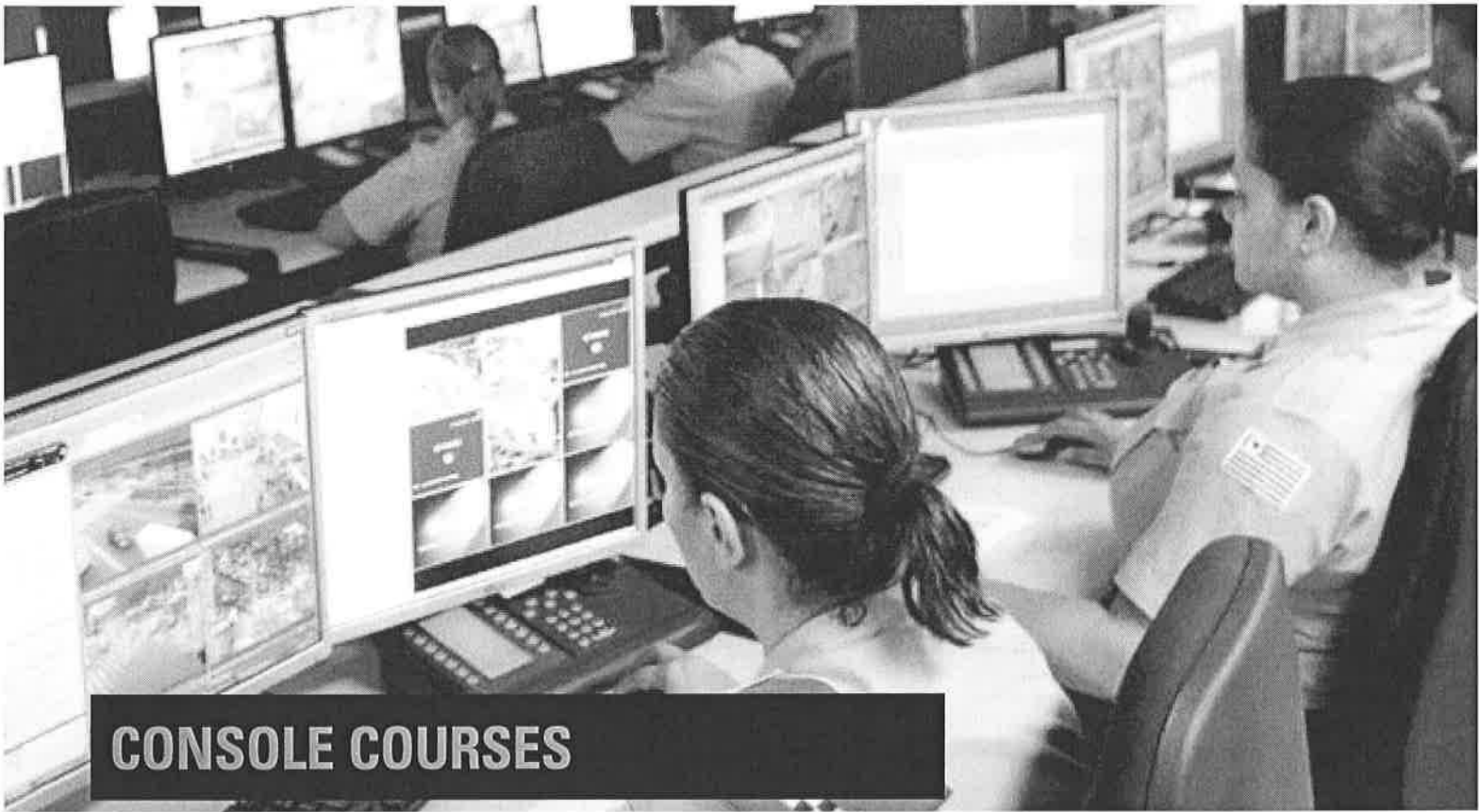


MCC 7500e



MCD 5000





## CONSOLE COURSES

<b>ASTRO® 25 IV&amp;D SYSTEM OVERVIEW (AST1038)</b>	<b>38</b>
<b>ASTRO® 25 DOMAIN CONTROLLER ADMINISTRATION (AST2015)</b>	<b>38</b>
<b>MCC 7000 SERIES DISPATCH CONSOLES WORKSHOP (CON012)</b>	<b>38</b>
<b>ASTRO® 25 NICE LOGGER INTEGRATION (AST1002)</b>	<b>39</b>
<b>MCD 5000 TECHNICAL WORKSHOP (RDS1022)</b>	<b>39</b>

### \* PLEASE NOTE:

**MCC 7000 Series Dispatch Consoles Workshop (CON012)** focuses on the consoles application in an M- or L-Core System.



**THE LEARNING  
MANAGEMENT  
SYSTEM (LMS)**

To register for a course, go to  
[www.astrosouth.com](http://www.astrosouth.com)

## RADIO SOLUTIONS CONSOLES

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

### CONSOLES TECHNICAL TRAINING CURRICULUM



### CURRICULUM COMPLETE

PARTICIPANT CAN MAINTAIN A MCC 7000 DISPATCH CONSOLE SITE INCLUDING: CONSOLE PC, VPM, CC GW'S AND AUX I/O SERVERS.  
\*PARTICIPANT PERFORMS TROUBLESHOOTING AND REPLACEMENT OF SITE DEVICES DURING COURSE.

### OPTIONAL CONSOLE TRAINING



# RADIO SOLUTIONS CONSOLES

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (888) 247-2346, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

## ASTRO® 25 IV&D SYSTEM OVERVIEW

### COURSE OVERVIEW

The ASTRO® 25 IV&D System Overview course will provide participants with knowledge and understanding of the ASTRO® 25 IV&D system. This course will address M, L and K Core systems. System architecture, components and features will be explained. In addition, RF and console sites and their architecture, features and components will be discussed. Finally, call processing for voice and mobile data applications will be covered, and an introduction to applications available in the ASTRO® 25 system will be provided.

### AUDIENCE

Core Technicians, Site Technicians, Console Technicians, Core Managers.

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Understand the general architecture of an ASTRO® 25 IV&D Radio System
- Understand key features of available in the ASTRO® 25 IV&D Radio System
- Understand the components of the ASTRO® 25 Zone Core
- Understand site components in the ASTRO® 25 system
- Understand the features, capabilities and components of the MCC7000 series dispatch consoles
- Understand concepts of Mobility and Call Processing in the ASTRO25
- Understand the applications for managing the ASTRO® 25 system

### REQUISITE KNOWLEDGE

None



**ONLINE, SELF-PACED**  
**LENGTH: 4 HOURS**  
**LMS COURSE CODE: AST1038**

## ASTRO® 25 DOMAIN CONTROLLER ADMINISTRATION

### COURSE OVERVIEW

This workshop covers the administrator and management functions in the ASTRO® 25 Domain Controller and how these functions affect both users and computers in the ASTRO® 25 system. Learning activities in this course focus on how to use the Domain Controllers to authenticate, administer, and authorize users and devices in the ASTRO® 25 System. Group Policies and Organizational Units, RADIUS, and DNS structure will be addressed during this course.

### AUDIENCE

Console Technicians, System Managers

### COURSE OBJECTIVES


After completing this course, the student will be able to:

- Understand the Domain Controller server platform
- Understand the DNS Hierarchy in the ASTRO® 25 system
- Implement RADIUS authentication in applicable devices in an ASTRO® 25 system.
- Use Active Directory to control users in the ASTRO® 25 system.
- Understand Group Policy objects and how they impact users in the ASTRO® 25 Domain.

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- ASTRO® 25 IV&D System Overview (AST1038)



**INSTRUCTOR-LED**  
**LENGTH: 3 DAYS**  
**LMS COURSE CODE: AST2015**

## MCC 7000 SERIES DISPATCH CONSOLES WORKSHOP

### COURSE OVERVIEW

This course familiarizes participants with installation, configuration, management and repair of MCC 7000 series dispatch consoles, Archiving Interface Servers, AUX I/O servers, and Conventional Channel Gateways. The focus is on a detailed discussion of console hardware and the installation and configuration of the MCC 7000 series consoles which consist of the MCC 7100 and MCC 7500 dispatch console.

### AUDIENCE

System Administrators, Console Technicians

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Install and configure the hardware and software components of the MCC 7000 Series Dispatch Consoles Subsystem
- Perform MCC 7000 Series site connectivity and bandwidth management
- Perform System Administrator functions using the MCC 7000 Series Administrator software
- Troubleshoot installation and configuration problems for the MCC 7000 Series Dispatch Consoles

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Bridging the Knowledge Gap (ACT100E or ACT101E)
- Networking Essentials in Communication Equipment (NST762)
- ASTRO® 25 Systems Applied Networking (NWT003)

### Required:

- ASTRO® 25 IV&D System Overview (AST1038)



**INSTRUCTOR-LED**  
**LENGTH: 4.5 DAYS**  
**LMS COURSE CODE: CON012**



**CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET**

## RADIO SOLUTIONS CONSOLES

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

### ASTRO® 25 NICE LOGGER INTEGRATION

#### COURSE OVERVIEW

This workshop covers the tasks and knowledge to implement a NICE logging solution in an ASTRO® 25 system. Learning activities in this course focus on both initial installation and configuration, and operation and troubleshooting the components after installation. Participants will be provided with an opportunity to demonstrate, with available lab equipment, tasks required to install and maintain the related subsystem components.

#### AUDIENCE

Console Technicians, System Managers

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the functionality of the different components and applications required for NICE Radio logging
- Install and configure required components into an ASTRO® 25 system
- Perform administrative tasks necessary for operation of the logging solution
- Use system tools and applications to identify potential causes of failure of the logging solution

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- ASTRO® 25 IV&D System Overview (AST1038)
- MCC7000 Series Dispatch Console Workshop (CON012)



**INSTRUCTOR-LED**  
**LENGTH: 4.5 DAYS**  
**LMS COURSE CODE:**  
**AST1002**

### MCD 5000 TECHNICAL WORKSHOP

#### COURSE OVERVIEW

This workshop supports those that install, configure, or support the MCD 5000 Deskset. This three day training course will cover installation procedures for the MCD5000 Deskset, Radio Gateway Unit (RGU), and connectivity to different station types. Configuration and programming of the MCD5000 and its supporting equipment will be covered through discussion and hands-on lab activities. Troubleshooting and maintenance techniques will be addressed to the Motorola Solutions recommended service level.

#### AUDIENCE

Console Technicians, System Managers

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Identify the MCD 5000 System Components and functions
- Install MCD 5000 Deskset
- Install Radio Gateway Units
- Configure MCD 5000 subcomponents
- Troubleshoot the MCD 5000 System to Motorola Solutions recommended service levels
- Configure MCD 5000 with the Operations and Management Center (OMC), as applicable.
- Use the Administrator Control Panel (ACP) to configure an MCD 5000 System with OMC.
- Describe the function of the MCD 5000 Deskset
- Describe all tasks on the MCD 5000 Deskset
- Discuss MCD 5000 Deskset Basic Operations

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

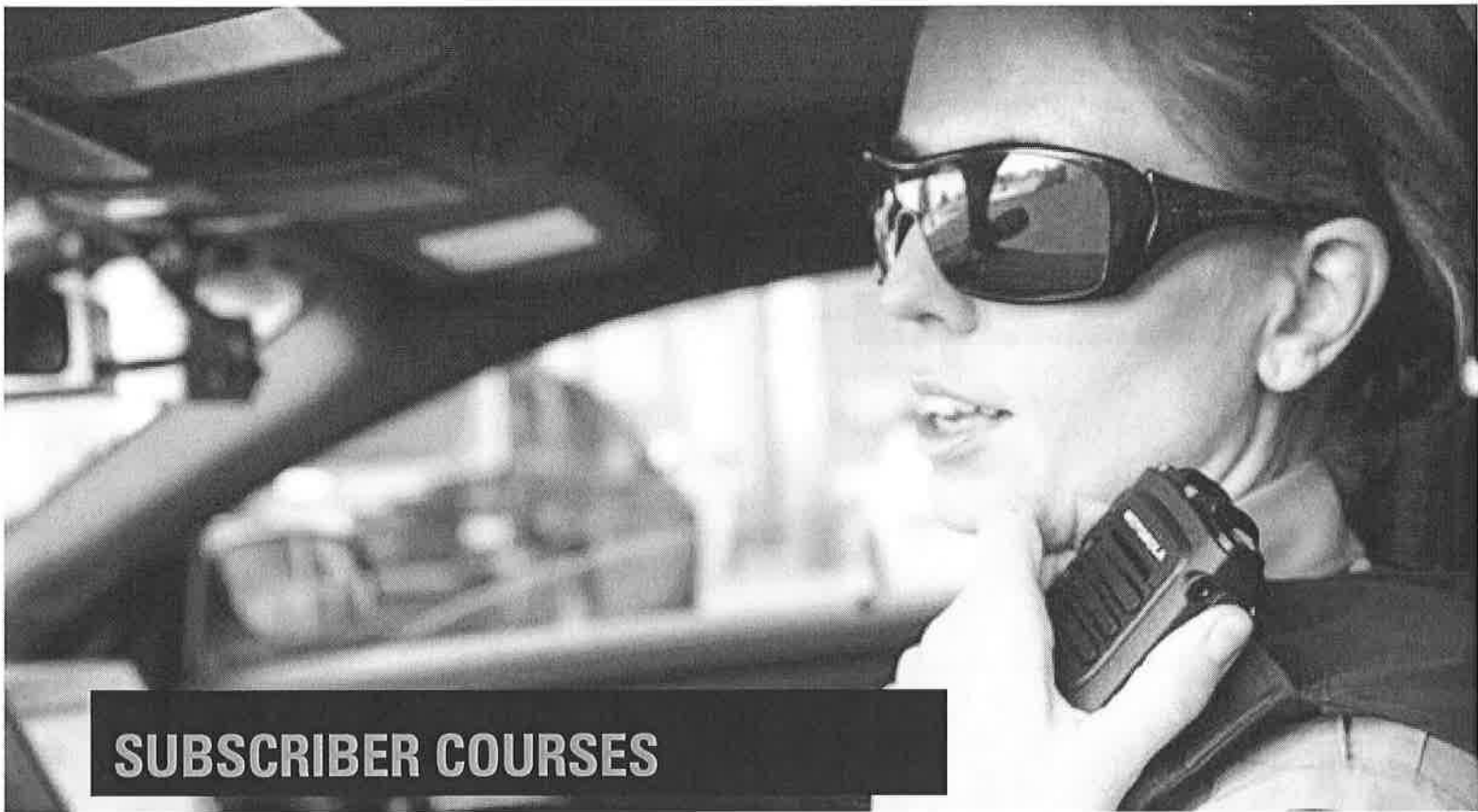
- Communication Systems Concepts (NST021)



**INSTRUCTOR-LED**  
**LENGTH: 3 DAYS**  
**LMS COURSE CODE:**  
**RDS1022**



[CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET](#)



## SUBSCRIBER COURSES

<b>CPS PROGRAMMING AND TEMPLATE BUILDING (ADT001V)</b>	<b>43</b>
<b>XTS/XTL TECHNICAL SUBSCRIBER ACADEMY (ADST005)</b>	<b>43</b>
<b>APX™ CPS PROGRAMMING AND TEMPLATE BUILDING (APX7001V)</b>	<b>44</b>
<b>APX TECHNICAL SUBSCRIBER ACADEMY (APX010)</b>	<b>44</b>
<b>APX™ RADIO MANAGEMENT WORKSHOP (RDS2017)</b>	<b>45</b>
<b>MOTOTRBO™ SUBSCRIBER AND REPEATER TECHNICAL SERVICE ACADEMY (TB0300)</b>	<b>45</b>
<b>SI500 RADIO MANAGEMENT R2.X (PSA1053)</b>	<b>46</b>

### THE APX RADIO TECHNICAL ACADEMY AND THE XTS/XTL RADIO TECHNICAL ACADEMY

These "academy" style technical training courses are designed to provide technicians handling install, configuration, maintenance and troubleshooting support on APX or XTS/XTL subscribers, with a broader and deeper view of the APX radio and XTS/XTL radio. In addition to focusing on the capability, function and features of the APX and XTS/XTL radios as well as the detailed theory of operation of those radios, these academies will continue to focus on the correct procedures used to complete radio performance checks, radio alignment, maintenance and troubleshooting. They will also highlight other useful skills. These radio academies will include lecture and lab work on topics such as: Radio Flashing, Encryption (including configuring radios for OTAR), Programming Over P25 (POP 25), Advanced System Key Management, Vacuum and Submersibility testing, Mobile radio installation, Multiple Control Head configuration and many other special setup or configuration modes.

**NOTE:** As new APX models are released, they will be addressed during the APX Academy training. This approach provides technicians the expertise they need to work on the whole family of radios.

## RADIO SOLUTIONS SUBSCRIBERS

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at (800) 237-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

### XTS/XTL SUBSCRIBER FAMILY

DO YOU HAVE CPS PROGRAMMING EXPERIENCE?

NO

YES



CPS PROGRAMMING AND  
TEMPLATE BUILDING  
ADT001-T

CPS PROGRAMMING AND TEMPLATE BUILDING  
ADT001V VIRTUAL CLASSROOM (5) 2-HOUR SESSIONS



XTS/XTL TECHNICAL SUBSCRIBER ACADEMY

INSTRUCTOR-LED 4.5 DAYS

LMS COURSE CODE:  
ADST005

### CURRICULUM COMPLETE

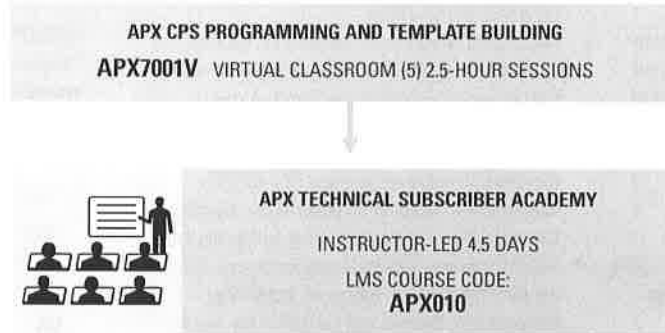
PARTICIPANT WILL BE ABLE TO PROGRAM, DEVELOP FLEET TEMPLATES, AND PERFORM MAINTENANCE ON ALL MEMBERS OF THE APX FAMILY OF RADIOS. MAINTENANCE WILL INCLUDE TESTING, ALIGNMENTS, DISASSEMBLY/RE-ASSEMBLY, SUBMERSION TEST, MOBILE RADIO INSTALLATION, AND TROUBLESHOOT TO THE BOARD LEVEL.

## RADIO SOLUTIONS SUBSCRIBERS

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

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## APX SUBSCRIBER FAMILY



## CURRICULUM COMPLETE

PARTICIPANT SHOULD BE ABLE TO PROGRAM, DEVELOP FLEET TEMPLATES, AND PERFORM MAINTENANCE ON ALL MEMBERS OF THE XTS/XTL FAMILY OF RADIOS. MAINTENANCE WILL INCLUDE TESTING, ALIGNMENTS, DISASSEMBLY/RE-ASSEMBLY, SUBMERSIBILITY TEST, MOBILE RADIO INSTALLATION, AND TROUBLESHOOT TO THE BOARD LEVEL.

## RADIO SOLUTIONS SUBSCRIBERS

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

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### CPS PROGRAMMING AND TEMPLATE BUILDING

#### COURSE OVERVIEW

This course provides communications management personnel and technicians with the knowledge and tools needed to program the radio units in the most efficient way depending on the system, features and options they require. The parameters and exercises shown in the class apply to a wide number of portable and mobile radios, including XTS 5000, XTS 3000, XTS 2500, XTS 1500, XTL 5000, XTL 2500, XTL 1500, MTS 2000, MCS 2000, the SPECTRA family, and the Professional Series.

#### AUDIENCE

Radio Technicians, System Managers

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Program the basic parameters of any radio using the Customer Programming Software (CPS)
- Program the specific parameters of any radio related with the system where the user is going to work: conventional, single site trunking, Simulcast, AMSS, SmartZone or ASTRO® 25
- Demonstrate knowledge of the options and features that can be programmed in a radio
- Create templates for the programming of subscribers in a system

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Basic features and options of two-way radios basic concepts of trunking



**VIRTUAL CLASSROOM**  
LENGTH: (6) 2-HOUR SESSIONS  
LMS COURSE CODE: ADT001V

### XTS/XTL TECHNICAL SUBSCRIBER ACADEMY

#### COURSE OVERVIEW

Participants will learn the capabilities, features and functions of the XTS/XTL family of radios as well as how to correctly complete performance checks, radio alignments, disassembly/reassembly, maintenance and troubleshooting. This academy will also focus on the detailed theory of operation. The XTS/XTL Academy will also cover in detail: Radio Flashing, Encryption, Key Loading (Including configuring the XTS/XTL radio for OTAR), Programming over P25 (Over the Air Programming), Advanced System Key Management, Vacuum and Submersibility Testing, Mobile Radio Installation and many other special setup or configuration modes with the radios. In addition to lecture, large amounts of hands-on, scenario based lab work will be used to reinforce knowledge transfer.

#### AUDIENCE

Radio Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Distinguish between the features and specifications of the XTS and XTL 5000 radios
- Verify the correct operations of the XTS and XTL 5000 radios by completing Performance Checks and Alignment procedures
- Maintain and troubleshoot an XTS and XTL 5000 radios
- Disassemble and reassemble the radios using the documented procedures
- Verify the housing integrity of an XTS 5000R portable radio
- Flash upgrade an XTS and an XTL 5000 Radio
- Interpret the circuit theory of operation and use this information to isolate faults found at both the board and the component level

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Communication Systems Concepts (NST021)
- Basic Radio (ARDS004)
- Theory of Radio Operations (RCS003E)

#### AND

- CPS Programming and Template Building Overview (ADT001V)

#### OR

- Test Out CPS Programming and Template Building (ADT001-T)



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE: ADST005



[CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET](#)

## RADIO SOLUTIONS SUBSCRIBERS

For information on prerequisites and to register for courses visit the LMS at:  
[LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at:  
(800) 247-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

### APX™ CPS PROGRAMMING AND TEMPLATE BUILDING

#### COURSE OVERVIEW

The APX CPS Programming and Template Building course provides communications management personnel and technicians with the knowledge and training necessary to build templates and program the APX family of radios in the most efficient way possible.

#### AUDIENCE

Radio Technicians, System Managers

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Build the APX family of programming templates using the APX CPS Programming Software
- Program the specific parameters related to the various system types in which the subscriber unit will operate: Conventional, Single Site Trunking, Simulcast, SmartZone or ASTRO® 25 IV&D TDMA and ASTRO® 25 IV&D X2
- Demonstrate knowledge of the APX CPS navigation, tools, options and features that make efficient programming of the radio possible
- Demonstrate a complete understanding of the various APX CPS programming efficiency tools, such as: Cloning, Drag and Drop, Codeplug Comparison Tool, Radio Flashing, Advance System Key Administrator, Codeplug Merging and many others

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Experience with the basic features and options of two-way radios and the basic concepts of trunking



VIRTUAL CLASSROOM  
LENGTH: (5) 2.5-HOUR  
SESSIONS  
LMS COURSE CODE  
APX7001V

### APX™ TECHNICAL SUBSCRIBER ACADEMY

#### COURSE OVERVIEW

Participants will learn the capabilities, features and functions of the APX family of radios as well as how to correctly complete performance checks, radio alignments, disassembly/reassembly, maintenance and troubleshooting. This academy will also focus on a detailed theory of operation for the APX family of radios. The APX Academy will also cover in detail: Radio Flashing, Encryption, Key Loading (Including configuring the APX radio for OTAR), Programming over P25 (Over the Air Programming), Advanced System Key Management, Vacuum and Submersibility Testing, APX Mobile Radio Installation and many other special setup or configuration modes with the radios. In addition to lecture, large amounts of hands-on with scenario based lab work will be used to reinforce knowledge transfer. This academy will cover in detail all models within the APX family of radios.

#### AUDIENCE

Radio Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Distinguish between the features and specifications of all available radios within the APX family of subscribers
- Verify the correct operation of the various radios within the APX family of subscribers by completing Performance Checks and Alignment procedures
- Maintain and troubleshoot radios within the APX family of subscribers
- Disassemble and reassemble various APX subscriber radios using the documented procedures

- Verify the housing integrity of an APX portable radio
- Flash upgrade the various radios within the APX family of subscribers
- Interpret the circuit theory of operation and use this information to isolate faults found at both the board and the component level

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Communication Systems Concepts (NST021)
- Basic Radio (ARDS004)
- Theory of Radio Operations (RCS003E)

#### Required:

- APX CPS Programming and Template Building (APX7001V)



INSTRUCTOR-LED  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
APX010



CLICK HERE TO VIEW THE  
SCHEDULE AND PRICE SHEET

## RADIO SOLUTIONS SUBSCRIBERS

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

### APX™ RADIO MANAGEMENT WORKSHOP

#### COURSE OVERVIEW

Participants will learn the capabilities, features, and functions of the APX™ Radio Management Suite. This course will cover an APX CPS overview, APX Radio Management Overview, Basic Networking Primer, ASTRO@ 25/CEN Networking and UNS Overview, and APX Radio Management Installation, Configuration, and Operations. In addition, the course will contain labs that will focus on installation, configuration, and operation using both wired and POP25 updates to APX Subscriber radios in both a LAN and WAN environment.

