System Release 7.17.2
ASTRO® 25
INTEGRATED VOICE AND DATA

ASTRO 25 Express
Setup Guide

NOVEMBER 2017

MN004282A01-A

Copyrights

The Motorola Solutions products described in this document may include copyrighted Motorola Solutions computer programs. Laws in the United States and other countries preserve for Motorola Solutions certain exclusive rights for copyrighted computer programs. Accordingly, any copyrighted Motorola Solutions computer programs contained in the Motorola Solutions products described in this document may not be copied or reproduced in any manner without the express written permission of Motorola Solutions.

No part of this document may be reproduced, transmitted, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without the prior written permission of Motorola Solutions, Inc.

Furthermore, the purchase of Motorola Solutions products shall not be deemed to grant either directly or by implication, estoppel or otherwise, any license under the copyrights, patents or patent applications of Motorola Solutions, except for the normal non-exclusive, royalty-free license to use that arises by operation of law in the sale of a product.

Disclaimer

Please note that certain features, facilities, and capabilities described in this document may not be applicable to or licensed for use on a specific system, or may be dependent upon the characteristics of a specific mobile subscriber unit or configuration of certain parameters. Please refer to your Motorola Solutions contact for further information.

Trademarks

MOTOROLA, MOTO, MOTOROLA SOLUTIONS, and the Stylized M Logo are trademarks or registered trademarks of Motorola Trademark Holdings, LLC and are used under license. All other trademarks are the property of their respective owners.

European Union (EU) Waste of Electrical and Electronic Equipment (WEEE) directive

The European Union's WEEE directive requires that products sold into EU countries must have the crossed out trash bin label on the product (or the package in some cases).

As defined by the WEEE directive, this cross-out trash bin label means that customers and end-users in EU countries should not dispose of electronic and electrical equipment or accessories in household waste.

Customers or end-users in EU countries should contact their local equipment supplier representative or service centre for information about the waste collection system in their country.

This page intentionally left blank.

Contact Us

Motorola Solutions Support Center

The Solutions Support Center (SSC) is the primary Motorola Solutions support contact. Call:

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

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

North America Parts Organization

For assistance in ordering replacement parts or identifying a part number, contact the Motorola Solutions Parts organization. Your first response when troubleshooting your system is to call the Motorola SSC.

For...	Phone
Phone Orders	**800-422-4210** (US and Canada Orders) For help identifying an item or part number, select choice 3 from the menu.
	302-444-9842 (International Orders) Includes help for identifying an item or part number and for translation as needed.
Fax Orders	**800-622-6210** (US and Canada Orders)

Comments

Send questions and comments regarding user documentation to documentation@motorolasolutions.com.

Provide the following information when reporting a documentation error:

- The document title and part number
- The page number with the error
- A description of the error

We welcome your feedback on this and other Motorola Solutions manuals. To take a short, confidential survey on Motorola Solutions Customer Documentation, go to docsurvey.motorolasolutions.com or scan the following QR code with your mobile device to access the survey.

This page intentionally left blank.

Document History

Version	Description	Date
MN004282A01-A	Original release of the *ASTRO 25 Express Setup Guide*.	November 2017

This page intentionally left blank.

Contents

List of Figures

This page intentionally left blank.

List of Tables

This page intentionally left blank.

List of Processes

This page intentionally left blank.

List of Procedures

This page intentionally left blank.

About ASTRO 25 Express Setup Guide

This guide provides basic installation, configuration, and verification information to support the initial setup of the essential equipment in the ASTRO® 25 Express trunking system.

What is Covered in This Manual?

This document contains the following chapters:

- ASTRO 25 Express System Preparation on page 21 describes basic preparation steps for an ASTRO® 25 Express system.
- Equipment Setup on page 23 describes the equipment setup used.
- Test and Verification on page 51 provides a list of recommended test equipment along with activities necessary to support performance testing and verification for the GTR 8000 Base Radio and Radio Frequency Distribution System (RFDS) activities.
- Site Preparation and R56 Compliance Checklist on page 75 provides information about obtaining and preparing all hardware, software, support, and test equipment necessary to set up, configure, and optimize the system.
- Service Laptop and Software Setup for ASTRO 25 Express on page 109 describes service laptp requirements and related software required.

Helpful Background Information

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

Related Information

See the following documents for associated information about the radio system.

Related Information	Purpose
Standards and Guidelines for Communication Sites	Provides standards and guidelines that should be followed when setting up a Motorola communications site. Also known as R56 manual. This document may be purchased by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
System Documentation Overview	Provides an overview of the ASTRO® 25 new system features, documentation set, technical illustrations, and system-level disaster recovery that support the ASTRO® 25 radio communication system.

This page intentionally left blank.

Chapter 1

ASTRO 25 Express System Preparation

This chapter describes basic preparation steps for an ASTRO® 25 Express system.

1.1 Preparation Overview

IMPORTANT: Before setting up the site, fully understand and follow all safety, training, and certification requirements and considerations.

Motorola Solutions offers various courses designed to assist in learning about the system. For information, go to http://www.motorolasolutions.com/training to view the current course offerings and technology paths. Motorola Online (MOL) website contains additional information, for more details go to https://businessonline.motorolasolutions.com and then click **Resource Center**.

Understand and follow R56 standards and guidelines for communication sites, including all safety requirements and considerations. See the R56 *Standards and Guidelines for Communication Sites* manual.

Table 1: R56 Compliance Audit

Activity	Description	Reference
R56 Standards and Compliance	The site should meet R56 standards and audited by an ETA-certified R56 auditor to verify compliance.	• *Standards and Guidelines for Communication Sites* manual may be purchased by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842). • Site Preparation and R56 Compliance Checklist on page 75: R56 Compliance Checklist and Audit Form is included in this appendix.

This table lists the references to the information required for site preparation.

Table 2: Prepare Support and Test Equipment

Activity	Description	Reference
Service Laptop Setup	A service laptop can be used to install and configure components and to check component status.	See Service Laptop and Software Setup for ASTRO 25 Express on page 109 for details regarding the hardware and software requirements, recommendations, and considerations for a service laptop.

Table continued…

Activity	Description	Reference
Equipment Setup	Covers the equipment setup procedures which are performed at the site.	See Equipment Setup on page 23.
Test and Verification	Covers the equipment test and verification procedures which are performed at the site.	See Test and Verification on page 51.
Configuration	Covers the basic configuration procedures which are performed at the site.	See GTR 8000 Base Radio Configuration Setup on page 36 and GCP 8000 Site Controller Configuration Setup on page 42.

Chapter 2

Equipment Setup

Equipment setup in this guide is based on a three-cabinet GTR 8000 Expandable Site Subsystem configuration (one primary cabinet and two expansion cabinets) for an ASTRO® 25 Express system.

2.1 ASTRO 25 Express Equipment Checklist

Take an inventory of all equipment with a Motorola Solutions representative present to ensure that the order is complete. Carefully inspect all equipment and accessories to verify that they are in good condition. Promptly report any damaged or missing items to the Motorola Solutions representative.

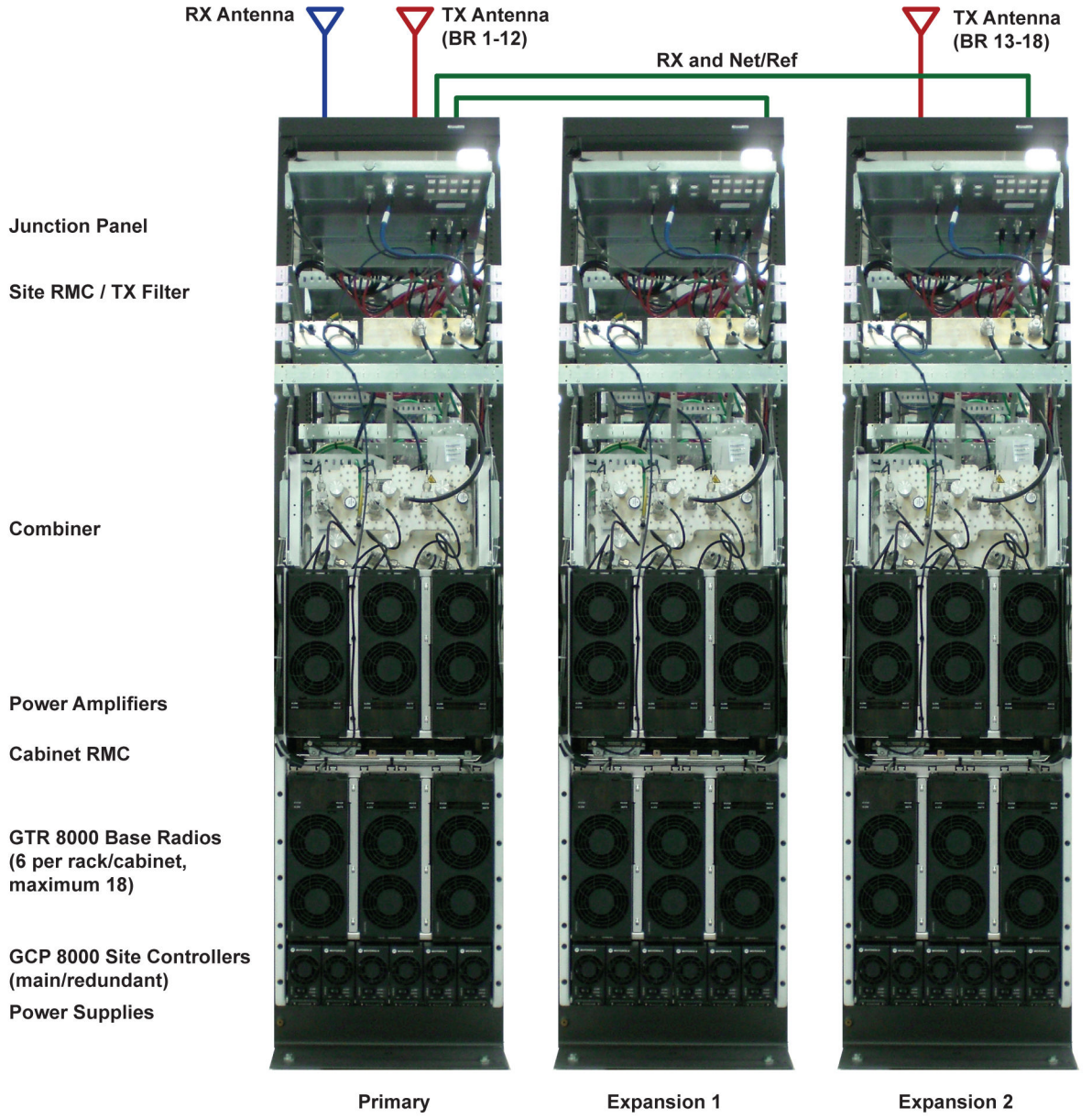
CAUTION: Do not tamper with factory configuration settings for these devices. Factory configuration settings include software configuration, firmware release, password, and physical connections. Motorola Solutions has configured and connected these devices to meet specific performance requirements. Tampering with these devices may result in unpredictable system performance or a catastrophic failure.

Table 3: Equipment Checklist

Equipment Checklist
GTR 8000 Expandable Site Subsystem (Primary Cabinet Expansion Cabinets)
Junction Panels
Site Receive Multicouplers (RMCs)*
Transmit (TX) Filter
GCP 8000 Site Controller
Expansion Hubs (XHubs)
Combiner*
Power Amplifiers (up to six, one for each base Radio)
Cabinet RMCs*
RMC
RMC Pass Through Module (UHF R1 and VHF only)
Transceiver (XCVR) – up to six per cabinet
Power Supplies (up to six, one for each base radio)

*Not available for UHF R1 and VHF

Figure 1: Site Equipment Basic Components for 700/800 MHz System



2.1.1
Receive Expansion Cable Length Specifications

This table provides the specifications for the GTR 8000 receive expansion cable lengths. The receive expansion cables connect the Expansion Cabinets and are not provided. Cable length is not critical;

however, maintain the lengths within ±50% of the values listed in the table to achieve a good balance between all receivers. Keep within a nominal loss of 1 dB.

Table 4: GTR 8000 Receive Expansion Cable Length Specifications

Cable Type	Length (ft)	Length (m)
EnviroFlex™ EF142	6.6	2
1/4–inch Superflex or equivalent	19	5.8
3/8–inch Superflex or equivalent	28	8.5
1/2–inch Superflex or equivalent	31	9.5

2.2 GTR 8000 Expandable Site Subsystem Setup

This section describes brief setup and configuration procedures relating to the GTR 8000 Expandable Site Subsystem. The following table lists the activities for installing the site equipment. In case detailed procedures are need, the table also covers the chapter references in the *GTR 8000 Expandable Site Subsystem Feature Guide*.

Setup Prerequisites:

- Appropriate cables
- Access to Software Download and Configuration/Service Software (CSS)
- IP/Domain Name Service (DNS) information
- Login and password information

Table 5: Installation Overview

Activity	Description	Manual Reference
Unpack and inspect	Inspect and take inventory of all racks or cabinets, cables, and other equipment to ensure that the order is complete.	Chapter 3, “Equipment Inspection and Inventory Recommendations”
Install hardware	Install all equipment using the site drawings and other documents provided by the Motorola Solutions representative. Follow the installation standards and guidelines for placing and installing the equipment.	Chapter 3, “Placement and Spacing Recommendations”, “Cabinet Bracing Recommendations”, “Floor Mounting Procedure for Cabinets or Racks”, “Floor Mounting for the GTR 8000 Expandable Site Subsystem”
Ground cabinets/racks	Ground cabinets/racks and equipment to protect against ground faults, electrical surges, and lightning in accordance with R56 standards.	Chapter 3, “Bonding and Grounding Requirements”, “Electrostatic Discharge Recommendations”

Table continued…

Activity	Description	Manual Reference
Connect cables	Connect all cables between cabinets/racks and external devices.	Chapter 3, “Cabling Requirements”
Connect multiple cabinets/racks and antennas	Follow the junction panel connection diagrams for Primary and Expansion cabinets and antennas.	GTR 8000 Expandable Site Subsystem Junction Panel Quick Connections on page 30
Preliminary check	Run a preliminary check of all equipment before applying power and beginning software installation.	Chapter 3, “Power Guidelines and Requirements” and “Connecting Power”

2.2.1
GTR 8000 Expandable Site Subsystem Power, Grounding, and Interface Connections

This section describes the GTR 8000 Expandable Site Subsystem power, grounding, and interface connections.

2.2.1.1
GTR 8000 Expandable Site Subsystem Power Connections

This section covers connecting power cables to the GTR 8000 Expandable Site Subsystem and the power distribution module, calculating the length of the wire for various gauges, and mounting the battery temperature sensor.

Power cables are connected to the GTR 8000 Base Radio Power Distribution Module. When making these connections, consider the following:

- The power distribution module located with the junction panel provides connections for AC and DC input.
- One or two DC inputs can be connected to the DC section of the power distribution module.
- Each GTR 8000 Base Radio must have a single, separate AC source with the proper power rating connected to the appropriate terminals in the AC section where it is then fed to the corresponding AC power supply input.
- Each DC input termination is rated for a maximum of 108 A.

2.2.1.2
GTR 8000 Expandable Site Subsystem Grounding Connections

Components in the GTR 8000 Expandable Site Subsystem are grounded to the rack grounding bar. To properly ground the GTR 8000 Expandable Site Subsystem, connect the rack grounding bar to the master ground bus bar through the junction panel.

2.2.1.3
Laptop Interface Connections

The service laptop must accommodate one of the following two interface connections:

- Connecting Through a Serial Port Link on page 27
- Connecting Through an Ethernet Port Link on page 28

2.2.1.3.1

Connecting Through a Serial Port Link

Perform this procedure to make a serial connection. The primary task of the serial connection is to set the device IP address and to set serial security services.

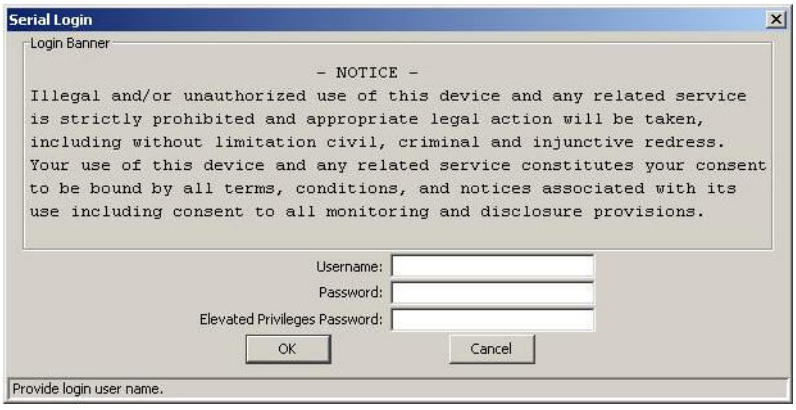
Prerequisites: The Configuration/Service Software (CSS) is loaded on your computer. See the *Private Network Management Client Feature Guide* if necessary.

Procedure:

1. Connect a serial cable to a laptop or computer running the CSS application, and the serial connector on the devices module. The serial cable, an RS232 cable, is a DB-9 straight through serial cable (female DB-9 to male DB-9). If the laptop does not have a serial port, use a USB-to-serial converter external device.
2. Open the CSS application.
3. Select **Tools** → **Connection Configuration** from the menu.
4. From the **Connection Screen** dialog box, select **Serial** on the **Connection Type** field.
5. From the **Serial Settings** on the dialog box, select the communication port in the **Serial Port** field that matches the one selected on the computer.
6. In the **Baud Rate** field, select the baud rate with which you want to communicate with the device: Baud Rate 19200
7. Click **Connect**.
8. In the login/password prompt screen, provide the required credentials as follows. Click **OK**.

   When accessing the device, if the default passwords do not work, the passwords may have been set to default values by a different system release of software. See the *CSS Online Help***Resetting Device Passwords** screen to reset the passwords to the current software release defaults. If **Authentication Services** are not enabled on a device, type any alphanumeric characters to populate the **Username**, **Password**, and **Elevated Privileges** password fields, as they cannot be left blank.

   Figure 2: CSS Login Banner



   - If a domain controller is available on the network, type the **Username** and **Password** for your RADIUS service user account assigned to the netwadm group in Active Directory. (The default user is **serviceuser**).
   - If a domain controller is not available on the network, type the **Username** and **Password** for the local bts_service account.
   - If the **Elevated Privileges Password** field is active, type the **Elevated Privileges Password** that was set up for this device.

See “Setting the Serial Security Services Using CSS” in the *GTR 8000 Expandable Site Subsystem Feature Guide* to configure Authentication Services on the device.

9 Click **OK** to close the dialog box.

The blank CSS main window appears. The **Service** menu is not available until you read the configuration file from the device using an Ethernet connection.

2.2.1.3.2
Connecting Through an Ethernet Port Link

Connect through a serial port link to set the IP address of the device and to set the serial security services. All other device function and feature configurations are performed via an Ethernet port connection in the Configuration/Service Software (CSS).

Prerequisites: CSS is loaded on your computer. See the *Private Network Management Client Feature Guide* if necessary. This procedure describes the steps required to perform a serial connection.

Procedure:

1 Connect a serial cable to a laptop or computer running the CSS application, and the serial connector on the device module. The serial cable, an RS232 cable, is a DB-9 straight through serial cable (female DB-9 to male DB-9). If the laptop does not have a serial port, use a USB to serial converter external device.