#### AUDIENCE

Radio Technicians, System Managers, Radio Programmers

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the APX Radio Management Suite operations and required software and hardware components
- Describe all deployment options for APX Radio Management Suite
- Configure a basic APX Radio Management system using a single PC, multiple PCs on a LAN, and multiple PCs on a WAN.
- Troubleshoot common APX Radio Management Installation, configuration, and operation issues
- Use Best Practices to implement and optimize Radio Management Performance

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- APX™ CPS Programming and Template (APX7001V Building)



**INSTRUCTOR-LED**  
**LENGTH: 2.5 DAYS**  
**LMS COURSE CODE:**  
**RDS2017**

### MOTOTRBO™ SUBSCRIBER AND REPEATER TECHNICAL SERVICE ACADEMY

#### COURSE OVERVIEW

Participants will learn the capabilities, features and functions of the MOTOTRBO™ family of radios and repeaters as well as how to correctly complete performance checks, radio alignments, disassembly/reassembly, maintenance, and troubleshooting. This Academy will also focus on the detailed theory of operation. In addition to lecture, large amounts of hands on, scenario based lab work will be used to reinforce knowledge transfer. This Academy will cover in detail different models within the MOTOTRBO™ family of radios and repeaters.

#### AUDIENCE

Radio Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Distinguish between the features and specifications of the MOTOTRBO™ portable and mobile radios and repeaters
- Verify the correct operations of the MOTOTRBO™ radios and repeaters by completing Performance Checks and Alignment procedures
- Maintain and troubleshoot MOTOTRBO™ radios and repeaters
- Disassemble and reassemble the radios using the documented procedures

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- CEDMEL2000 - Introduction to MOTOTRBO™ Systems for Technicians



**INSTRUCTOR-LED**  
**LENGTH: 3.5 DAYS**  
**LMS COURSE CODE:**  
**TB0300**



[CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET](#)

## RADIO SOLUTIONS SUBSCRIBERS

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

### Si500 RADIO MANAGEMENT R2.X

#### COURSE OVERVIEW

This course provides an overview and presentation of the basic functions available in Radio Management tool from the perspective of Si devices management. It includes video simulations of typical operations performed in Radio Management on Si devices, together with useful tips and practical examples.

#### AUDIENCE

Radio Management users

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the Radio Management application and its features.
- Lead users through their first logging.
- Demonstrate typical operations performed in Radio Management on Si devices.

#### REQUISITE KNOWLEDGE

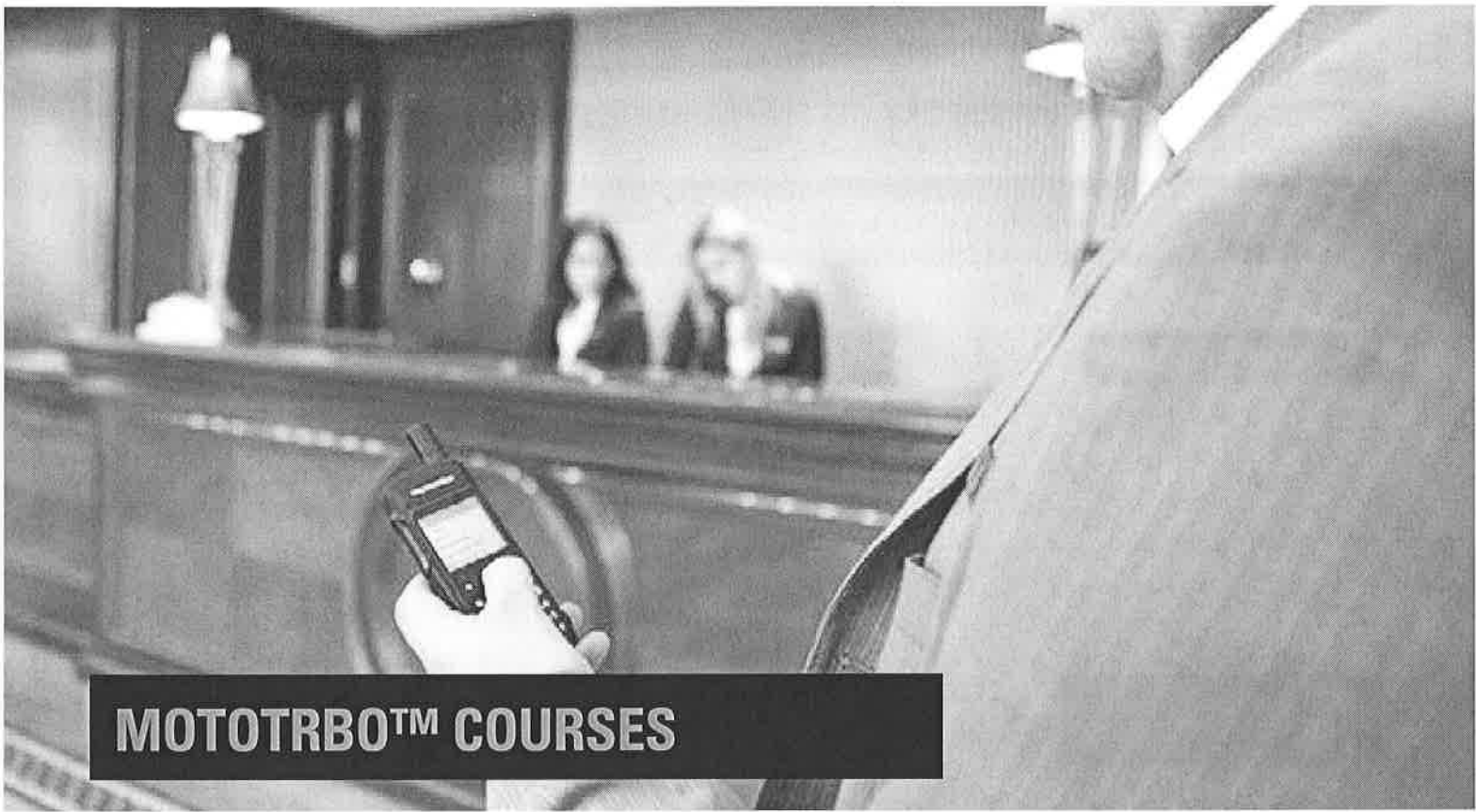
None



ONLINE, SELF-PAGED  
LENGTH: 1 HOUR  
LMS COURSE CODE  
PSA1053



## **MOTOTRBO™ SYSTEMS PORTFOLIO**



## MOTOTRBO™ COURSES

<b>MOTOTRBO™ SYSTEM INTRODUCTION FOR TECHNICIANS (CEDMEL2000)</b>	<b><u>51</u></b>
<b>MOTOTRBO™ SYSTEMS APPLIED NETWORKING (PCT2007)</b>	<b><u>51</u></b>
<b>MOTOTRBO™ RADIO MANAGEMENT WORKSHOP (PCT2022)</b>	<b><u>52</u></b>
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<b>MOTOTRBO™ CAPACITY MAX DESIGN AND DEPLOY (PCT2010)</b>	<b><u>52</u></b>
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<b>MOTOTRBO™ SYSTEM ACADEMY (PCT3002)</b>	<b><u>54</u></b>
<b>MOTOTRBO™ SYSTEM ACADEMY FOR CONNECT PLUS (PCT3003)</b>	<b><u>55</u></b>
<b>MOTOTRBO™ CONNECT PLUS TO CAPACITY MAX MIGRATION TRAINING (PCT3012)</b>	<b><u>55</u></b>



**THE LEARNING  
MANAGEMENT  
SYSTEM (LMS)**

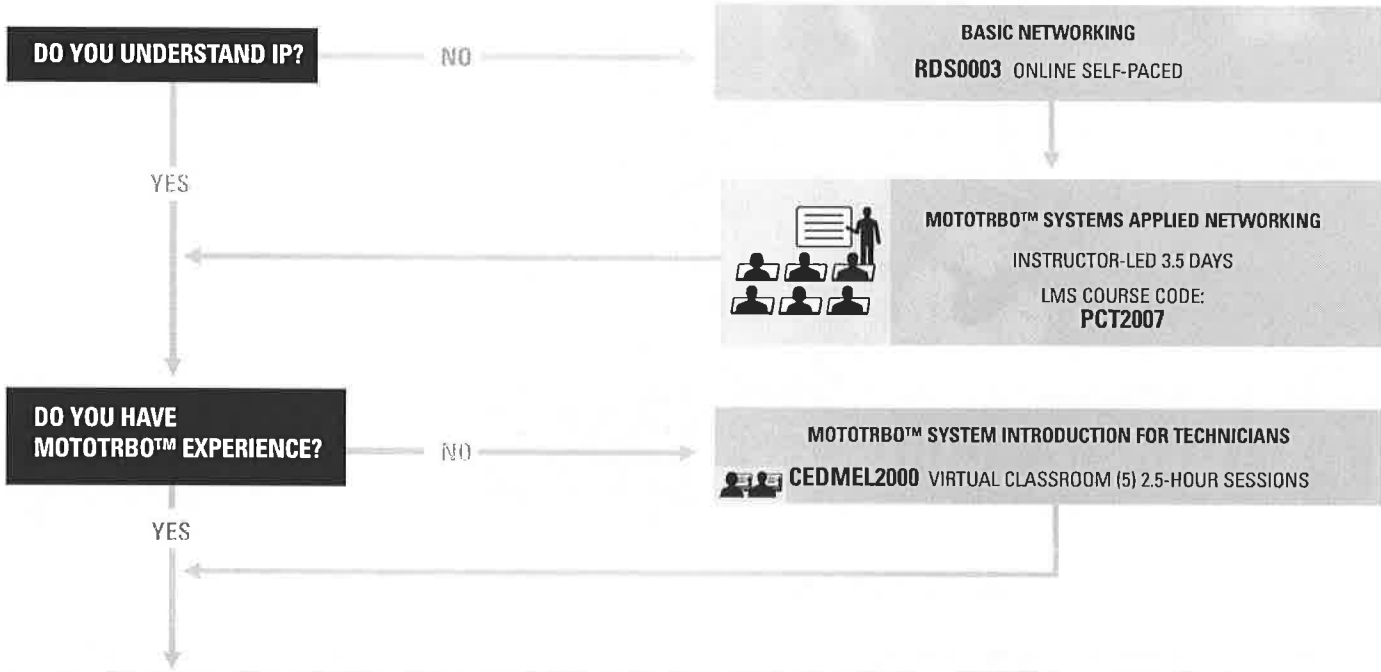
To register for a course, go to  
[www.mototrbo.com/learn](http://www.mototrbo.com/learn)

**RADIO SOLUTIONS MOTOTRBO™**

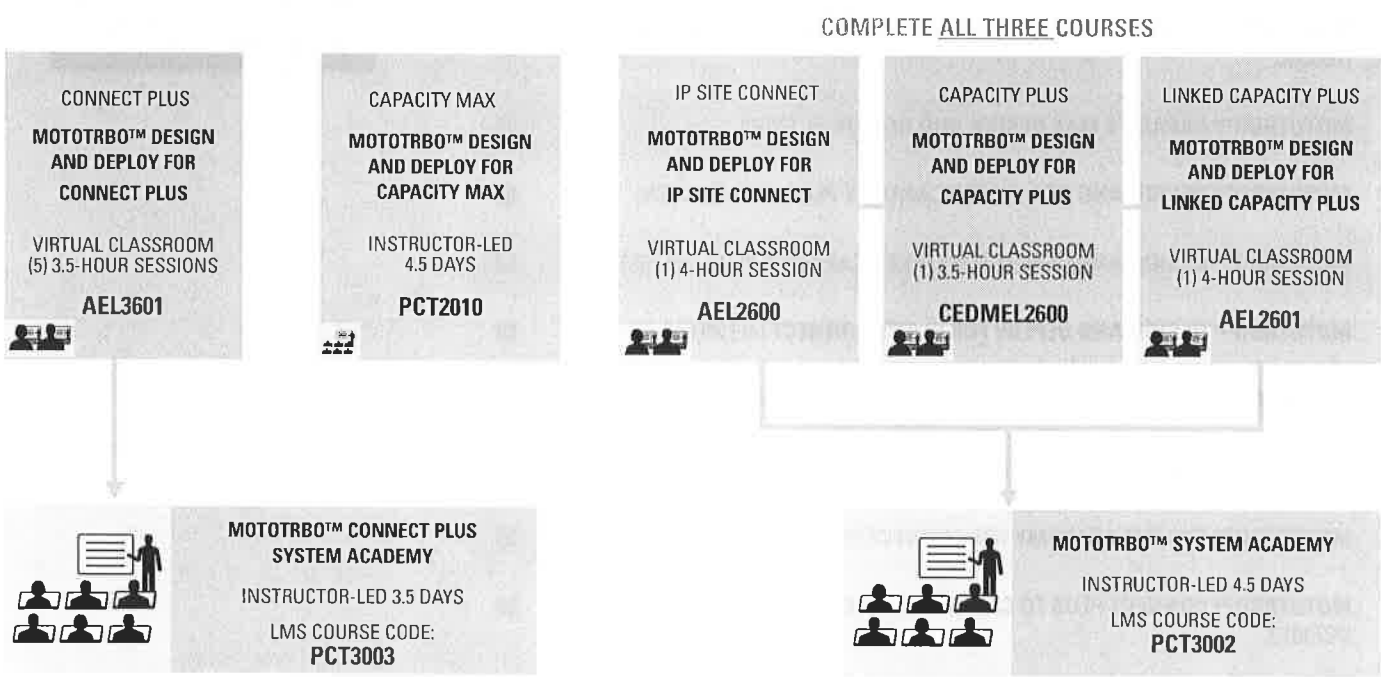
For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOTRBO.SOLUTIONS.COM](http://LEARNING.MOTOTRBO.SOLUTIONS.COM)

For general information, contact North America Education Services help desk at: (800) 247-2366, option 4 or [training.na@motorolapoftrbo.com](mailto:training.na@motorolapoftrbo.com)

**MOTOTRBO™ TECHNICAL TRAINING CURRICULUM  
BASED ON YOUR CURRENT IP AND MOTOTRBO™ EXPERIENCE**



**CHOOSE YOUR SPECIALIZED SYSTEM TRAINING**



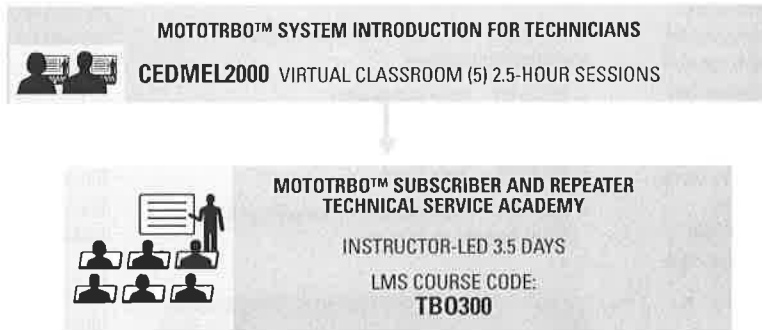
**CURRICULUM COMPLETE**  
PARTICIPANT SHOULD BE ABLE TO DESCRIBE THE KEY CHARACTERISTICS OF THE SYSTEM, DESCRIBE THE KEY CONFIGURATION ITEMS IN BOTH SUBSCRIBERS AND REPEATERS, PROGRAM EFFECTIVE REPEATER AND SUBSCRIBER CODEPLUG TEMPLATES FOR THE SYSTEM, AND DESCRIBE THE APPLICABLE IP NETWORKING REQUIREMENTS WHEN DESIGNING A SYSTEM.

## RADIO SOLUTIONS MOTOTRBO™

For information on prerequisites and to register for courses visit the LMS at:  
[LEARNING.MOTOROLA-SOLUTIONS.COM](http://LEARNING.MOTOROLA-SOLUTIONS.COM)

For general information, contact North America Education Services Desk at:  
[1800 267-2346](tel:18002672346), [na\\_training\\_cp@motorola-solutions.com](mailto:na_training_cp@motorola-solutions.com)

### MOTOTRBO™ TECHNICAL TRAINING CURRICULUM FOR SUBSCRIBER / REPEATER MAINTENANCE TECHNICIAN



### CURRICULUM COMPLETE

PARTICIPANT WILL LEARN THE COMMON MOTOTRBO™ FEATURES AND CAPABILITIES TO DESIGN AND DEPLOY MOTOTRBO™ SYSTEMS. PARTICIPANT SHOULD BE ABLE TO COMPLETE PERFORMANCE CHECKS, RADIO ALIGNMENTS, DISASSEMBLY/REASSEMBLY, MAINTENANCE, AND TROUBLESHOOTING OF VARIOUS MOTOTRBO™ RADIO TYPES.

## RADIO SOLUTIONS MOTOTRBO™

For information on prerequisites and to register for courses visit the LMS at:  
LEARNING.MOTOROLASOLUTIONS.COM

For general information, contact North America Education Services help desk at:  
(800) 247-2346, option 4 or training.na@motorolasolutions.com

### MOTOTRBO™ SYSTEM INTRODUCTION FOR TECHNICIANS

#### COURSE OVERVIEW

This is an introductory course to the MOTOTRBO™ system theory of operation, key components and topologies. MOTOTRBO™ Systems Introduction for Technicians gives the Professional-Level Empower Certification seekers all the basic information they need to know about common MOTOTRBO™ features and capabilities, along with system design and deploy principles. Upon successfully completing this course, individuals should be ready to take the more advanced Design and Deploy courses for IP Site Connect, Capacity Plus (Multi-Site and Single Site), Capacity Max and/or Connect Plus.

#### AUDIENCE

Anyone who will sell, design, configure, deploy, or maintain MOTOTRBO™ Digital Radio Systems. This would include, but is not limited to: Design Engineers, Communication System Technicians, Technical Support Personnel and Service Technicians.

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the different components available to build your MOTOTRBO™ system.
- Explain the MOTOTRBO™ Modes and Systems.
- Describe the various Data Application's capabilities and everyday uses within the MOTOTRBO™ systems.
- Describe MOTOTRBO™s Digital and Analog features.
- Explain system and channel capacity planning.
- Explain MOTOTRBO™ IP network design considerations.
- Describe organizational requirement and resources needed to design the fleetmap.
- Describe the use and purpose of various tools such as: Radio Management, Tuner, RDAC, Air Tracer, Site Survey and 3rd Party Application Tools.
- Navigate the main screens of the Customer Programming Software (CPS) needed to configure the radios and repeaters.

#### REQUISITE KNOWLEDGE

Participants should have a basic understanding of radio communication fundamentals.

Knowledge of basic two-way FM and digital communications theory.

- RDS0003 – Basic Networking
- RDS0002 – Basic RF
- RDS0004 – Basic Radio
- AAE1402 – Professional and Commercial Radios (PCR) Portfolio Overview



**VIRTUAL CLASSROOM**  
LENGTH: (5) 3-HOUR SESSIONS  
LMS COURSE CODE: CEDMEL2000

### MOTOTRBO™ SYSTEMS APPLIED NETWORKING

#### COURSE OVERVIEW

The MOTOTRBO™ Systems Applied Networking provides technicians with the necessary information required for understanding the typical networking requirements for implementing a variety of MOTOTRBO™ solutions. The course includes familiarization/review of basic networking concepts and MOTOTRBO™-specific networking requirements. This course will focus on specific configurations for IP Site Connect, Linked Capacity Plus, and Connect Plus trunking systems.

#### AUDIENCE

Technical System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Recall Basic Networking Concepts
- Identify recommended network components for MOTOTRBO™ systems
- Define LAN/WAN topologies for MOTOTRBO™ systems
- Perform backup, restore and recovery of recommended network components
- Identify network security concepts for MOTOTRBO™ systems

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Networking Essentials in Motorola Solutions Communication Systems (NST762)



**INSTRUCTOR-LED**  
LENGTH: 3.5 DAYS  
LMS COURSE CODE: PCT2007

 [CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET](#)

## RADIO SOLUTIONS MOTOTRBO™

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### MOTOTRBO™ RADIO MANAGEMENT WORKSHOP

#### COURSE OVERVIEW

The MOTOTRBO™ Radio Management 2.0 Workshop course provides technicians with the necessary information and practice to use the MOTOTRBO™ Radio Management 2.0 programming tool effectively.

#### AUDIENCE

System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Deploy and use RM 2.0 in a variety of real-world scenarios.
- Create and maintain configurations for basic MOTOTRBO™ Configurations (Connect Plus and Capacity Max excluded).
- Utilize Wi-Fi programming within RM 2.0.
- Use the RM Import and Export feature for database population.
- Convert existing radio templates and codeplugs to RM 2.0 Configurations.
- License and activate Radio and Application features.
- Use advanced features such as Data Mining.
- Use RM 2.0 to ease mass-deployments of subscribers.

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- PCT1032 MOTOTRBO™ Radio Management 2.0 Configuration Mode completion
- Networking Essentials or Network + Certification
- A high-level working knowledge of IP networking is very important



**INSTRUCTOR-LED**  
LENGTH: 2 DAYS  
LMS COURSE CODE:  
PCT2022

### MOTOTRBO™ SUBSCRIBER AND REPEATER TECHNICAL SERVICE ACADEMY

#### COURSE OVERVIEW

Participants will learn the capabilities, features and functions of the MOTOTRBO™ family of radios and repeaters as well as how to correctly complete performance checks, radio alignments, disassembly/reassembly, maintenance, and troubleshooting. This Academy will also focus on the detailed theory of operation. In addition to lecture, large amounts of hands on, scenario based lab work will be used to reinforce knowledge transfer. This Academy will cover in detail different models within the MOTOTRBO™ family of radios and repeaters.

#### AUDIENCE

Radio Technicians

#### COURSE OBJECTIVES


After completing this course, the student will be able to:

- Distinguish between the features and specifications of the MOTOTRBO™ portable and mobile radios and repeaters
- Verify the correct operations of the MOTOTRBO™ radios and repeaters by completing Performance Checks and Alignment procedures
- Maintain and troubleshoot MOTOTRBO™ radios and repeaters
- Disassemble and reassemble the radios using the documented procedures

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- CEDMEL2000 - Introduction to MOTOTRBO™ Systems for Technicians



**INSTRUCTOR-LED**  
LENGTH: 3.5 DAYS  
LMS COURSE CODE:  
TBQ300

### MOTOTRBO™ CAPACITY MAX DESIGN AND DEPLOY

#### COURSE OVERVIEW

MOTOTRBO™ Capacity Max Design and Deploy begins by covering the design process for a Capacity Max Radio system. Under the Instructor's guidance, participants will have the opportunity to practice designing and deploying a small scale, 2 Site/3 Channel, Capacity Max system in a safe classroom environment. This course will also cover how to configure Capacity Max using Radio Management 2.0 Configuration Mode.

In order to get the most of the hands-on activities, Participants MUST bring their own laptop to class with the latest RM 2.0 Configuration Mode software loaded. Please download this software from MOL (Motorola Solutions Online).

#### AUDIENCE

System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Design a simple a 1-System 2 Site/3 Channel Capacity Max system
- Calculate Capacity Max capacity and bandwidth using a Case Scenario and System Design tools.
- Using Radio Management Configuration Mode, configure your radios and infrastructure.
- Deploy a 1-System 2 Site/3 Channel Capacity Max system.
- Using System Advisor, learn the fundamentals of troubleshooting and maintaining a Capacity Max system
- Execute Radio Management database backup and restore
- Describe how to optimize a Capacity Max system

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- CEDMEL2000 - MOTOTRBO™ System Introduction for Technicians.
- PCT1047 – MOTOTRBO™ Capacity Max Technical Overview (OLT)
- PCT1046 – MOTOTRBO™ Capacity Max Theory of Operations (OLT)
- PCT1032 – Radio Management 2.0 Configuration Mode (OLT)
- Understanding IP Network Addressing
- Knowledge of RF Propagation modelling tools



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
PCT2010

## RADIO SOLUTIONS MOTOTRBO™

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### MOTOTRBO™ DESIGN AND DEPLOY FOR CAPACITY PLUS

#### COURSE OVERVIEW

MOTOTRBO™ Capacity Plus Design and Deploy training covers the key components and architectures of MOTOTRBO™ Capacity Plus Radio systems. Participants will be able to describe the MOTOTRBO™ Capacity Plus system, its capabilities, system components, and data applications. Participants will also be able to describe various MOTOTRBO™ Capacity Plus system topologies. They will learn how to design and deploy a MOTOTRBO™ Capacity Plus radio system. This course will also cover how to configure a MOTOTRBO™ Capacity Plus system using MOTOTRBO™ Customer Programming Software (CPS).

#### AUDIENCE

System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the MOTOTRBO™ Capacity Plus system, its capabilities, system components, and data application.
- Describe the MOTOTRBO™ Capacity Plus theory of operation.
- Describe the available MOTOTRBO™ Capacity Plus topologies.
- Learn the steps needed to configure a Capacity Plus system using MOTOTRBO™ CPS to program the subscribers and repeaters.

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- RDS0003 – Basic Networking
- RDS0002 – Basic RF
- RDS0004 - Basic Radio
- AAE1402 – Professional and Commercial Radios (PCR) Portfolio Overview
- CEDMEL2000 – MOTOTRBO™ System Introduction for Technicians



INSTRUCTOR-LED  
LENGTH: 0.5 DAYS  
LMS COURSE CODE:  
CEDMEL2600N



CLICK HERE TO VIEW THE  
SCHEDULE AND PRICE SHEET

### MOTOTRBO™ DESIGN AND DEPLOY FOR LINKED CAPACITY PLUS

#### COURSE OVERVIEW

MOTOTRBO™ Linked Capacity Plus Design and Deploy training introduces the key components and architectures of MOTOTRBO™ Linked Capacity Plus Radio systems. Participants will be able to describe the MOTOTRBO™ Linked Capacity Plus system, its capabilities, system components, and data applications. Participants will also be able to describe the MOTOTRBO™ Linked Capacity Plus system topology. They will learn what's involved with Designing and Deploying a MOTOTRBO™ Linked Capacity Plus radio system. This course will also cover how to configure a MOTOTRBO™ Linked Capacity Plus system using MOTOTRBO™ Customer Programming Software (CPS).

#### AUDIENCE

System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the MOTOTRBO™ Linked Capacity Plus system, its capabilities, system components, and data application.
- Describe the MOTOTRBO™ Linked Capacity Plus theory of operation.
- Describe the available MOTOTRBO™ Linked Capacity Plus topologies.
- Learn the steps needed to configure a Linked Capacity Plus system using MOTOTRBO™ CPS to program the subscribers and repeaters.

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- RDS0003 – Basic Networking
- RDS0002 – Basic RF
- RDS0004 - Basic Radio
- AAE1402 – Professional and Commercial Radios (PCR) Portfolio Overview
- CEDMEL2000 – MOTOTRBO™ System Introduction for Technicians



INSTRUCTOR-LED  
LENGTH: 0.5 DAYS  
LMS COURSE CODE:  
AEL2601N

### MOTOTRBO™ DESIGN AND DEPLOY FOR IP SITE CONNECT

#### COURSE OVERVIEW

MOTOTRBO™ IP Site Connect Design and Deploy training introduces the key components and architectures of the MOTOTRBO™ IP Site Connect radio systems. Participants will be able to describe the MOTOTRBO™ IP Site Connect system and its capabilities, system components, and data applications capabilities. Participants will also be able to describe various MOTOTRBO™ IP Site Connect system topologies. Participants will learn how to design and deploy a MOTOTRBO™ IP Site Connect radio system. This course will also cover how to configure a MOTOTRBO™ IP Site Connect System using MOTOTRBO™ Customer Programming Software. This course was designed for individuals who already have a good understanding of MOTOTRBO™ systems, but who want to now focus on IP Site Connect.

#### AUDIENCE

System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the MOTOTRBO™ Capacity Plus system, its capabilities, system components, and data application.
- Describe the MOTOTRBO™ Capacity Plus theory of operation.
- Describe the available MOTOTRBO™ Capacity Plus topologies.
- Learn the steps needed to configure a Capacity Plus system using MOTOTRBO™ CPS to program the subscribers and repeaters.

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- RDS0003 – Basic Networking
- RDS0002 – Basic RF
- RDS0004 - Basic Radio
- AAE1402 – Professional and Commercial Radios (PCR) Portfolio Overview
- CEDMEL2000 – MOTOTRBO™ System Introduction for Technicians



INSTRUCTOR-LED  
LENGTH: 0.5 DAYS  
LMS COURSE CODE:  
AEL2600N

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(800) 247-2345, option 4 or training.na@motorolasolutions.com

### MOTOTRBO™ CONNECT PLUS DESIGN AND DEPLOY

#### COURSE OVERVIEW

MOTOTRBO™ Connect Plus Design and Deploy introduces the key components and architectures of a MOTOTRBO™ Connect Plus Digital Radio system. The goal of the training is to teach participants how to correctly design and deploy a Connect Plus system in the field.

#### AUDIENCE

System Managers and Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the MOTOTRBO™ Connect Plus system.
- Describe in detail MOTOTRBO™ Connect Plus theory of operation.
- Identify the available MOTOTRBO™ Connect Plus topologies.
- Configure a MOTOTRBO™ Connect Plus system using MOTOTRBO™ CPS to program both MOTOTRBO™ radios and MOTOTRBO™ repeaters.
- Configure a MOTOTRBO™ option board using MOTOTRBO™ Connect Plus Option Board CPS.
- Use the MOTOTRBO™ Connect Plus Network Management Application to configure, monitor, and make adjustments to MOTOTRBO™ Connect Plus sites and subscriber units.

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- CEDMEL2000: MOTOTRBO™ System Introduction for Technicians

One or more of the following:

- AEL2600: MOTOTRBO™ IP Site Connect Design and Deploy
- CEDMEL2600: MOTOTRBO™ Capacity Plus Design and Deploy
- AEL2601: MOTOTRBO™ Linked Capacity Plus Design and Deploy

### MOTOTRBO™ SYSTEM ACADEMY

#### COURSE OVERVIEW

This course allows the participant to acquire in-depth hands-on experience planning, configuring and deploying the following MOTOTRBO™ Systems and Solutions: Digital Conventional, IP Site Connect, Capacity Plus and Linked Capacity Plus.

**NOTE:** MOTOTRBO™ Connect Plus Systems are covered in a separate class, please reference course Design and Deploy for MOTOTRBO™ Connect Plus (AEL3601) to learn how to plan, configure and deploy MOTOTRBO™ Connect Plus systems

#### AUDIENCE

System Administrators, System Technicians, Field Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Create and implement functional programming templates for example radio sites and systems that include:
- Digital Conventional simplex and repeater-based systems.
- IP Site Connect multisite conventional systems.
- Capacity Plus single-site trunked systems.
- Linked Capacity Plus multisite trunked systems.

Students will also receive instruction and/or hands-on experience with:

- Receiver voting topologies.
- Integrating MOTOTRBO™ Anywhere
- Integrating Avtec Scout consoles

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- MOTOTRBO™ System Introduction for Technicians (CEDMEL2000)
- MOTOTRBO™ Design and Deploy for IP Site Connect (AEL2600)
- MOTOTRBO™ Design and Deploy for Capacity Plus (CEDMEL2600)
- MOTOTRBO™ Design and Deploy for Linked Capacity Plus (AEL2601)



VIRTUAL CLASSROOM  
LENGTH: 5 DAYS (3.5  
HRS/DAY)  
LMS COURSE CODE:  
AEL3601



INSTRUCTOR-LED  
LENGTH: 3.5 DAYS  
LMS COURSE CODE:  
PCT3002



CLICK HERE TO VIEW THE  
SCHEDULE AND PRICE SHEET

# RADIO SOLUTIONS MOTOTRBO™

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For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

## MOTOTRBO™ SYSTEM ACADEMY FOR CONNECT PLUS

### COURSE OVERVIEW

MOTOTRBO™ Connect Plus System Academy allows the participant to acquire in-depth experience planning, configuring and deploying MOTOTRBO™ Connect Plus Trunking systems in a hands-on laboratory environment. This course reinforces and provides tangible context for individuals who have completed the virtual instructor-led MOTOTRBO™ Design and Deploy course and who wish to master the key elements of the MOTOTRBO™ Connect Plus Digital Radio system.

### AUDIENCE

System Administrators, System Technicians, Field Technicians, Support Personnel

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Apply Connect Plus system theory and technical capabilities and features to real-world scenarios.
- Create and implement functional programming templates for Connect Plus subscribers and repeaters.
- Configure Connect Plus XRC site controllers for single and multi-site systems.
- Configure Connect Plus XRT gateways for key applications such as MOTOTRBO™ Anywhere.
- Configure site controller redundancy.
- Determine bandwidth requirements for inter-site links using the Connect Plus System Planner.
- Configure Auto-Fallback operation in subscribers and the site infrastructure.
- Configure Emergency Calling and Emergency Alert operation.

- Configure option board codeplugs for over the air delivery.
- Perform over the air programming (OTAP) of key subscriber files such as the network frequency file, option board firmware and option board codeplugs.
- Describe and configure Network Address Translation (NAT) in site routers that are representative of typical customer equipment.
- Troubleshoot Connect Plus systems from the network, subscriber, and repeater perspectives.

### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- MOTOTRBO™ System Introduction for Technicians (CEDMEL2000)
- MOTOTRBO™ Connect Plus Design and Deploy (AEL3601)



## MOTOTRBO™ CONNECT PLUS TO CAPACITY MAX MIGRATION TRAINING

### COURSE OVERVIEW

This Virtual Instructor-Led training will guide you in migrating a Connect Plus to a Capacity Max radio system using the Capacity Max Bridge (CMB). Receive expert guidance on how to install, configure, and troubleshoot the CMB while also learning about the differences in system operations.

**NOTE:** : To gain the most benefit from this training, field experience or proficiency at deploying both Capacity Max and Connect Plus systems is strongly recommended.

### AUDIENCE

Dealers, Channel Partners, Technicians, MSI Employees

### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the features and capabilities of the Capacity Max Bridge (CMB).
- Use Radio Management to configure the CMB for your system.
- List the types of calls the CMB can bridge and the differences between the two MOTOTRBO™ systems.
- Monitor the CMB for optimal performance.

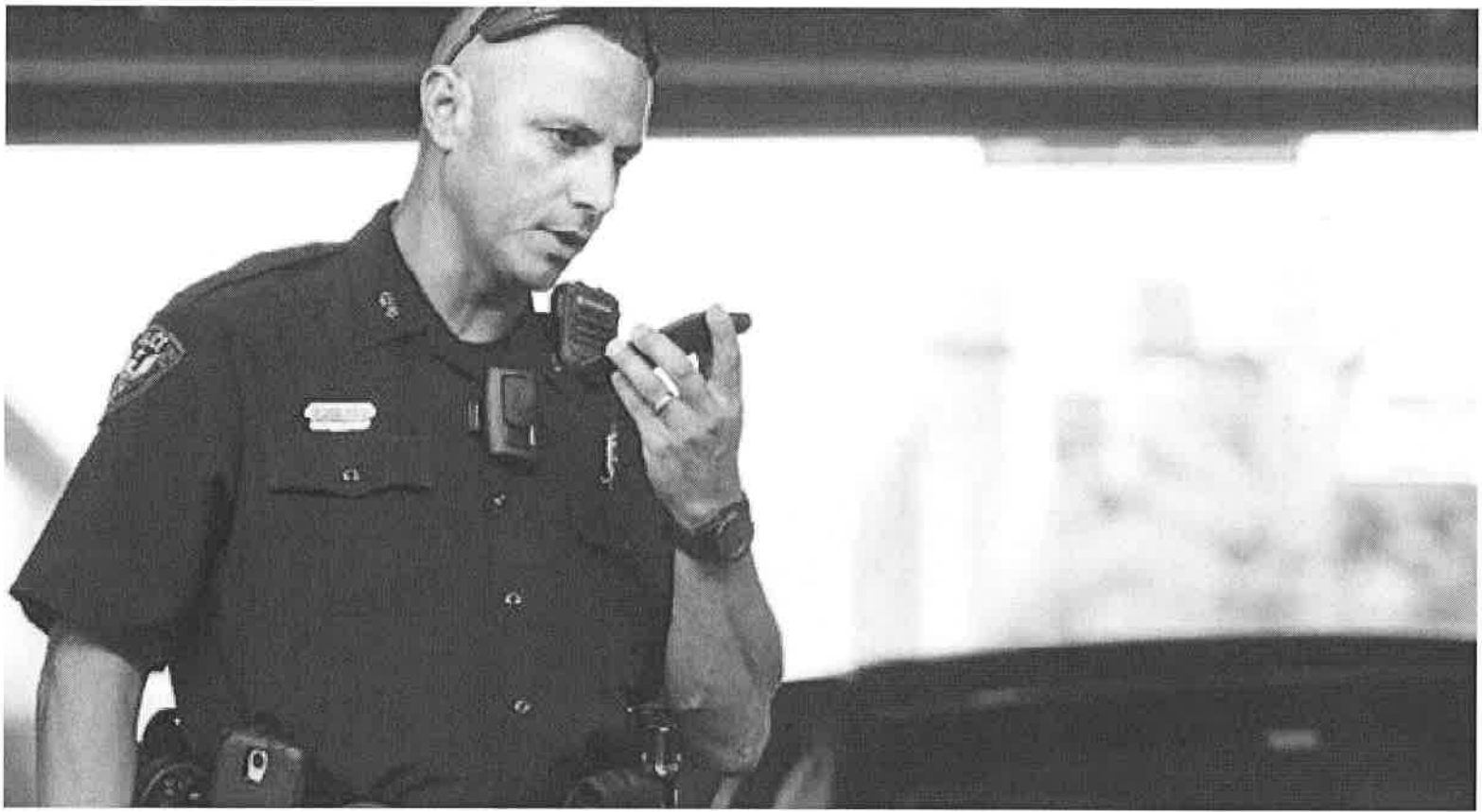
### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- AEL3601 - MOTOTRBO™ Connect Plus Design and Deploy
- PCT2010 - MOTOTRBO™ Capacity Max Design and Deploy



 [CLICK HERE TO VIEW THE SCHEDULE AND PRICE SHEET](#)



# PUBLIC SAFETY LTE DELIVERS A HIGH DEGREE OF THE 5 C's



## COVERAGE WITHOUT COMPROMISE

Public Safety LTE networks handle peak usage and prioritize system traffic to the end of coverage. Extend network coverage during disaster recovery situations and optimize coverage at the edge with LTE deployable trailers. Because first responders can instantly access video, photos, maps and more, they're better prepared to arrive at a dangerous crime scene or search patient medical records from a moving ambulance.



## CAPACITY FOR IT ALL

Capacity isn't only critical for emergencies, it's essential for day-to-day operations. When thousands of people converge at sports venues, concerts, festivals and rallies, mobile capacity must be sufficient and robust to keep everyone safe.



## CAPABILITIES TO IMPROVE SITUATIONAL AWARENESS

When public safety personnel have a unified picture of what's unfolding, they are better equipped to respond. High-speed data, location information, photos and streaming video can significantly improve collaboration and outcomes.



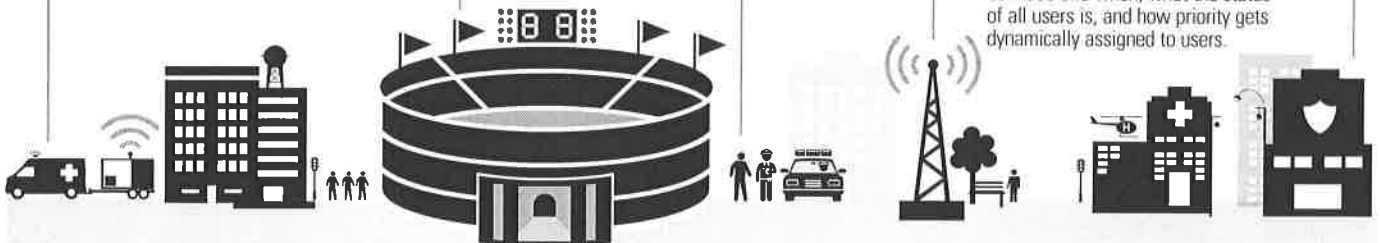
## COST SAVING

**ON A LARGE SCALE**  
An optimized Public Safety LTE network that saves money via economies of scale on devices and infrastructure partnership where needed.



## CONTROL OF YOUR COMMUNICATIONS

An optimized Public Safety LTE network gives you greater control over your system, software and devices. You decide who accesses the system, what changes need to be made and when, what the status of all users is, and how priority gets dynamically assigned to users.





## PUBLIC SAFETY LTE COURSES

<b>PUBLIC SAFETY LTE ARCHITECTURE AND SIGNALING (LTE2005)</b>	<b>58</b>
<b>PUBLIC SAFETY LTE SYSTEM ADMINISTRATION (LTE2006)</b>	<b>58</b>
<b>PUBLIC SAFETY LTE APPLIED NETWORKING (LTE2007)</b>	<b>58</b>
<b>PUBLIC SAFETY LTE SYSTEM OVERVIEW (AAE1603)</b>	<b>59</b>



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SYSTEM (LMS)**

To register for a course, go to  
[training.motorolasolutions.com](http://training.motorolasolutions.com)

## PUBLIC SAFETY LTE COURSES

For information on prerequisites and to register for courses visit the LMS at: [LEARNING.MOTOROLASOLUTIONS.COM](http://LEARNING.MOTOROLASOLUTIONS.COM)

For general information, contact North America Education Services help desk at: [257-2346\\_option\\_4\\_training\\_na@motorolasolutions.com](mailto:257-2346_option_4_training_na@motorolasolutions.com)

### PUBLIC SAFETY LTE ARCHITECTURE AND SIGNALING

#### COURSE OVERVIEW

This lab-based class provides students a practical understanding of 3GPP LTE/EPC signaling as used in a public safety LTE network.

Students use an Aricent EPC core system, Ericsson eNodeB, and Motorola Solutions subscriber units to: manage LTE/EPC network elements and interfaces, determine subscriber and network element status, capture and analyze LTE signaling, and analyze end-to-end service signaling and quality of service.

#### AUDIENCE

Customers

#### COURSE OBJECTIVES


After completing this course, the student will be able to:

- Describe LTE network elements and function
- Describe LTE/EPC interfaces
- Analyze LTE/EPC signaling flows
- Evaluate network element status based on NE interface and signaling state
- Trace UE state based on signaling
- Validate and troubleshoot end-to-end service signaling
- Describe LTE Quality of Service (QoS) operation
- Describe LTE to ASTRO® 25 inter-working options

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Public Safety LTE System Overview (AAE1603)
- Networking Essentials in Motorola Solutions Communications Equipment (NST762)



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
LTE2005

### PUBLIC SAFETY LTE SYSTEM ADMINISTRATION

#### COURSE OVERVIEW

The MOTOTRBO™ Systems Applied Networking provides technicians with the necessary information required for understanding the typical networking requirements for implementing a variety of MOTOTRBO™ solutions. The course includes familiarization/review of basic networking concepts and MOTOTRBO™-specific networking requirements. This course will focus on specific configurations for IP Site Connect, Linked Capacity Plus, and Connect Plus trunking systems.

#### AUDIENCE

Technical System Managers and technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Recall Basic Networking Concepts
- Identify recommended network components for MOTOTRBO™ systems
- Define LAN/WAN topologies for MOTOTRBO™ systems
- Perform backup, restore and recovery of recommended network components
- Identify network security concepts for MOTOTRBO™ systems

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Networking Essentials in Motorola Solutions Communication Systems (NST762)



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
LTE2006

### PUBLIC SAFETY LTE APPLIED NETWORKING

#### COURSE OVERVIEW

The Public Safety LTE Applied Networking course covers the operation and maintenance of Motorola Solutions supplied network transport equipment used in a PS LTE network. Participants will learn the operation and replacement tasks required to maintain Layer 2 switches, Layer 3 switches, the NTP server, DNS server, firewalls, and other devices which provide backhaul transport and connectivity services in the network.

This lab-based course offers students practice with critical maintenance procedures on standalone equipment without impacting network operation.

#### AUDIENCE

Customer System Managers, Customer Network Transport Technical Staff

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Check and manage status of LTE network transport devices
- Upgrade and downgrade device firmware or operating system
- Backup and restore device configuration
- Replace device hardware
- Validate and troubleshoot device operation

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- Public Safety LTE System Overview (AAE1603)
- Networking Essentials in Motorola Solutions Communications Equipment (NST762)



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
LTE2007

## PUBLIC SAFETY LTE COURSES

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### PUBLIC SAFETY LTE SYSTEM OVERVIEW

#### COURSE OVERVIEW

The Public Safety LTE System Overview self-paced course presents a high-level description of the Public Safety LTE system and an introduction into the network elements that comprise the system.

#### AUDIENCE

System Managers, System Technicians

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe LTE (Long-Term Evolution) technologies
- Describe the networks and their connections in a Public Safety LTE system
- Describe the functionality of the elements in aM Public Safety LTE system
- Describe how Prioritization works
- Describe bearers and data paths
- Describe the User Equipment (UE)

#### REQUISITE KNOWLEDGE

- None





## SOFTWARE & APPLICATIONS

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## SOFTWARE & APPLICATIONS

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### WAVE CERTIFIED INTEGRATION ENGINEER

#### COURSE OVERVIEW

The WAVE Certified Integration Engineer course provides instruction in designing, integrating, and troubleshooting WAVE systems. It also provides the groundwork for a basic understanding of how WAVE delivers a Radio-over-IP solution. The training scope covers WAVE integration to MOTOTRBO™, ASTRO, and DIMETRA systems.

#### AUDIENCE

Sales/Systems Engineers who will design and implement WAVE solutions, presale/post sale engineers, Motorola Solutions STs and FTs, partners, and customers.

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Understand and identify WAVE components.
- Install and configure the WAVE Management Server, Media Server, Proxy Server, Desktop Communicator, Advanced Desktop Communicator, Web and Mobile Communicators.
- Identify radio systems compatible with WAVE and list integration steps.
- Maintain and support a WAVE domain.

#### REQUISITE KNOWLEDGE

General knowledge of:

- IP Networking
- IP Telephony
- Server-class Operating Systems
- Mobile Device Applications
- LMR Radio Systems
- Motobridge
- MOTOTRBO™
- VMware vSphere – server virtualization platform
- Windows Active Directory
- IP Security



**INSTRUCTOR-LED**  
LENGTH: 4.5 DAYS  
LMS COURSE CODE:  
AST3001

### WAVE 7000 ADMINISTRATION AND MAINTENANCE WORKSHOP

#### COURSE OVERVIEW

The course covers the following:

- WAVE 7000 system overview and a list of features
- WAVE 7000 server administration, maintenance and troubleshooting content
- PSX PTT application overview, available call types

The intent of the course is to present the WAVE 7000 system in the context of the entire solution including IMW and LTE elements.

However, a detailed discussion of IMW and PS LTE components and applications is outside of the scope of this course.

#### AUDIENCE

System Administrators, Field Engineers, Support Engineers

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Provide information regarding the WAVE 7000 system, its function and capabilities.
- Perform the call types offered within the WAVE 7000 solution.
- Recognize WAVE 7000 administration tools and their functions.
- Define and describe the features of WAVE 7000 system.
- Execute back up and restore operations for WAVE 7000 system.
- Understand and explain process of geo-redundancy, as well as its administration, maintenance, provisioning and synchronization.
- Define and describe Secure Signaling and Service Authentication of WAVE 7000.
- Fix the presented issues of WAVE 7000 System.

#### REQUISITE KNOWLEDGE

- None



**INSTRUCTOR-LED**  
LENGTH: 3 DAYS  
LMS COURSE CODE:  
LTE2043

### INTELLIGENT MIDDLEWARE 5.2 OPERATION AND ADMINISTRATION

#### COURSE OVERVIEW

The purpose of this course is to provide the steps to operate and maintain a customer's IMW 5.2 system within their Motorola Solutions system (ASTRO, Dimetra, LTE).

#### AUDIENCE

Partners/Resellers and customers who would be responsible for the operation and maintenance of a customer's IMW system within their Motorola Solutions systems (ASTRO, Dimetra, LTE).

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe IMW features.
- Perform installation of IMW.
- Configure an IMW system.
- Identify the IMW tools to administer the system.
- Perform routine administration.
- Perform troubleshooting.
- Understand system-specific considerations.

#### REQUISITE KNOWLEDGE

- None



**INSTRUCTOR-LED**  
LENGTH: 2 DAYS  
LMS COURSE CODE:  
RDS2025



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## SOFTWARE & APPLICATIONS

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### COMMANDCENTRAL VAULT END USER

#### COURSE OVERVIEW

The CommandCentral Vault End User course starts out by providing a high level overview of CommandCentral Vault. It then demonstrates all of the tasks and end user may be required to do. It goes through grouping and filtering of videos, it walks through the tasks of adding annotations, creating video clips, adding appropriate tags, and how to handle audio and picture files.

#### AUDIENCE

End users

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe the CommandCentral Vault GUI and the Vault functions
- Navigate through, Group and Filter Videos
- Describe the Video overview screen
- Create clips, add annotations, and add appropriate tags to videos
- Describe how to handle Audio and picture files

#### REQUISITE KNOWLEDGE

- None



ONLINE, SELF-PACED  
LENGTH: 1 HOUR  
LMS COURSE CODE:  
PSA1044

### COMMANDCENTRAL VAULT REDACTION

#### COURSE OVERVIEW

This training provides instruction on how to perform the redaction of videos in CommandCentral Vault.

#### AUDIENCE

Record Specialists, Administrators, FOIA Officers or anyone who is required to redact videos before they are distributed.

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Prepare Videos for redaction
- Understand the key relationship between concepts of how redaction works such key frames, threshold setting, lighting, object movement, and so forth...
- -Redact and save a video

#### REQUISITE KNOWLEDGE

- None



ONLINE, SELF-PACED  
LENGTH: 0.5 HOURS  
LMS COURSE CODE:  
PSA1062

### COMMANDCENTRAL ANALYTICS END USER

#### COURSE OVERVIEW

The CommandCentral Analytics End User course provides an overview of CommandCentral Analytics. It consists of eight modules: Overview, Basic Operations, Dashboard, Roll Call and Maps, Trendcaster, Reporting, New Tabs, and Email Reports.

#### AUDIENCE

End users

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Describe what CommandCentral Analytics is.
- Perform Basic Operations.
- Set and read Trendcaster.
- Manage tabs.
- Manage the application.

#### REQUISITE KNOWLEDGE

- None



ONLINE, SELF-PACED  
LENGTH: 1 HOUR  
LMS COURSE CODE:  
RDS2023



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## SOFTWARE & APPLICATIONS

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### COMMANDCENTRAL PREDICTIVE END USER

#### COURSE OVERVIEW

The CommandCentral Predictive End User course provides an overview of CommandCentral Predictive. It consists of four modules: Overview, Basic Operations, Map View and TAP View, and Gaining Access (for Users with administration privileges). The course presents an overview of the application features and key users. It includes a presentation of the User Menu together with instructions on how to perform basic operations and use the main tabs of the application. For users with system administration privileges, it provides guidance on how to gain access to CommandCentral Predictive, how to create and manage user accounts.

#### AUDIENCE

End users

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Understand and identify the key features of CommandCentral Predictive.
- Perform basic operations.
- Use the Map View and TAP View tabs.
- Gain access to the application.

#### REQUISITE KNOWLEDGE

- None



ONLINE, SELF-PACED  
LENGTH: 0.5 HOURS  
LMS COURSE CODE:  
RDS2024

### COMMANDCENTRAL AGENCY SYSTEM ADMINISTRATION

#### COURSE OVERVIEW

The CommandCentral Agency System Administration course provides an overview of the System Administration functions that apply to all of the CommandCentral Applications in the CommandCentral suite of Applications. This course covers the creation and modification of user information and the creation and modification of groups with permissions that users are assigned to. The group permissions determine what an end user is able to see, modify or do in the CommandCentral suite of applications.