- For a base radio, the IP address of the laptop must be set to the `192.168.1.<x>` subnet (where ***<x>*** is any number between 2 and 253). Configure the **Speed/Duplex** setting of the computer Ethernet interface to **10 Mb Half Duplex**.
- For a site controller, the IP address of the laptop must be set to an address on the subnet of the local site, which varies depending on the site and zone numbers.

2 Open the CSS application.

3 From the menu, select **Tools** → **Connection Configuration**.

4 From the **Connection Screen** dialog box, verify that **Ethernet** is selected in the **Connection Type** area.

5 If connected through the LAN switch, specify the IP address for the device in the **Ethernet Settings** area and perform the following actions:

If…	Then…
If you know the IP address for the device.	perform the following actions: **a** Enter the IP address for the device in the **Device IP Address** field. **b** Continue with step 6.
If you have a Trunked Device and do not know the IP address, but know the system identification of the device (the zone, site, subsite, and device ID of the device).	perform the following actions: **a** Click **Fetch DNS Entry** to open the **DNS IP Address Calculation Screen** dialog box. **b** Select the desired device type from the **Device** list box. **c** Enter the proper values in the **Zone**, **Site**, **Subsite**, and **Device ID** fields. **NOTICE:** Some fields, such as **Subsite**, do not allow entries for some devices. Therefore, select the device first.

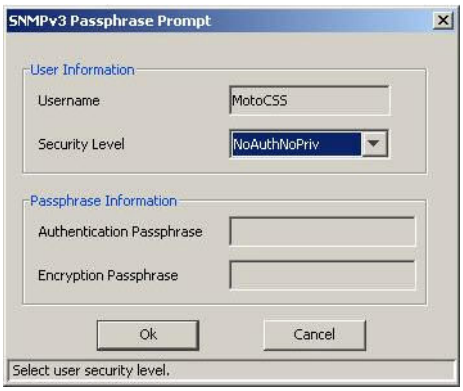
If…	Then…
	d Click **OK**. The Domain Name Services (DNS) information of the device automatically appears in the **Device IP Address** field. **e** Continue with step 6.

6 If connected directly to the Ethernet service port of the device, click **Front Panel Ethernet**.

7 Click **Connect**.

If this device is SNMPv3-capable, a **Passphrase Prompt** screen appears. Proceed to step 9.

Figure 3: SNMPv3 Security Level Option Prompt



For Windows XP computers: If after clicking **Connect**, a "comm.Error" is encountered when connecting to the front panel Ethernet port on a base radio, follow the procedure in step 8 to repair the local area connection (LAN) or high-speed Internet connection.

8 Clear the ARP cache and allow for a new Ethernet MAC ID to be associated with the base radio fixed IP address.

The front panel Ethernet port on GTR 8000 Base Radios have a fixed IP address (192.168.1.1). However the Ethernet MAC ID for each front panel connection is unique to each base radio. A communication error can occur when configuring multiple base radios through the front panel Ethernet port. When connected to the initial base radio, Windows XP associates the fixed IP address of the front panel port with the front panel Ethernet MAC ID. When connecting to the next base radio, the Address Resolution Protocol (ARP) cache is not cleared and causes a communication error.

a In Windows XP, from the **Start** menu, select **Settings** → **Network Connections** → **Local Area Connection**

b Click the **Support** tab and select **Repair**.

The **Repair Local Area Connection** window opens and displays the different caches that are cleared.

c Reconnect the Ethernet cable to the front panel Ethernet port, if not connected.

9 In the **SNMPv3 Security Level Option** Prompt, enter the **User Information** and **Passphrase Information**. Click **OK**. If Authentication Services are not enabled on a device, click **OK** when the window appears.

See “Changing SNMPv3 Configuration and User Credentials in CSS” in the *GTR 8000 Expandable Site Subsystem Feature Guide* to configure or change SNMPv3 configuration and user credentials on the device.

10 Select **File** → **Read Configuration From Device** from the menu.

The parameters download from the device to the computer. When the download is complete, the CSS main window opens. Use the map on the left side of the screen to view configuration information for the device.

2.2.1.4 GTR 8000 Expandable Site Subsystem Junction Panel Quick Connections

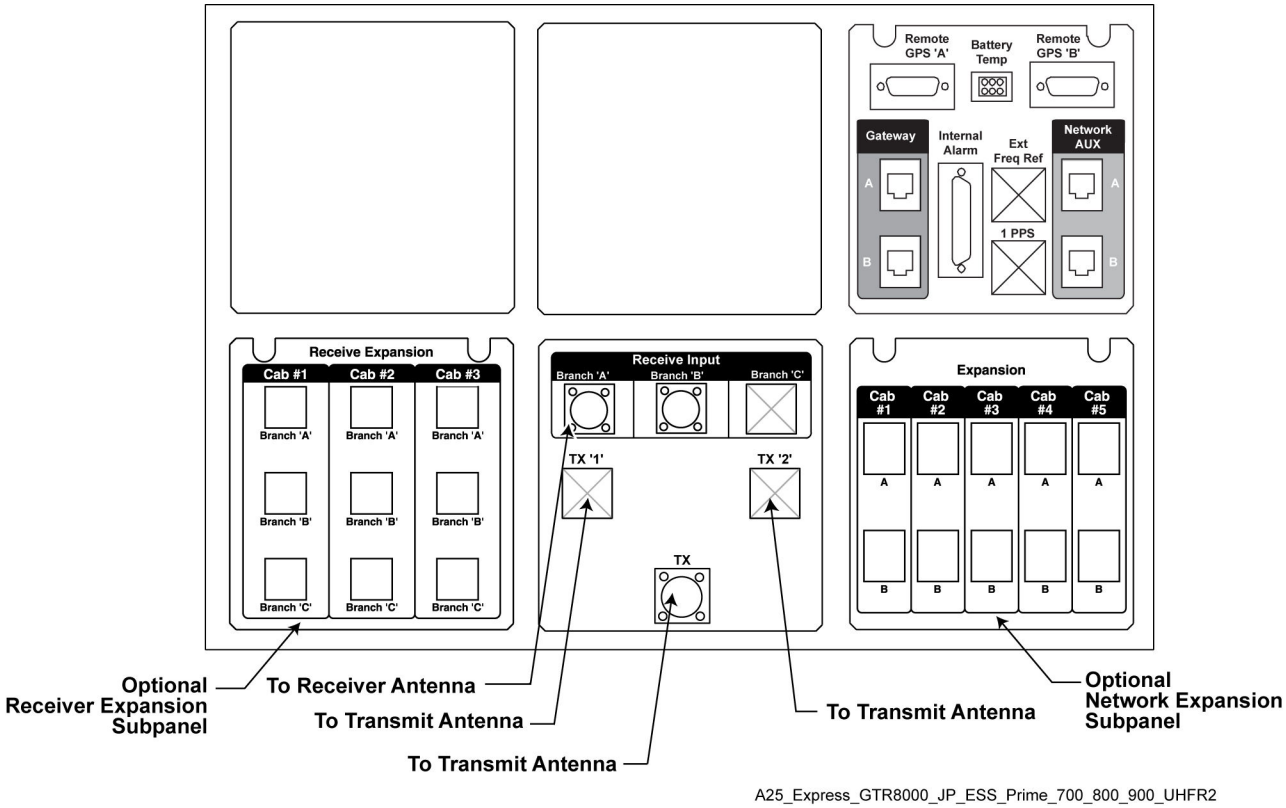
The junction panel for the GTR 8000 Expandable Site Subsystem provides locations for all the connections to external devices for the standard configuration. Cables provided by Motorola Solutions include the specific connectors required for the junction panel on one end and the subsystem equipment on the other end.

The figures provide information on the 700/800/900/UHF R2 435–524 MHz and UHF R1 380–435 MHz/VHF 136–174 MHz junction panel connections for the following GTR 8000 Expandable Site Subsystem configurations:

- GTR 8000 Expandable Site Subsystem Prime Cabinet for ASTRO® 25 Express System
- GTR 8000 Expandable Site Subsystem Prime Cabinet with Expansion Cabinet for ASTRO® 25 Express System
- GTR 8000 Expandable Site Subsystem Expansion Cabinet for ASTRO® 25 Express System

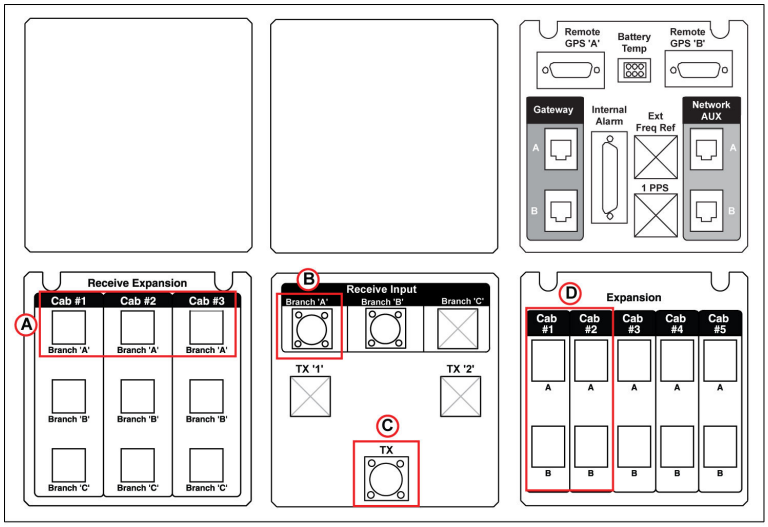
IMPORTANT: Do not remove the label from a connector location until you insert the connector.

Figure 4: Junction Panel for Prime Cabinet (700/800/900/UHF R2 435–524 MHz)



- A. RF coax to Receive antenna
- B. RF coax to Transmit antenna

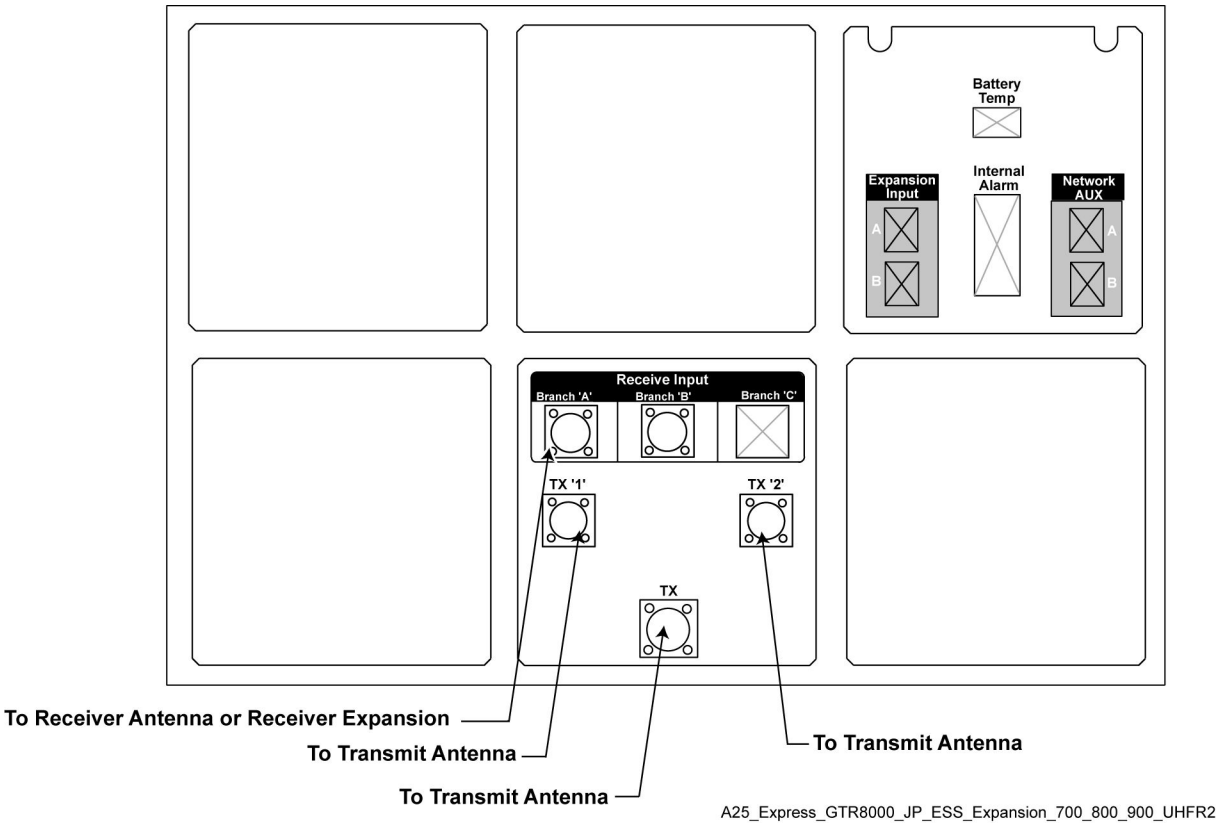
Figure 5: Junction Panel for Prime Cabinet with Expansion Cabinets (700/800/900/UHF R2 435–524 MHz)



GTR8000_JP_ESS_Prime_700_800_UHFR2_QR_w_exp

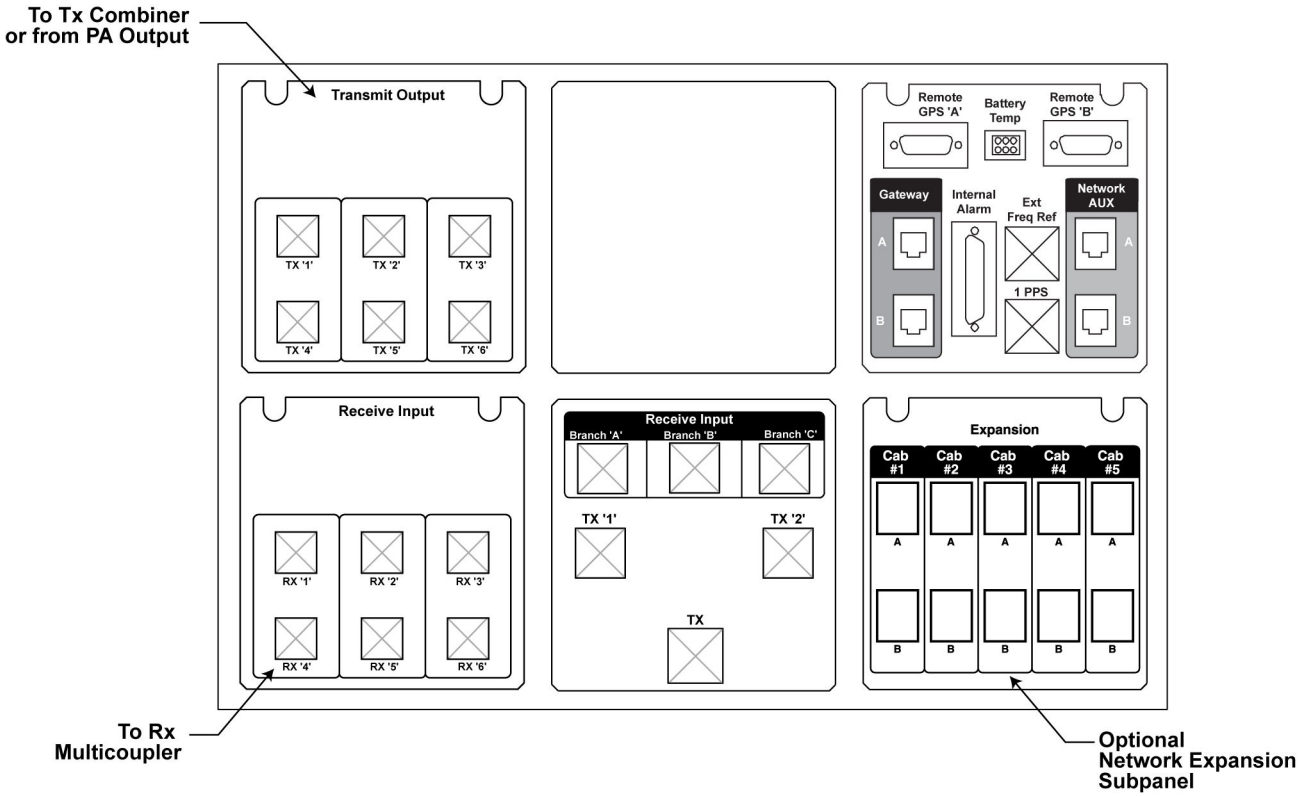
- A. RF coax RX Expansion ports: Cab#1 is primary, Cab#2 and #3 are for Expansion cabinets
- B. RF coax to Receive antenna
- C. RF coax to Transmit antenna
- D. Ethernet RJ-45 connection for the site controller Expansion Hubs (XHubs) in Expansion cabinets

Figure 6: Junction Panel for Expansion Cabinet (700/800/900/UHF R2 435–524 MHz)



- A. RF coax to the RX Expansion port in Primary the junction panel
- B. RF coax to Transmit antenna
- C. Ethernet RJ-45 connection for the site controller XHubs in the Expansion cabinets

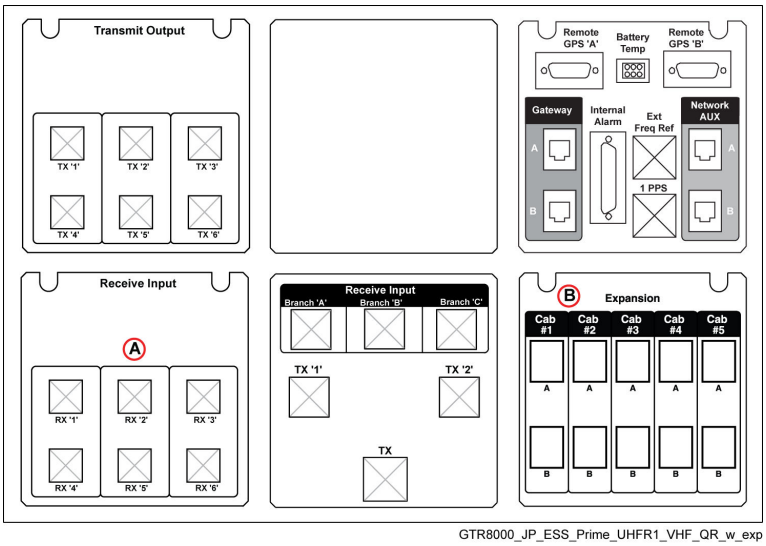
Figure 7: Junction Panel for Prime Cabinet (UHF R1 380–435 MHz/VHF 136–174 MHz)



A25_Express_GTR8000_JP_ESS_Prime_VHF_UHFR1

- A. BNC female connector to Receive Multicoupler (one for each base radio) TX antenna connection through third-party combiner