#### AUDIENCE

System Administrators or anyone who is responsible for setting up users, and groups along with their access permissions in the CommandCentral suite of applications

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Add users to the CommandCentral application
- Modify user information
- Remove users from the CommandCentral applications
- Add groups to the CommandCentral application
- Add permissions to the groups
- Define which layers in inform that a group may access
- Assign User to specific Groups for their access level

#### REQUISITE KNOWLEDGE

- None



ONLINE, SELF-PACED  
LENGTH: 0.5 HOURS  
LMS COURSE CODE:  
PSA1045

### COMMANDCENTRAL VAULT SYSTEM ADMINISTRATION

#### COURSE OVERVIEW

The CommandCentral Vault System Administration course provides an overview of CommandCentral Vault's System Administrator tasks. It covers: Device management tasks, including deleting devices, and adding new devices to vault. Adding new devices is referred to as the "Out of Box Experience". It then explains how to assign devices to officers, and finally goes through the steps to set up tags. Tags are used to identify or classify videos in to categories that are important to an agency. How these tags can be used for searching, grouping or if they can be available on the Si device are determined by setting the system administrator makes. This course also explains how to set up the default global retention durations, how to set the Recovery period before a video is deleted, and how to set unique retention times for special video types.

#### AUDIENCE

Command Central Vault System Administrators

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Add, delete and assign Si Devices
- Set video retention and recovery durations
- Create and Manage Tags
- Fix the presented issues of WAVE 7000 System.

#### REQUISITE KNOWLEDGE

- None



ONLINE, SELF-PACED  
LENGTH: 0.5 HOURS  
LMS COURSE CODE:  
PSA1043

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## SOFTWARE & APPLICATIONS

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For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training.na@motorolasolutions.com](mailto:training.na@motorolasolutions.com)

### COMMANDCENTRAL AWARE FIELD WORKSHOP

#### COURSE OVERVIEW

The CommandCentral Aware Field Workshop course consists of several modules to address customer training needs for the Aware solution. This training provides information on the general Aware interface including video, messaging, mapping, and radio consoles as well as modules that address the optional applications found in the Aware solution. This course is divided into two sections: one to address the needs of customer system administrators and the second to train operators of the Aware position. The administrator content covers the information necessary to manage user, camera, reports and other tasks that are necessary to administer the Aware solution. The operator content covers the controls and functionality of the various applications that make up the Aware solution to allow users to make the most effective use of their Aware positions.

#### AUDIENCE

Aware position operators, System Administrators, System Administrators/Managers

#### COURSE OBJECTIVES

After completing this course, the participant will be able to:

- Understand the functionality of applications that comprise CommandCentral Aware.
- Operate CommandCentral Aware applications.
- Use the administrative tools to manage the applications that comprise CommandCentral Aware.

#### REQUISITE KNOWLEDGE

None



**INSTRUCTOR-LED**  
LENGTH: 1-2 DAYS  
LMS COURSE CODE:  
RDS2027

### COMMANDCENTRAL INFORM END USER

#### COURSE OVERVIEW

This course provides an overview of the CommandCentral Inform User Interface. It then goes into detail on how to display and modify how Inform displays each application the user is using so only relevant data is presented.

#### AUDIENCE

Officers, detectives, commanders or anyone who needs to use the CommandCentral Inform application

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Navigate the CommandCentral Inform User Interface
- Configure your Instance of CommandCentral Inform to display data that is relevant to your job.

#### REQUISITE KNOWLEDGE

None



**ONLINE, SELF-PACED**  
LENGTH: 1 HOUR  
LMS COURSE CODE:  
PSA1057

**FOR MORE INFORMATION,  
CONTACT YOUR MOTOROLA  
SOLUTIONS REPRESENTATIVE**



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## **ADDITIONAL COURSES**

**MOSCAD NFM PROGRAMMING, MAINTENANCE AND OPERATOR (FXD010)**

**66**

## RADIO SOLUTIONS ADDITIONAL COURSES

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For general information, contact North America Education Services help desk at: (800) 247-2346, option 4 or [training\\_na@motorolasolutions.com](mailto:training_na@motorolasolutions.com)

### MOSCAD NFM/SDM MAINTENANCE AND PROGRAMMING

#### COURSE OVERVIEW

The course focuses on a detailed discussion of the different types of Network Fault Management systems, SDM3000 RTU hardware, hands-on activities with programming the RTU's, Attach Site Builder Applications for Tag Generation, Generating Tags and Files, navigating with the web browser features and the Graphic Master Computer.

#### AUDIENCE

System Managers, Service Technicians, Motorola Solutions Service Center, End Users

#### COURSE OBJECTIVES

After completing this course, the student will be able to:

- Install NFM SDM3000 builder software on students' laptops.
- Configure alarm points using SDM3000 builder.
- Generate Tags and Files to import alarm tags.
- Navigating and acknowledging alarms at the Graphic Master Computer.
- Utilize the web browser features to view and configure the system.
- Create Custom Tabs.
- Create Custom Maps.

#### REQUISITE KNOWLEDGE

Completion of the following course(s) or equivalent experience:

- A basic understanding of Windows navigation
- Laptop computer with Windows XP
- Windows program files must be on the "C" directory



**INSTRUCTOR-LED**  
**LENGTH: 3 DAYS**  
**LMS COURSE CODE:**  
**FXD010**



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## 13.3 SAMPLE ADVANCED PLUS (WARRANTY & MAINTENANCE SOW)



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This Statement of Work (SOW), including all of its subsections and attachments is an integral part of the Services Agreement or other signed agreement between Motorola Solutions, Inc. (Motorola) and Customer ("Agreement") and is subject to the terms and conditions set forth in the Agreement.

Advanced Plus Services are Network Event Monitoring, Technical Support, Network Hardware Repair, Remote Security Patch Installation, OnSite Support, Annual Preventive Maintenance and Network Updates. Each of these services are summarized below and expanded upon in the in the appendices A, B, C, D, E, F and G. In the event of a conflict between the Sections below and an individual SOW Subsection, the individual SOW Subsection prevails.

### **Advanced Plus Services**

Motorola's Advanced Plus Services are designed for customers who would benefit from Motorola's support experience. Advanced Plus Services are delivered through a combination of centralized resources within Motorola's Solutions Support Center (SSC) collaborating with authorized local field services delivery resources that are experienced in managing mission critical networks and associated technologies. The MSI SSC operates 24 x 7 x 365, leveraging field resources that are either dedicated to the network or engaged as needed.

Advanced Plus Services applies to fixed end communications network equipment located at the network core, RF site and dispatch sites. Advanced Plus Services do not include maintenance of mobile or portable devices, or network backhaul.

The services described in this SOW will be performed in accordance with the Customer Support Plan (CSP) agreed upon by the parties.

The CSP will define the system elements covered under Advanced Plus Services. The division of responsibilities between Motorola and Customer shall be defined and documented in the Appendices of this SOW, the Advanced Plus Services CSP and other portions of the Agreement.

### **Customer Support Plan (CSP)**

The Advanced Plus Services Statement of Work summarizes Motorola's delivery approach and standard goals. Since individual customer technologies, systems, operating environments, and operational capabilities differ, the outlined services approach in the Advanced Plus Services SOW will be adapted to each Customer's own environment and unique needs via the CSP.

The CSP is a critical component of this SOW and, once created, will automatically become integrated into this SOW by this reference. Motorola and Customer will collaborate to define the Customer-specific processes, procedures, network information, and other relevant support details required to perform the Services set forth in the Advanced Plus Services SOW.

### **Centralized Service Delivery**

Network Event Monitoring provides for real time continuous event management for radio communications networks. The SSC Network Operations Center utilizes sophisticated tools for



remote monitoring and event characterization of customer communications networks. When an event is detected, technologists acknowledge and assess the situation, and initiate a defined response. Appendix A contains the SOW for Network Event Monitoring.

Technical Support provides telephone consultation for technical issues that require a high level of ASTRO 25 network experience and troubleshooting capabilities. Technical Support is delivered through the Motorola Solution Support Center (SSC) by a staff of technical support specialists skilled in diagnosis and swift resolution of infrastructure performance and operational issues. Motorola applies leading industry standards in recording, monitoring, escalating and reporting for Technical Support calls from its contracted customers, reflecting the importance of maintaining mission critical systems. Appendix B contains the SOW for Technical Support.

The Service Desk provides a single point of contact for all Service related items, including communications between Customer, Third-Party Subcontractors, and Motorola. The Service Desk provides an ingress/egress point for Service Requests, Service Incidents, Changes, and Dispatch. All incoming transactions through the Service Desk are recorded, tracked and updated through the Motorola Customer Relationship Management (CRM) system. Key responsibilities are: Documentation of customer inquiries, requests, concerns and related tickets. Tracking and resolution of issues, and timely communication with all stakeholders is based on the nature of the incident and the requirements of the CSP. The Services Desk will manage service requests received from authorized parties and will coordinate the appropriate response with Customer and third parties, as necessary.

### **Field Service Delivery**

Advanced Plus Services are provided by authorized local field Services delivery resources. Annual Preventive Maintenance and OnSite Support are both managed from the SSC, but delivered by authorized local field services resources.

OnSite Support provides local, trained and qualified technicians who arrive at the customer location upon a dispatch service call to diagnose and restore the communications network. This involves running diagnostics on the hardware or FRU (Field Replacement Unit) and replacing defective infrastructure or FRU. The system technician will respond to the customer location based on predefined severity levels. Appendix E contains the SOW for Onsite Support.

Annual Preventive Maintenance Service provides proactive, regularly scheduled operational test and alignment of infrastructure and network components to continually meet original manufacturer's specifications. Certified field technicians perform hands-on examination and diagnostics of network equipment on a routine and prescribed basis. Appendix F contains the SOW for Annual Preventive Maintenance.

### **Network Hardware Repair**

Motorola provides a hardware repair service for all of the Motorola and select third-party infrastructure equipment supplied by Motorola. The Motorola authorized Repair Depot manages and performs the repair of Motorola supplied equipment as well as coordinating the equipment repair logistics process. Appendix C contains the SOW for Network Hardware Repair.



Network Hardware Repair with Advanced Replacement is a purchasable option under which Motorola will provide Customer with an advanced replacement unit(s) or Field Replacement Units (FRUs) as they are available in exchange for Customer's malfunctioning equipment. Malfunctioning equipment will be evaluated and repaired by the infrastructure repair depot and returned to depot's FRU inventory upon completion of repair. Customers who prefer to maintain their existing FRU inventory have an option to request a "Loaner" FRU while their unit is being repaired. If purchased, an appendix with the Network Hardware Repair with Advanced Replacement SOW will be included at the end of this document.

## **Security Management Operations**

### **Remote Security Patch Installation**

Motorola maintains a dedicated vetting lab for each supported ASTRO 25 release for the purpose of pre-testing security updates. In some cases, when appropriate, Motorola will make the updates available to outside vendors, allow them to test, and then incorporate those results into this offering. Once tested, Motorola posts the updates to a secured extranet website and sends an email notification to the customer. If there are any recommended configuration changes, warnings, or workarounds, Motorola will provide detailed documentation along with the updates on the website. In addition to testing the security updates, Remote Security Patch Installation includes remote installation of the updates. Appendix D contains the SOW for Remote Security Patch Installation.

### **Security Monitoring**

ASTRO 25 Security Monitoring is a purchasable solution that provides 24x7x365 monitoring of the radio network security elements by specialized security technologists with years of experience working with ASTRO 25 mission-critical networks. For highly complex or unusual security events, our technologists have direct and immediate access to Motorola engineers for rapid resolution. If purchased, an appendix with the Security Monitoring SOW will be included at the end of this document.

## **Network Updates**

Network Updates Service is a comprehensive approach to technology sustainment of the ASTRO 25 system. It incorporates both software and hardware updates aligned with the ASTRO 25 platform lifecycle so the customer's system is maintained at a high level of support. Network Updates service provides a complete package of hardware, software and implementation services required to update the ASTRO 25 system with an equivalent level of functionality.

Network Updates enable the ASTRO 25 system to function at high levels of operation over time, and allow for feature enhancement and system expansion, such as expansion of RF sites, dispatch positions, data sub-systems, network management positions, while maximizing the lifespan of the investment. Network updates provide access to the latest available standard and optional features (optional features may require an additional fee for licensing and hardware). Software and hardware updates to platform components optimize the availability of repair services support and may also provide increased capacity and processing capability. Live network updates are performed



with minimal interruption to system operation and with minimal reliance on owner resources. Appendix G contains the SOW for Network Updates.

## **My View Portal**

MyView Portal is a web-based platform that provides a transparent, single source view of network maintenance and operations along with historical system and service delivery information. It can be accessed from a desktop, laptop or tablet web browser.

**Event Monitoring Reports:** See resolution status for incidents and notifications by severity level.

**Technical Support:** View case status details to compare them to committed response times.

**OnSite Support:** Observe case details by severity level and track the progress of onsite support issue resolution.

**Annual Preventive Maintenance:** Access the maintenance status for all sites and quickly identify actions needed to take to optimize system performance.

**Network Hardware Repair:** Track return material authorizations (RMAs) shipped to our repair depot and eliminate the need to call for status updates.

**Security Patching:** Receive automated patch downloads and status on completed updates.

**System Upgrade Notifications:** View hardware and software updates in addition to alerts to areas that need compliance attention

**Trending Reports:** Access up to 13 months of historical data and system activity to analyze case management.

**Asset and Contract Information:** View all the assets purchased for the network, recent orders, and contract information.

The data presented in MyView Portal is in support of the appendix SOW's which provide the terms of any service delivery commitments associated with this data.



## Appendix A: Network Event Monitoring Statement of Work

Network Event Monitoring provides real-time fault monitoring for radio communications networks on a continuous basis. Network Event Monitoring utilizes sophisticated tools for remote monitoring and event characterization of your communications networks. When an event is detected, skilled technologists acknowledge and assess the situation, and initiate a defined response.

The terms and conditions of this Statement of Work (SOW) are an integral part of Motorola's Service Agreement or other applicable agreement to which it is attached and made a part thereof by this reference.

### 1.0 Description of Network Event Monitoring Services

Network Event Monitoring is a service designed to monitor elements of a communication system for events, as set forth in the Monitored Elements Table. When the SSC detects an event, then, based on the severity of the event, trained technologists acknowledge and remotely diagnose the event and initiate an appropriate response in accordance with the customer handling procedure. Appropriate responses could include, but are not limited to, continuing to monitor the event for further development, attempting remote remediation via engagement of Technical Support resources, or initiating dispatch of a Field Servicer ("Servicer") for onsite remediation if required.

#### 1.1 Availability

Network Event Monitoring is available 24 hours a day, 7 days a week. Network Event Monitoring availability is based on the level of contracted service and defined in the Customer Support Plan (CSP).

#### 1.2 Geographic Availability

Network Event Monitoring is a globally provided service unless limited by data export control regulations. Timeframes are based on the customer's local time zone.

#### 1.3 Inclusions

Network Event Monitoring can be delivered on Motorola sold infrastructure as stated in the Monitored Elements Table.

#### 1.4 Limitations and Exclusions

- 1.4.1 Does not include monitoring of anything outside of the radio network or monitoring of infrastructure provided by a third party, unless specifically stated. Monitored elements must be within the radio network and capable of sending traps to the Unified Event Manager (UEM).
- 1.4.2 Additional support charges above and beyond the contracted service agreement fees may apply if Motorola determines that system faults were caused by the customer making changes to critical system parameters.
- 1.4.3 The following activities are outside the scope of the Network Monitoring service, but are optional services that are available to remote Network Monitoring customers at an



additional cost:

- Emergency on-site visits required to resolve technical issues that cannot be resolved by SSC working remotely with the local customer technical resource.
- System installations, upgrades, and expansions.
- Customer training.
- Hardware repair and/or exchange.
- Network security services.
- Network transport (WAN ports, WAN cloud, redundant paths).
- Information Assurance.
- Any services not expressly included in this statement of work.

1.4.4 Reference the event catalogue to confirm monitored equipment.

1.5 Motorola has the following responsibilities:

- 1.5.1 Provide dedicated connectivity through a network connection necessary for monitoring communication networks. The Connectivity Matrix further describes the connectivity options.
- 1.5.2 If determined necessary by Motorola, provide Motorola owned equipment for monitoring system elements. If Motorola installs or replaces Motorola owned equipment, the type of equipment and location installed is listed in the Motorola Owned & Supplied Equipment Table.
- 1.5.3 Verify connectivity and event monitoring prior to system acceptance or start date.
- 1.5.4 Monitor system continuously during hours designated in the CSP in accordance with the pre-defined times specified in the Engagement Matrix.
- 1.5.5 Remotely access the customer's system to perform remote diagnosis as permitted by customer pursuant to the Connectivity Matrix.
- 1.5.6 Create a case, as necessary. Gather information to perform the following:
  - Characterize the issue
  - Determine a plan of action
  - Assign and track the case to resolution.
- 1.5.7 Cooperate with customer to coordinate transition of monitoring responsibilities between Motorola and customer as specified in section 1.6.12 and 1.6.12.1.
- 1.5.8 Maintain communication as needed with the customer in the field until resolution of the case

1.6 The Customer has the following responsibilities:

- 1.6.1 Allow Motorola continuous remote access to enable the monitoring service.
- 1.6.2 Provide continuous utility service to any Motorola equipment installed or utilized at customer's premises to support delivery of the service. Customer acknowledges Risk of loss to any Equipment provided to Customer as part of the Services will reside with Customer upon delivery and will remain with Customer until Equipment is returned to Motorola or its authorized representative.
- 1.6.3 Provide Motorola with predefined customer information and preferences prior to Start Date necessary to complete the CSP, including, but not limited to:
  - Case notification preferences and procedure



- Repair Verification Preference and procedure
- Database and escalation procedure forms.
- Submit changes in any information supplied to Motorola and included in the CSP to the CSM.

- 1.6.4 Provide the following information when initiating a service request:
- Assigned system ID number
  - Problem description and site location
  - Other pertinent information requested by Motorola to open a Case.
- 1.6.5 Notify the SSC when customer performs any activity that impacts the system. (Activity that impacts the system may include, but is not limited to, installing software or hardware upgrades, performing upgrades to the network, renaming elements or devices within the network, or taking down part of the system to perform maintenance.)
- 1.6.6 Allow Servicicers access to equipment (including any connectivity or monitoring equipment) if remote service is not possible.
- 1.6.7 Allow Servicicers access to remove Motorola owned monitoring equipment upon cancellation of service.
- 1.6.8 Provide all customer managed passwords required to access the customer's system to Motorola upon request or when opening a case to request service support or enable response to a technical issue.
- 1.6.9 Pay additional support charges above and beyond the contracted service agreements that may apply if it is determined that system faults were caused by the customer making changes to critical system parameters
- 1.6.10 Obtain at Customer's cost all third party consents or licenses required to enable Motorola to provide the monitoring service.
- 1.6.11 Cooperate with Motorola and perform all acts that are reasonable or necessary to enable Motorola to provide the services described in this SOW.
- 1.6.12 Contact Motorola to coordinate transition of monitoring when monitoring responsibility is to be transferred to or from Motorola. (I.e. normal business hours to after-hours monitoring) as set forth in pre-defined information provided by customer CSP.
- 1.6.12.1 Upon contact, customer must provide customer name, site id, status on any open cases, severity level, and brief description of case and action plan to Motorola.
- 1.6.13 Acknowledge that cases will be handled in accordance with the times and priorities as defined in the Engagement Matrix.
- 1.6.14 Cooperate with Motorola and perform all acts that are reasonable or necessary to enable Motorola to provide the Network Event Monitoring.



### Engagement Matrix

The event types are based on the defined levels as follows:

Severity Level	Severity Definition	Engagement Times
1	<p>This is defined as a critical/major incident that causes the system and/or infrastructure to experience a loss of call processing functionality and no work-around or immediate solution is available.</p> <p>The following are examples of this kind of failure:</p> <ul style="list-style-type: none"> <li>o 33% of call processing resources impaired</li> <li>o Remote Site/subsystem severed</li> <li>o Site Environment alarms: <ul style="list-style-type: none"> <li>o Smoke</li> <li>o Unauthorized access</li> <li>o Temperature</li> <li>o Power failure</li> </ul> </li> </ul>	Response provided 24 hours, 7 days a week, including US Holidays.
2	<p>This is defined as a moderate/minor incident that causes the system to operate with a continuous reduction in capacity or functionality of core services (core services include, voice, data or network management).</p> <p>The following are examples of this kind of failure:</p> <ul style="list-style-type: none"> <li>o Less than 33% of call processing resources impaired</li> <li>o Failure of a single redundant component</li> </ul>	Response provided 8 x 5 on standard business days, which is normally Monday through Friday 8AM to 5PM, excluding US Holidays.
3	<p>This is defined as a minor issue, which has little or no impact on the functionality, efficiency or usability of core services. The following are examples of this kind of severity:</p> <ul style="list-style-type: none"> <li>o Faults that have no impact in how the user perceives the system to work</li> <li>o Intermittent issues</li> <li>o Requests for information</li> <li>o Preventive Maintenance or upgrade related work</li> </ul>	Response provided 8 x 5 on standard business days, which is normally Monday through Friday 8AM to 5PM, excluding US Holidays.



### Connectivity Matrix

Request connectivity 8 weeks in advance of service start date

System Type	Connectivity	Setup and Maintenance
ASTRO® 25	Internet VPN	Motorola
ASTRO® 25	T1	Motorola

### Motorola Owned & Supplied Equipment Table

Equipment Type	Location Installed
Firewall/Router	Master Site
Service Delivery Management Server	Master Site for each Zone



### Monitored Elements Table

Master Site Infrastructure	RF Site Equipment	Dispatch Site Equipment
Servers & Backup Servers	Channels	Consoles
MOSCAD (digital inputs & RS232 serial alarms)	MOSCAD (digital inputs & RS232 serial alarms)	AIS Servers
TRAK	RF Site Communication Path	Operator Position (OP)
Core LAN Switch	Switch	Conventional Channel Gateway (CCGW)
Packet Data Gateway (PDG)	Site Controller	Call Processor
Radio Network Gateway (RNG)	Router	Logging Replay Station (only within the Radio Network Interface "RNI")
Zone Database Server (ZDS)	Gateway Router	Voice Processing Module (VPM)
Gateway Router	Network Time Protocol (NTP)	Client Station
Controller – Zone & Domain	Firewall	MCC 7100 (only within the Radio Network Interface "RNI")
Firewall Manager Servers	SmartX Site Converter (only the converter, not the legacy sites)	MCC 7500 IP Logging Recorders
Air Traffic Router (ATR)		
Unified Event Manager (UEM)		
Zone Statistical Server (ZSS)		
Install Server		

*\*Some or all of the above equipment may be monitored depending on system configuration and need. Other equipment (not listed) may be monitored as an option, consult with your Customer Support Manager for details.*



## Appendix B: Technical Support Statement of Work

Motorola's Technical Support service provides telephone consultation for technical issues that require a high level of ASTRO 25 network knowledge and troubleshooting capabilities. Remote Technical Support is delivered through the Motorola Support Center (SSC) by a staff of technical support specialists skilled in diagnosis and swift resolution of infrastructure performance and operational issues.

Motorola applies leading industry standards in recording, monitoring, escalating and reporting for Technical Support calls from its contracted customers, reflecting the importance of maintaining mission critical systems.

### 1.0 Description of Technical Support Services

Motorola's Solution Support Center's (SSC) primary goal is Customer Issue Resolution (CIR), providing Incident Restoration and Service Request Fulfillment on Motorola's currently supported infrastructure. This team of highly skilled, knowledgeable, and experienced specialists is available to the customer as an integrated part of the support and technical issue resolution process. The SSC remotely supports the customer and works with but not limited to fault diagnostics tools, simulation networks and fault database search engines.

Technical Support is available Monday - Friday 8:00am - 5:00pm local site time and 24 hours a day, 7 days a week for Severity 1 Incidents. Technical Support availability for severity 2, 3 and 4 incidents is outlined in the [Severity Level Response Goals](#). Calls requiring incidents or service requests will be logged in Motorolas Customer Relationship Management (CRM) system. This helps ensure that technical issues are prioritized, updated, tracked and escalated as necessary, until resolution. Technical Support Operations assigns the impact level in accordance with the agreed [Severity Level Definitions](#) stated in this document.

Motorola will track the progress of each case from initial capture to resolution. Motorola will advise and inform the customer of the case progress and tasks that require further investigation and assistance from the customer's technical resources.

This service requires the customer to provide a suitably trained technical resource that delivers maintenance and support to the customer's system, and who is familiar with the operation of that system. Motorola provides technical consultants to support the local resource in the timely closure of infrastructure, performance and operational issues.

### 1.1 Scope

Technical Support service is available Monday - Friday 8:00am - 5:00pm local site time and 24 hours a day, 7 days a week for Severity 1 Incidents. See [Severity Level Definitions](#).

### 1.2 Inclusions

Technical Support service will be delivered on Motorola sold infrastructure including integrated 3<sup>rd</sup> party products.



### 1.3 Limitations and Exclusions

The following activities are outside the scope of the Technical Support service, but are optional services that are available to remote Technical Support customers at an additional cost:

- Emergency on-site visits required to resolve technical issues that cannot be resolved with the SSC working remotely with the local customer technical resource.
- Third party support for equipment not sold by Motorola.
- System installations, upgrades, and expansions.
- Customer training.
- Hardware repair and/or exchange.
- Network security services.
- Network transport management.
- Motorola services not included in this statement of work.
- Any technical support required as a result of a virus or unwanted intrusion is excluded if the system is not protected against these security threats by Motorolas Pre-tested Security Update Service when applicable.