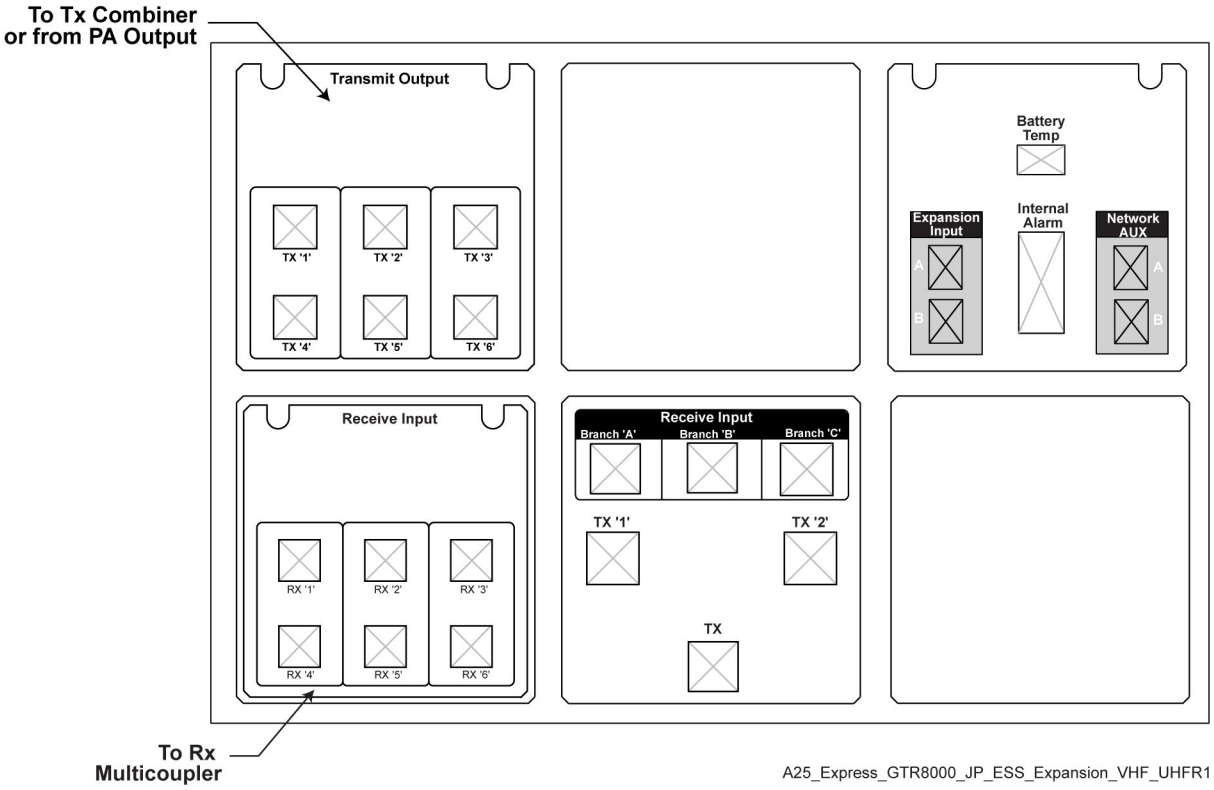
Figure 8: Junction Panel for Prime Cabinet with Expansion Cabinets (UHF R1 380–435 MHz/VHF 136–174 MHz)



GTR8000_JP_ESS_Prime_UHFR1_VHF_QR_w_exp

- A. BNC female connector to Receive Multicoupler (one for each base radio)
- B. Ethernet RJ-45 connection for the site controller XHubs in Expansion cabinets. Individual TX antenna connections through combiner to TX RFDS

Figure 9: Junction Panel for Expansion Cabinet (UHF R1 380–435 MHz/VHF 136–174 MHz)



- A. BNC female connector to Receive Multicoupler (one for each base radio)
- B. Ethernet RJ-45 connection for the site controller XHubs in Expansion cabinets. Individual TX antenna connections through combiner to TX RFDS

2.2.1.5
GCP 8000 Site Controller Interface Connections

The GCP 8000 Site Controller has ports on the front and the back that allow it to connect to various devices, including base radios, expansion ports, and other site equipment. In a GTR 8000 Expandable Site Subsystem configuration, the Ethernet connections from the individual base radios run on the backplane and connect to the switch on the site controller. This configuration minimizes the need for Ethernet cables.

Figure 10: Ports on the GCP 8000 Site Controller for a GTR 8000 Expandable Site Subsystem

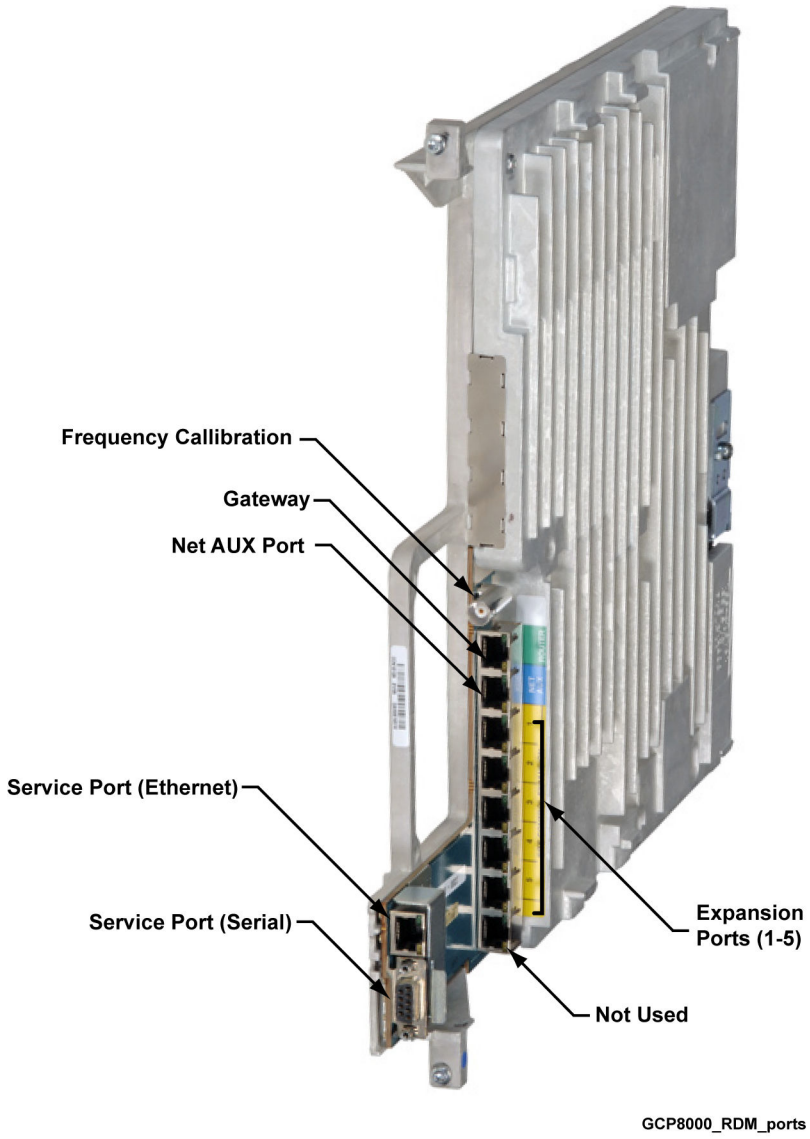


Table 6: Description of Ports on the GCP 8000 Site Controller (Front View)

Port	Description
Service Port (DB-9)	Service port for initial configuration of the site controller IP address.
Service Port (RJ-45)	Connects to service computer/laptop for local access using Configuration/Service Software (CSS). Also may be used for localized software downloads.
Router (Gateway port)	Not in use.

Table continued…

Port	Description
Site Expansion (15)	Connection to Cab #1-5 ports on the junction panel to connect to the Expansion Hubs (XHubs) in the expansion cabinets.
Frequency Calibration	Port available on the site controller module for measuring and calibrating the frequency reference.

2.3 Configuration Manager for Trunking

The Configuration Manager software is an ASTRO® 25 software application that supports installation, configuration, and verification of your system. The Configuration Manager provides the capability for a system manager to configure radio users and talkgroups in a Subscriber Access Control Database in the system site controller. In an ASTRO® 25 Express system, the integrated GCP 8000 Site Controller functions as the system site controller. Configuration Manager can be deployed on a service laptop or on a customer provided workstation. See the *Configuration Manager for Trunking Systems User Guide*.

2.4 GTR 8000 Base Radio Configuration Setup

Use the Configuration setup to verify or establish configuration parameters for the system components.

Locate the IP address for the equipment before performing the procedures. See the IP plan that came with the system.

2.4.1 GTR 8000 Base Radio Configuration Using CSS

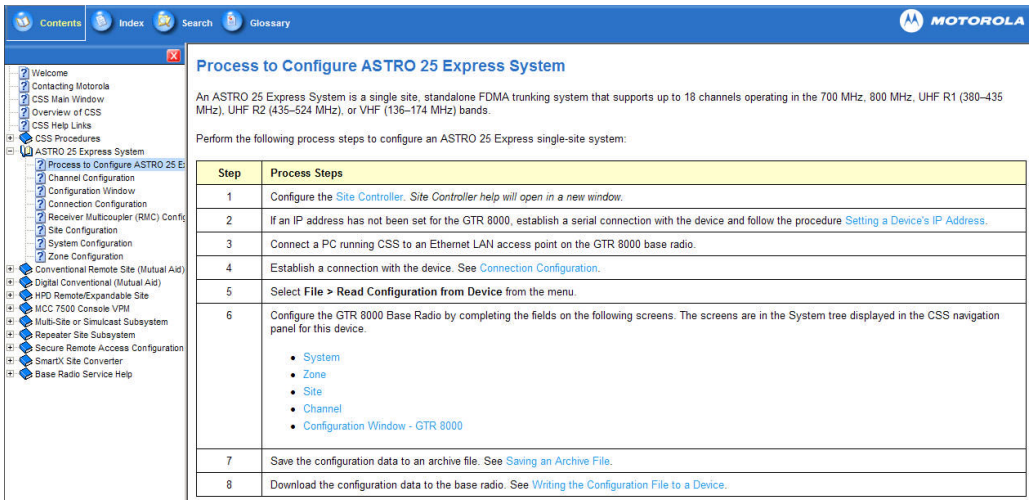
Table 7: Base Radio Configuration

Activity	Description	Reference
Configure the Base Radios	If not open, launch the Configuration/Service Software (CSS) and open the CSS Core Help. In the Contents, expand the ASTRO 25 Express System option and select the Process topic.	*CSS Online Help*, “Process to Configure ASTRO 25 Express System”. Configuration Screens on page 38 lists all Base Radio configuration screens and the fields to configure.

Table continued…

Activity	Description	Reference

Figure 11: Base Radio Configuration



2.4.1.1

Configuring a GTR 8000 Base Radio Using CSS

Follow this process to configure the GTR 8000 Expandable Site Subsystem for an ASTRO® 25 Express System using the Configuration/Service Software (CSS).

CAUTION: Changing the GTR 8000 Base Radio parameters can seriously affect performance. See your custom configuration templates for configuration recommendations provided from your Motorola Solutions representatives when configuring the devices. Do not deviate from specified settings without following the proper change procedures for your organization.

Prerequisites: Obtain the IP address for the transceiver before performing this procedure. Contact your system administrator for this information.

Process:

1. Connect through the Ethernet port to the site controller and then read the configuration file from the transceiver. See Laptop Interface Connections on page 26 for instructions.
2. Click **System** in the **System** tree and complete the fields.
3. Click **Site** in the **System** tree and complete the fields.
4. Click **Channel** in the **System** tree and complete the fields.
5. Click **Configuration** in the **System** tree and complete the fields on all four tabs.
6. From the menu:
   - To save the configuration data to a new archive, select **Save As** → **File**
   - To overwrite the existing archive file, select **Save** → **File**

   IMPORTANT: Save any configuration changes to a local or network drive as described in step 7. If the transceiver fails, you can load your settings to a replacement transceiver. If the configuration file is not saved to a local or network drive, repeat the setup steps after replacing a transceiver.
7. From the **File** menu, select **File** → **Write Configuration to Device**. Click **OK**.

   CSS writes the configuration data to the device. The device stores the data its non-volatile memory. When finished, a confirmation window appears.

2.4.1.2

Configuration Screens

This table describes screens used while configuring the GTR 8000 Base Radio in the Configuration/ Service Software (CSS). For information on Time Division Multiple Access (TDMA) configurations, see the *Dynamic Dual Mode for TDMA Operation Feature Guide*.

NOTICE:

- You may skip the shaded fields in this table, as the default values should be left as is.
- [R] designation on a field means a Restart is required if the field value is changed.
- An ASTRO® 25 Express System supports Phase 2 TDMA operation in the single-site standalone system. X2-TDMA operation is not supported.

Table 8: Configuration Screens for the GTR 8000 Base Radio

Configuration Screen	Field	Value
System	WACN ID (hex)	This field is not used for ASTRO® 25 Express single-site systems.
	System ID (hex)	The identification number for the site. This number must be unique within the site. Enter the hexadecimal number that identifies the communications system in which this base radio is located. Range is 001 (the default) through FFE.
Zone	Grant Timeout Timer (ms)	Default 1000. Specifies a time period for which an assigned voice channel remains active after access to the channel is granted. Ranges from 400 ms to 6500 ms.
	Carrier Fade Timeout Timer (ms)	Default 1200. Specifies a time period for a voice channel to remain active if disconnect is not received from a transmitting subscriber. Ranges from 100 ms to 6300 ms. If the Phase 2 TDMA feature is present in your system, set the Carrier Fade Timeout Timer (ms) field to 1900 for systems that have a value less than 1900. For systems that have a value greater than 1900, use the higher value entered for the system.
Site	Site ID	Enter the identification number for the site. This number must be unique within the site.
	Site Name	The name assigned to the site where the site controller is located. Enter a name or alias for the site (up to 32 alphanumeric characters).
	Access Code Index Requested (hex)	The site uses the Access Code Index, together with the System ID to calculate the Network Access Code (NAC). The site generates and uses NACs so that subscribers can communicate and ignore signals from distant site or other systems.
	MOSCAD IP	The IP address of the MOSCAD NFM with which the GTR 8000 Expandable Site Subsystem communicates. Leave the default value of 0.0.0.0 in this field.

Table continued…

Configuration Screen	Field	Value
		This field is not used for ASTRO® 25 Express single-site systems.
	Control Channel Slot Time (microslots)	This field is used to enter the length of time (in microslots) required for each control channel message packet. The value can be from 1 to 40 with a default value of 6 microslots. (One microslot is equal to 7.5 ms).
	Zone Core Link Minimum Jitter Buffer (ms)	Select a value (in ms) as the minimum jitter buffer time for outbound audio, to account for network jitter on the arriving XIS packets.
	TDMA Mode [R]	Specifies the mode of operation as either X2 TDMA or Phase 2 TDMA. Choose Phase 2 TDMA for Frequency Division Multiple Access (FDMA) mode of operation.  **NOTICE:** In an Express system X2 TDMA is not a valid selection. Also, even for an FDMA-only mode of operation, when TDMA is not used, choose Phase 2 TDMA. Although 900 MHz is not supported in TDMA mode, a 900 MHz station must be configured via CSS for Phase 2 TDMA rather than TDMA operation. This selection insures that the DSP has the correct software image installed. Selection of TDMA makes the station temporarily inoperative.
Channel	Autocalculate Frequencies (Not available for UHF and VHF bands.)	Enables or disables the Autocalculate Frequencies capabilities. • If Enabled: the RX frequency is automatically set to 45 MHz below the Tx frequency in the 800 MHz band, 30 MHz above the Tx frequency in the 700 MHz band and 39 MHz below the Tx frequency for the 900 MHz band. • If Disabled, type in all frequency values manually.
	Tx Frequency (MHz)	Enter the transmit frequency for the channel. For 700/800/900 MHz and UHF frequency bands, the Tx Frequency value must be divisible by 6.25 kHz or 5.0 kHz to be valid. For VHF frequency bands, the Tx Frequency value must be divisible by 6.25 kHz or 2.5 kHz to be valid. The CSS displays the minimum and maximum frequencies. These frequencies are based on hardware capabilities. See *CSS Online Help* for conditions based on the frequency band.
	X2/FDMA Tx Modulation Type [R]	This field allows you to select the modulation type used for all TDMA or Phase 1 FDMA transmissions

Table continued…

Configuration Screen	Field	Value
		from this base radio. Phase 2 TDMA always uses the H-DQPSK modulation mode and is not impacted by the selection made here. Options are either ASTRO CAI (LSM) or ASTRO CAI (C4FM). If the Tx Modulation Type field is changed from C4FM to LSM and the PA does not support the power level values in the Tx Power Out and Tx Power Level Battery Backup fields, a popup appears and changes those values to the maximum level supported by that modulation type.
	RX Frequency (MHz)	If Autocalculate Frequencies are disabled, enter the receive frequency for the channel. If the value is invalid, the system displays a warning. For 700/800/900 MHz and UHF frequency bands, the RX Frequency value must be divisible by 6.25 kHz or 5.0 kHz to be valid. For VHF frequency bands, the Tx Frequency value must be divisible by 6.25 kHz or 2.5 kHz to be valid. The CSS displays the minimum and maximum frequencies. These frequencies are based on hardware capabilities.
	RX Channel Bandwidth	Default Narrow 12.5 kHz
	Dual Branch Receive Operations	For one branch of hardware, select **Disabled**. For two branches of hardware, select **Enabled**. **Enabled** provides diversity operation for Phase 2 TDMA and redundancy operation for FDMA. For details, see the *Dynamic Dual Mode for TDMA Operation Feature Guide*.
	Packet Data Channel Slot Time (microslots)	Default 10. Lets you enter the size of the Packet Data Channel (PDCH) slot in units of micro slots. All subscribers share the data channels. This field defines the amount of time required to accurately indicate the presence of a subscriber transmission on the PDCH. This timer keeps subsequent subscribers from interfering with the inbound message attempt. This field is not applicable to ASTRO® 25 Express single-site systems and should be left at its default.
	Base Station Identification (Optional; if blank, no BSI is transmitted.)	Enter a Base Station ID for this base radio (up to 20 alphanumeric characters).
	Signal Quality Delta	Set the signal quality delta in decibels.
	Time to Failure	Set the time to failure value (in seconds).
Configuration – Hardware Configuration Tab	Phase 1 FDMA, TDMA, CC, and Phase 2 TDMA sections:	
	Tx Power Out (Watts)	This parameter requests the transmit power that should be supplied by the channel PA. CSS also displays the actual transmit power output for the channel.

Table continued…

Configuration Screen	Field	Value
	Tx Power Level Battery Backup (Watts)	This parameter indicates the transmit power that should be used by the channel when running on battery backup. When running with battery backup, CSS also displays the actual power level being output by the channel.
	Phase 2 TDMA section	
	Power Supply Type	Select the power supply from the drop-down list.
	Frequency Reference	Default Integrated References A/B. Specifies the source of the frequency reference for the system.
	Time Reference	Specifies the source of the time reference for the system.
	Battery Type	Select a battery type from the drop-down list. This field indicates the type of storage battery used so the power supply circuitry can select the best charging rate. Whenever AC power is lost, the channel uses the Tx Power Level Battery Backup value.
	This following parameters support the Transceiver Option Card (TOC):	
	Transceiver Option Card Actual	This read-only field is set from the CSS when a TOC is Detected or Not Detected.
	Transceiver Option Card [R]	Select whether a TOC is Enabled or Disabled. This field works with the TOC Actual parameter.
	Fall Back to Internal Frequency Reference	Select **Enabled** to use the alternative Internal Frequency when the external frequency reference fails. This default is **Disabled**. Dependency: This field is only accessible under the following conditions: • TOC is set to **Enabled** • Frequency Reference is NOT set to**Integrated Frequency Reference**
Configuration – Station Configuration Tab	Station Name	Enter a name or alias for this base radio (up to 32 alphanumeric characters).
	ASTRO Fade Tolerance (Frames)	Enter the number of missed frame syncs (in a row) before a call is terminated. Default is 3.
	Dynamic Frequency Blocking Capability	Leave the default value.
	Failsoft Capable	Enable or disable this feature. Enabled means that this channel can have up to seven interfering channels and that this channel can operate in failsoft mode. Also, this channel can be an interfering channel for another channel. Disabled means that this channel cannot operate in failsoft mode.
	Serviceability Fault Reporting	This function is not supported in ASTRO® 25 Express single-site systems and should be set to “Disabled”.

Table continued…

Configuration Screen	Field	Value
	Illegal Carrier Determination	Default Enabled. The illegal carrier determination feature allows the channel to detect and respond to unrecognized signaling on the channel that exceeds a particular threshold for at least a certain amount of time. The system can detect an Illegal carrier, using the value in the RF Threshold Value (dBm) field.
	RF Threshold Value (dBm)	Default depends on the RF band. The RF threshold parameter determines the minimum RF signal level is recognized before classifying an illegal carrier event and reporting an alarm to the Technician log.
	Set Default RF Threshold	Select button (while connected to base radio) to set RF Threshold to its default value.
	Malfunction Timer Value (seconds)	When Illegal Carrier Determination is checked, this field allows you to specify the length of time (in seconds) a signal must continuously exceed the RF Threshold Value (dBm) before being reported as an illegal carrier and removed from system use. Default 50.
Configuration – Infrastructure Interface Tab	Ethernet Type	Allows you to select the duplex and speed for the channels Ethernet connection. Choose 10 Mbit, half-duplex (the default) or 100 Mbit, full-duplex. Changing Duplex Settings from 100 Full to 10 Half results in loss of connectivity for a short time, and CSS may report an error. Reading the CSS Configuration again should restore the connectivity.
Configuration – Receiver Multicoupler Configuration Tab	GTR 8000 Configuration	Select GTR 8000 Expandable Site Subsystem
	Site Receiver Multicoupler Configuration (RMC) Configuration	Specifies whether a Site RMC is installed.
	Site RMC Attenuation	Automatically calculated
	Cabinet RMC Configuration	Automatically set
	Cabinet RMC Attenuation	Automatically calculated
	System Gain (dB)	Automatically calculated

2.5 GCP 8000 Site Controller Configuration Setup

This section describes the GCP 8000 Site Controller configuration.

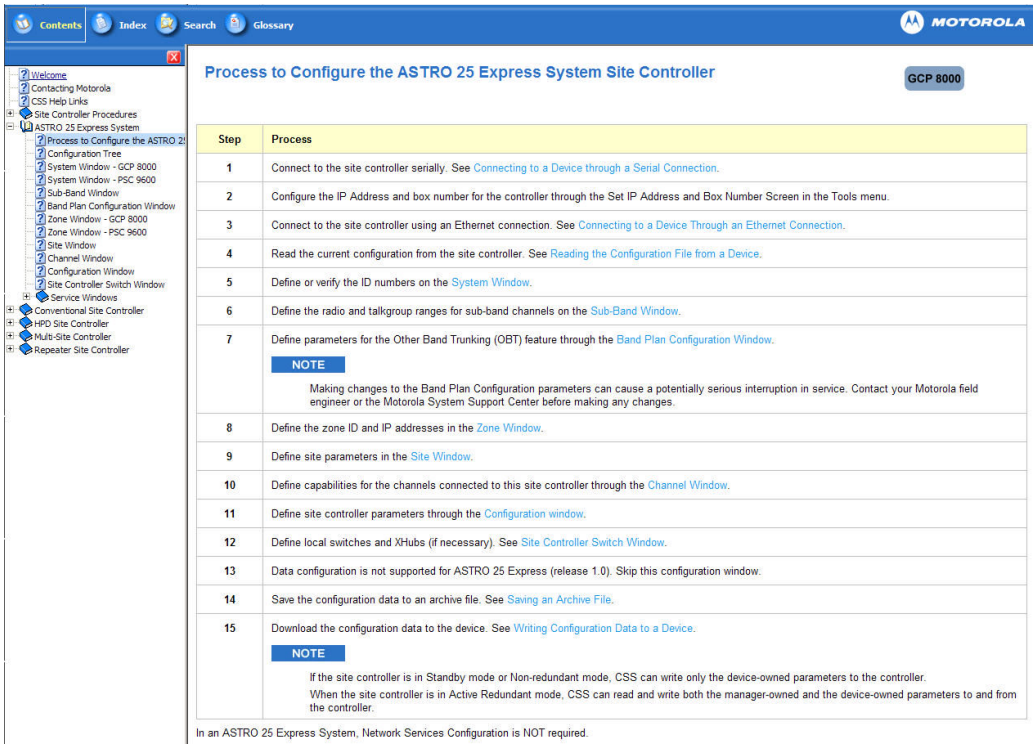
2.5.1
Configuring the GCP 8000 Site Controller Using CSS

Use this process to configure the GCP 8000 Site Controller for an ASTRO® 25 Express System using the Configuration/Service Software (CSS).

Process:

1. Launch the Configuration/Service Software (CSS) application. See *CSS Online Help*, “Process to Configure a Repeater Site Subsystem”.
2. From the **Help** menu, select **CSS Help**.
3. In the **Contents**, expand the ASTRO 25 Express System option and select the **Process topic**.
4. Perform Step 1 of the Process. The link opens in a new browser window, displaying the **Site Controller Online Help**.
5. In **Site Controller Online Help**, expand the **ASTRO 25 Express System** option.
6. Open the **Process to Configure the ASTRO 25 Express System Site Controller** topic. See *CSS Online Help*, “Process to Configure the ASTRO 25 Express System Site Controller”.

   Figure 12: Process to Configure the ASTRO 25 Express System Site Controller



Configuration Screens for the GCP 8000 Site Controller are listed in GCP 8000 Site Controller Configuration Screens on page 43.

2.5.2
GCP 8000 Site Controller Configuration Screens

The following screens are used while configuring the GCP 8000 Site Controller in the Configuration/ Service Software (CSS).

NOTICE: Skip the shaded fields in this table, as the default values should be left as is.

Table 9: GCP 8000 Site Controller Configuration Screens

Configuration Screen	Field	Value
System	WACN ID (hex)	Enter a unique ID for the Wide Area Communications Network. Hexadecimal range of values is 00001 through FFFFE.
Sub-Band – Radio Tab	Number of Valid Entries	Consult Fleetmap or System Administrator. Up to 128 are allowed.
	Lower Radio ID	Consult Fleetmap or System Administrator.
	Upper Radio ID	Consult Fleetmap or System Administrator.
	Subband Restricted	Consult Fleetmap or System Administrator.
Sub-Band – Talkgroup Tab	Number of Valid Entries	Consult Fleetmap or System Administrator. Up to 128 are allowed.
	Lower Talkgroup ID	Consult Fleetmap or System Administrator.
	Upper Talkgroup ID	Consult Fleetmap or System Administrator.
	Subband Restricted	Consult Fleetmap or System Administrator.
Band Plan Configuration –Band Plan Information Tab	Band Plan ID	Consult Fleetmap or System Administrator. Up to 20 are allowed.
	Band Plan Name	Enter a name or alias (up to 32 alphanumeric characters).
Band Plan Configuration –Frequency Band Plan Tab	Index	Automatic defaults entered for Index 1 to 4
	Identifier Enable	Click the check box to enable the Band Plan Index entry. Deselect check box for Index 3 and Index 4; X2-Time Division Multiple Access (TDMA) is not supported in ASTRO® 25 Express system.
	Channel Type	Frequency Division Multiple Access (FDMA) or TDMA
	Base Frequency (MHz)	Enter the base frequency for the **Band Plan Index** entry. Value must adhere to the frequency ranges allowed for your type of ASTRO® 25 Express system.
	Channel Spacing (kHz)	Enter the frequency difference between two consecutive channels. Value must adhere to the channel spacing requirements for your frequency band.
	Tx/Rx Offset (kHz)	Enter the frequency difference between the transmit frequency and receive frequency.
Zone	RX Bandwidth (kHz)	12.5 (the default)
	RFSS ID (Zone ID)	Default 1
	ZC IP Address 1	Default 0.0.0.0
	ZC IP Address 2	Default 0.0.0.0

Table continued…

Configuration Screen	Field	Value
Site – Site Configuration Tab	Site ID	Default 1
	Link Debounce Timer (sec)	Default 3 **IMPORTANT:** Changing the value of the **Link Debounce Timer** field from its default value of 3 seconds may affect the site recovery time in a system configuration for Dynamic System Resilience (DSR).
	Trunk Recovery Timeout Timer (sec)	Default 5
	Site Name	Enter a name or alias (up to 16 alphanumeric characters) for this site.
	Site Trunking Indication Holdoff Time (sec)	Default 0
	Site Trunking Indication Holdoff Time Actual (sec)	Default 0
	Site Trunking Priority Monitoring Override	Select Enable to allow all talkgroups to be priority monitor-capable in Site Trunking. Default is **Disabled**.
	Site Trunking Indication Override	Select **Enabled** to prevent the Site from transmitting site trunking indications to subscriber radios. Select **Disabled** to allow transmission of site trunking indications to subscriber radios.
	In-Call User Alert	Choose to **Enable** or **Disable** this feature. Default is **Disabled**.
	Site Call Load Capacity Override	This field allows you to determine if the **Site Call Load Capacity** parameter value is auto-calculated by CSS or overridden by a user-specified value. **Default** is disabled. **CAUTION:** Do not override the calculated value for the **Site Call Load Capacity** parameter because it can have a major impact on system performance. Contact Motorola Solutions Support Center (SSC) for guidance on making any manual changes to this parameter.
	Site Call Load Capacity	This field allows you to define the maximum limit of the number of simultaneous calls handled by the site. The range of values for this field is 10-30, with a default value of 30. CSS displays the current value of this field on the **Channel** screen. When the value is changed, either automatically or manually, the **Channel** screens (table view only) **Site Call Load Capacity** (read-only) field is updated to the same value.
	TDMA Mode	Phase 2 TDMA
	Reporting on X2 Only Radio	The default is **Disabled**

Table continued…

Configuration Screen	Field	Value
	Minimum Repeater to Trunk	This parameter supports the Minimum Channel to Fail-soft feature for an Express Expandable Site Subsystem in a non-simulcast Trunked configuration. Configure the minimum number of channels that must remain operational for the site to function in Trunked mode. When the number of operational channels at the site in a non-Simulcast system is less than the value configured for the “Minimum Repeaters To Trunk”, the site immediately goes into RF Site Failsoft Mode. Otherwise, as long as the number of operational channels is equal to or greater than the value configured, the site operates in Trunked Mode. The allowable range of values is 2 to 28, with a default value of 2.
Site – Daylight Saving Time Tab	Offset Time from Local to GMT	Select a value for the number of hours added to or subtracted from Greenwich Mean Time to equal the local time.
	Automatic Adjust for DST	Choose **Enabled** or **Disabled** to allow the site controller to automatically adjust for Daylight Saving Time.
	Daylight Saving Start	Select which week of the month, the day of the week, the month of the year, and the hour at which Daylight Saving Time starts.
	Daylight Saving End	Select which week of the month, the day of the week, the month of the year, and the hour at which Daylight Saving Time ends.
	Daylight Saving Time Shifted	Select a value (in hours: minutes format) for the amount of time that shifts while Daylight Saving Time is in effect.
Channel	Channel number	Select a Channel number to configure. (Only Channel 1 through 18 can be configured for an ASTRO® 25 Express system.)
	Channel Configuration	If the channel number selected is used in the system, select **Configured**.
	BSI Calling	If the channel is set to **BSI Capable**, enter a base Station ID Calling (up to 20 alphanumeric characters, though only the first 8 characters are transmitted).
	Control Channel Preference Level	If **Channel** is set to **Control Channel Capable**, enter a value as the preference level that this channel is used as the control channel at the site. Value can be 1 through 4, with 1 as the highest preference and 4 as the lowest.
	Sub-Band	Choose **Enabled** to allow this channel to be assigned to sub-band frequencies.
	Channel Assignment Type	Select the type of channel grant used for other band trunking, either **Explicit** or **Implicit** (the default).
	DFB Capable	This field should be left at default.

Table continued…

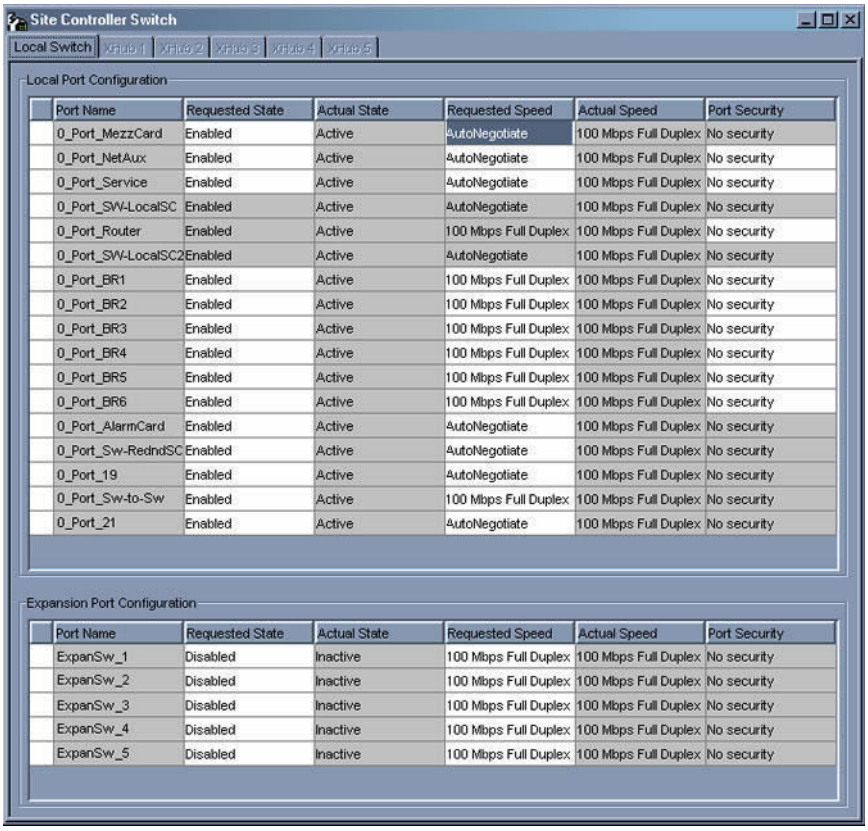
Configuration Screen	Field	Value
	BSI Capable	Choose **Enabled** to allow transmit of a Base Station Identification Calling. (Cannot enable on a control channel.)
	Failsoft Capable	Choose **Enabled** to allow this channel to operate in Failsoft mode.
	Control Channel Capable	Choose **Enabled** to designate this channel as a control channel. Only Channels 1 through 4 can be designated as control channel capable.
	Protect Capable	Default **Disabled**
	Voice Capable	Choose **Enabled** to allow this channel to be assigned as a voice channel.
	TX Channel Freq (MHz)	Enter the transmit frequency (in MHz) for this channel.
	FDMA TX Band Plan Element	Enter the Index number to associate this channel with an element in the Frequency Band Plan table.
	RX Channel Freq (MHz)	Enter the receive frequency (in MHz) for this channel.
	FDMA RX Band Plan Element	Enter the Index number to associate this channel with an element in the Frequency Band Plan table.
	TDMA Tx Band Plan Element	An index number to associate this channel with an element in the Frequency Band Plan table (where the band plan Channel Type is TDMA). The range of values is 1 to 16 with a default value of 3.
	TDMA RX Band Plan Element	An index number to associate this channel with an element in the Frequency Band Plan table (where the band plan Channel Type is TDMA). The range of values is 1 to 16 with a default value of 3.
	Channel Access Type	TDMA Only, or Dynamic Channel, or FDMA Only
Configuration	Controller Name	Enter a name (up to 32 alphanumeric characters) for the site controller.
	Hardware Platform	GCP 8000
	Site Platform Type	GTR 8000
	Time Reference	1PPS
	Power Supply Type Requested	Choose the type of power supply from the drop-down list.
	Battery Type	Select a battery type from the drop-down list or choose None.

Table continued…

Configuration Screen	Field	Value

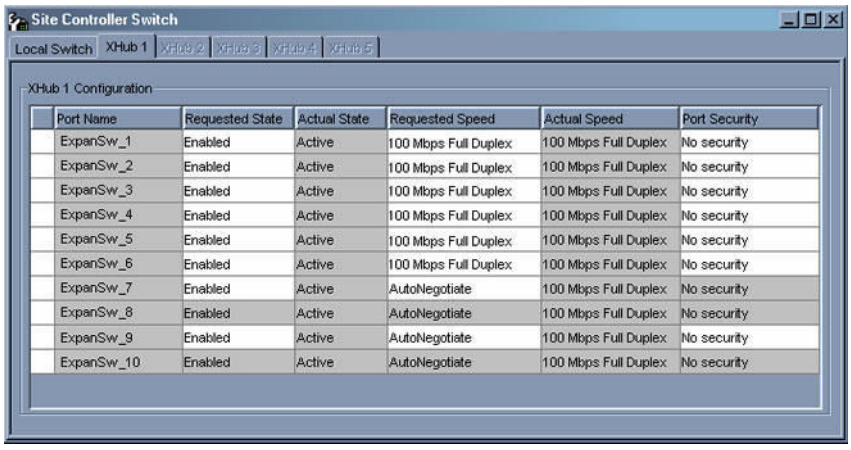
Site Controller Switch – Local Switch Tab. Match the fields to this example.

Figure 13: Site Controller Switch Window – Local Switch Tab



Site Controller Switch – XHub 1, and so on. Match the fields to this example.

Figure 14: Site Controller Switch Window – XHub 1 Tab



2.6 Subscriber Radios Setup

Follow this section to configure subscriber radios.

2.6.1

XTS 5000 Portable or XTL 5000 Mobile Subscribers Configuration

The XTS 5000 Portable or XTL 5000 Mobile subscribers are configured using the Customer Programming Software (CPS) for the radio model. The following parameters must be set using CPS. Shaded parameters are required if implementing radio-to-radio encryption. Skip the shaded parameters if encryption is not being implemented.

Table 10: Subscriber Configuration Parameters

Parameter		Option		Value
Trunking	Trunking Configuration	SmartZone	Display Site Trunking	Default checked (leave as default)
			Alert Site Trunking	Default checked (leave as default)
	Trunking System	General	Type	ASTRO 25
			Home System ID	Customer specific
			Home WACN ID	Customer specific
			Unit ID	The ID of the subscriber unit
			Coverage Type	Disabled
		ASTRO 25 Channel ID	Entire band plan as defined in site controller	
		ASTRO 25 Control Channels	Frequencies of possible control channels	
	Trunking Personality	General	Protocol Type	ASTRO 25
			System ID	Pointer to the Trunking System created
		Emergency	Console Ack Required	Unchecked
		Talkgroup	List of talkgroups with IDs	Hexadecimal value of talkgroup IDs (example 800015 is hex F)
			Secure/Clear strapping	Choose if talkgroup permits only encrypted calls, only clear calls, or both clear and secure
			Key Select	Select which keys from the Secure Multikey List are used
Channel Assignment	Channels	Selector positions	Associate selector positions with personalities and talkgroups created	

Table continued…

Parameter		Option		Value
			in the “talk-group” section.	
Radio Configuration	Secure Configuration	General	Secure equipped	Checked
			Secure Type	Hardware (for Advanced Digital Privacy (ADP) radios)
	Secure Multikey List	Common Key Reference (CKR)	Enter CKR numbers and aliases	The encryption keys which are assigned to talkgroups.