### 1.4 Motorola has the following responsibilities:

- 1.4.1 Provide availability to the Motorola Solution Support Center (800-221-7144), 24 hours a day, 7 days a week to respond to Customer's requests for Severity 1 support. Refer to Severity Level Response Time Goals for Severity 2, 3 and 4 response times.
- 1.4.2 Respond initially to Incidents and Technical Service Requests in accordance with the response times set forth in the Severity Level Response Time Goals section of this document and the severity level defined in the Severity Level Definitions section of this document.
- 1.4.3 Provide caller a plan of action outlining additional requirements, activities or information required to achieve restoral/fulfillment.
- 1.4.4 Maintain communication with the customer in the field as needed until resolution of the case.
- 1.4.5 Coordinate technical resolutions with agreed upon third party vendors, as needed.
- 1.4.6 Manage functionally escalated support issues to additional Motorola technical resources, as applicable.
- 1.4.7 Determine, in its sole discretion, when a case requires more than the Technical Support services described in this SOW and notify customer of an alternative course of action.

### 1.5 The Customer has the following responsibilities:

- 1.5.1 Provide Motorola with predefined information prior to contract start date necessary to complete Customer Support Plan (CSP).
- 1.5.2 Submit changes in any information supplied in the Customer Support Plan (CSP) to the Customer Support Manager (CSM).
- 1.5.3 Contact the SSC in order to engage the Technical Support service, providing the necessary information for proper entitlement services. Including but not limited to the name of contact, name of customer, system ID number, site(s) in question, and brief description of the problem including pertinent information for initial issue



- characterization.
- 1.5.4 Maintain suitable trained technical resources that provide field maintenance and technical maintenance services to the system, and who are familiar with the operation of that system.
  - 1.5.5 Supply suitably skilled and trained on-site presence when requested by the SSC.
  - 1.5.6 Validate issue resolution prior to close of the case in a timely manner.
  - 1.5.7 Acknowledge that cases will be handled in accordance with the times and priorities as defined in the Severity Level Definitions and in the Severity Level Response Time Goals section in this document.
  - 1.5.8 Cooperate with Motorola and perform all acts that are reasonable or necessary to enable Motorola to provide the Technical Support.
  - 1.5.9 Obtain at Customer's cost all third party consents or licenses required to enable Motorola to provide the Service.



## Severity Level Definitions

The following severity level definitions will be used to determine the maximum response times:

Severity Level	Severity Definition
Severity 1	<p>This is defined as a failure that causes the system and/or infrastructure a loss of voice functionality and no work-around or immediate solution is available.</p> <p>The following are examples of this kind of failure:</p> <ul style="list-style-type: none"> <li>• 33% of call processing resources impaired</li> <li>• Site Environment alarms:               <ul style="list-style-type: none"> <li>○ Smoke,</li> <li>○ Unauthorized access</li> <li>○ Temperature</li> <li>○ Power failure</li> </ul> </li> </ul>
Severity 2	<p>This is defined as a fault that causes the system to operate with a continuous reduction in capacity or functionality of core services (core services consist of: Voice, data or network management).</p> <p>The following are examples of this kind of failure:</p> <ul style="list-style-type: none"> <li>○ Less than 33% of call processing resources impaired</li> <li>○ Failure of a single redundant component</li> </ul>
Severity 3	<p>This is defined as a fault which reduces the functionality, efficiency or usability of core services (voice, data and network management) and there is a viable work-around in place.</p> <p>The following are examples of this kind of severity:</p> <ul style="list-style-type: none"> <li>○ Intermittent faults that are infrequent and minor impact to core services</li> <li>○ Statistical reporting problems</li> </ul>
Severity 4	<p>This is defined as a minor issue, which has little or no impact on the functionality, efficiency or usability of core services. The following are examples of this kind of severity:</p> <ul style="list-style-type: none"> <li>○ Faults resulting in minor functions or features being unsupported or unreliable in ways that are not noticeable to the user.</li> <li>○ Faults that have no impact in how the user perceives the system to work.</li> <li>○ Cosmetic issues.</li> <li>○ Requests for information.</li> </ul>



### Severity Level Response Goals

The response times are based on the defined severity levels as follows:

Severity Level	Response Time
Severity 1	A Motorola SSC Technician will make contact with the customer technical representative within one hour of the request for support being logged in the issue management system. Continual effort will be maintained to restore the system or provide a workaround resolution. Response provided 24 x 7.
Severity 2	A Motorola SSC Technician will make contact with the customer technical representative within four hours of the request for support being logged at the issue management system. Response provided 8 x 5 on standard business days, which is normally Monday through Friday 8AM to 5PM, excluding US Holidays.
Severity 3	A Motorola SSC Technician will make contact with the customer technical representative within the next business day of the request for support being logged at the issue management system. Response provided 8 x 5 on standard business days, which is normally Monday through Friday 8AM to 5PM, excluding US Holidays.
Severity 4	A Motorola SSC Technician will make contact with the customer technical representative within the next business day of the request for support being logged at the issue management system. Response provided 8 x 5 on standard business days, which is normally Monday through Friday 8AM to 5PM, excluding US Holidays.



## Appendix C: Network Hardware Repair Statement of Work

Motorola provides a hardware repair service for all of the Motorola and select third-party infrastructure equipment supplied by Motorola. The Motorola authorized Repair Depot manages and performs the repair of Motorola supplied equipment as well as coordinating the equipment repair logistics process.

### 1.0 Description of Services

Infrastructure components are repaired at a Motorola authorized Infrastructure Depot Operations (IDO). At Motorola's discretion, select third party Infrastructure may be sent to the original equipment manufacturer or third party vendor for repair.

### 1.1 Scope

Repair Authorizations are obtained by contacting the Solutions Support Center (SSC) which is available 24 hours a day, 7 days a week.

Repair authorizations can also be obtained online via Motorola Online at <https://businessonline.Motorolasolutions.com>, under Repair Status/Submit Infrastructure RA.

### 1.2 Inclusions

Network Hardware Repair is available on Motorola sold communication systems which may include some aspect of third party hardware and software. Motorola will make a "commercially reasonable effort" to repair Motorola manufactured infrastructure products for seven years after product cancellation.

### 1.3 Exclusions

If infrastructure is no longer supported by Motorola, the original equipment manufacturer or a third party vendor, Motorola may return said equipment to the customer without repair or replacement. The following items are excluded from Network Hardware Repair:

- 1.3.1 All Motorola infrastructure hardware over seven (7) years from product cancellation date.
- 1.3.2 All Third party infrastructure hardware over two (2) years from product cancellation date.
- 1.3.3 All Broadband infrastructure over three (3) years from product cancellation date
- 1.3.4 Physically damaged infrastructure.
- 1.3.5 Third party equipment not shipped by Motorola
- 1.3.6 Consumable items including, but not limited to, batteries, connectors, cables, toner/ink cartridges, tower lighting, laptop computers, monitors, keyboards and mouse.
- 1.3.7 Video retrieval from Digital In-Car Video equipment.
- 1.3.8 Infrastructure backhaul such as: Antennas, Antenna Dehydrator, Microwave<sup>1</sup>, Line Boosters, Amplifier, Data Talker Wireless Transmitter, Short haul modems, UPS1
- 1.3.9 Test equipment.
- 1.3.10 Racks, furniture and cabinets.
- 1.3.11 Firmware and/or software upgrades.

<sup>1</sup> Excluded from service agreements but may be repaired on an above contract, time and material basis. All UPS Systems must be shipped to IDO for repair. Note! Excludes batteries and on-site services



1.4 Motorola has the following responsibilities:

- 1.4.1 Enable Customer access to the Motorola call Center operational 24 hours a day, 7 days per week, to create requests for repair service.
- 1.4.2 Provide repair return authorization numbers when requested by Customer.
- 1.4.3 Receive malfunctioning infrastructure from Customer and document its arrival, repair and return.
- 1.4.4 Perform the following service on Motorola infrastructure:
  - Perform an operational check on the infrastructure to determine the nature of the problem.
  - Replace malfunctioning Field Replacement Units (FRU) or components.
  - Verify that Motorola infrastructure is returned to Motorola manufactured specifications, as applicable.
  - Perform a box unit test on all serviced infrastructure.
  - Perform a system test on select infrastructure.
- 1.4.5 Provide the following service on select third party infrastructure:
  - Perform pre-diagnostic and repair services to confirm infrastructure malfunction and eliminate sending infrastructure with no trouble found (NTF) to third party vendor for repair, when applicable.
  - Ship malfunctioning infrastructure components to the original equipment manufacturer or third party vendor for repair service, when applicable.
  - Track infrastructure sent to the original equipment manufacturer or third party vendor for service.
  - Perform a post-test after repair by Motorola, original equipment manufacturer, or third party vendor to confirm malfunctioning infrastructure has been repaired and functions properly in a Motorola system configuration, when applicable.
  - Re-program repaired infrastructure to original operating parameters based on software/firmware provided by customer. If the customer software version/configuration is not provided, shipping times will be delayed. If the Infrastructure repair depot determines that the malfunctioning infrastructure is due to a software defect, the repair depot reserves the right to reload infrastructure with a similar software version.
  - Properly package repaired infrastructure.
  - Ship repaired infrastructure to the customer specified address during normal operating hours of Monday through Friday 7:00am to 7:00pm CST, excluding holidays. FRU will be sent two-day air unless otherwise requested. Motorola will pay for such shipping, unless customer requests shipments outside of the above mentioned standard business hours and/or carrier programs, such as NFO (next flight out). In such cases, customer will be responsible for payment of shipping and handling charges.

1.5 The Customer has the following responsibilities:



- 1.5.1 Contact or instruct Servicer to contact the Motorola Support Center (SSC) and request a return authorization number prior to shipping malfunctioning infrastructure.
- 1.5.2 Provide model description, model number and serial number, type of system, software and firmware version, symptom of problem and address of site location for FRU or infrastructure.
- 1.5.3 Indicate if infrastructure or third party infrastructure being sent in for service was subjected to physical damage or lightning damage.
- 1.5.4 Follow Motorola instructions regarding inclusion or removal of firmware and software applications from infrastructure being sent in for service.
- 1.5.5 Provide Customer purchase order number to secure payment for any costs described herein that are outside the scope of the existing Agreement between Motorola and Customer to which this SOW is attached.
- 1.5.6 Properly package and ship the malfunctioning FRU, at customer's expense. Customer is responsible for properly packaging the malfunctioning infrastructure FRU to ensure that the shipped infrastructure arrives undamaged and in repairable condition.
- 1.5.7 Clearly print the return authorization number on the outside of the packaging.
- 1.5.8 Maintain versions and configurations for software/applications and firmware to install repaired equipment.
- 1.5.9 Provide Motorola with proper software/firmware information to reprogram equipment after repair unless current software has caused this malfunction.
- 1.5.10 Cooperate with Motorola and perform all acts that are reasonable or necessary to enable Motorola to provide the infrastructure repair services to customer.
- 1.5.11 Obtain at Customer's cost all third party consents or licenses required to enable Motorola to provide the Service.



## Appendix D: Remote Security Patch Installation Service Statement of Work

To verify compatibility with your ASTRO 25 system, Motorola's Remote Security Patch Installation provides pre-tested 3<sup>rd</sup> party software (SW) security updates.

In addition to testing the security updates, Remote Security Patch Installation includes remote installation of the updates.

This Statement of Work ("SOW") is subject to the terms and conditions of Motorola's Professional Services Agreement, Service Agreement or other applicable agreement in effect between the parties ("Agreement"). Motorola and Customer may be referred to herein individually as a "Party" or together as "Parties"

### 1.0 Description of Remote Security Patch Installation

Motorola shall maintain a dedicated vetting lab for each supported ASTRO 25 release for the purpose of pre-testing security updates. In some cases, when appropriate, Motorola will make the updates available to outside vendors, allow them to test, and then incorporate those results into this offering. Depending on the specific ASTRO 25 release and customer options, these may include updates to antivirus definitions, OEM vendor supported Windows Workstation and Server operating system patches, Solaris and Red Hat Linux (RHEL) operating system patches, VMware ESXi Hypervisor patches, Oracle database patches, PostgreSQL patches, and patches for other 3rd party Windows applications such as Adobe Acrobat and Flash.

Motorola has no control over the schedule of releases. The schedule for the releases of updates is determined by the Original Equipment Manufacturers (OEMs), without consultation with Motorola. Antivirus definitions are released every week. Microsoft patches are released on a monthly basis. Motorola obtains and tests these updates as they are released. Other products have different schedules or are released "as-required." Motorola will obtain and test these OEM vendors supported updates on a quarterly basis.

### 1.1 Connectivity

To accommodate remote installation of security updates, a connection is required from Motorola to the customer ASTRO 25 network. There are two different options. 1) T1 line purchased and maintained by Motorola, or 2) The customer internet connection is used and a Virtual Private Network (VPN) is established between Motorola and the ASTRO 25 network. Since this relies on the customer internet connection, the customer is responsible for the availability of the connection.

Along with the connection itself, Motorola supplied hardware is required to be deployed to the customer premises on the ASTRO 25 network. Motorola shall load software, configure, and ship the hardware to the customer supplied contact for installation. This hardware and its maintenance is part of the connectivity service.

ASTRO 25 connectivity is ordered separately from Remote Security Patch Installation and has a separate statement of work. See that SOW for more detail on terms of the connection.

If connectivity is already established for a different service such as network or security monitoring then the same connection can be used for Remote Security Patch Installation. There is no need for a separate connection to be established.

### 1.2 Security Update Installation



Motorola shall push the tested security updates over the established connection. The timing and coordination with the customer of each update depends on the updates themselves. Motorola requires IP connectivity to all elements that are in scope for patching. If IP connectivity from Motorola is not available then those elements will not be considered for remote patching and will require alternative arrangements outside of the scope of this statement of work.

#### 1.2.1 Antimalware Signature Update Installation

Antimalware signature updates are released often, but Motorola collects and tests them on a weekly basis. The updates are non-intrusive (for example, no reboots or manual configuration changes are required) and automatically implemented. Therefore, antimalware signature updates will be pushed within a week of testing without Customer coordination. An email will be sent to inform the Customer that the signatures have been updated.

#### 1.2.2 Microsoft Windows Security Update Installation

Microsoft typically releases security updates every second Tuesday of the month (aka "Patch Tuesday"); however, selected security updates are sometimes released on other days, and it is possible that no security updates are released during a month. Security updates for some 3rd party Windows software (Non-Motorola and non-Microsoft applications that run on Windows, such as Adobe Reader and Flash) are also released on Patch Tuesday. The most recent Windows and 3rd party Windows security updates available will be acquired by Motorola on each Patch Tuesday. These patch security updates require at least one week for incorporation into the offering and a minimum of 36 hours for testing in the Motorola vetting labs, after which security updates with no issues are then released. Patches may be held back at the discretion of Motorola if they are found to cause any problems to features, performance or functionality and will only be released when the issues are fully resolved.

It is important to understand that it is often the case that after security updates are installed, Microsoft requires the patched computer to be rebooted before the security updates take full effect and vulnerabilities are mitigated. The clients include dispatch consoles and there is no way for Motorola to know when it is safe to reboot. The customer must reboot at a time chosen by them so as to not impact operations.

Once the security updates are vetted, Motorola will start pushing the updates to the customer without customer coordination or notification. An email will be sent requesting that the clients be rebooted. It is the customer's responsibility to reboot all of the clients before the next set update is sent. When preparing for the next month's push of security updates, Motorola will first scan to verify all of the previous updates were implemented and if any computer has not been rebooted. Motorola will send an email requesting that the remaining computers be rebooted before any new updates are pushed.

#### 1.2.3 Microsoft Windows Security Updates Outside ASTRO 25 Firewalls

Connections to other networks (from now on referred to as Customer Enterprise Network, or CEN) must be delineated by firewalls. All updates deployed by Remote Security Patch Installation are specific to equipment inside the ASTRO 25 Radio Network with only the following exceptions: Key Management Facility (KMF), Text messaging Services (TMS) and advanced Messaging Services (AMS) and MCC 7100 consoles. In these exceptions, the customer has a choice of including these machines in the Remote Security Patch Installation



service, or including them in their own IT security patch procedures.

The KMF, TMS, and AMS are all outside the firewall (relative to the Radio Network) and therefore updates require that the firewall be opened. The default for Remote Security Patch Installation is that these functions are included.

The MCC 7100 console may be directly on the radio network or in the CEN. Any MCC 7100 on the radio network would simply be included in the standard Remote Security Patch Installation offering. However, the MCC 7100 may also be located in the CEN and connected through a VPN to a firewall at a dispatch location. In this case, the default for Remote Security Patch Installation is to not update these consoles.

If the customer requires inclusion for the CEN based MCC 7100 consoles, then they must contact their Customer Service Manager and make a formal request. They must also consent to allow Motorola to open the firewall to allow access for updates.

#### 1.2.4 Quarterly Security Update Installation

The quarterly patch updates are for Solaris and Red Hat Linux (RHEL) operating systems, and VMWare ESXi hypervisor (virtualization). They are tested and released on a quarterly basis, at end of March, June, September, and December. Motorola will schedule installation of the updates with the customer in the first weeks of the following quarter. Motorola will send the customer an ITIL with details on the upgrade and scheduling for each of the events.

These updates are intrusive and require customer coordination. Examples of how they affect the customer include reboots to implement the patches and rolling (switching from one zone controller to the other) of the zone controllers. Systems with redundant zone controllers (L2, M2, M3) have low downtime (minutes) as the zone controllers are rolled, but systems with single zone controllers (L1, M1) will be down for longer periods. During these times, the system will be in "Site trunking" mode. It is up to the customer to understand the operational impacts and to coordinate these events with users.

This effort will be done during standard business hours, or 8am to 5pm CST. Customers requesting that downtime be during non-standard hours must submit an official request through their CSM. The ITIL will show work being done during standard hours such as prep work, downloading of the patches to memory, etc and the actual reboots or ZC rollover will be initiated when requested. Additional remote work will proceed the next day during standard hours.

Motorola System Enhancement Releases ("SERs") and Field Service Bulletins ("FSBs") are not part of this service. However in some instances, these fixes must be done to allow the latest security patches. If it is possible for the specific required FSB to be installed remotely, then Motorola will include it as part of Remote Security Patch Installation. Otherwise, Motorola will communicate this to the customer and the patches that cannot be delivered. The Customer and their CSM will determine how to get the SER or FSB installed. Once the SER or FSB appears on the system, Remote Security Patch Installation will then install the affected patches.

For minimal downtime and to avoid redundant efforts, the customer should coordinate any



maintenance or other updates such as FSB's and SER's with Motorola.

### 1.3 Scope

Remote Security Patch Installation supports the currently shipping Motorola ASTRO 25 System Release (SR) and strives to support five (5) releases prior. Motorola reserves the right to adjust which releases are supported as business conditions dictate. Contact your Customer Service Manager for the latest supported releases.

Remote Security Patch Installation is available for any L or M core system in a supported release. Remote Security Patch Installation is not available for K cores.

Systems that have non-standard configurations that have not been certified by Motorola Systems Integration and Testing (SIT) are specifically excluded from this Service unless otherwise agreed in writing by Motorola. Service does not include pre-tested intrusion detection system (IDS) updates for IDS solutions. Certain consoles, MOTOBRIDGE, MARVLIS, Symbol Equipment, AirDefense Equipment, AVL, Genesis, WAVE and Radio Site Security products are also excluded. Motorola will determine, in its sole discretion, the third party software that is supported as a part of this offering.

### 1.4 Motorola has the following responsibilities:

- 1.4.1 Obtain relevant third party software ("SW") security updates as made available from the OEM's. This includes antivirus definition updates, operating systems patches, hypervisor patches, database patches, and selected other third party patches that Motorola deployed in ASTRO 25 system releases covered by this Remote Security Patch Installation. Motorola does not control when these updates are released, but as much as possible vet the updates on this schedule:
  - McAfee Antivirus definitions– Weekly
  - Windows OS updates – Monthly
  - Solaris, RHEL OS, VMware ESXi updates – Quarterly
- 1.4.2 Each assessment of relevant third party SW will take at least one week to incorporate the security updates into the Remote Security Patch service and 36 additional hours of examination time to evaluate the impact each update has on the system.
- 1.4.3 Perform rigorous testing of updates to verify whether they degrade or compromise system functionality on a dedicated ASTRO 25 test system with standard supported configurations.
- 1.4.4 Address any issues identified during testing by working as necessary with Motorola selected commercial supplier(s) and/or Motorola product development engineering team(s). If a solution for the identified issues cannot be found, the patch will not be posted on Motorola's site.
- 1.4.5 Pre-test STIG recommended remediation when applicable.
- 1.4.6 Release all tested updates to Motorola's secure extranet site.
- 1.4.7 Coordinate updates with customer as outlined in section 1.
- 1.4.8 In the event that no updates are released by the OEM's during the usual time



period, Motorola will send a notice that no new patches were sent.

- 1.4.9 Notify customer of update releases by email.
- 1.4.10 A supported Remote Security Patch Installation ASTRO 25 release matrix will be kept on the extranet site for reference.

1.5 The Customer has the following responsibilities:

- 1.5.1 This service requires connectivity from Motorola to the customer's ASTRO 25 system. This connectivity must be established prior to service start.
- 1.5.2 Maintain IP connectivity from Motorola to all elements in the system that require remote patching.
- 1.5.3 Provide Motorola with pre-defined information (customer contacts, system information, etc) prior to contract start date necessary to complete a Customer Support Plan (CSP).
- 1.5.4 Submit changes in any information supplied in the Customer Support Plan (CSP) to the Customer Support Manager (CSM).
- 1.5.5 Upgrade system to a supported system release as necessary to continue service.
- 1.5.6 Refrain from making uncertified changes of any type to the system.
- 1.5.7 Adhere closely to the System Support Center (SSC) troubleshooting guidelines provided upon system acquisition. A failure to follow SSC guidelines may cause the customer and Motorola unnecessary or overly burdensome remediation efforts. In such case, Motorola reserves the right to charge an additional service fee for the remediation effort.
- 1.5.8 Comply with the terms of the applicable software license agreement(s) between the Customer and Motorola and non-Motorola software copyright owner.
- 1.5.9 Obtain at Customer's cost all third party consents or licenses required to enable Motorola to provide the Service.
- 1.5.10 Upon successful installation of patches on windows clients (e.g. Dispatch Ops Position, NM Client, etc.) and receiving notification indicating the task has been successfully executed by Motorola, affected computers must be rebooted by the customer within 72 hours.
- 1.5.11 Understand downtime implications associated with reboots and patch activities and internally coordinate with users as necessary.

1.6 Disclaimer:

Motorola disclaims any and all warranties with respect to pre-tested antivirus definitions, database security updates, hypervisor patches, operating system software patches, intrusion detection sensor signature files, or other 3<sup>rd</sup> party files, express or implied. Further, Motorola disclaims any warranty concerning the non-Motorola software and does not guarantee that customer's system will be error-free or immune to security breaches as a result of these services.



## Appendix E: OnSite Support Statement of Work

Motorola's OnSite Support service provides case management and escalation for onsite technical service requests. The service is delivered by the Motorola's Solution Support Center (SSC) in conjunction with a local service provider. The SSC is responsible for opening a case for onsite support and monitoring the status of that case to maintain response time conformance.

The terms and conditions of this Statement of Work (SOW) are an integral part of Motorola's Service Agreement or other applicable agreement to which it is attached and made a part thereof by this reference.

### 1.0 Description of Services

The Motorola SSC will receive customer request for OnSite service provider and dispatch a servicer. The servicer will respond to the customer location based on predefined Severity Levels set forth in Severity Level Definitions table and Response times set forth in Severity Level Response Time Goals table in order to restore the system.

Motorola will provide case management as set forth herein. The SSC will maintain contact with the on-site Motorola Service Shop until system restoral and case closure. The SSC will continuously track and manage cases from creation to close through an automated case tracking process.

### 1.1 Scope

OnSite Support is available 24 hours a day, 7 days a week in accordance with Severity Level Definitions and Severity Level Response Time Goals tables.

### 1.2 Inclusions

Onsite Support can be delivered on Motorola-sold infrastructure.

### 1.3 Motorola has the following responsibilities:

- 1.3.1 Receive service requests.
- 1.3.2 Create a case as necessary when service requests are received. Gather information to characterize the issue, determine a plan of action and assign and track the case to resolution.
- 1.3.3 Dispatch a field servicer ("Servicer") as required by Motorola's standard procedures and provide necessary case information.
- 1.3.4 Provide the required personnel access to relevant customer information as needed.
- 1.3.5 Servicer will perform the following on-site:
  - 1.3.6 Run diagnostics on the Infrastructure or Field Replacement Units (FRU).
  - 1.3.7 Replace defective Infrastructure or FRU, as supplied by customer.
  - 1.3.8 Provide materials, tools, documentation, physical planning manuals, diagnostic/test equipment and any other requirements necessary to perform the maintenance service.
  - 1.3.9 If a third party vendor is needed to restore the system, the Servicer may accompany that vendor onto the customer's premises.
  - 1.3.10 Verify with customer that restoration is complete or system is functional, if required



by customer's repair verification in the Customer Support Plan. If verification by customer cannot be completed within 20 minutes of restoration, the case will be closed and the Servicer will be released.

- 1.3.11 Escalate the case to the appropriate party upon expiration of a response time.
- 1.3.12 Close the case upon receiving notification from customer or servicer, indicating the case is resolved.
- 1.3.13 Notify customer of case status as defined by the Customer Support Plan:
- 1.3.14 Open and closed; or
- 1.3.15 Open, assigned to the servicer, arrival of the servicer on-site, deferred or delayed, closed.
- 1.3.16 Provide Case activity reports to customer if requested.