Chapter 3

Test and Verification

The chapter provides a list of recommended test equipment along with activities necessary to support performance testing and verification for the GTR 8000 Base Radio and Radio Frequency Distribution System (RFDS) activities.

IMPORTANT:
Prepare and set up the site and site equipment properly, and verify all safety and installation considerations and requirements are addressed before system test and verification activities.

Test the operation of the system by making calls from the subscriber units and ensuring call completion and quality. Contact your System Administrator for the specific parameters for subscribers, talkgroups, frequency bands, and channels.

3.1 Test and Verification Requirements, Setup, and Procedures

The following test requires recording of various measurements. Many measurements in this process are calculated and require the use of the provided Excel spreadsheet. The following two performance parameters calculated during this process are critical for the system to meet coverage requirements:

- Transmit Effective Radiated Power (ERP)
- Receive Effective Receive Sensitivity (ERS)

IMPORTANT: Any personnel performing test and verification process activities must review all the information provided in this document before performing these activities. To perform these activities, familiarity with the Configuration/Service Software (CSS) application is required and the CSS Online help used to support these activities.

The GTR 8000 Expandable Site Subsystem is optimized at the factory and no major adjustments are required. See the following sections for more details.

3.1.1 Required Test Equipment and Tools

The test and verification activities are based on the use of the following equipment. Your test equipment may vary. See the manufacturer for detailed information regarding the use and operation of all test equipment.

- Aeroflex/IFR 2975 or 3900 series Communications Analyzer with P25 Option

  NOTICE: The 2975 requires software version 1.9.2.1 or greater, and it needs an external 20 dB TNC attenuator installed on the Gen Port (MECA 612-20-3 or Pasternack PE7003-20).

- Portable Rubidium frequency standard (Stanford Research Systems FS725) or for Simulcast Sites with an FDM module installed in the TRAK 9100.
- Rohde&Schwarz NRT-Z14 Directional Power Sensor with NRT-Z5 USB Adapter. It has sufficient accuracy if used with the recommended test setup to verify base radio Tx rated power within published specifications. If the station is operating according to specifications, other wattmeters may not be able to provide consistent enough results to determine. The following can be substituted, but out-of-tolerance results are likely due to the other wattmeter:
  - A wattmeter with LSM, H-DQPSK, and C4FM with N-f QC connectors:
    + Wattmeter with APM-100 Element in the correct frequency band

    + Wattmeter with APM-50 Element
    + Wattmeter with APM-5 or APM-10 Element
  - A wattmeter with C4FM ONLY with N-f QC connectors:
    + Wattmeter 100 Element in the correct frequency band
    + Wattmeter 50 Element in the correct frequency band
    + Wattmeter 5 or 10 Element
- 150 W or greater, 30 dB or 40 dB RF Attenuator (RF-Lambda RFS150G02, JFW 50FHAO-030-200)
- QN-f to N-m test cable (QFNM-24, TestedRFCables)
- N-m to 7/16-m adapter
- N-m to 7/16-f adapter
- 20 dB or 30 dB directional coupler (Mini-Circuits ZFDC-20-4-N)
- Service laptop computer with Configuration/Service Software (CSS)

NOTICE: If your service laptop is running a firewall (Black Ice, Symantec, Zone Alarm, and so on), you may have to configure or stop the firewall during this procedure. The service laptop must be configured as a Dynamic Host Configuration Protocol (DHCP) client.

3.1.2
Setting up the Aeroflex/IFR Analyzers

The Aeroflex/IFR analyzers support remote operation with a laptop. For remote operation, configure the analyzer as a Dynamic Host Configuration Protocol (DHCP) client.

Procedure:

1. If you are not using remote operation, connect a mouse to the analyzer before powering up.
2. Turn on the analyzer (and the FS725 portable Rb standard if used) and allow them to warm up. If using the FS725 portable Rb standard, check that the lock indicator is on after 20 minutes.
3. Connect the laptop and (if using remote operation) the analyzer to port 20 - 24 of the external RF site switch with a standard Ethernet cable.

   If no external site switch is available, use the Net Aux port on top of the cabinet, and connect this port to a temporary test switch that you provide. If the external site switch ports are locked down, a convenient connectivity solution is to disconnect a non-critical device during optimization and connect a temporary test switch to this port. This solution provides ports available to support the laptop and analyzer. For systems using advanced information assurance policies, work with the appropriate resource to gain access to the site switch.
4. Remove the site link connection to isolate the site from the rest of the system, which ensures that the base radios at this site cannot be remotely keyed up.

   CAUTION: If step 4 is performed on a live system, the channel should be disabled before removing the link.
5. Connect a BNC-m to BNC-m cable from the frequency standard (TRAK 9100 with FDM or SRS FS725) 10 MHz output to the analyzer EXT REF I/O.

   NOTICE: After recalling the analyzer test setup, configure the analyzer to use the external frequency reference.
6. If using a wattmeter not a Rohde&Schwarz, install the 100 W element into the wattmeter, and for the APM-16, use the battery test position to verify that the battery is satisfactory. Turn the wattmeter **ON**. Check the wattmeter meter zero reading and adjust if needed.

7 Start recording the project, site, T and ME, and balance of the antenna data on the test result sheets.

3.1.3
Configuring the Analyzer

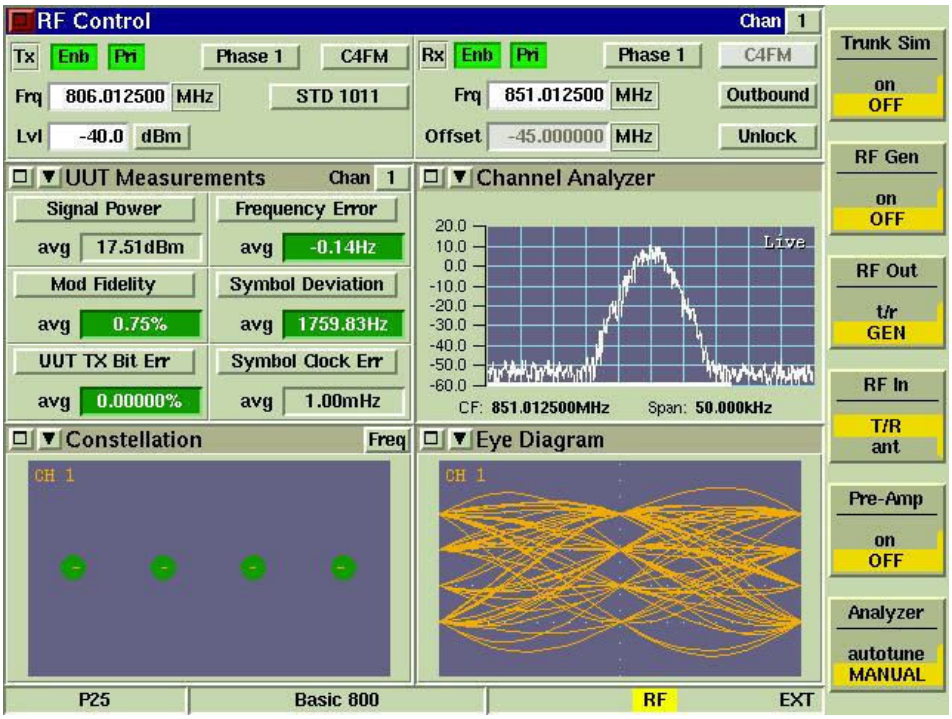
Perform this procedure to configuring the analyzer for testing.

Procedure:

1 Recall the `12 - P25-Test` configuration file from the `3900 Samples` directory.

The setup should look like the screen shown in this figure. If the Aeroflex 3900 does not recall the meter tile correctly, you may need to manually edit the meters. See the manufacturer documentation.

Figure 15: RF Control Screen



2 Change the Communications Analyzer frequency reference to **External**.

3 For each channel tested, set the Analyzer receiver frequency equal to the base radio Tx frequency.

4 For each channel tested, set the Analyzer receiver frequency equal to the base radio RX frequency.

3.1.4
Testing RF Connections for the Analyzer

Perform this procedure to test the RF connections for the analyzer.

Procedure:

1 For the RX test connections, connect a TNC-male to an N-male test cable with known loss from the Analyzer Gen Port to the Primary Rack Receive Input Branch ‘A’ connector (on top of the junction panel).

Leave this connection in place for all the channels tied to this RX antenna. For multiple RX antennas, move the connection to the other junction panel when needed.

Figure 16: Receive Input

2 To make Tx test connections, perform the following actions:

a Disconnect the base radio Tx Output QN connector where it connects to the Tx combiner input.

b Connect the base radio Tx Output QN connector to a female QN adapter or test cable with known loss.

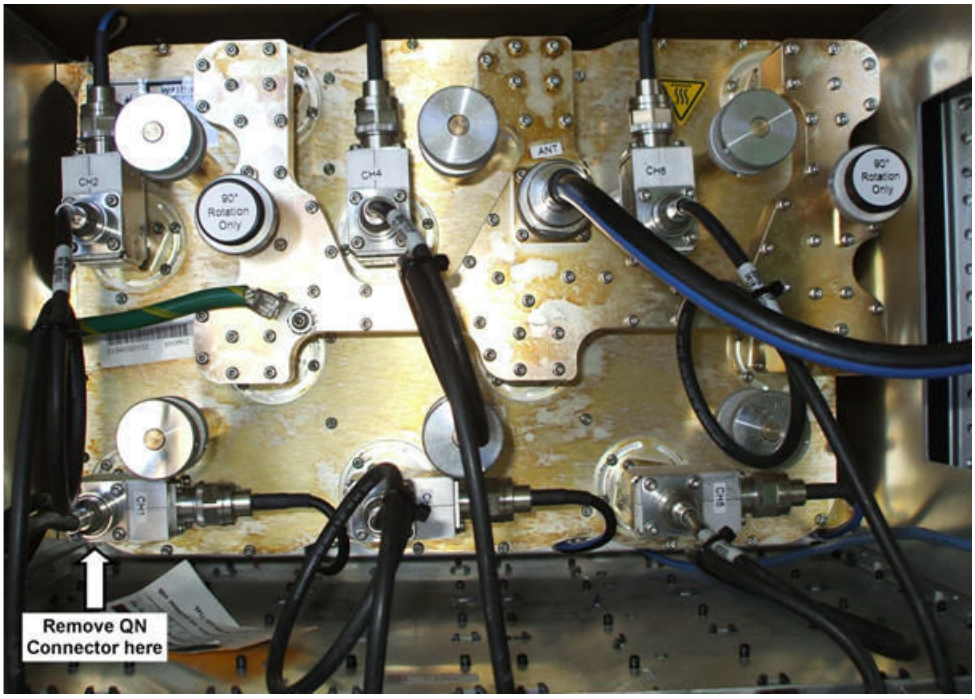
c Connect the other end of the test cable or adapter to the wattmeter input.

d Connect the wattmeter output to the high-power RF Attenuator input.

e Connect the RF Attenuator output to the Analyzer T/R input using N cables.

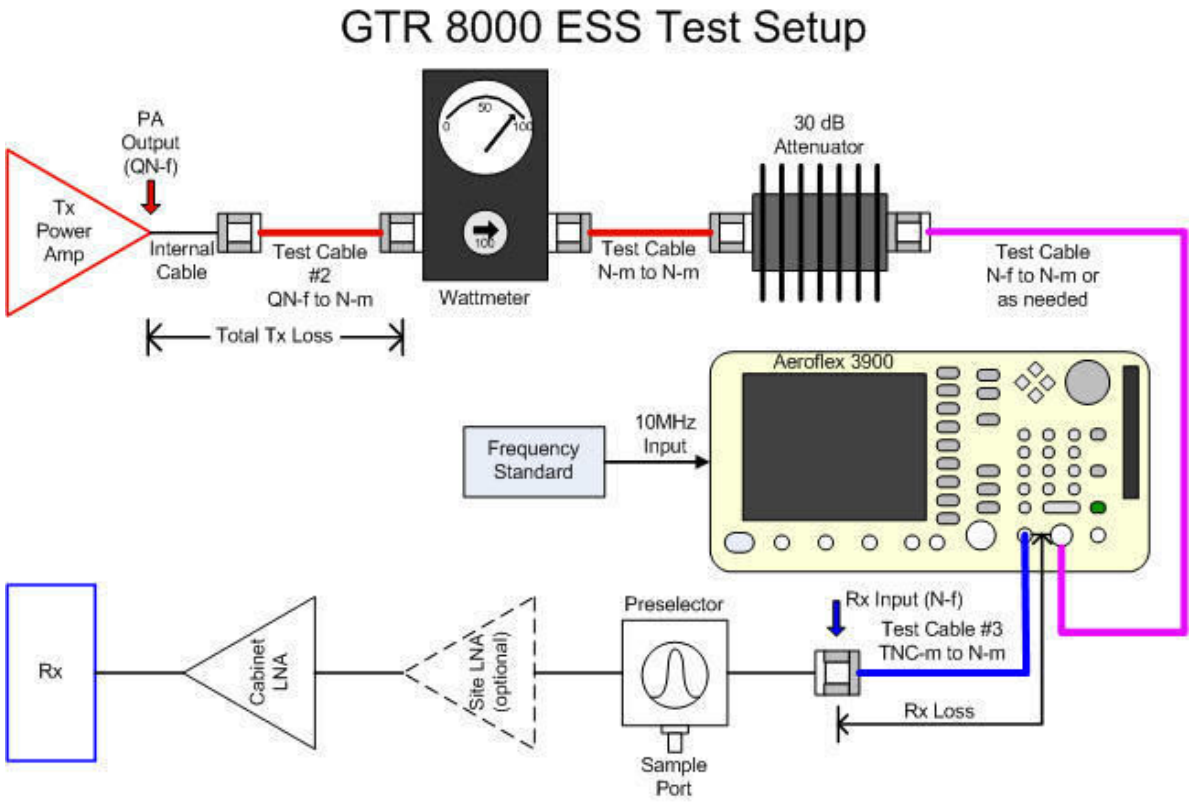
NOTICE: This connection changes for each base radio tested.

Figure 17: Tx Test Connections



3 Use this figure to verify the Tx and RX test connections.

Figure 18: GTR 8000 Expandable Site Subsystem Test Setup



3.1.5
Testing the Base Radio

Performing base radio tests involves the following base radio test activities.

Process:

1. Perform a preliminary testing setup of the base radio. See Configuring Preliminary Base Radio Settings on page 55.
2. Test the base radio transmitter. See Testing the Transmitter on page 56.
3. Test the base radio receiver. See Testing the Receiver for FDMA Operation on page 58 or Testing the Receiver for APCO TDMA Operation on page 60.

3.1.5.1
Configuring Preliminary Base Radio Settings

Perform this procedure to configure the base radio to prepare it for testing.

Procedure:

1. Using the service laptop and the Configuration/Service Software (CSS) application, connect and read the base radio configuration (codeplug).
2. Identify and verify base radio configuration settings.

   When moving to different channels, disconnect the CSS session by pressing CTRL+K from the base radio to which you are currently connected. If necessary, you can reconnect to the base radio later in the procedure. If a message appears stating the base radio is connected to another

device, shut down and restart the CSS or the base radio. Again, read the base radio configuration.

3 From the system tree, select **Configuration** → **Hardware Configuration Tab**.

4 Set Tx power out (Watts) to the rated power (See “Rate Power” table).

5 Select the **Station Configuration** tab and perform the following actions:

a Set **Illegal Carrier Determination** to **Enabled**.

b Set **Illegal Carrier Determination RF Threshold (dBm)** to the default value.

c Check that simulcast operation matches your site.

6 Select the **Receiver Multicoupler (RMC) Configuration** tab.

The RX specification for sensitivity of the Expandable Site Subsystem configuration is predicated on the cabinet and, if present, the Site RMC being configured for operation without a Tower Top Amplifier (TTA).

7 Verify that the **Receiver Multicoupler (RMC) Configuration** tab in the CSS **Configuration** window matches the hardware configuration and attenuator values. Ensure that the RMC attenuators are initially set in accordance with the table.

Table 11: Attenuator Values of GTR 8000 Expandable Site Subsystem with No TTA

Band	TTA	Cabinet	Site RMC	Cabinet RMC
UHF	No	Single	N/A	1 dB
UHF	No	Multiple	4 dB	15 dB
700/800	No	Single	N/A	0 dB
700/800	No	Multiple	1 dB	10 dB

8 Ensure the RMC configuration in the CSS matches the actual installation.

If…	Then…
If a site RMC is installed...	perform the following actions: **a** In CSS, set the **Site RMC Configuration** as **Installed**. **b** Set the **Site RMC Attenuation** value to match those values as established from the actual DIP switches. **c** Set the **Cabinet RMC Attenuation** value the same as its actual DIP switches.

9 Save the configuration changes to the base radio by performing the following actions:

a From the menu, select **File** → **Write Configuration To Device**.

b Click **OK** on the confirmation window.

NOTICE: If a TTA is installed at the site, re-configure the settings in the CSS **Receiver Multicoupler (RMC) Configuration** tab in another activity in this process (TTA test section).

3.1.5.2 Testing the Transmitter

Perform this procedure to test the base radio transmitter.

Procedure:

1. Perform the following actions to perform the Transmitter Test (Internal Diagnostic) test.
   a. From the Configuration/Service Software (CSS) menu, select **Service** → **Metering Screen**.
   b. Select the **Transmitter** tab.

      If the test fails, diagnose and correct the problem before continuing with this base radio.
   c. Click **Transmitter Test**.
   d. From the menu, select **Service** → **Test and Measurement Screen**.
   e. In the **Test and Measurement** screen, if the radio is not in service mode, click **Change to Service Mode**.
   f. When the confirmation dialog box appears, click **OK**.

      The base radio begins a reset sequence to change modes, which take several minutes.
   g. After the base radio resets, re-open the **Test and Measurement** screen.
2. Perform the following actions to check the Rated Power.
   a. Identify the appropriate value from the table, and record the power and **In Cable Loss** value.

      Table 12: Rated Power

Band >>	700/800	UHF R2	UHF R1	VHF
Frequency Range	762-776 851-870	450-512	380-435	136-174
Power C4FM	100 W	110 W	110 W	100 W
Power LSM	100 W	100 W	100 W	60 W
Int Cable Loss	0.18 dB	0.13 dB	0.13 dB	0.04 dB

      Set the CSS **Tx Power Output Watts** field for the rated power.
   b. Key the base radio with a V.52 test pattern. In CSS, select the **ASTRO Test Patterns** tab and set the **Select Pattern to Transmit**field to V.52 or V.52 Frequency Division Multiple Access (FDMA). Click **Start Pattern Transmission**. Leave the station keyed until instructed to de-key it.
   c. Record the Power Sensor or wattmeter reading and calculate for the cable losses to determinate the Rated Power Corrected result.
   d. Verify that the Rated Power Corrected result is within ±10% of the Base Radio Tx Rated Power. If using a wattmeter that is not a Rohde&Schwarz, you may not be within ±10%.
3. Perform the following actions to check the Frequency Error.

   Use an external 10 MHz reference source, capable of delivering 10-18 dBm (2-5 Vpp) to the Front Panel Ext. Freq Ref BNC connector, with a suitable frequency accuracy to perform this activity. See the *GTR 8000 Expandable Site Subsystem Feature Guide* for port connections.
   a. Record the Frequency Error value and calculate the resulting error in parts per billion (ppb).
   b. Verify that the calculated Frequency Error in ppb is within the specification (≤ 2.5 ppb for Simulcast, ≤ 9.5 ppb for a single site).
   c. For a single site, if the Frequency Error is out of tolerance, perform the site controller reference oscillator alignment as documented in the CSS.
4. Perform the following actions to check the Tx Bit Error Rate (BER).

a After 30 seconds, record the Analyzer UUT Tx Bit BER value.

b Verify that the Tx BER is ≤ 0.01%.

If the Tx BER test fails, ensure that the analyzer is correctly configured to decode the V.52 test pattern. This test pattern name can be called O.153 or STD511 in the test equipment. For the 3900, expand the **UUT Measurements** pane to access this setting.

5 Perform the following actions to check the Modulation Fidelity.

a On the Analyzer, qualitatively assess the Constellation (3900 Only) and the Eye Diagram. The 4-level eye diagram and constellation plot should look like the patterns shown on the Analyzer Figure 15: RF Control Screen on page 53 in the **Test Equipment → Analyzer Configuration (3900)** section.

b Monitor the Mod Fidelity value for 30 seconds, then note and record the highest reading.

c Verify that the Modulation Fidelity reading is < 5%.

6 Perform the following actions to check the Symbol Deviation.

a On the Analyzer, identify the Symbol Deviation value and record the value.

b Verify that the Symbol Deviation is 1800 Hz ± 5% (1710 Hz to 1890 Hz).

7 Perform the following actions to check the Symbol Rate Accuracy (Clock Error).

a On the Analyzer, identify the Symbol Clock Error value (3900 series only) and record the value.

b Verify that the Symbol Clock Error is ≤ 48 MHz (±10 ppm).

c From the CSS menu, select **Service → Test and Measurement Screen**.

d From the **Test and Measurement** screen, click the **ASTRO Test Pattern** tab. Click **Stop Pattern Transmission** to stop the Pattern Transmission Tests.

Manually disable the test pattern as a base radio resets. Do not disable the test pattern.

e Verify that the transmitter has de-keyed by observing that the wattmeter now reads 0.

3.1.5.3
Testing the Receiver for FDMA Operation

Perform this procedure to test the base radio receiver.

Procedure:

1 Perform the following actions to perform the Receiver Test (Internal Diagnostic).

a From the Configuration/Service Software (CSS) menu, select **Service → Test And Measurement Screen**.

b From the **Test And Measurement Screen**, click the **ASTRO BER & RSSI Report** tab.

c Click **Start Receiver Test**.

d Wait a few seconds for the test to conclude, then record the Pass or Fail result. If the test fails, troubleshoot and repair before proceeding.

2 Perform the following actions to check the Received Signal Strength Indication (RSSI) Direct into the Receiver.

a Turn on the Analyzer Generator if not enabled.

b Establish an Analyzer Generate RF Level that produces a level of –47.0 dBm into the RX Input. Account for test cable loss. Generate Level = –47 dBm + test cable loss.

c Under the **Settings** area, select **Project 25** in the **Pattern Type** and establish the **Sampling Period** as 10 seconds.

IMPORTANT: Use the RSSI Measurement function in the CSS to verify RSSI levels, though the Bit Error Rate (BER) function displays RSSI.

d Start the RSSI Measurement Test. Click **Start RSSI Measurement**.

e Wait for 30 seconds and record the CSS Received Signal Strength (dBm) value.

f Click **Stop RSSI Measurement**.

g Verify that the RSSI Direct value is within specifications: –47 dBm –2 dB to + 5.25 dB (–49 dBm to –43.75 dBm).

3 Perform the following actions to check Rx Bit Error Rate (BER) Calibration.

a Set the Analyzer Generate test pattern to **STDCAL** and CSS Pattern type as **Project 25**.

b Click **Start BER Measurement**.

c After 30 seconds, record the CSS BER % value.

d Verify that the Rx BER Calibration BER % is 4.977% ±0.01% (4.967% to 4.987%).

4 Perform the following actions to check Rx BER Floor.

a Set the Analyzer Generate test pattern to **STD 1011** and CSS Pattern type as **Project 25**.

b After 30 seconds, record the CSS BER % value.

c Click **Stop BER Measurement**.

d Verify that the Rx BER Floor BER % is ≤ 0.01%.

5 **For GTR 8000 Expandable Site Subsystem only:** Perform the following actions to check the Sensitivity Direct into the Receiver.

The Rx sensitivity specification values are correct only when the Remote Multicouplers (RMCs) are configured as detailed in Configuring Preliminary Base Radio Settings on page 55. If the RMC attenuation is changed, as for a Tower Top Amplifier (TTA), the base radios may no longer meet this specification. This situation does not mean that the base radio is defective, but that the RMC gain is part of this specification, and if the RMC gain is changed, the sensitivity of the base radio also changes.

Table 13: Rx Sensitivity Specifications

This table provides the Rx Sensitivity specifications (after accounting for cable losses) for each band and frequency range:

Band	700/800	UHF R2	UHF R1	VHF
Frequency Range	792-825	450-512	380-435	136-174
Specification	-123 dBm	-121.5 dBm	-115.5 dBm	-117 dBm

a Record the appropriate sensitivity specification.

b In the **Test and Measurement** screen, click the **ASTRO BER RSSI Report** tab.

c Under the **Settings** area, set the **Sampling Period** as 1 second.

d Click **Start BER Measurement**.

e Adjust the Analyzer Generate RF Level for a CSS Bit Error Rate of 5% ± 0.25%.

f Record the Analyzer Generate Level and calculate the corrected sensitivity accounting for cable loss.

g Click **Stop BER Measurement**.

h Click **Start RSSI Measurement**.

i Record the CSS RSSI (dBm) value.

j Click **Stop RSSI Measurement**.

k Verify that the Sensitivity Corrected value is < Specification + 1 dB. The Sensitivity RSSI value is a relative value that may prove useful for troubleshooting.

l Disconnect the Tx test cable from the base radio Tx output connector and restore the normal connection to the Tx combiner input.

m Terminate the CSS session with the base radio by pressing CTRL+K.

n Repeat the test activities on the remaining base radios at the site, see Testing the Base Radio on page 55. After completing the base radio testing, continue with Testing the RFDS on page 60.

6 If Rx B is used as a backup and the site is not TDMA:

a Disconnect the test cable from the generator to Rx A at the base radio and connect it to Rx B.

b Increase the generator level to -47 dBm.

c Wait for Branch A to fail.

- This can take up to two (2) minutes.
- CSS Channel tab Time to Failure (sec) field controls the time to fail.

d Repeat step 5 of this procedure.

3.1.5.4
Testing the Receiver for APCO TDMA Operation

See chapter 5 in the *Dynamic Dual Mode for TDMA Operation Feature Guide* for TDMA testing using the Aeroflex service monitor.

To perform a self-test of the receiver's sensitivity, see “Checking the Receiver Sensitivity (Self-test Method)” in chapter 5 of the *GTR 8000 Expandable Site Subsystem Feature Guide*.

3.1.6
Testing the RFDS

Performing this process to test the Radio Frequency Distribution System (RFDS).

Procedure:

1 Test the transmit (TX) RFDS output at rated power. See Testing TX RFDS Output at Rated Power on page 60.

2 Establish the TX Effective Radiated Power (ERP) and set the base radio power output. See Establishing TX ERP and Setting Base Radio Power Output on page 63.

3 Test the receive (RX) capability on systems with a Tower Top Amplifier (TTA). See Testing RX with a Tower Top Amplifier (TTA) on page 64.

4 Test the receive (RX) capability on systems without a TTA. See Testing RX without a Tower Top Amplifier (TTA) on page 68

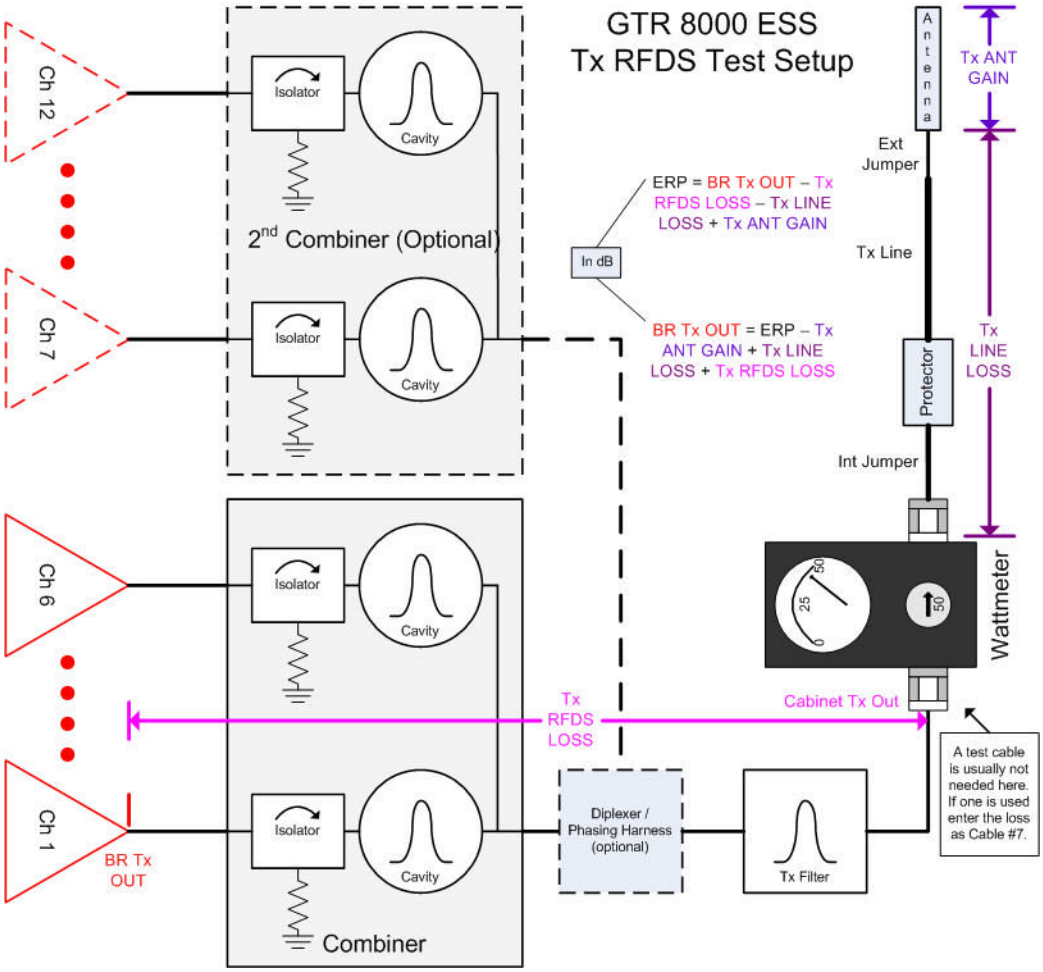
3.1.6.1
Testing TX RFDS Output at Rated Power

Perform this procedure to test the transmit (TX) Radio Frequency Distribution System (RFDS) output at rated power.

Procedure:

1 Configure the RFDS TX test setup as shown in this figure.

Figure 19: TX RFDS Test Setup



2 Tune the combiner.

3 To check TX RFDS output at rated power, identify and record the TX RFDS Max Loss in dB specification from the following table:

The base radio specification for this activity is to produce no less than the specified RFDS Max Loss for a given RFDS configuration. This table shows the overall TX RFDS loss in dB from the base radio TX output to the cabinet TX output. Calculate the actual TX RFDS Insertion Loss. Ensure that the calculated value is less than or equal to the TX RFDS Max Loss value.

Table 14: TX RFDS Loss (in dB)

Band:	800 Only	800 Only	700 Only	700 Only	700/800 Only	UHF R2
Range:	851 – 870	851 – 870	762 – 776	762 – 776	762 – 870	450 - 512
1 or 2 Combiners:	6 Ch	12 Ch	6 Ch	12 Ch	12 Ch	6 Ch

Table continued…

Band:	800 Only	800 Only	700 Only	700 Only	700/800 Only	UHF R2
150 kHz Spacing:	4.0	4.3	4.0	4.3	4.7	5.1
250 kHz Spacing:	3.5	3.8	3.5	3.8	4.2	4.5
500 kHz Spacing:	3.3	3.6	3.3	3.6	4.0	4.1
3000 kHz Spacing:	3.2	3.5	3.2	3.5	3.9	N/A

4 Perform the following actions to measure the RF power at the Primary Rack TX Connector.

a Install wattmeter inline (to read forward power). If using a wattmeter other than a Rohde&Schwarz, use the 50 Watt element.

b Connect to the base radio and read the configuration (codeplug) by pressing CTRL+R.

c From the Configuration/Service Software (CSS) menu, select **Service** → **Test and Measurement Screen**.

d From the **Test and Measurement** screen, if the base radio is not in Service Mode, click **Change to Service Mode**.

e From the confirmation dialog box, click **OK**.

The base radio begins a reset sequence to change modes, which take a few minutes.

f After the base radio resets, re-open the **Test and Measurement** screen.

g Key the base radio (V.52). Select the **Start Pattern Transmission** button.

h Record the wattmeter reading.

i If using a wattmeter other than a Rohde&Schwarz, perform the next three actions. Otherwise, proceed to step 4 j.

1 De-key the base radio and verify that the wattmeter reading drops to zero.

2 Install the 5 W or 10 W wattmeter element to read reflected power.

CAUTION: Orient the element correctly to read reverse (reflected) power, otherwise damage may occur.

NOTICE: If the station is left keyed up, the forward power reading may change over time. This behavior is normal for the ceramic cavities used in this combiner. Even if the power reading drops over time, it still meets its published specification.

3 Key the base radio (V.52). Click **Start Pattern Transmission**.

j Record the reverse power reading. If the reflected power is greater than 5 W, correct the antenna, line, protector, or jumper that may be resulting in an unacceptable reflected power.

k De-Key the base radio. Click **Stop Pattern Transmission** and verify that the wattmeter drops to zero.

l If using a wattmeter other than a Rohde&Schwarz, re-install the 50 W element in the wattmeter (orient to read forward power).

m Verify the RFDS Rated Forward Power > specified RFDS Power Output – 8.1% and the Return Loss (VSWR) at the combiner output is ≤ –14 dB (1.5:1).

3.1.6.2

Establishing TX ERP and Setting Base Radio Power Output

Perform this procedure to establish the transmit (TX) Effective Radiated Power (ERP) and set the base radio power output.

Procedure:

1. Calculate the value to program into the Configuration/Service Software (CSS) TX power out (Watts) using the formula TX Power Out = ERP - TX Ant Gain + TX Line Loss + TX RFDS Loss. All the values are in dB or dBm.
2. Identify the **Set CSS Power Out to** value and enter this value in the CSS.
3. To write this value to the base radio, open CSS, select **Configuration** from the system tree, and click the **Hardware Configuration** tab. Enter the value into the **Tx Power Output (Watts)** field. Press CTRL+W.
4. Calculate a **Set CSS Power to** value. This value sets the transmitter output to no greater than the desired ERP. If the base radio rated power results in an ERP of less than the desired ERP, the **Set CSS Power to** value equals the rated power. It is possible to set the CSS TX power output Watts to 10% higher than rated power, however, the spreadsheet calculates only a value up to the base radio rated power.
5. Record the actual CSS TX power out value.
6. If you did not change the CSS TX power from the rated value previously used, transfer the wattmeter readings previously obtained.
7. From CSS, select **Service** → **Test and Measurement Screen**.
8. From the **Test and Measurement** screen, key the base radio (V.52). Click **Start Pattern Transmission**.
9. Record the wattmeter reading.
10. If using a wattmeter other than a Rohde&Schwarz, perform the following actions. If using a Rohde&Schwarz, proceed to step 11.
    a. De-key the base radio and verify that the wattmeter reading drops to zero.
    b. Install the 5 W or 10 W wattmeter element to read reflected power.

    CAUTION: Orient the element correctly to read reverse (reflected) power, otherwise damage may occur.

    c. Key the base radio (V.52). Click **Start Pattern Transmission**.
11. Record the reverse power reading.
12. De-Key the base radio. Click **Stop Pattern Transmission** and verify that the wattmeter drops to zero.
13. If using a wattmeter other than a Rohde&Schwarz, re-install the 50W element in the wattmeter (orient to read forward power).
14. Verify that the actual ERP ≤ licensed ERP.

    The actual combiner power and the actual reflected power measurements taken become the baseline values for future PM checks of the site.
15. Perform the following actions to set up CSS metering.
    a. In the CSS menu, select **Service** → **Metering Screen**. Select the **Transmitter** tab. Click **Test Transmitter**.
    b. Record the CSS Base Radio Forward Power, Base Radio Reflected Power, and Base Radio Voltage Standing Wave Ratio (VSWR) values. (these values become the baseline for future routine checks).

c Verify that the CSS Base Radio Forward Power (Watts) and CSS TX Power Out values agree ±7% and that the CSS Base Radio VSWR ≤1.5:1.

d Terminate the CSS session by pressing CTRL+K.

16 Repeat all the above RFDS test activities on the remaining base radios at the site, then proceed with the next step.

17 Remove the (inline) wattmeter, restore the TX antenna jumper cable to the cabinet TX antenna port, and power down the wattmeter.

Ensure that you establish the appropriate site ERP values. It is a regulatory (FCC in the USA) requirement.

If the site uses a Tower Top Amplifier (TTA), see Testing RX with a Tower Top Amplifier (TTA) on page 64. If the site does not use a TTA, see Testing RX without a Tower Top Amplifier (TTA) on page 68.