#### 1.4 Customer has the following responsibilities:

- 1.4.1 Contact Motorola, as necessary, to request service.
- 1.4.2 Provide Motorola with the following pre-defined customer information and preferences prior to start date necessary to complete Customer Support Plan (CSP):
  - Case notification preferences and procedure.
  - Repair verification preference and procedure.
  - Database and escalation procedure forms.
  - Submit changes in any information supplied in the CSP to the Customer Support Manager (CSM).
- 1.4.3 Provide the following information when initiating a service request:
  - Assigned system ID number.
  - Problem description and site location.
  - Other pertinent information requested by Motorola to open a case.
- 1.4.4 Allow Servicers access to equipment.
- 1.4.5 Supply infrastructure or FRU, as applicable, in order for Motorola to restore the system.
- 1.4.6 Maintain and store in an easily accessible location any and all software needed to restore the system.
- 1.4.7 Maintain and store in an easily accessible location proper system backups.
- 1.4.8 For E911 systems, test the secondary/backup Public Safety Answering Point (PSAP) connection to be prepared in the event of a catastrophic failure of a system. Train appropriate personnel on the procedures to perform the function of switching to the backup PSAP.
- 1.4.9 Verify with the SSC that restoration is complete or system is functional, if required by repair verification preference provided by customer.
- 1.4.10 Cooperate with Motorola and perform all acts that are reasonable or necessary to enable Motorola to provide these services.
- 1.4.11 Obtain and provide applicable third party consents or licenses at Customer cost to enable Motorola to provide the Services.



### Severity Level Definitions

The following severity level definitions will be used to determine the maximum response times:

Severity Level	Severity Definition
Severity 1	<p>This is defined as a failure that causes the system and/or infrastructure a loss of voice functionality and no work-around or immediate solution is available.</p> <p>The following are examples of this kind of severity:</p> <ul style="list-style-type: none"> <li>● 33% of call processing resources impaired</li> <li>● Site Environment alarms:               <ul style="list-style-type: none"> <li>○ Smoke</li> <li>○ Unauthorized access</li> <li>○ Temperature</li> <li>○ Power failure</li> </ul> </li> </ul>
Severity 2	<p>This is defined as a fault that causes the system to operate with a continuous reduction in capacity or functionality of core services (core services are voice, data or network management).</p> <p>The following are examples of this kind of severity:</p> <ul style="list-style-type: none"> <li>● Less than 33% of call processing resources impaired</li> <li>● Failure of a single redundant component</li> </ul>
Severity 3	<p>This is defined as a fault which reduces the functionality, efficiency or usability of core services (voice, data and network management) and there is a viable work-around in place.</p> <p>The following are examples of this kind of severity:</p> <ul style="list-style-type: none"> <li>● Intermittent faults that are infrequent and minor impact to core services</li> <li>● Statistical reporting problems</li> </ul>
Severity 4	<p>This is defined as a minor issue, which has little or no impact on the functionality, efficiency or usability of core services. The following are examples of this kind of severity:</p> <ul style="list-style-type: none"> <li>● Faults resulting in minor functions or features being unsupported or unreliable in ways that are not noticeable to the user.</li> <li>● Faults that have no impact in how the user perceives the system to work.</li> <li>● Cosmetic issues.</li> <li>● Requests for information.</li> <li>● Preventive Maintenance</li> </ul>



### Severity Level Response Time Goals

(Customer's Response Time Classification is designated in the Customer Support Plan.)

Severity Level	Standard Response Time
Severity 1*	Within 4 hours from receipt of notification continuously
Severity 2	Within 4 hours from receipt of notification Standard Business Day
Severity 3	Within 8 hours from receipt of notification Standard Business Day
Severity 4	Within 12 hours from receipt of notification Standard Business Day

\* Premier Response is an option that can be purchased, it provides a 2-hour response time for severity 1 issues.



## Appendix F: Annual Preventive Maintenance Statement of Work

The terms and conditions of this Statement of Work (SOW) are an integral part of Motorola's Service Agreement or other applicable agreement to which it is attached and made a part thereof by this reference.

Annual Preventive Maintenance will provide an annual operational test and alignment, on the customer's infrastructure equipment (Infrastructure or Fixed Network Equipment or "FNE") to monitor the Infrastructure's conformance to specifications, as set forth in the applicable attached Exhibit(s), all of which are hereby incorporated by this reference.

### 1.0 Scope

Annual Preventive Maintenance will be performed during standard business hours (unless otherwise agreed to in writing). If the system or Customer requirements dictate this service must occur outside of standard business hours, Motorola will provide an additional quotation. Customer is responsible for any charges associated with unusual access requirements or expenses.

### 1.1 Inclusions

Annual Preventive Maintenance service will be delivered on Motorola sold infrastructure including integrated third party products per the level of service as defined in Table 1: PM Tasks Performed.

### 1.2 Limitations and Exclusions

Unless specifically described in Table 1, the following activities are outside the scope of the Annual Preventive Maintenance service, but are optional services that are available to Annual Preventive Maintenance customers at an additional cost:

- 1.2.1 Emergency on-site visits required to resolve technical issues.
- 1.2.2 Third party support for equipment not sold by Motorola as part of the original system.
- 1.2.3 System installations, upgrades, and expansions.
- 1.2.4 Customer training.
- 1.2.5 Hardware repair and/or exchange.
- 1.2.6 Network security services.
- 1.2.7 Network transport.
- 1.2.8 Information Assurance.
- 1.2.9 Motorola services not included in this statement of work.
- 1.2.10 Any maintenance required as a result of a virus or unwanted intrusion is excluded if the system is not protected against these security threats by Motorola's Pre-tested Security Update Service when applicable.
- 1.2.11 Tower mapping analysis or tower structure analysis

### 1.3 Motorola has the following responsibilities:

- 1.3.1 Notify the customer of any planned system downtime needed to perform this Service.
- 1.3.2 Advise customer of any issue that requires immediate attention.
- 1.3.3 Maintain communication with the customer as needed until completion



("resolution" implies a problem is being fixed) of the Annual Preventive Maintenance.

- 1.3.4 Determine, in its sole discretion, when a case requires more than the Preventive Maintenance services described in this SOW and notify customer of an alternative course of action.
- 1.3.5 Provide customer with a report documenting system performance against expected parameters along with recommended actions. Time allotment TBD.
- 1.3.6 Provide trained and qualified personnel with proper security clearance required to complete Annual Preventive Maintenance service.

1.4 The Customer has the following responsibilities:

- 1.4.1 Provide preferred schedule for Annual Preventative Maintenance to Motorola.
- 1.4.2 Authorize and acknowledge any scheduled system downtime.
- 1.4.3 Maintain periodic backup of databases, software applications, and firmware.
- 1.4.4 Establish and maintain a suitable environment (heat, light, and power) for the equipment location and provide Motorola full, free, and safe access to the equipment so that Motorola may provide services. All sites shall be accessible by standard service vehicles.
- 1.4.5 Submit changes in any information supplied in the Customer Support Plan (CSP) to the Customer Support Manager (CSM).
- 1.4.6 Provide site escorts in a timely manner if required.
- 1.4.7 Provide Motorola with requirements necessary for access to secure facilities.
- 1.4.8 Obtain at Customer's cost all third party consents or licenses required to enable Motorola to provide the Service.



Table 1: PM Tasks Performed

<b>MASTER SITE CHECKLIST</b>	
<b>SERVERS</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.
NM Client Applications	Review UEM events and transport medium types, (microwave/leased line/telco, etc). Event log review for persistent types. Verify all NM client applications are operating correctly.
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.
Complete Backup	Verify backups have been done or scheduled. SZ database (BAR), Centracom CDM/ADM database, etc.
<b>ROUTERS</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
<b>SWITCHES</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
Capture Diags	Perform recommended diagnostic tests based on switch type. Capture available diagnostic logs.
Verify Redundant Switches	Test redundancy in CWR devices. Core router switchover (coordinate with customer).
<b>DOMAIN CONTROLLERS</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.
<b>FIREWALLS</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.



<b>LOGGING EQUIPMENT</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.
Server CPU Health	i.e. memory, HDD, CPU, disk space/utilization.
<b>MISCELLANEOUS EQUIPMENT</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.
Server CPU Health	i.e. memory, HDD, CPU, disk space/utilization.

<b>PRIME SITE CHECKLIST</b>	
<b>SOFTWARE</b>	
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.
<b>SWITCHES</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
Capture Diags	Perform recommended diagnostic tests based on switch type. Capture available diagnostic logs.
<b>MISCELLANEOUS EQUIPMENT</b>	
Equipment Alarms	Check LED and/or other status indicators for fault conditions.
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.
Site Frequency Standard Check	Check lights and indicators for A/B receivers.
<b>COMPARATORS</b>	
Equipment Alarms	Verify no warning/alarm indicators.
Clean Fans and Equipment	Use antistatic vacuum to clean cooling pathways



<b>DISPATCH SITE CHECKLIST</b>	
<b>GENERAL</b>	
Inspect all Cables	Inspect all cables/connections to external interfaces are secure
Mouse and Keyboard	Verify operation of mouse and keyboard
Configuration File	Verify each operator position has access to required configuration files
Console Op Time	Verify console op time is consistent across all ops
Screensaver	Verify screensaver set as customer prefers
Screen Performance	Verify screen operational/performance
Touchscreen	Verify touchscreen operation (if applicable)
Cabling/Lights/Fans	Visual inspection of all equipment - cabling/ lights/ fans
Filters/Fans/Dust	Clean any filters/ fans/ dust- all equipment
Monitor and Hard Drive	Confirm monitor and hard drive do not "sleep"
DVD/CD	Verify / clean DVD or CD drive
<b>HEADSET UNPLUGGED TESTING</b>	
Speakers	Test all speakers - audio quality, volume, static, drop-outs, excess hiss when turned up.
Channel Audio in Speaker	Verify selected channel audio in select speaker only.
Footswitch Pedals	Verify both footswitch pedals operational
Radio On-Air Light	Verify radio on air light comes on with TX (if applicable)
Radio TX and RX	Verify radio TX/RX from both headset jacks. Verify levels OK. Check volume controls for noise/static or drop-outs.
Speaker Mute	Verify select speaker muted.
Telephone Operation	Verify telephone operational through both headset jacks. Check volume controls for noise/static or drop-outs.
Audio Switches	Verify select audio switches to speaker when phone off-hook. (if interfaced to phones)
Radio Takeover in Headset	Verify radio-takeover in headset mic when phone off-hook (mic switches to radio during PTT and mutes to phone).
<b>OTHER TESTS</b>	
Phone Status Light	Verify phone status light comes on when phone off-hook (if applicable)
Desk Microphone Operation	Confirm desk mic operation (if applicable)
Radio IRR Operation	Verify radio IRR operational (if applicable)



Telephone IRR Operation	Verify telephone [if on radio computer] IRR operational (if applicable)
Recording	Verify operator position being recorded on long term logging recorder (if applicable)
<b>COMPUTER PERFORMANCE TESTING</b>	
Computer Reboot	Reboot op position computer
Computer Operational	Confirm client computer is fully operational (if applicable)
<b>AUDIO TESTING</b>	
Audio Levels and Quality	Confirm all conventional resources are functional with adequate audio levels and quality
Secure Mode	Confirm any secure talkgroups are operational in secure mode
<b>EQUIPMENT ROOM TESTS</b>	
Recording - AIS Test	Verify audio logging of trunked calls
Recording	Test op position logging on analog recorder (with customer assistance)
System Alarms	Review alarm system on all equipment for errors
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.

## RF SITE CHECKLIST

Equipment Alarms	Verify no warning/alarm indicators.
Clean Fans and Equipment	Use antistatic vacuum to clean cooling pathways
Site Frequency Standard Check	Check lights and indicators for A/B receivers.
Basic Voice Call Check	Voice test each voice path, radio to radio.
Control Channel Redundancy (trunking)	Roll control channel, test, and roll back.
Site Controller Redundancy (trunking)	Roll site controllers with no dropped audio.
GTR 8000 Results Sheet	Complete GTR tests - Frequency Error, Modulation Fidelity, Forward at Set Power, Reverse at Set Power, Gen Level Desense no Tx.

## MOSCAD CHECKLIST

### MOSCAD SERVER

Equipment Alarms	Verify no warning/alarm indicators.
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Check Alarm/Event History	Review MOSCAD alarm and events to find if there are chronic issues.
Windows Event Logs	Review Windows event logs. Save and clear if full.
Password Verification	Site devices to verify passwords. Document changes if any found.
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.
<b>MOSCAD CLIENT</b>	
Equipment Alarms	Verify no warning/alarm indicators.
Check Alarm / Event History	Review MOSCAD alarm and events to find if there are chronic issues.
Windows Event Logs	Review Windows event logs. Save and clear if full.
Password Verification	Site devices to verify passwords. Document changes if any found.
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.
<b>MOSCAD RTU's</b>	
Equipment Alarms	Verify no warning/alarm indicators.
Verify Connectivity	Verify Connectivity

<b>FACILITIES CHECKLIST</b>	
<b>VISUAL INSPECTION EXTERIOR</b>	
ASR Sign	Verify that the ASR sign is posted.
Warning Sign - Tower	Verify warning sign is posted on the tower.
Warning Sign - Gate	Verify that a warning sign is posted at the compound gate entrance.
10 Rule Sign	Verify that a 10 rules sign is posted on the inside of the shelter door.
Outdoor Lighting	Verify operation of outdoor lighting/photocell.
Exterior of Building	Check exterior of building for damage/disrepair.
Fences / Gates	Check fences/gates for damage/disrepair.
Landscape / Access Road	Check landscape/access road for accessibility.
<b>VISUAL INSPECTION INTERIOR</b>	
Electrical Surge Protectors	Check electrical surge protectors for alarms.
Emergency Lighting	Verify emergency lighting operation.
Indoor Lighting	Verify indoor lighting.



Equipment Inspection	Visually inspect that all hardware (equipment, cables, panels, batteries, racks, etc.) are in acceptable physical condition for normal operation.
Site Frequency Standard Check	Check lights and indicators for A/B receivers.
Regulatory Compliance (License, ERP, Frequency, Deviation)	Check station for regulatory compliance. Update station logs.
Clean Fans and Equipment	Use antistatic vacuum to clean cooling pathways
<b>UPS</b>	
Visual inspection (condition, cabling)	Verify corrosion, physical connections, dirt/dust, etc.
<b>GENERATOR</b>	
Visual Inspection	Verify, check panel housing, cracks, rust and weathering. Physical connections, corrosion, dirt/dust, etc.
Fuel	Verify fuel levels in backup generators, document date of last fuel delivered from fuel service provider.
Oil	Check the oil dipstick for proper level. Note condition of oil.
Verify operation (no switchover)	Check, verify running of generator, ease of start or difficult. Is generator "throttling" or running smooth? Any loud unusual noise? Etc.
<b>HVAC</b>	
Air Filter	Check air filter and recommend replacement if required.
Coils	Check coils for dirt
Outdoor Unit	Check that outdoor unit is unobstructed
Wiring	Wiring (insect/rodent damage)
Cooling / Heating	Check each HVAC unit for cooling/heating

## MICROWAVE CHECKLIST

### RADIO

Alarms	Check alarm / event history
Software	Verify version of application
TX Frequency	Verify transmit frequency
TX Power	Verify transmit power
RX Frequency	Verify receive frequency
RX Signal Level	Verify receive signal level and compare with install baseline documentation



Save configuration	Save current configuration for off site storage
Backhaul Validation	Monitor UEM status (alarms, logs, etc.) for all links. If UEM not used to monitor microwave, then use provided microwave alarm mgmt server.
<b>WAVEGUIDE</b>	
Visual Inspection	Inspect for wear or dents (from ground using binoculars).
Connection Verification	Verify all connections are secured with proper hardware (from ground using binoculars).
<b>DEHYDRATOR</b>	
Visual Inspection	Inspect moisture window for proper color
Pressure Verification	Verify pressure of all lines
Re-Pressurization	Bleed lines temporarily to verify the dehydrator re-pressurizes
Run Hours	Record number of hours ran

## TOWER CHECKLIST

### STRUCTURE CONDITION

Rust	Check structure for rust.
Cross Members	Check for damaged or missing cross members.
Safety Climb	Check safety climb for damage.
Ladder	Verify that ladder system is secured to tower.
Welds	Check for cracks or damaged welds.
Outdoor lighting/photocell	Test outdoor lighting and photocell.
Drainage Holes	Check that drainage holes are clear of debris.
Paint	Check paint condition.

### TOWER LIGHTING

Lights/Markers	Verify all lights/markers are operational.
Day/Night Mode	Verify day and night mode operation.
Power Cabling	Verify that power cables are secured to tower.

### ANTENNAS AND LINES

Antennas	Visually inspect antennas for physical damage (from ground using binoculars).
Transmission Lines	Verify that all transmission lines are secure on the tower.

### GROUNDING

Structure Grounds	Inspect grounding for damage or corrosion
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### GUY WIRES

Tower Guys	Check guy wires for fraying and tension.
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Guy Wire Hardware	Check hardware for rust.
<b>CONCRETE CONDITION</b>	
Tower Base	Check for chips or cracks.



## Appendix G: Network Updates Statement of Work

This Statement of Work ("SOW") is subject to the terms and conditions of Motorola's Professional Services Agreement, Service Agreement or other applicable agreement in effect between the parties ("Agreement"). Motorola and Customer may be referred to herein individually as a "Party" or together as "Parties"

### 1.0 Description of Service

As network updates become available, Motorola agrees to provide the Customer with applicable software and hardware updates and implementation services necessary to maintain their ASTRO 25 system at an exceptional level of support. ASTRO 25 system software and hardware updates improve system functionality/operation and extend the useful life of the network.

### 1.1 Scope

This service includes 3rd party and Motorola Solution software as well as select hardware to maintain supportability. All updates are pre-tested and certified in a dedicated ASTRO 25 test lab to ensure that they are compatible and do not interfere with the ASTRO 25 network functionality. Network updates may also include feature enhancements. At Motorola's option, feature enhancements may be offered for purchase.

### 1.2 The ASTRO 25 software covered under this agreement include:

- Base stations
- Site controllers
- Comparators
- Routers
- LAN switches
- Servers
- Dispatch consoles
- Logging equipment
- Network management terminals
- Network Fault Management ("NFM") products
- Network security devices such as firewalls and intrusion detection sensors
- Associated peripheral infrastructure software

1.3 Motorola Solution will provide certified hardware version updates necessary to refresh the system with an equivalent level of functionality. Any hardware versions and/or replacement hardware required to support new features or those not specifically required to maintain existing functionality are not included. Unless otherwise stated, platform migrations are not included.

1.4 If originally provided by Motorola, the following hardware components are eligible hardware for



refresh when necessary to maintain the system functionality in place at the time this agreement was executed:

- Servers
- PC Workstations
- Routers
- LAN Switches

1.5 If originally provided by Motorola, the following hardware components are eligible for board-level refreshes when necessary to maintain the system functionality in place at the time this agreement was executed. A "board-level refresh" is defined as any Field Replaceable Unit ("FRU") for the products listed below:

- GTR 8000 Base Stations
- GCP 8000 Site Controllers
- GCM 8000 Comparators
- MCC 7500 Console Operator Positions
- STR 3000 Base Stations
- Quantar Base Stations
- ASTROTAC Comparators
- PSC 9600 Site Controllers
- PBX Switches for Telephone Interconnect
- NFM/NFM XC/MOSCAD RTU

1.6 The parties agree that this agreement only covers those items expressly stated above. There is no coverage on any additional software or hardware products unless specifically described in this agreement. Motorola may, at its sole discretion, choose to include coverage for other items. Refer to section 2.0 for exclusions and limitations.

1.7 Motorola will provide implementation services necessary to install the system software and hardware updates. Any implementation services that are not directly required to support the network updates are not included. Unless otherwise stated, implementation services necessary for system expansions, platform migrations, and/or new features or functionality that are implemented concurrent with the system refresh are not included.

1.8 Motorola agrees to provide the necessary software design and technical resources necessary to complete the network updates.

1.9 The pricing in this agreement is based on the system configuration outlined in the System Pricing Configuration. This configuration is to be reviewed annually from the contract effective date. Any change in system configuration may require a price adjustment to this agreement.

1.10 This agreement applies only to system release versions within the ASTRO 25 7.x platform.

1.11 Motorola will issue Software Maintenance Agreement ("SMA") bulletins on an annual basis and post them in soft copy on a designated extranet site for Customer access. Standard and



optional features for a given ASTRO 25 system release are listed in the SMA bulletin.

- 1.12 Coverage Continuity. The parties agree that this agreement requires continuous coverage beginning within (90) days after system acceptance. Beyond (90) days from system acceptance or if payments are discontinued, additional payment(s) will be necessary to cover the period for which coverage was discontinued or delayed. The total of payments for lapses in coverage will not exceed 3 years.
- 1.13 Motorola responsibilities
  - 1.13.1 Identify and communicate with Customer the scope of the network updates as they become available.
  - 1.13.2 Work with Customer to schedule applicable network updates.
  - 1.13.3 Assign program management support required to perform network updates as necessary.
  - 1.13.4 Assign field installation resources required to perform network updates as necessary.
  - 1.13.5 Assign centralized engineering resources required to perform network updates as necessary.
  - 1.13.6 Install network updates.
  - 1.13.7 Deliver impact and change management training as necessary.
  - 1.13.8 Perform appropriate system backups.
  - 1.13.9 Work with the Customer to validate that all system maintenance is current.
  - 1.13.10 Deliver post update implementation training to the customer as needed.
  - 1.13.11 Validate all system update deliverables are complete.
  - 1.13.12 Obtain completion sign off from the customer.
- 1.14 Customer responsibilities
  - 1.14.1 Contact Motorola to schedule and engage the appropriate Motorola resources.
  - 1.14.2 Customer will allow the permanent installation of a server which will be connected to Motorola and will be used for system auditing, software uploads, and software update installation.
  - 1.14.3 Assist in site walks of the system during the system audit when necessary.
  - 1.14.4 Provide a list of any FRUs and/or spare hardware to be included in the network updates when applicable.
  - 1.14.5 Purchase any additional software and hardware necessary to implement optional system features or system expansions.
  - 1.14.6 Provide or purchase labor to implement optional system features or system expansions.
  - 1.14.7 Participate in impact and change management training as necessary.
  - 1.14.8 Inform system users of system update and scheduled system downtime if necessary.
  - 1.14.9 Cooperate with Motorola to provide post update implementation training as needed.
  - 1.14.10 Provide Motorola with completion sign off.



## 2.0 Exclusions and Limitations

The parties agree that Systems that have non-standard configurations that have not been certified by Motorola Systems Integration Testing are specifically excluded from this agreement unless otherwise agreed in writing by Motorola and included in this SOW.

2.1 This agreement does not cover any hardware or software supplied to the Customer when purchased directly from a third party, unless specifically included in this SOW.

2.2 This agreement does not cover software support for unauthorized modifications or other misuse of the covered software.

2.3 Updates for equipment add-ons or expansions during the term of this ASTRO 25 agreement are not included in the coverage of this SOW unless otherwise agreed to in writing by Motorola and Customer.

## 3.0 Special provisions

The coverage and the parties' responsibilities described in this Statement of Work will automatically terminate if Motorola no longer supports the ASTRO 25 7.x software version in the Customer's system or discontinues this agreement; in either case, Motorola will refund to Customer any prepaid fees for services applicable to the terminated period.

## 4.0 High-Speed Connectivity Specifications

4.1 The minimum supported link between the core and the zone is a full T1

4.2 Any link must realize or a sustained transfer rate of 175 kBps / 1.4 Mbps or better, bidirectional

4.3 Interzone links must be fully operational when present

4.4 Link reliability must satisfy these minimum QoS levels:

4.4.1 Port availability must meet or exceed 99.9% (three nines)

4.4.2 Round trip network delay must be 100 ms or less between the core and satellite (North America) and 400 ms or less for international links o Packet loss shall be no greater than 0.3%

4.4.3 Network jitter shall be no greater than 2 ms

4.5 The network requirements above are based on the SLA provided for Sprint Dedicated IP Services as of April, 2012. It is possible other vendors may not be able to meet this



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exact SLA, so these cases must be examined on a case-by-case basis.



**System Pricing Configuration - This configuration is to be reviewed annually from the contract effective date. Any change in system configuration may require a price adjustment.**

<b>Core</b>	
Master Site Configuration	0
Zones in Operation (Including DSR and Dark Master Sites)	0
Zone Features: IV&D, TDMA, Telephone Interconnect, CNI, HPD, CSMS, IA, POP25, Text Messaging, Outdoor Location, ISSI 8000, InfoVista, KMF/OTAR	0
<b>RF System</b>	
Voice RF Sites & RF Simulcast Sites (including Prime Sites)	0
Repeaters/Stations (FDMA)	0
Repeaters/Stations (TDMA)	0
HPD RF Sites	0
HPD Stations	0
<b>Dispatch Console System</b>	
Dispatch Sites	0
MCC 7500 Operator Positions (VPM)	0
Conventional Channel Gateways (CCGW)	0
Conventional Site Controllers (GCP 8000 Controller)	0
<b>Logging System</b>	



Number of AIS Servers	0
Number of Voice Logging Recorder	0
Number of Logging Replay Clients	0
<b>Network Management and MOSCAD NFM</b>	
Network Management Clients	0
MOSCAD NFM Systems	0
MOSCAD NFM RTUs	0
MOSCAD NFM Clients	0

**REMOVE the following appendices if Network Hardware Repair with Advanced Replacement, Security Monitoring or Preventive Maintenance Level 2 are not sold.**



## Appendix H: Network Hardware Repair with Advanced Replacement Overview

Network Hardware Repair with Advanced Replacement is a repair exchange service for Motorola and select third party infrastructure supplied by Motorola. When available, Motorola will provide customer with an advanced replacement unit(s) or Field Replacement Units (FRUs) in exchange for customer's malfunctioning equipment. Malfunctioning equipment will be evaluated and repaired by the infrastructure repair depot and returned to depot's FRU inventory upon completion of repair. For customers who prefer to maintain their existing FRU inventory they have an option to request a "Loaner" FRU while their unit is being repaired. Refer to the [Advanced Exchange or Loaner Decision Process flowchart](#) for details on the loaner process.

The Motorola authorized repair depot manages and performs the repair of Motorola supplied equipment as well as coordinating the equipment repair logistics process.

The terms and conditions of this Statement of Work (SOW) are an integral part of Motorola's Service Agreement or other applicable agreement to which it is attached and made a part thereof by this reference.

### 1.0 Description of Services

Infrastructure components are repaired at a Motorola authorized Infrastructure Depot Operations (IDO). At Motorola's discretion, select third party infrastructure may be sent to the original equipment manufacturer or third party vendor for repair.

### 1.1 Scope

Repair authorizations are obtained by contacting the Solutions Support Center which is available 24 hours a day, 7 days a week. Repair authorizations can also be obtained online via Motorola Online at under Repair Status/Submit Infrastructure RA.

Motorola Online: <https://businessonline.Motorolasolutions.com>

### 1.2 Inclusions

Network Hardware Repair with Advanced Replacement is available on Motorola sold infrastructure including integrated 3<sup>rd</sup> party products. Motorola will make a "commercially reasonable effort" to repair Motorola manufactured infrastructure products for seven (7) years after product cancellation.

### 1.3 Exclusions

If infrastructure is no longer supported by either Motorola, the original equipment manufacturer or a third party vendor, as applicable Motorola may return said equipment to the customer without repair or replacement. The following items are excluded from Network Hardware Repair with Advanced Replacement:

- 1.3.1 All Motorola infrastructure hardware over seven (7) years from product cancellation date.
- 1.3.2 All third party infrastructure hardware over three (3) years from product cancellation date.
- 1.3.3 All broadband infrastructure three (3) years from product cancellation date
- 1.3.4 Physically damaged infrastructure.
- 1.3.5 Third party equipment not shipped by Motorola.



- 1.3.6 Consumable items including, but not limited to, batteries, connectors, cables, toner/ink cartridges, tower lighting, laptop computers, monitors, keyboards and mouse.
- 1.3.7 Video retrieval from digital in-car video equipment.
- 1.3.8 Infrastructure backhaul such as: antennas, antenna dehydrators, microwave<sup>1</sup>, line boosters, amplifier, data talker wireless transmitter, short haul modems and UPS.<sup>1</sup>
- 1.3.9 Test equipment.
- 1.3.10 Racks, furniture and cabinets.
- 1.3.11 Non-standard configurations, customer-modified infrastructure and certain third party infrastructure are excluded from advanced replacement service.
- 1.3.12 Firmware and/or software upgrades.

<sup>1</sup> Excluded from service agreements but may be repaired on an above contract, time and material basis. All UPS Systems must be shipped to IDO for repair. Excludes batteries and any on-site services.

#### 1.4 Motorola has the following responsibilities:

- 1.4.1 Enable customer access to the Motorola call center which is operational 24 hours a day, 7 days per week, to create requests for advanced replacement service.
- 1.4.2 Use commercially reasonable efforts to maintain FRU inventory on supported platforms.
- 1.4.3 Provide new or reconditioned FRUs to the customer, upon request and subject to availability. The FRU will be of similar equipment and version, and will contain equivalent boards and chips, as the customer's malfunctioning FRU.
- 1.4.4 Load firmware/software for equipment that requires programming. The software version information must be provided for the replacement FRU to be programmed accordingly. If the customer software version/configuration is not provided, shipping times will be delayed.
- 1.4.5 Package and ship Advance Exchange FRU from the FRU inventory to customer specified address.
  - During normal operating hours of Monday through Friday 7:00am to 7:00pm CST, excluding holidays, FRU will be shipped from Motorola as soon as possible depending on stock availability and configuration requested. Motorola will pay for the shipping to the customer, unless customer requests shipments outside of standard business hours and/or carrier programs, such as weekend or next flight out (NFO) shipment. In such cases, customer will be responsible for shipping and handling charges.
  - When sending the advanced replacement FRU to customer, provide a return air bill in order for customer to return the customer's malfunctioning FRU. The customer's malfunctioning FRU will become property of the Motorola repair depot or select third party and the customer will own the advanced replacement FRU.
  - When sending a loaner FRU to customer, Motorola will pay for outbound shipping charges. Inbound shipping to Motorola for repair is the responsibility of the customer. Motorola will repair and return the customer's FRU and will provide a return air bill for the customer to return IDO's loaner FRU. Refer to [Advanced Exchange or Loaner Decision Process flowchart](#) for the loaner process and [Shipping Charges](#) for shipping charge



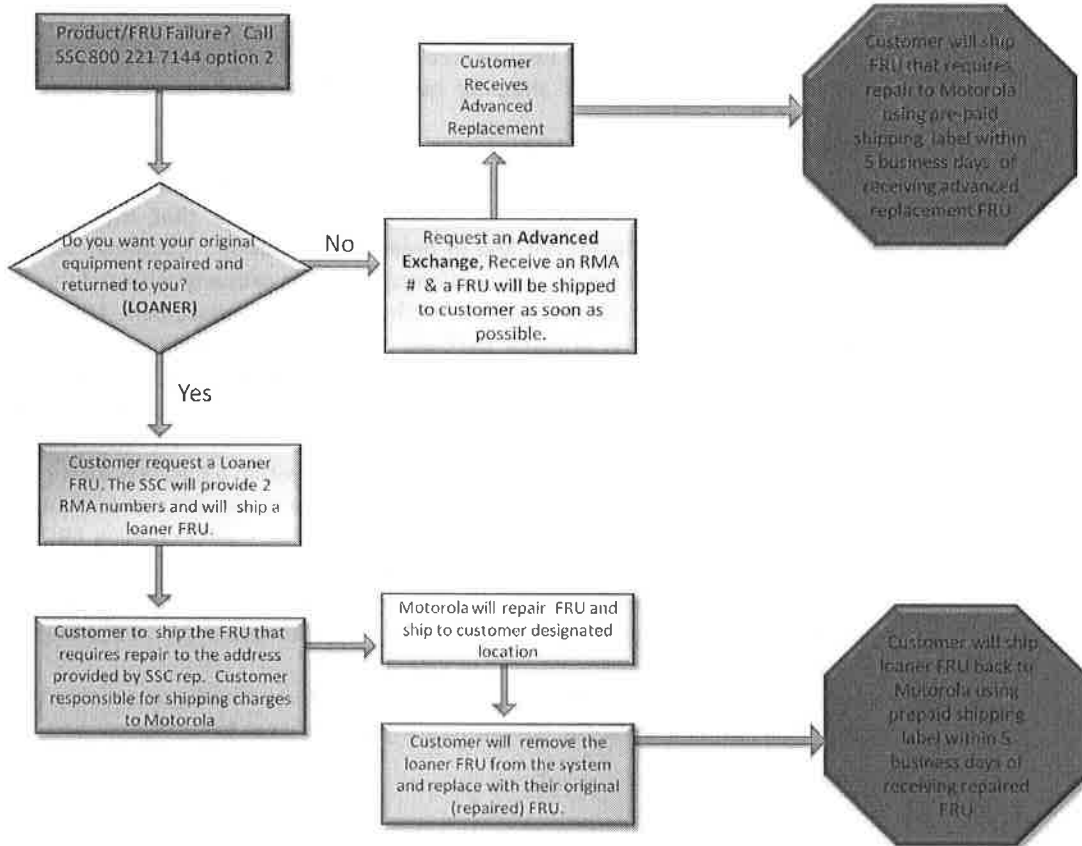
- detail.
- 1.4.6 Provide repair return authorization number upon customer request for Infrastructure that is not classified as an advanced replacement or loaner FRU.
  - 1.4.7 Provide a repair Return Authorization (RA) number so that the returned FRU can be repaired and returned to FRU stock.
  - 1.4.8 Receive malfunctioning FRU from Customer, carry out repairs and testing and return it to the FRU stock
  - 1.4.9 Receive malfunctioning infrastructure from customer and document its arrival, repair and return.
  - 1.4.10 Perform the following service on Motorola infrastructure:
    - Perform an operational check on the infrastructure to determine the nature of the problem.
    - Replace malfunctioning Field Replacement Units (FRU) or components.
    - Verify that Motorola infrastructure is returned to Motorola manufactured specifications, as applicable
    - Perform a box unit test on all serviced infrastructure.
    - Perform a system test on select infrastructure.
  - 1.4.11 Provide the following service on select third party infrastructure:
    - Perform pre-diagnostic and repair services to confirm infrastructure malfunction and eliminate sending infrastructure with no trouble found (NTF) to third party vendor for repair, when applicable.
    - Ship malfunctioning infrastructure components to the original equipment manufacturer or third party vendor for repair service, when applicable.
    - Track infrastructure sent to the original equipment manufacturer or third party vendor for service.
    - Perform a post-test after repair by Motorola, to confirm malfunctioning infrastructure has been repaired and functions properly in a Motorola system configuration, when applicable.
  - 1.4.12 For loaner equipment, Motorola will ship repaired infrastructure to the customer specified address during normal operating hours of Monday through Friday 7:00am to 7:00pm CST, excluding holidays. FRU will be sent two-day air unless otherwise requested. Motorola will pay for such shipping, unless customer requests shipments outside of the above mentioned standard business hours and/or carrier programs, such as NFO (next flight out). In such cases, customer will be responsible for payment of shipping and handling charges.
- 1.5 The Customer has the following responsibilities:
- 1.5.1 Contact or instruct Servicer to contact the Motorola System Support Center (SSC) and request a return authorization number prior to shipping malfunctioning infrastructure or third party infrastructure named in the applicable attached exhibit.
  - 1.5.2 Provide model description, model number and serial number, type of system and firmware version, software options, symptom of problem and address of site id for FRU or infrastructure.
  - 1.5.3 Indicate if FRU or third party FRU being sent in for service was subjected to



- physical damage or lightning damage.
- 1.5.4 Follow Motorola instructions regarding inclusion or removal of firmware and software applications from infrastructure being sent in for service.
  - 1.5.5 Provide customer purchase order number to secure payment for any costs described herein.
  - 1.5.6 Pay for shipping of Advanced Replacement or Loaner FRU from Motorola repair depot if customer requested shipping outside of standard business hours or carrier. See [Shipping Charges](#).
  - 1.5.7 Properly package and ship the malfunctioning FRU using the pre-paid air-bill that arrived with the advanced replacement FRU. Customer is responsible for properly packaging the malfunctioning infrastructure FRU to ensure that the shipped infrastructure arrives undamaged and in repairable condition. Customer will be subject to a replacement fee for malfunctioning FRUs not properly returned.
  - 1.5.8 Within five (5) business days of receipt of the advanced replacement FRU from Motorola's FRU inventory, properly package customer's malfunctioning FRU and ship the malfunctioning Infrastructure to Motorola's repair depot for evaluation and repair. Customer must send the return air bill back to the repair depot in order to facilitate proper tracking of the returned infrastructure. Customer will be subject to a full replacement fee for FRUs not returned within 5 business days.
  - 1.5.9 For Infrastructure and/or third party infrastructure repairs that are not exchanged in advance, properly package Infrastructure and ship the malfunctioning FRU, at Customer's expense and risk of loss to Motorola.
  - 1.5.10 Clearly print the return authorization number on the outside of the packaging.
  - 1.5.11 Maintain information of software/applications and firmware for re-loading of infrastructure.
  - 1.5.12 Cooperate with Motorola and perform all acts that are reasonable or necessary to enable Motorola to provide the infrastructure repair services to customer.



Advanced Exchange or Loaner Decision Process:





## Shipping Charges:

Service	Advanced Replacement Contract Shipping Charges
Exchanges (Outbound to customer)	Motorola
Exchanges or Loaners Next Flight Out (Outbound to customer)	Customer
Exchanges or Loaners Non-Motorola carrier * (Outbound to customer )	Customer
Exchanges (Inbound to Motorola)	Motorola
Loaner (Outbound to customer)	Motorola
Loaner Repair (Inbound to Motorola)	Customer
Loaner Repair & Return (Outbound to customer)	Motorola
Loaner Installation (OnSite Servicer)	Customer

\*Motorola shipping carriers – FedEx and DHL



## Appendix I: Security Monitoring Service Overview

Motorola's Security Monitoring Services includes anti-malware monitoring and authentication log monitoring. There are also options for firewall monitoring, intrusion detection system (IDS) monitoring, and ASTRO 25 system log monitoring.

Motorola's ASTRO 25 Security Monitoring is a complete solution that provides peace of mind and reduces the risk that your network availability will be impacted by a security threat. The solution includes 24x7x365 monitoring of the radio network security elements by experienced, specialized security technologists with years of experience working with ASTRO 25 mission-critical networks. For highly complex or unusual security events, our technologists have direct and immediate access to Motorola engineers for rapid resolution.

This Statement of Work ("SOW") is subject to the terms and conditions of Motorola's Professional Services Agreement, Service Agreement or other applicable agreement in effect between the parties ("Agreement"). Motorola and Customer may be referred to herein individually as a "Party" or together as "Parties"

### 1. Description of Security Monitoring Services

#### 1.1. Anti-malware Monitoring

ASTRO 25 comes installed with Anti-malware software ("SW"). Security Monitoring will verify that malware definition updates, as provided by the Anti-malware OEM, are installed and running. The anti-malware SW is monitored for activity such as deletion, quarantine, and alerting of suspicious SW.

#### 1.2. Authentication Monitoring

1.2.1. Active directory (including domain Linux and RADIUS) and two-factor authentication log-ins are monitored.

1.3. Firewall Monitoring – The ASTRO 25 system potentially has several firewall options. See Table 1 in the addendum for a list. In any of these firewall applications, Motorola provisions and deploys the firewalls with the ASTRO 25 system. Motorola will monitor each one that has the firewall monitoring option.

1.4. IDS (Intrusion Detection System) Monitoring. An IDS is an option to ASTRO 25 that may be deployed between the ASTRO 25 firewall and the CEN.

#### 1.5. Centralized Log Monitoring

ASTRO 25 has an option that provides the ability to forward device syslogs to a single virtual server called Centralized Syslog Server. This allows monitoring of Linux components for authentication events.

### 2. Scope

The Motorola Secure Operations Center (SOC) consists of highly trained and experienced security specialists. When an event is detected, the technologists will run remote diagnostics



and initiate an appropriate response. This response could involve: continuing to monitor the event for further development, attempting to remotely restore the system, or opening of a case for dispatch of a field servicer (“Servicer”).

3. Motorola Responsibilities:

- 3.1. Provide, maintain, and replace when necessary, hardware (“HW”) and SW required to monitor ASTRO 25 security elements. HW may include a firewall, router, or physical server. SW may include virtual servers either on the ASTRO 25 core or a separate physical server, related OS, SIEM collectors, and SW that allows distribution of updates and remote diagnostics.
- 3.2. Verify connectivity and monitoring is active prior to system acceptance or start date.
- 3.3. Coordinate with customer to maintain Motorola service authentication credentials.
- 3.4. Maintain properly trained and accredited technicians. Monitor the customer’s system 24/7/365 for malicious or unusual activity.
- 3.5. Reports are posted to the SSC quality webpage. Contact your CSM for access.

4. The Customer has the following responsibilities:

- 4.1. Security Monitoring requires a connection from the customer’s ASTRO 25 system to Motorola’s SOC in Schaumburg. Motorola offers either a T1 option or a Virtual Private Network (VPN) option through a customer supplied internet connection.
- 4.2. Allow Motorola continuous remote access to monitor the ASTRO 25 system. This includes keeping the connection plugged-in, providing passwords, and working with Motorola to understand and maintain proper administration privileges.
- 4.3. Provide continuous utility service to any Motorola equipment installed or utilized at the customer’s premises to support delivery of this service.
- 4.4. Provide customer contact information necessary to complete the Customer Support Plan. Notify your CSM within 2 weeks of any contact changes.
- 4.5. As necessary, upgrade the ASTRO 25 system to supported releases.
- 4.6. Allow Motorola dispatched-servicers physical access to the equipment when required.
- 4.7. Comply with the terms of the applicable software license agreements between Customer and Motorola and the non-Motorola software copyright owners.
- 4.8. Cooperate with Motorola and perform all acts that are reasonable or necessary to enable Motorola to provide the services described in this SOW.
- 4.9. Obtain at Customer’s cost all third party consents or licenses required to enable Motorola to provide the Services.

5. Disclaimer

Motorola disclaims any warranty concerning the non-Motorola software and does not guarantee that customer’s system will be error-free or immune to security breaches as a result of these services.



## Addendum

### Potential ASTRO 25 Firewalls

CNI	Customer Network Interface. This firewall separates the ASTRO 25 Radio Network from the customer's IT network (often referred to as the CEN or Customer Enterprise network). There are single and redundant (high-availability) options for the CNI, the redundant option meaning there are two firewalls. Both firewalls must be monitored in the redundant case.
DSR	Dynamic System Resilience. This is an ASTRO 25 option where a geographically separated backup master site is implemented as a "hot-standby" in case of disaster at the primary. This option potentially doubles the number of firewalls in the system.
ZCP	Zone Core Protection. This ASTRO 25 option places firewalls at the master site where the RF and console sites connect. This protects the core from attack from a compromised site and propagation of the attack to the other sites. There are always 2 firewalls in this option for redundancy.
TI	Telephone Interconnect. This ASTRO 25 option allows calls to be made to/from ASTRO 25 subscribers. A firewall is required to protect the RNI from the telephone connection. One firewall may serve the dual purpose of the TI and ISSI interface.
ISSI	Inter RF Subsystem Interface. This option allows connectivity to a separate system. The original intent of this option was to connect to another P25 system supplied by either Motorola or any other P25 compliant vendor. This standard has since been used to allow connection to non-P25 systems through additional interfaces such as WAVE. In any case, a firewall is necessary to protect the RNI from this connection.
MCC 7100	The MCC 7100 dispatch console may be configured such that it can connect via Virtual Private Network (VPN) through an internet connection. A firewall is required to terminate on the ASTRO 25 side of that connection. This firewall may be physically located at either a console site or the master site and there may be multiple firewalls for this purpose.
Custom	Some customers may opt to install their own firewalls and want them monitored, most commonly at console sites. The customer will have to work with Motorola to determine if and how custom firewalls can be monitored. Additional charges may apply.



## Appendix J: Preventive Maintenance Level 2

The terms and conditions of this Statement of Work (SOW) are an integral part of Motorola's Service Agreement or other applicable agreement to which it is attached and made a part thereof by this reference.

Annual Preventative Maintenance will provide an annual operational test and alignment, on the customer's infrastructure equipment (Infrastructure or Fixed Network Equipment or "FNE") to monitor the Infrastructure's conformance to specifications, as set forth in the applicable attached Exhibit(s), all of which are hereby incorporated by this reference.

### 1.0 Scope

Annual Preventive Maintenance will be performed during standard business hours (unless otherwise agreed to in writing). If the system or Customer requirements dictate this service must occur outside of standard business hours, Motorola will provide an additional quotation. Customer is responsible for any charges associated with unusual access requirements or expenses.

### 1.1 Inclusions

Annual Preventive Maintenance service will be delivered on Motorola sold infrastructure including integrated third party products per the level of service as defined in Table 1: PM Tasks Performed.

### 1.2 Limitations and Exclusions

Unless specifically described in Table 1, the following activities are outside the scope of the Annual Preventive Maintenance service, but are optional services that are available to Annual Preventive Maintenance customers at an additional cost:

- 1.2.1 Emergency on-site visits required to resolve technical issues.
  - 1.2.2 Third party support for equipment not sold by Motorola as part of the original system.
  - 1.2.3 System installations, upgrades, and expansions.
  - 1.2.4 Customer training.
  - 1.2.5 Hardware repair and/or exchange.
  - 1.2.6 Network security services.
  - 1.2.7 Network transport.
  - 1.2.8 Information Assurance.
  - 1.2.9 Motorola services not included in this statement of work.
  - 1.2.10 Any maintenance required as a result of a virus or unwanted intrusion is excluded if the system is not protected against these security threats by Motorola's Pre-tested Security Update Service when applicable.
  - 1.2.11 Tower mapping analysis or tower structure analysis
- 1.3 Motorola has the following responsibilities:
- 1.3.1 Notify the customer of any planned system downtime needed to perform this Service.
  - 1.3.2 Advise customer of any issue that requires immediate attention.
  - 1.3.3 Maintain communication with the customer as needed until completion



- ("resolution" implies a problem is being fixed) of the Annual Preventive Maintenance.
- 1.3.4 Determine, in its sole discretion, when a case requires more than the Preventive Maintenance services described in this SOW and notify customer of an alternative course of action.
  - 1.3.5 Provide customer with a report documenting system performance against expected parameters along with recommended actions. Time allotment TBD.
  - 1.3.6 Provide trained and qualified personnel with proper security clearance required to complete Annual Preventive Maintenance service.
- 1.4 The Customer has the following responsibilities:
- 1.4.1 Provide preferred schedule for Annual Preventative Maintenance to Motorola.
  - 1.4.2 Authorize and acknowledge any scheduled system downtime.
  - 1.4.3 Maintain periodic backup of databases, software applications, and firmware.
  - 1.4.4 Establish and maintain a suitable environment (heat, light, and power) for the equipment location and provide Motorola full, free, and safe access to the equipment so that Motorola may provide services. All sites shall be accessible by standard service vehicles.
  - 1.4.5 Submit changes in any information supplied in the Customer Support Plan (CSP) to the Customer Support Manager (CSM).
  - 1.4.6 Provide site escorts in a timely manner if required.
  - 1.4.7 Provide Motorola with requirements necessary for access to secure facilities.
  - 1.4.8 Obtain at Customer's cost all third party consents or licenses required to enable Motorola to provide the Service.



Table 1: PM Tasks Performed

<b>MASTER SITE CHECKLIST</b>			
<b>SERVERS</b>		<b>Level 1</b>	<b>Level 2</b>
Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.	x	x
NM Client Applications	Review UEM events and transport medium types, (microwave/leased line/telco, etc). Event log review for persistent types. Verify all NM client applications are operating correctly.	x	x
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.	x	x
Complete Backup	Verify backups have been done or scheduled. SZ database (BAR), Centracom CDM/ADM database, etc.	x	x
Server Check Disks	Perform checkdisk on server hard drives		x
Verify Redundant ZC's	Perform Zone Controller switchover. ZC1 to ZC2 and back again (coordinate with customer).		x
<b>ROUTERS</b>		<b>Level 1</b>	<b>Level 2</b>
Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
<b>SWITCHES</b>		<b>Level 1</b>	<b>Level 2</b>
Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
Capture Diags	Perform recommended diagnostic tests based on switch type. Capture available diagnostic logs.	x	x
Verify Redundant Switches	Test redundancy in CWR devices. Core router switchover (coordinate with customer).	x	x
<b>DOMAIN CONTROLLERS</b>		<b>Level 1</b>	<b>Level 2</b>
Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.	x	x
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.	x	x
<b>FIREWALLS</b>		<b>Level 1</b>	<b>Level 2</b>



Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.	x	x
<b>LOGGING EQUIPMENT</b>		Level 1	Level 2
Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.	x	x
Server CPU Health	i.e. memory, HDD, CPU, disk space/utilization.	x	x
<b>MISCELLANEOUS EQUIPMENT</b>		Level 1	Level 2
Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.	x	x
Server CPU Health	i.e. memory, HDD, CPU, disk space/utilization.	x	x

<b>PRIME SITE CHECKLIST</b>			
<b>SOFTWARE</b>		Level 1	Level 2
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.	x	x
Verify System SW Installed	Verify software versions installed on system. Document any changes.		x
<b>SWITCHES</b>		Level 1	Level 2
Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
Capture Diags	Perform recommended diagnostic tests based on switch type. Capture available diagnostic logs.	x	x
Verify Redundant Switches	Test redundancy in CWR devices. Core router switchover (coordinate with customer).		x
<b>MISCELLANEOUS EQUIPMENT</b>		Level 1	Level 2
Equipment Alarms	Check LED and/or other status indicators for fault conditions.	x	x
Capture Diags	Perform recommended diagnostic tests based on server type. Capture available diagnostic logs.	x	x
Site Frequency Standard Check	Check lights and indicators for A/B receivers.	x	x
Server CPU Health	i.e. memory, HDD, CPU, disk space/utilization.		x



Site Controller Redundancy (trunking)	Roll site controllers with no dropped audio.		X
<b>COMPARATORS</b>		<b>Level 1</b>	<b>Level 2</b>
Equipment Alarms	Verify no warning/alarm indicators.	X	X
Clean Fans and Equipment	Use antistatic vacuum to clean cooling pathways	X	X



<b>DISPATCH SITE CHECKLIST</b>			
<b>GENERAL</b>		Level 1	Level 2
Inspect all Cables	Inspect all cables/connections to external interfaces are secure	X	X
Mouse and Keyboard	Verify operation of mouse and keyboard	X	X
Configuration File	Verify each operator position has access to required configuration files	X	X
Console Op Time	Verify console op time is consistent across all ops	X	X
Screensaver	Verify screensaver set as customer prefers	X	X
Screen Performance	Verify screen operational/performance	X	X
Touchscreen	Verify touchscreen operation (if applicable)	X	X
Cabling/Lights/Fans	Visual inspection of all equipment - cabling/ lights/ fans	X	X
Filters/Fans/Dust	Clean any filters/ fans/ dust- all equipment	X	X
Monitor and Hard Drive	Confirm monitor and hard drive do not "sleep"	X	X
DVD/CD	Verify / clean DVD or CD drive	X	X
Time Synchronization	Verify console time is synchronized with NTP server		X
Anti-Virus	Verify anti-virus is enabled and that definition files are up to date (within two weeks of current date)		X
<b>HEADSET UNPLUGGED TESTING</b>		Level 1	Level 2
Speakers	Test all speakers - audio quality, volume, static, drop-outs, excess hiss when turned up.	X	X
Channel Audio in Speaker	Verify selected channel audio in select speaker only.	X	X
Footswitch Pedals	Verify both footswitch pedals operational	X	X
Radio On-Air Light	Verify radio on air light comes on with TX (if applicable)	X	X
Radio TX and RX	Verify radio TX/RX from both headset jacks. Verify levels OK. Check volume controls for noise/static or drop-outs.	X	X
Speaker Mute	Verify select speaker muted.	X	X
Telephone Operation	Verify telephone operational through both headset jacks. Check volume controls for noise/static or drop-outs.	X	X
Audio Switches	Verify select audio switches to speaker when phone off-hook. (if interfaced to phones)	X	X
Radio Takeover in Headset	Verify radio-takeover in headset mic when phone off-hook (mic switches to radio during PTT and mutes to phone).	X	X
<b>OTHER TESTS</b>		Level 1	Level 2