3.1.6.3
Testing RX with a Tower Top Amplifier (TTA)

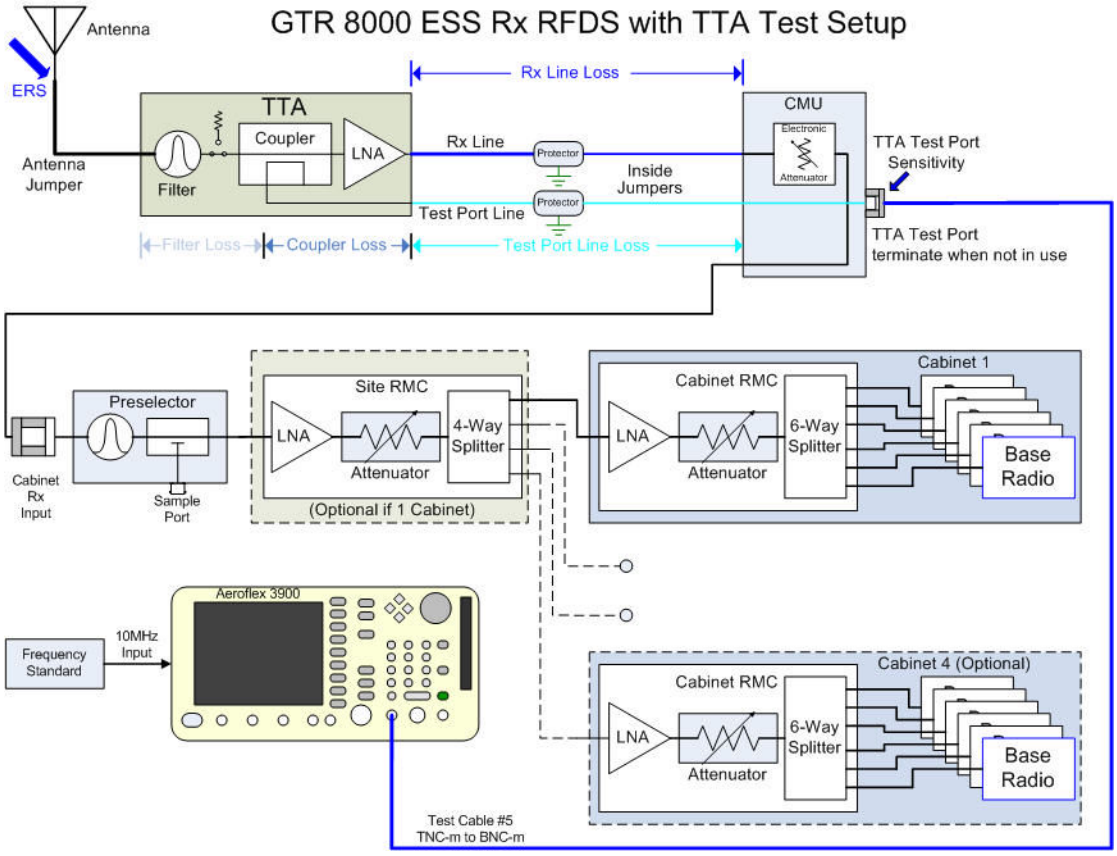
Perform this procedure to test the receive (RX) capability on systems with a Tower Top Amplifier (TTA).

Prerequisites: Test the TTA before installation on the tower. The following tests do not verify that the TTA is performing to specifications. The values documented in the procedure are only relative baseline values that can be used to set the baseline or troubleshoot the system in the future.

Procedure:

1 Configure RX with a TTA test setup as shown in the figure.

Figure 20: GTR 8000 Expandable Site Subsystem RX RFDS with TTA Test Setup



2 Perform the following actions to establish the TTA configuration.

NOTICE:
The following guidelines result in RX operation acceptable in many situations. However, the best performance is achieved if an RF engineer analyzes the site-specific conditions and provides the Control Monitoring Unit (CMU) and RMU attenuation values.

The RX Total Line Loss + CMU attenuation should be a minimum of 11 dB. For 700/800 MHz systems, this value sets a nominal reserve gain of 10 dB for the TTA.

Minimum CMU attenuation = 11 – RX total line loss. Do not use a CMU attenuation value lower than this value. The value can be set higher if specific site conditions warrant it.

a Calculate the CMU attenuator values.

b Record the actual **Gain and Test Port Coupling Loss** values if actual test data is available, otherwise review default values and change them to match your TTA specification.

c Record the actual **Gain and Test Port Coupling Loss** values if actual test data is available, otherwise review default values and change them to match your TTA specification.

d Record the **TTA Test Port Cable Loss**.

e Record the **Total Line Losses dB** and the **Antenna Gain dB** values.

f Calculate a **CMU Attenuator Value**.

g Program the CMU attenuator to this value or other desired value. Perform this programming once for each TTA. Use the instructions provided with the CMU to program it. Do not leave the CMU attenuator value at 0 or a value less than calculated above. Additional gain in the CMU does not provide increased performance.

h Record the value set into the CMU in the actual **CMU Atten** setting field of the **Tower Top Amplifier Data** section.

3 Perform the following actions to set the Remote Multicoupler (RMC) configuration.

Table 15: GTR 8000 Expandable Site Subsystem Attenuator Values

If RMC attenuation information is not available from an RF engineer, use the default settings as shown in this table.

Band	TTA	Cabinet	Site RMC	Cabinet RMC
UHF	Yes	Single	N/A	7 dB
UHF	Yes	Multiple	8 dB	13 dB
700/800	Yes	Single	N/A	7 dB
700/800	Yes	Multiple	8 dB	13 dB

a Identify and set the RMC attenuator values.

b Set the site RMC (if present) and the cabinet RMC dip switches to match the desired attenuation values.

c Ensure the Configuration/Service Software (CSS) values match the hardware configuration and RMC attenuation values are set up for the hardware in the CSS.

d Verify that the CSS GTR 8000 RMC configuration matches the actual installation. If a site RMC is installed, set the **Site RMC Configuration** in the CSS as **Installed**, and set the **CSS Site RMC Attenuation** to the same value as the actual dip switches.

e Set the CSS **Cabinet RMC Attenuation** value the same as its actual dip switches. To save the changes to the base radio, select **File** → **Write Configuration To Device** from the menu. Click **OK** on the **Confirmation** window.

f Record the CSS **Site RMC Attenuation** value.

g Record the CSS **Cabinet RMC Attenuation**, and CSS **System Gain** (dB) values.

CAUTION: The Receive path attenuators must be configured before performing the following portion of the procedure. The RX path must be complete to the RX antenna on the tower.

4 Perform the following actions to perform the base radio tests with TTA.

a Connect to the base radio and read the configuration (codeplug). Alternatively press CTRL+R.

b From CSS, select **Service** → **Test and Measurement Screen**.

c When the **Test and Measurement** screen appears, if base radio is not in **Service Mode**, click **Change to Service Mode**.

d From the confirmation dialog box, click **OK**.

The base radio begins a reset sequence to change modes, which take a few minutes.

e After the base radio resets, re-open the **Test and Measurement** screen.

f Click the **ASTRO BER RSSI Report** tab. Under the **Settings** area, set the **Pattern Type** as P25 and establish the **Sampling Period** as 1 second.

g Configure the analyzer to generate an **STD1011** pattern.

h Set the **Analyzer Generate Frequency** equal to the base radio RX frequency.

i Connect the Analyzer Gen port to the TTA Test Port using a TNC-m to BNC-m test cable with known loss.

j Configure the TTA so that the Antenna port is terminated in a 50 Ohm load.

5 Perform the following actions to establish an RX Noise Level TTA Terminated value.

a Turn off the analyzer generator.

b Click **Start RSSI Measurement** to start the Received Signal Strength Indication (RSSI) measurement test.

c Record the **CSS RSSI** value.

This value is relative and is documented to baseline the performance.

6 Perform the following actions to establish an RX RSSI TTA test port reference level.

a Turn on the analyzer generator

b Establish an analyzer generate RF level that produces a CSS RSSI level of -90.0 dBm.

c Record the analyzer generate RF level and calculate the actual test port ref level.

This value is relative and is documented to baseline the performance.

d Click **Stop RSSI Measurement** to stop the RSSI measurement test.

7 Perform the following actions to establish an Rx Sensitivity TTA Test Port Terminated value.

a Start Bit Error Rate (BER) measurement. In the CSS **Test and Measurement** screen, select the **ASTRO BER RSSI Report** tab. Click **Start BER Measurement**.

b Adjust the **Analyzer Generate RF Level** for a 5% ± 0.25% BER.

c Record the **Analyzer Generate RF Level**.

d Click **Stop BER Measurement** to stop the BER measurement.

e Click **Start RSSI Measurement** to start RSSI measurement.

f Record the CSS RSSI (dBm) value.

g Click **Stop RSSI Measurement** to stop RSSI measurement.

h Calculate the Actual Sensitivity using Sensitivity Terminated – Test Cable Loss - TTA Test Port Cable Loss - TTA Test Port Coupling Loss. This value is relative and is documented to baseline the performance.

8 Perform the following actions to establish an RX desense TTA without transmitters keyed.

The degradation specification is < 2 dB @ 700/800 MHz, < 6 dB @ 450 MHz, or < 10 dB @ 150 MHz. This test and the RX Desense TTA with transmitters keyed test cannot be performed accurately if the channel is in use within the site coverage area (for example, legacy system waiting for cut over).

a Configure the TTA so that the antenna port is connected to the antenna (normal operation).

b Start BER measurement. In the CSS **Test and Measurement** screen, select the **ASTRO BER RSSI Report** tab. Click **Start BER Measurement**.

c If needed, readjust the **Analyzer Generate RF Level** for 5% ± 0.25% BER.

d Calculate and record the **Analyzer Generate RF Level**.

e Click **Stop BER Measurement**.

NOTICE:
The difference between this level and the level recorded in the RX sensitivity step 7 is the site desense (degradation). Also, if the CSS BER reading is not stable, the reading indicates external interference or variable noise floor. Make a note on the test result sheet that Channel ***<X>*** BER went to ***<Y>***% while performing this test.

Calculate the Degradation no TX value. The degradation should be less than specified in the proceeding measurement. If the degradation is higher than recommended, consult with the RF Engineer to determine what impact degradation could have on talk-in coverage.

For sites with a TTA, the result from this test becomes the benchmark for future PM checks.

9 Perform the following actions to establish an RX desense TTA with transmitters keyed (required only for VHF sites).

For the degradation specification, see RX desense TTA without transmitters keyed.

NOTICE: This test cannot be performed if the channel under test or any of the channels being keyed up are in use with an operating system in the same coverage area.

a Key-up all transmitters at the site. Connect to the base radio and read the configuration (codeplug), alternatively press CTRL+R.

b From CSS, select **Service** → **Test and Measurement Screen**

c When the **Test and Measurement** screen appears, if base radio is not in Service Mode, click **Change to Service Mode**.

d From the confirmation dialog box, click **OK**.

The base radio begins a reset sequence to change modes, which take a few minutes.

e After the base radio resets, re-open the **Test and Measurement** screen.

f Select the **ASTRO BER RSSI Report** tab. Click **Start BER Measurement**.

g If needed, readjust the **Analyzer Generate RF Level** for 5% ± 0.25% BER.

h Record the **Analyzer Generate RF Level**.

i De-key transmitters at the site.

j Click **Stop BER Measurement** to stop the BER Measurement.

k Calculate the Degradation with TX value. The degradation should be less than specified . If the degradation is higher than recommended, consult with the system engineer to determine what impact degradation could have on talk-in coverage.

10 Perform the following actions to establish an RX Noise Level TTA to Antenna value.

a Turn off the analyzer generator.

b Click **Start RSSI Measurement** to start the RSSI measurement.

c Record the CSS RSSI Value.

d Click **Stop RSSI Measurement** to stop the RSSI measurement.

This measurement is a relative value and is documented to baseline the performance.

11 Perform the following actions to establish an Effective Receiver Sensitivity value.

a Calculate the Effective Receiver Sensitivity as the maximum of Rx Desense no Tx OR Rx Desense with Tx – Test Cable Loss - TTA Test Port Cable Loss - TTA Test Port Coupling Loss. Ensure that this actual value is appropriate so that there are no impacts to the system talk-in coverage.

b Terminate the CSS session by pressing CTRL+K.

12 Perform this procedure for all the remaining channels, then proceed to step 14.

13 If Rx B is used as a backup and the site is not TDMA:

a Disconnect the test cable from the generator to Rx A at the base radio and connect it to Rx B.

b Increase the generator level to -47 dBm.

c Wait for Branch A to fail.

- This can take up to two (2) minutes.
- CSS Channel tab Time to Failure (sec) field controls the time to fail.

d Repeat step 3 through step 11 of this procedure.

14 When all channels are complete, disconnect the test cable to the TTA test port, terminate the TTA test port with a 50 Ohm termination.

15 Proceed to base radio final configuration. See Setting the Final Base Radio Configuration on page 71.

3.1.6.4

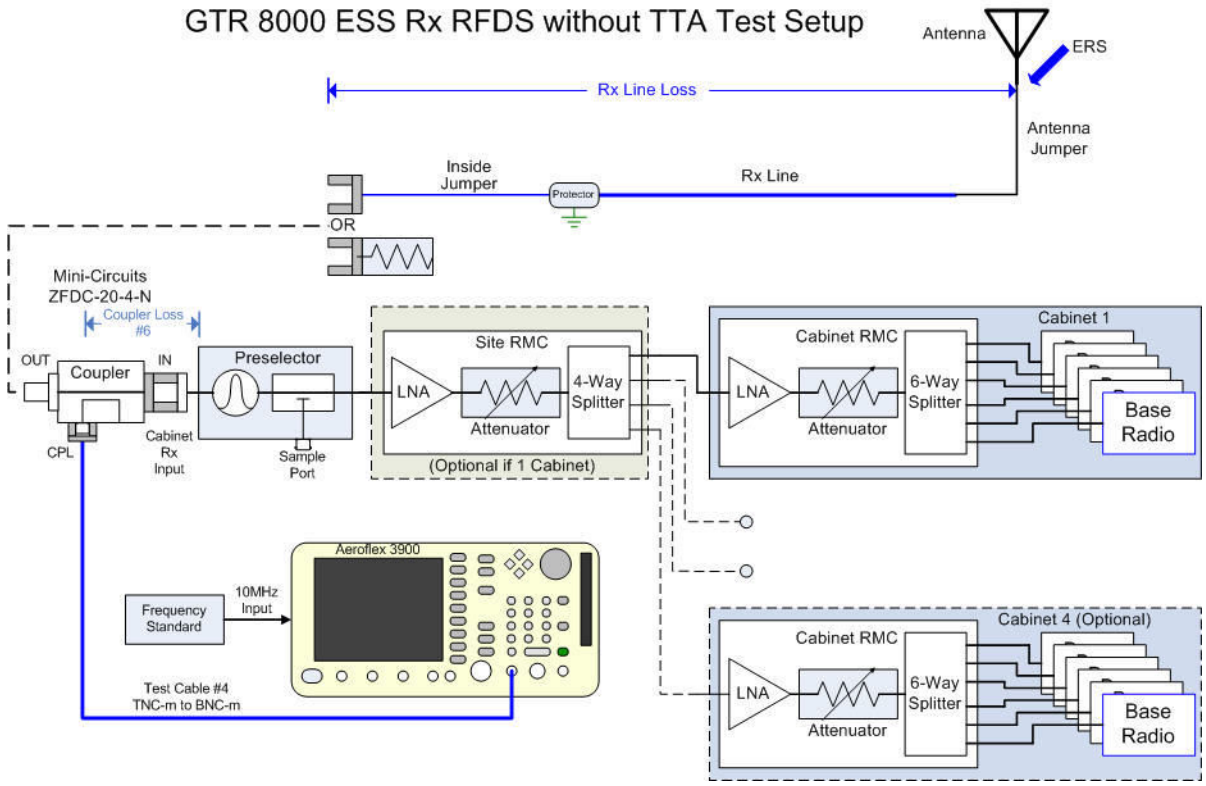
Testing RX without a Tower Top Amplifier (TTA)

Perform this procedure to test the receive (RX) capability on systems without a Tower Top Amplifier (TTA).

Procedure:

1 Configure the RX without a TTA test setup as shown in this figure.

Figure 21: GTR 8000 Expandable Site Subsystem RX RFDS without TTA Test Setup



2 Perform the following actions to establish a Remote Multicoupler (RMC) configuration.

a Identify and set the RMC Attenuator values.

Table 16: GTR 8000 Expandable Site Subsystem Attenuator Values

If RMC Attenuation information is not available from an RF engineer, use the default attenuator values in this table.

Band	TTA	Cabinet	Site RMC	Cabinet RMC
UHF	No	Single	N/A	1 dB
UHF	No	Multiple	4 dB	15 dB
700/800	No	Single	N/A	0 dB
700/800	No	Multiple	1 dB	10 dB

b Ensure the Configuration/Service Software (CSS) values match the hardware configuration and RMC Attenuator values are set up for the hardware in the CSS.

Verify that the CSS GTR 8000 RMC configuration matches the actual installation.

c If a site RMC is installed, set the **Site RMC Configuration** in the CSS as **Installed**, and set the **CSS Site RMC Attenuation** to the same value as the actual dip switches.

d To save and write the changes to the base radio, alternatively press CTRL+W, and click **OK** in the confirmation window.

e Record the CSS Site RMC Attenuation.

f Record the CSS Cabinet RMC Attenuation, and CSS System Gain (dB) value.

CAUTION: The RX path attenuators must be configured before performing the following portion of the procedure. The RX path must be complete to the RX antenna on the tower.

g Insert a directional coupler (IsoTee may be used but a coupler is preferred) at the top of the cabinet on the Rx Input connector. Terminate the open end (towards antenna) with a 50 Ohm termination.

h Connect the Analyzer Gen port to the coupler (or IsoTee) port pointing towards the base radio receivers using a cable with known loss.

3 Perform the following actions to perform base radio tests without TTA.

a Connect to the base radio and read the configuration (codeplug) by pressing CTRL+R.

b Verify the base radio (Station) is in **Service Mode**.

c In the CSS **Test and Measurement** screen, select the **ASTRO BER RSSI Report** tab. Under the **Settings** area, set the **Pattern Type** as P25 and the **Sampling Period** as 1 second.

d Configure the Analyzer to generate an **STD1011** pattern.

e Set the **Analyzer Generate Frequency** equal to the base radio RX frequency.

4 Perform the following actions to establish an **Rx Sensitivity Coupler Terminated** value.

If this test fails and the Base Radio Sensitivity Direct is passed, you most likely have incorrect data for your test cable or coupler loss. To perform this test, you must have an accurate value for the coupler loss factor.

a In the CSS **Test and Measurement** screen, select the **ASTRO BER RSSI Report** tab. Click **Start BER Measurement**.

b Adjust the **Analyzer Generate RF Level** for a 5% ± 0.25% Bit Error Rate (BER).

c Record the **Analyzer Generate RF Level** and calculate the **Calculated Actual Sensitivity** as Sensitivity Terminated – Test Cable Loss – Directional Coupler Loss Factor.

d Verify that the **Calculated Actual Sensitivity** is ≤ RX Sensitivity Direct Specification + 1 dB.

5 Perform the following actions to test an RX Desense Coupler without transmitters keyed.

The degradation specification is < 2 dB @ 700/800 MHz, < 6 dB @ 450 MHz, or < 10 dB @ 150 MHz.

This test and the RX Desense Coupler with transmitters keyed test cannot be performed accurately if the channel is in use within the coverage area of the site (legacy system for example, waiting for cutover).

a Disconnect from the coupler and connect the RX antenna jumper to the coupler.

b Readjust the Analyzer **RF LEVEL** if needed for 5% ± 0.25% BER.

c Record the Analyzer **RF LEVEL**.

The difference between this level and the level recorded in the RX Sensitivity step is the site desense (degradation). If the CSS BER reading is not stable, this reading indicates external interference or variable noise floor. Make a note that Channel ***<x>*** BER went to ***<y>***% while performing this test.

d Calculate the Degradation no TX value. The degradation should be less than specified in the proceeding measurement. If the degradation is higher than recommended, determine what impact this degradation could have on talk-in coverage. For sites without a TTA, the result from this test becomes the benchmark for future PM checks.