Phone Status Light	Verify phone status light comes on when phone off-hook (if applicable)	X	X
Desk Microphone Operation	Confirm desk mic operation (if applicable)	X	X
Radio IRR Operation	Verify radio IRR operational (if applicable)	X	X
Telephone IRR Operation	Verify telephone [if on radio computer] IRR operational (if applicable)	X	X
Recording	Verify operator position being recorded on long term logging recorder (if applicable)	X	X
IRR Setup Parameters	Check IRR set-up parameters, and also audio card set-up and level adjustments		X
Paging Controls	Confirm all paging controls are functional (including third party encoders if under maintenance)		X
<b>COMPUTER PERFORMANCE TESTING</b>		<b>Level 1</b>	<b>Level 2</b>
Computer Reboot	Reboot op position computer	X	X
Computer Operational	Confirm client computer is fully operational (if applicable)	X	X
For XP and older Operating Systems: Hard Drive Fragmentation	Check status of hard drive fragmentation- perform if needed		X
Event Logs	Pull event logs and review for major errors		X
Hard Drive Backup	Create backup of drive for offsite storage.		X
Memory Usage	Check memory usage		X
Application Logs and Alerts	Review built in application logs and alerts		X
Hard Drive Usage	Check available space (10% minimum)		X
<b>AUDIO TESTING</b>		<b>Level 1</b>	<b>Level 2</b>
Audio Levels and Quality	Confirm all conventional resources are functional with adequate audio levels and quality	X	X
Secure Mode	Confirm any secure talkgroups are operational in secure mode	X	X
Trunked Resources	Confirm all trunked resources on screen are functioning by placing a call in both directions (at the customer's discretion) and at a single op position		X
<b>EQUIPMENT ROOM TESTS</b>		<b>Level 1</b>	<b>Level 2</b>
Recording - AIS Test	Verify audio logging of trunked calls	X	X
Recording	Test op position logging on analog recorder (with customer assistance)	X	X
System Alarms	Review alarm system on all equipment for errors	X	X



Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.	X	X
SDM AUX I/O Server	Confirm all AUX I/O's functional on one operator position		X
Backup Resources	Confirm all backup radios meet RF specs and combiner/antenna system fully functional		X
Verify System SW Installed	Verify software versions installed on system. Document any changes.		X
IP Network Redundancy	If redundant equipment used (e.g., routers, switches), then switch to redundant equipment and confirm operation.		X

RF SITE CHECKLIST		Level 1	Level 2
Equipment Alarms	Verify no warning/alarm indicators.	X	X
Clean Fans and Equipment	Use antistatic vacuum to clean cooling pathways	X	X
Site Frequency Standard Check	Check lights and indicators for A/B receivers.	X	X
Basic Voice Call Check	Voice test each voice path, radio to radio.	X	X
Control Channel Redundancy (trunking)	Roll control channel, test, and roll back.	X	X
Site Controller Redundancy (trunking)	Roll site controllers with no dropped audio.	X	X
GTR 8000 Results Sheet	Complete GTR tests - Frequency Error, Modulation Fidelity, Forward at Set Power, Reverse at Set Power, Gen Level Desense no Tx.	X	X

MOSCAD CHECKLIST		Level 1	Level 2
<b>MOSCAD SERVER</b>			
Equipment Alarms	Verify no warning/alarm indicators.	X	X
Check Alarm/Event History	Review MOSCAD alarm and events to find if there are chronic issues.	X	X
Windows Event Logs	Review Windows event logs. Save and clear if full.	X	X
Password Verification	Site devices to verify passwords. Document changes if any found.	X	X
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.	X	X
Verify System SW Installed	Verify software versions installed on server. Document any changes.		X
Server CPU Health	i.e. memory, HDD, CPU, Disk space/utilization.		X



Verify Patches	Verify security patches monthly/quarterly (Motorola and 3rd Party). Document any changes.		X
<b>MOSCAD CLIENT</b>		<b>Level 1</b>	<b>Level 2</b>
Equipment Alarms	Verify no warning/alarm indicators.	X	X
Check Alarm / Event History	Review MOSCAD alarm and events to find if there are chronic issues.	X	X
Windows Event Logs	Review Windows event logs. Save and clear if full.	X	X
Password Verification	Site devices to verify passwords. Document changes if any found.	X	X
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.	X	X
Verify System SW Installed	Verify software versions installed on system. Document any changes.		X
Verify Patches	Verify security patches monthly/quarterly (Motorola and 3rd Party). Document any changes.		X
Server CPU Health	i.e. memory, HDD, CPU, disk space/utilization.		X
Complete Backup	Verify backups have been done or scheduled. SZ database (BAR), Centracom CDM/ADM database, etc.		X
<b>MOSCAD RTU's</b>		<b>Level 1</b>	<b>Level 2</b>
Equipment Alarms	Verify no warning/alarm indicators.	X	X
Verify Connectivity	Verify Connectivity	X	X
Password Verification	Site devices to verify passwords. Document changes if any found.		X
Check Alarm / Event History	Review MOSCAD alarms and events to find if there are chronic issues.		X
Verify System SW CD's	Perform audit of software media on site. Versions, KC numbers, types, etc.		X
Verify System SW Installed	Verify software versions installed on system. Document any changes.		X

<b>FACILITIES CHECKLIST</b>			
<b>VISUAL INSPECTION EXTERIOR</b>		<b>Level 1</b>	<b>Level 2</b>
ASR Sign	Verify that the ASR sign is posted.	X	X
Warning Sign - Tower	Verify warning sign is posted on the tower.	X	X
Warning Sign - Gate	Verify that a warning sign is posted at the compound gate entrance.	X	X
10 Rule Sign	Verify that a 10 rules sign is posted on the inside of the shelter door.	X	X
Outdoor Lighting	Verify operation of outdoor lighting/photocell.	X	X



Exterior of Building	Check exterior of building for damage/disrepair.	X	X
Fences / Gates	Check fences/gates for damage/disrepair.	X	X
Landscape / Access Road	Check landscape/access road for accessibility.	X	X
<b>VISUAL INSPECTION INTERIOR</b>		<b>Level 1</b>	<b>Level 2</b>
Electrical Surge Protectors	Check electrical surge protectors for alarms.	X	X
Emergency Lighting	Verify emergency lighting operation.	X	X
Indoor Lighting	Verify indoor lighting.	X	X
Equipment Inspection	Visually inspect that all hardware (equipment, cables, panels, batteries, racks, etc.) are in acceptable physical condition for normal operation.	X	X
Site Frequency Standard Check	Check lights and indicators for A/B receivers.	X	X
Regulatory Compliance (License, ERP, Frequency, Deviation)	Check station for regulatory compliance. Update station logs.	X	X
Clean Fans and Equipment	Use antistatic vacuum to clean cooling pathways	X	X
<b>UPS</b>		<b>Level 1</b>	<b>Level 2</b>
Visual inspection (condition, cabling)	Verify corrosion, physical connections, dirt/dust, etc.	X	X
Verify rollover and rollback	Verify automatic switch to backup power when main power fails		X
Battery voltage checks	Verify, check and measure battery voltages.		X
<b>GENERATOR</b>		<b>Level 1</b>	<b>Level 2</b>
Visual Inspection	Verify, check panel housing, cracks, rust and weathering. Physical connections, corrosion, dirt/dust, etc.	X	X
Fuel	Verify fuel levels in backup generators, document date of last fuel delivered from fuel service provider.	X	X
Oil	Check the oil dipstick for proper level. Note condition of oil.	X	X
Verify operation (no switchover)	Check, verify running of generator, ease of start or difficult. Is generator "throttling" or running smooth? Any loud unusual noise? Etc.	X	X
Verify rollover and rollback	***Depends on configuration of Transfer switch. Auto versus manual*** Rollover should be tested weekly under load.		X
<b>HVAC</b>		<b>Level 1</b>	<b>Level 2</b>
Air Filter	Check air filter and recommend replacement if required	X	X
Coils	Check coils for dirt	X	X



Outdoor Unit	Check that outdoor unit is unobstructed	x	x
Wiring	Wiring (insect/rodent damage)	x	x
Cooling / Heating	Check each HVAC unit for cooling/heating	x	x

<b>MICROWAVE CHECKLIST</b>			
<b>GENERAL</b>		Level 1	Level 2
Transport Performance	Confirm transport performance by viewing UEM for site link warnings or errors.		x
<b>RADIO</b>		Level 1	Level 2
Alarms	Check alarm / event history	x	x
Software	Verify version of application	x	x
TX Frequency	Verify transmit frequency	x	x
TX Power	Verify transmit power	x	x
RX Frequency	Verify receive frequency	x	x
RX Signal Level	Verify receive signal level and compare with install baseline documentation	x	x
Save configuration	Save current configuration for off site storage	x	x
Backhaul Validation	Monitor UEM status (alarms, logs, etc.) for all links. If UEM not used to monitor microwave, then use provided microwave alarm mgmt server.	x	x
<b>WAVEGUIDE</b>		Level 1	Level 2
Visual Inspection	Inspect for wear or dents (from ground using binoculars).	x	x
Connection Verification	Verify all connections are secured with proper hardware (from ground using binoculars).	x	x
<b>DEHYDRATOR</b>		Level 1	Level 2
Visual Inspection	Inspect moisture window for proper color	x	x
Pressure Verification	Verify pressure of all lines	x	x
Re-Pressurization	Bleed lines temporarily to verify the dehydrator re-pressurizes	x	x
Run Hours	Record number of hours ran	x	x

<b>TOWER CHECKLIST</b>			
<b>STRUCTURE CONDITION</b>		Level 1	Level 2
Rust	Check structure for rust.	x	x
Cross Members	Check for damaged or missing cross members.	x	x
Safety Climb	Check safety climb for damage.	x	x
Ladder	Verify that ladder system is secured to tower.	x	x
Welds	Check for cracks or damaged welds.	x	x



Outdoor lighting/photocell	Test outdoor lighting and photocell.	x	x
Drainage Holes	Check that drainage holes are clear of debris.	x	x
Paint	Check paint condition.	x	x
<b>TOWER LIGHTING</b>		Level 1	Level 2
Lights/Markers	Verify all lights/markers are operational.	x	x
Day/Night Mode	Verify day and night mode operation.	x	x
Power Cabling	Verify that power cables are secured to tower.	x	x
<b>ANTENNAS AND LINES</b>		Level 1	Level 2
Antennas	Visually inspect antennas for physical damage (from ground using binoculars).	x	x
Transmission Lines	Verify that all transmission lines are secure on the tower.	x	x
<b>GROUNDING</b>		Level 1	Level 2
Structure Grounds	Inspect grounding for damage or corrosion	x	x
<b>GUY WIRES</b>		Level 1	Level 2
Tower Guys	Check guy wires for fraying and tension.	x	x
Guy Wire Hardware	Check hardware for rust.	x	x
<b>CONCRETE CONDITION</b>		Level 1	Level 2
Tower Base	Check for chips or cracks.	x	x

**APPENDIX A-1**

**2 C.F.R. § 200.326 and 2 C.F.R. Part 200, Appendix II  
Required Contract Clauses**



2 C.F.R. § 200.326 and 2 C.F.R. Part 200, Appendix II, Required Contract Clauses

Requirements under the Uniform Rules. A non-Federal entity's contracts must contain the applicable contract clauses described in Appendix II to the Uniform Rules (Contract Provisions for non-Federal Entity Contracts Under Federal Awards), which are set forth below. 2 C.F.R. § 200.326.

1. Equal Employment Opportunity.a. Key Definitions.

- (1) Federally Assisted Construction Contract. The regulation at 41 C.F.R. § 60-1.3 defines a "federally assisted construction contract" as any agreement or modification thereof between any applicant and a person for construction work which is paid for in whole or in part with funds obtained from the Government or borrowed on the credit of the Government pursuant to any Federal program involving a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, or any application or modification thereof approved by the Government for a grant, contract, loan, insurance, or guarantee under which the applicant itself participates in the construction work.
- (2) Construction Work. The regulation at 41 C.F.R. § 60-1.3 defines "construction work" as the construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction.

b. Applicability. This requirement applies to all FEMA grant and cooperative agreement programs.

c. "During the performance of this contract, the contractor agrees as follows:

- (1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
- (2) The contractor will, in all solicitations or advertisements for employees

placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

- (3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- (4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- (5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- (6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- (7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States."

## 2. Davis Bacon Act and Copeland Anti-Kickback Act.

- a. Applicability of Davis-Bacon Act. The Davis-Bacon Act only applies to the emergency Management Preparedness Grant Program, Homeland Security Grant Program, Nonprofit Security Grant Program, Tribal Homeland Security Grant Program, Port Security Grant Program, and Transit Security Grant Program. **It**

**does not apply to other FEMA grant and cooperative agreement programs, including the Public Assistance Program.**

- b. All prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. §§ 3141-3144 and 3146-3148) as supplemented by Department of Labor regulations at 29 C.F.R. Part 5 (Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction)). See 2 C.F.R. Part 200, Appendix II, ¶ D.
- c. In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week.
- d. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.
- e. In contracts subject to the Davis-Bacon Act, the contracts must also include a provision for compliance with the Copeland “Anti-Kickback” Act (40 U.S.C. § 3145), as supplemented by Department of Labor regulations at 29 C.F.R. Part 3 (Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States). The Copeland Anti-Kickback Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to FEMA.
- f. The regulation at 29 C.F.R. § 5.5(a) does provide the required contract clause that applies to compliance with both the Davis-Bacon and Copeland Acts. However, as discussed in the previous subsection, the Davis-Bacon Act does not apply to Public Assistance recipients and subrecipients. **In situations where the Davis-Bacon Act does not apply, neither does the Copeland “Anti-Kickback Act.”** However, for purposes of grant programs where both clauses do apply, FEMA requires the following contract clause:

**“Compliance with the Copeland “Anti-Kickback” Act.**

- (1) Contractor. The contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract.
- (2) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clause above and such other clauses as the FEMA may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The

prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.

(3) Breach. A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a contractor and subcontractor as provided in 29 C.F.R. § 5.12.”

3. Contract Work Hours and Safety Standards Act.

- a. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.
- b. Where applicable (see 40 U.S.C. § 3701), all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. §§ 3702 and 3704, as supplemented by Department of Labor regulations at 29 C.F.R. Part 5. See 2 C.F.R. Part 200, Appendix II, ¶ E.
- c. Under 40 U.S.C. § 3702, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week.
- d. The requirements of 40 U.S.C. § 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.
- e. The regulation at 29 C.F.R. § 5.5(b) provides the required contract clause concerning compliance with the Contract Work Hours and Safety Standards Act:

“Compliance with the Contract Work Hours and Safety Standards Act.

- (1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work

done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The (write in the name of the Federal agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.”

#### 4. Rights to Inventions Made Under a Contract or Agreement.

- a. Stafford Act Disaster Grants. This requirement **does not apply to the Public Assistance,** Hazard Mitigation Grant Program, Fire Management Assistance Grant Program, Crisis Counseling Assistance and Training Grant Program, Disaster Case Management Grant Program, and Federal Assistance to Individuals and Households – Other Needs Assistance Grant Program, as FEMA awards under these programs do not meet the definition of “funding agreement.”
- b. If the FEMA award meets the definition of “funding agreement” under 37 C.F.R. § 401.2(a) and the non-Federal entity wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that “funding agreement,” the non-Federal entity must comply with the requirements of 37 C.F.R. Part 401 (Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements), and any implementing regulations issued by

FEMA. See 2 C.F.R. Part 200, Appendix II, ¶ F.

- c. The regulation at 37 C.F.R. § 401.2(a) currently defines “funding agreement” as any contract, grant, or cooperative agreement entered into between any Federal agency, other than the Tennessee Valley Authority, and any contractor for the performance of experimental, developmental, or research work funded in whole or in part by the Federal government. This term also includes any assignment, substitution of parties, or subcontract of any type entered into for the performance of experimental, developmental, or research work under a funding agreement as defined in the first sentence of this paragraph.
5. Clean Air Act and the Federal Water Pollution Control Act. Contracts of amounts in excess of \$150,000 must contain a provision that requires the contractor to agree to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act (42 U.S.C. §§ 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. §§ 1251-1387). Violations must be reported to FEMA and the Regional Office of the Environmental Protection Agency. See 2 C.F.R. Part 200, Appendix II, ¶ G.
- a. “Clean Air Act
    - (1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq.
    - (2) The contractor agrees to report each violation to the (name of the state agency or local or Indian tribal government) and understands and agrees that the (name of the state agency or local or Indian tribal government) will, in turn, report each violation as required to assure notification to the (name of recipient), Federal Emergency Management Agency, and the appropriate Environmental Protection Agency Regional Office.
    - (3) The contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by FEMA.

Federal Water Pollution Control Act

- (1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq.
- (2) The contractor agrees to report each violation to the (name of the state agency or local or Indian tribal government) and understands and agrees that the (name of the state agency or local or Indian tribal

government) will, in turn, report each violation as required to assure notification to the (name of recipient), Federal Emergency Management Agency, and the appropriate Environmental Protection Agency Regional Office.

(3) The contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by FEMA.”

6. Debarment and Suspension.

- a. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.
- b. Non-federal entities and contractors are subject to the debarment and suspension regulations implementing Executive Order 12549, *Debarment and Suspension* (1986) and Executive Order 12689, *Debarment and Suspension* (1989) at 2 C.F.R. Part 180 and the Department of Homeland Security’s regulations at 2 C.F.R. Part 3000 (Nonprocurement Debarment and Suspension).
- c. These regulations restrict awards, subawards, and contracts with certain parties that are debarred, suspended, or otherwise excluded from or ineligible for participation in Federal assistance programs and activities. See 2 C.F.R. Part 200, Appendix II, ¶ H; and *Procurement Guidance for Recipients and Subrecipients Under 2 C.F.R. Part 200 (Uniform Rules): Supplement to the Public Assistance Procurement Disaster Assistance Team (PDAT) Field Manual* Chapter IV, ¶ 6.d, and Appendix C, ¶ 2 [hereinafter *PDAT Supplement*]. A contract award must not be made to parties listed in the SAM Exclusions. SAM Exclusions is the list maintained by the General Services Administration that contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. SAM exclusions can be accessed at [www.sam.gov](http://www.sam.gov). See 2 C.F.R. § 180.530; *PDAT Supplement*, Chapter IV, ¶ 6.d and Appendix C, ¶ 2.
- d. In general, an “excluded” party cannot receive a Federal grant award or a contract within the meaning of a “covered transaction,” to include subawards and subcontracts. This includes parties that receive Federal funding indirectly, such as contractors to recipients and subrecipients. The key to the exclusion is whether there is a “covered transaction,” which is any nonprocurement transaction (unless excepted) at either a “primary” or “secondary” tier. Although “covered transactions” do not include contracts awarded by the Federal Government for purposes of the nonprocurement common rule and DHS’s implementing regulations, it does include some contracts awarded by recipients and subrecipient.
- e. Specifically, a covered transaction includes the following contracts for goods or services:

- (1) The contract is awarded by a recipient or subrecipient in the amount of at least \$25,000.
- (2) The contract requires the approval of FEMA, regardless of amount.
- (3) The contract is for federally-required audit services.
- (4) A subcontract is also a covered transaction if it is awarded by the contractor of a recipient or subrecipient and requires either the approval of FEMA or is in excess of \$25,000.

d. “Suspension and Debarment

- (1) This contract is a covered transaction for purposes of 2 C.F.R. pt. 180 and 2 C.F.R. pt. 3000. As such the contractor is required to verify that none of the contractor, its principals (defined at 2 C.F.R. § 180.995), or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. § 180.940) or disqualified (defined at 2 C.F.R. § 180.935).
- (2) The contractor must comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.
- (3) This certification is a material representation of fact relied upon by Harbor Department. If it is later determined that the contractor did not comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, in addition to remedies available to City of Los Angeles Mayor’s Office and Harbor Department, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.
- (4) The bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.”

9. Byrd Anti-Lobbying Amendment.

- a. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.
- b. Contractors that apply or bid for an award of \$100,000 or more must file the required certification. See 2 C.F.R. Part 200, Appendix II, ¶ I; 44 C.F.R. Part 18; *PDAT Supplement*, Chapter IV, 6.c; Appendix C, ¶ 4.
- c. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or

attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. § 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award. See PDAT Supplement, Chapter IV, ¶ 6.c and Appendix C, ¶ 4.

d. “Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352 (as amended)”

Contractors who apply or bid for an award of \$100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient.”

APPENDIX A, 44 C.F.R. PART 18 – CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

(To be submitted with each bid or offer exceeding \$100,000)

The undersigned [Contractor] certifies, to the best of his or her knowledge, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or

cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor, \_\_\_\_\_, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. § 3801 *et seq.*, apply to this certification and disclosure, if any.

\_\_\_\_\_  
Signature of Contractor's Authorized Official

\_\_\_\_\_  
Name and Title of Contractor's Authorized Official

\_\_\_\_\_  
Date"

10. Procurement of Recovered Materials.

- a. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.
- b. A non-Federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with Section 6002 of the Solid Waste Disposal Act, Pub. L. No. 89-272 (1965) (codified as amended by the Resource Conservation and Recovery Act at 42 U.S.C. § 6962). See 2 C.F.R. Part 200, Appendix II, ¶ J; 2 C.F.R. § 200.322; *PDAT Supplement*, Chapter V, ¶ 7.
- c. The requirements of Section 6002 include procuring only items designated in guidelines of the EPA at 40 C.F.R. Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of

competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired by the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

- d. “(1) In the performance of this contract, the Contractor shall make maximum use of products containing recovered materials that are EPA- designated items unless the product cannot be acquired—
- (i) Competitively within a timeframe providing for compliance with the contract performance schedule;
  - (ii) Meeting contract performance requirements; or
  - (iii) At a reasonable price.

(2) Information about this requirement, along with the list of EPA-designate items, is available at EPA’s Comprehensive Procurement Guidelines web site, <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.”

#### 11. Additional FEMA Requirements.

- a. The Uniform Rules authorize FEMA to require additional provisions for non-Federal entity contracts. FEMA, pursuant to this authority, requires or recommends the following:

b. Changes.

To be eligible for FEMA assistance under the non-Federal entity’s FEMA grant or cooperative agreement, the cost of the change, modification, change order, or constructive change must be allowable, allocable, within the scope of its grant or cooperative agreement, and reasonable for the completion of project scope. FEMA recommends, therefore, that a non-Federal entity include a changes clause in its contract that describes how, if at all, changes can be made by either party to alter the method, price, or schedule of the work without breaching the contract. The language of the clause may differ depending on the nature of the contract and the end-item procured.

c. Access to Records.

All non-Federal entities must place into their contracts a provision that all contractors and their successors, transferees, assignees, and subcontractors acknowledge and

agree to comply with applicable provisions governing Department and FEMA access to records, accounts, documents, information, facilities, and staff. See DHS Standard Terms and Conditions, v 3.0, ¶ XXVI (2013).

d. “Access to Records. The following access to records requirements apply to this contract:

(1) The contractor agrees to provide City of Los Angeles Mayor’s Office, Harbor Department, the FEMA Administrator, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.

(2) The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

(3) The contractor agrees to provide the FEMA Administrator or his authorized representatives access to construction or other work sites pertaining to the work being completed under the contract.”

12. DHS Seal, Logo, and Flags.

- a. All non-Federal entities must place in their contracts a provision that a contractor shall not use the DHS seal(s), logos, crests, or reproductions of flags or likenesses of DHS agency officials without specific FEMA pre-approval. See DHS Standard Terms and Conditions, v 3.0, ¶ XXV (2013).
- b. “The contractor shall not use the DHS seal(s), logos, crests, or reproductions of flags or likenesses of DHS agency officials without specific FEMA pre-approval.”

13. Compliance with Federal Law, Regulations, and Executive Orders.

- a. All non-Federal entities must place into their contracts an acknowledgement that FEMA financial assistance will be used to fund the contract along with the requirement that the contractor will comply with all applicable federal law, regulations, executive orders, and FEMA policies, procedures, and directives.
- b. “This is an acknowledgement that FEMA financial assistance will be used to fund the contract only. The contractor will comply will all applicable federal law, regulations, executive orders, FEMA policies, procedures, and directives.”

14. No Obligation by Federal Government.

- a. The non-Federal entity must include a provision in its contract that states that the Federal Government is not a party to the contract and is not subject to any obligations or liabilities to the non-Federal entity, contractor, or any other party pertaining to any matter resulting from the contract.
- b. “The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the non-Federal entity, contractor, or any other party pertaining to any matter resulting from the contract.”

15. Program Fraud and False or Fraudulent Statements or Related Acts.

- a. The non-Federal entity must include a provision in its contract that the contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to its actions pertaining to the contract.
- b. “The contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to the contractor’s actions pertaining to this contract.”