6 Perform the following actions to test an RX Desense Coupler with transmitters keyed.

This test cannot be performed if the channel under test or any of the channels being keyed up are in use with an operating system in the same coverage area.

a Key up transmitters at the site.

b Readjust the Analyzer RF LEVEL if needed for 5% ± 0.25% BER.

c Record the Analyzer RF LEVEL.

d Dekey all base radios.

e In the CSS, click **Stop BER Measurement**.

f Calculate the Degradation with TX value. The degradation should be less than specified above. If the degradation is higher than recommended, consult with the system engineer to determine what impact this degradation could have on talk-in coverage.

7 Perform the following actions to establish an **Rx Noise Level with Antenna** value.

a Turn off the Analyzer Generator.

b In the CSS, click **Start RSSI Measurement**.

c Record the CSS Received Signal Strength Indication (RSSI) (dBm) value.

d In the CSS, click **Stop RSSI Measurement**.

8 Perform the following actions to test Effective Receiver Sensitivity.

a Calculate the Effective Receiver Sensitivity as the maximum of Rx Desense no Tx or Rx Desense with Tx – Test Cable Loss – Directional Coupler Loss Factor + Rx Total Line Losses. Ensure that this actual value is appropriate to prevent impact on the system talk-in coverage.

b Terminate the CSS session by pressing CTRL+K.

9 Perform this procedure for all the remaining channels, then proceed to step 11.

10 If Rx B is used as a backup and the site is not TDMA:

a Disconnect the test cable from the generator to Rx A at the base radio and connect it to Rx B.

b Increase the generator level to -47 dBm.

c Wait for Branch A to fail.

- This can take up to two (2) minutes.
- CSS Channel tab Time to Failure (sec) field controls the time to fail.

d Repeat step 2 through step 8 of this procedure.

11 When all channels are complete, disconnect the test cables and restore the connection from the RX antenna jumper to the cabinet RX input.

12 Proceed to final base radio configuration. See Setting the Final Base Radio Configuration on page 71.

3.1.7
Setting the Final Base Radio Configuration

Perform the following procedure to set your base radio to its final configuration.

Procedure:

1 Perform the following actions to clear the status logs:

a Connect to the base radio and read the configuration (codeplug) by pressing CTRL+R.

b From the Configuration/Service Software (CSS) menu, select **Service** → **Status Report Screen**. Click **Clear Report**.

c Change the **Report Type** to **Engineering**. Click **Clear Report**.

2 Validate Launch Time Delay Offset.

For simulcast sites ONLY, in the CSS, click the **ASTRO Simulcast** tab. If a launch time delay is required at this site, enter the value in microseconds into the **Launch Time Offset**. This value is saved when the base radio is placed back into Normal Mode. Do not enter any value unless an RF engineer has determined the correct value. This field is normally left blank.

3 Record the CSS Launch Time value.

4 Make an Illegal Carrier Determination.

RF Threshold Value default is normally sufficient unless you have a high noise floor or low-level interference. Add +13.5 dB to the base radio RX noise level. If this level is higher than the existing default number, use the new value.

5 Edit the RF Threshold Value (dBm) field and write the new configuration by pressing CTRL+W.

6 Perform the following actions to verify that base radio is in Normal mode.

a From CSS, select **Service** → **Mode Screen**

b From the **Mode** screen, verify that the base radio mode is set to **Normal**.

c If the base radio is in **Service Mode**, click **Change to Normal Mode**.

7 Perform the following actions to check base radio Hardware Status.

a From the CSSe menu, select **Service** → **Status Panel**. Select the **Hardware Status** tab, and ensure that no failures are indicated. Select the **Operational Status** tab and ensure that the base radio indicates that it is in Normal mode and that both the Transmitter and Receiver are Enabled.

b Perform substep a. for all base radios and then continue with the next step.

8 Perform the following Site and Analyzer Final actions.

a Configure the Analyzer for Internal Reference.

b Disconnect the cable from the Analyzer Reference I/O to the TRAK.

9 Remove the FDM module.

If a temporary FDM module was installed in the TRAK at the beginning of this procedure, remove the module from the TRAK.

10 Restore the site link connection.

Table 17: GTR 8000 Expandable Site Subsystem Attenuator Values

These attenuator settings are the default configuration:

Band	TTA	Cabinet	Site RMC	Cabinet RMC
UHF	No	Single	N/A	1 dB
UHF	Yes	Single	N/A	7 dB
UHF	No	Multiple	4 dB	15 dB
UHF	Yes	Multiple	8 dB	13 dB
7/800	No	Single	N/A	0 dB
7/800	Yes	Single	N/A	7 dB

Table continued…

Band	TTA	Cabinet	Site RMC	Cabinet RMC
7/800	No	Multiple	1 dB	10 dB
7/800	Yes	Multiple	8 dB	13 dB

Figure 22: Attenuation Value (13 dB)

This figure shows an example of Attenuation value set to 13 dB.

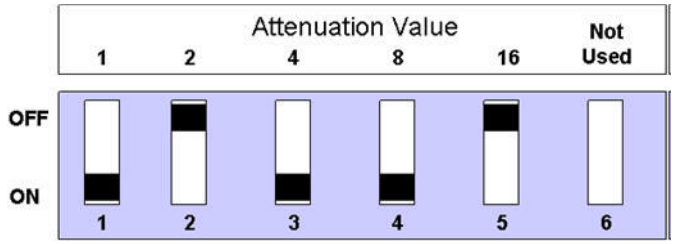
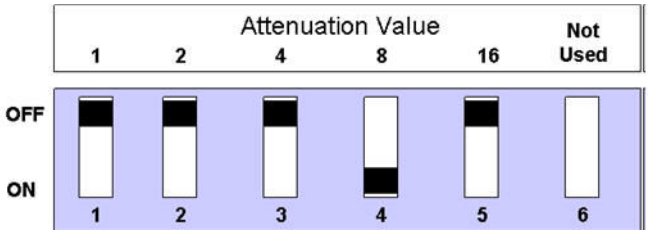


Figure 23: Attenuation Value (8 dB)

This figure shows an example of Attenuation value set to 8 dB.



This page intentionally left blank.

Appendix A

Site Preparation and R56 Compliance Checklist

This section provides information about obtaining and preparing all hardware, software, support, and test equipment necessary to set up, configure, and optimize the system.

A document listing detailed parameter information for all system components is provided with your system.

A.1 Site Preparation

The following table lists the activities for preparing the site and the chapter references in the Motorola Solutions R56 *Standards and Guidelines for Communication Sites* manual. This manual may be purchased by calling the North America Parts Organization at 800–422–4210 or the international number at 302–444–9842.

Activity	Description	R56 Manual Reference
Review the site plan	Prevent potential on-site and off-site interference by other local radio systems. Minimize cable lengths. Determine the location of telecom equipment.	Chapter 2, “Site Design and Development”
Determine site access and security	Outline site access and security measures.	Chapter 2, “Site Design and Development”
Review safety considerations	Outline general, installation, and environmental safety guidelines and requirements, and OSHA-related considerations.	Chapter 3, “Communications Site Building Design and Installation”
Schedule installation of telephone service	Ensure options and functions of onsite, two-way communications for personnel safety and maintenance.	Chapter 3, “Communications Site Building Design and Installation”
Review grounding specifications	Ensure that the site meets or exceeds the design, grounding, power, and surge suppression requirements listed in R56 Compliance Checklist on page 76.	Chapter 4, “External Grounding” Chapter 5, “Internal Ground” Chapter 6, “Power Sources” Chapter 7, “Surge Protective Devices”

Table continued…

Activity	Description	R56 Manual Reference
Schedule Installation of site power	Cover grounding, power sources, and surge protection.	Chapter 4, “External Grounding” Chapter 5, “Internal Ground” Chapter 6, “Power Sources” Chapter 7, “Surge Protective Devices”

A.2
R56 Compliance Checklist

Activity	Description	Reference
R56 Compliance	The site should meet R56 standards and be audited by an ETA-certified R56 auditor to verify compliance.	Motorola Solutions R56 *Standards and Guidelines for Communication Sites* Manual, and the following checklist.

R56 Compliance Checklist	
Customer Name:	Project Name:
Project Manager:	Project No.:
Inspector Name:	Audit Date:

Table 18: General

1. GENERAL		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
a.	A copy of the Project Manager Compliance Sheet has been completed, certi-								

Table continued…

1. GENERAL		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	fied, and supplied for attachment to this audit.								
b.	Project Manager Compliance Sheet shows that all appropriate requirements have been met.								
	TOTALS for Section 1						Enter Section 1 totals here and on AUDIT SUMMARY		

Table 19: Building Design and Installation

2. BUILDING DESIGN AND INSTALLATION		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
a.	The ceiling height is sufficient to meet requirements for equipment installation.								3.6.1
b.	Cable runway system meets the proper in-								3.10.5

Table continued…

2. BUILDING DESIGN AND INSTALLATION		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	stallation requirements.								
c.	The floor is sealed as required.								3.6.2
d.	Transmission line entry ports, holes, or openings which penetrate the outer surface of the building have been properly sealed.								3.7.1
e.	Adequate lighting requirements have been met.								3.11
f.	Maximum required fire suppression equipment is properly installed.								3.12
g.	A first aid kit is available and meets requirements.								3.13.1
h.	Required personal protec-								3.13.2

Table continued…

2. BUILDING DESIGN AND INSTALLATION		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	tive safety items are available for servicing batteries which require such items.								
i.	A telephone, microwave link, or cellular phone has been made available.								3.14
j.	Phone numbers of importance are posted at the site.								3.14
k.	The minimum required signage is posted at the site.								3.15
	TOTALS for Section 2						Enter Section 2 totals here and on AUDIT SUMMARY		

Table 20: External Grounding

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
a.	An External Ground Bus bar (EGB) of suitably sized material is properly installed at the transmission line entry point.								4.4.3
b.	The EGB grounding electrode conductor has been properly installed.								4.4.3
c.	When a Tower Ground Bus bar (TGB) is used, it meets the proper installation and bonding requirements.								4.4.3.1
d.	Each transmission line outer shield is properly bonded to the tower or TGB								4.7.9

Table continued…

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	at the transition of the vertical transmission line run with a weather-sealed transmission line grounding kit.								
e.	Each transmission line outer shield is properly bonded to the EGB with a weather-sealed transmission line grounding kit.								4.7.9
f.	The tower is properly bonded with the required number of grounding conductors.								4.7.6, 4.9
g.	Ice bridges / cable supports have been properly bonded to the EGB.								4.7.10.2

Table continued…

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
h.	Each ice bridge / cable support post has been properly bonded to the grounding electrode system.								4.7.10.2
i.	Ice bridges / cable supports have been properly isolated from the tower.								4.7.10.2
j.	Guy wires are properly bonded and their grounding conductor maintains a continuous vertical drop to the grounding electrode.								4.7.6.2.1
k.	Fencing has been properly bonded to a ground system as required.								4.7.10.1

Table continued…

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
l.	Each fence gate is properly bonded to its supporting fence post as required.								4.7.10.1
m.	Gate supporting fence posts are properly bonded as required.								4.7.10.1
n.	Generator and support skids have been properly bonded as required.								4.7.7.1, 6.9.7
o.	Items listed are properly bonded to the grounding electrode system as required.								
	o.1 Metallic entry ports								4.7.10
	o.2 Cable conduits or raceways								4.7.10

Table continued…

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	o.3 Metallic piping (water, gas, electrical conduits, and so on.)								4.7.10
	o.4 Air conditioner units								4.7.10
	o.5 Metal siding and/or roofing on buildings								4.7.10
	o.6 Vent covers and grates								4.7.10
	o.7 Metal fuel storage tanks (above or below ground)								4.7.10, 6.9.7
	o.8 Building skid or pier foundations								4.7.10
	o.9 Anchors on prefabricated buildings								4.7.10
	o.10 Metallic structures for antenna supports, light fixtures, and so on								4.7.6.3, 4.7.10

Table continued…

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	o.11 Satellite dish supports								4.8
	o.12 GNSS antenna supports								4.8
	o.13 Hand and safety rails								4.7.10
	o.14 Ladders and safety cages								4.7.10
	o.15 Security bars and window frames								4.7.10
	o.16 Main electrical ground								4.3, 6.2.2
	o.17 Main Telco ground								4.3, 4.7.10
p.	Approved bonding techniques have been used for the connection of dissimilar metals.								4.5
q.	Approved methods have been used for conductor								4.6

Table continued…

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	connection and termination.								
r.	Bonding surfaces for lugs and clamps are free of paint and corrosion and a conductive anti-oxidant compound has been applied.								4.5.4, 4.6.1
s.	All painted or galvanized bonding surfaces for exothermic welds were cleaned and painted to inhibit rusting.								4.6
t.	All grounding conductors have been routed towards the EGB, TGB, or the grounding electrode system and the minimum								4.4.2.2

Table continued…

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	bending radius has been observed.								
u.	Grounding conductors are routed as straight as possible and protected from physical damage as required.								4.4.2.3
v.	Grounding conductors maintain the minimum required separation from other cable groups.								4.4.2.3
w.	Grounding conductors are securely fastened as required.								4.4.2.3
x.	Grounding conductors meet or exceed the conductor size requirements.								4.4.2.1

Table continued…

3. EXTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
y.	Braided grounding conductors are not used anywhere in the external ground system.								4.7.9
	TOTALS for Section 3						Enter Section 3 totals here and on AUDIT SUMMARY		

Table 21: Internal Grounding

4. INTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
a.	A properly sized Master Ground Bus (MGB) is installed as required.								5.3.1
b.	The MGB grounding electrode conductor has been properly bonded and rout-								5.3.1.3

Table continued…

4. INTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	ed towards the grounding electrode system.								
c.	All conductor connections to the MGB follow approved connection methods.								5.4.3
d.	Where required a Sub-System Ground Bus Bar (SSGB) has been properly installed.								5.3.2
e.	The SSGB has been bonded back to the MGB as required.								5.3.2.3
f.	All conductor connections to the SSGB follow the approved connection methods.								5.4.3

Table continued…

4. INTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
g.	Where required, an Internal Perimeter Ground Bus (IPGB) is properly installed.								5.3.7
h.	Only ancillary equipment is bonded to the IPGB.								5.3.7
i.	Each ancillary support apparatus is properly bonded to the IPGB, MGB, or SSGB.								5.4.1, 5.5.1.6
j	Items listed are properly bonded to the MGB, SSGB, or IPGB by the approved connection methods.								
	j.1 Piping systems								5.5.1.6, 5.5.1.7
	j.2 Steel roof trusses								5.5.1.7

Table continued…

4. INTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	j.3 Exposed support beams or columns								5.5.1.7
	j.4 Ceiling grids								5.8.3.2
	j.5 Raised equipment floor support structure at the proper intervals								5.4.2, 5.8.3.2
	j.6 Any exposed metallic building materials (metal siding)								5.5.1.6
k.	Surge Protection Device (SPD) metal housings are bonded to the MGB, SSGB, or IPGB as required.								5.5.1.6
l.	Separately derived AC electrical systems are bonded to the MGB or								5.5.1.1

Table continued…

4. INTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	SSGB as required.								
m.	Primary telephone, control, and data network circuit SPDs are properly installed bonded to the MGB or SSGB as required.								5.5.1.8.2
n.	RF transmission line SPDs are bonded to the MGB or a separate equipment area SSGB as required.								5.5.1.8.1
o.	Cable runways are bonded to the MGB or SSGB as required.								5.5.1.5
p.	Each cable runway section is bonded to the adjoin-								5.5.1.5

Table continued…

4. INTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	ing section as required.								
q.	Ground bus conductors and their extensions are sized as required.								5.3.5, 5.3.6
r.	All ground bus conductors, ground bus extensions, and equipment grounding conductors are routed towards the MGB or SSGB as required.								5.3.4
s.	Bonding connections to a ground bus or its extensions have been properly insulated as required.								5.3.4
t.	Cabinets have been properly bon-								5.5.1.4

Table continued…

4. INTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	ded back to the MGB, SSGB, or ground bus by approved methods.								
u.	Racks have been properly bonded back to the MGB, SSGB, or ground bus by approved methods.								5.5.1.4
v.	Any RGB located in a cabinet or rack is properly bonded back to the MGB, SSGB, or ground bus as required.								5.3.3
w.	Individual system component chassis equipment is properly bonded as required.								5.5.1.3
x.	Secondary telephone,								5.5.1.8.3, 5.8.3.1

Table continued…

4. INTERNAL GROUNDING		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	control, and data network circuit SPDs are properly installed and bonded back to MGB or SSGB as required.								
y.	All required control center and dispatch equipment is properly bonded back to the MGB, SSGB, or ground bus conductor as required.								5.8.3
	TOTALS for Section 4						Enter Section 4 totals here and on AUDIT SUMMARY		

Table 22: Power Sources

5. POWER SOURCES		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
a.	Circuit breakers are labeled to identify the receptacle outlet they are protecting.								6.2.6
b.	Proper clearance requirements are being observed for power panels.								6.2.4
c.	Outlet boxes are permanently marked to identify their assigned circuit breakers and panels.								6.2.10
d.	Power receptacle outlets are mounted securely to the supporting structure.								6.2.11
e.	Adequate service receptacle outlets are provided								6.2

Table continued…

5. POWER SOURCES		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	for the technician.								
f.	Each critical piece of equipment has a dedicated branch circuit and dedicated simplex receptacle.								6.2.10
g.	Power receptacles are installed by the equipment load as required.								6.2.10
h.	Extension cords, including temporary outlet strips, are not used in the final installation.								6.2.9
i.	Exterior receptacle outlets and circuits are GFCI protected as required.								6.2.5.1
j.	AC power receptacle out-								6.2.11

Table continued…

5. POWER SOURCES		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	lets and strips are of the proper type and securely mounted off the floor.								
k.	Appropriate clearance is being observed for the safe servicing of UPS and battery banks.								6.5.1
l.	The neutral – ground bonding conductor has been properly installed in the main service disconnect as required.								6.2.2
m.	Equipment grounding conductors have been installed as required.								6.2.7
n.	Solar panels have been located away from objects								6.6.2

Table continued…

5. POWER SOURCES		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	that could damage or block sunlight to the panel.								
o.	Proper mounting practices are being observed for solar panels or wind generators.								6.6.2
p.	Battery racks are bolted to the floor or wall.								6.7.9
q.	Battery conductors are enclosed in PVC, metallic conduit, or raceways.								6.7.9
r.	A battery disconnect and suitable circuit protection device has been installed as required.								6.7.9
s.	When a standby power generator has								6.8

Table continued…

5. POWER SOURCES		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	been installed, it meets the proper installation requirements.								
t.	Standby generators are located in areas only accessible by authorized personnel.								6.9.1
u.	Standby generators have an adequate area provided for servicing.								6.9.1
v.	Fuel storage tanks for standby generators are located in a secured area.								6.9.2
w.	A dedicated electrical circuit has been provided at the generator.								6.9.4
x.	A transfer switch of the proper ampac-								6.9.3

Table continued…

5. POWER SOURCES		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	ity rating has been installed to switch between commercial power and standby generator power.								
y.	A main service disconnect has been installed as required.								6.2.1, 6.2.5
z.	Electrical panel board ampacity ratings are properly coordinated.								6.2
	TOTALS for Section 5						Enter Section 5 totals here and on AUDIT SUMMARY		

Table 23: Transient Voltage Surge Suppression

6. TRANSIENT VOLTAGE SURGE SUPPRESSION		Site Name:							
		Motorola Solultions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
a.	A Type 1 SAD/MOV Surge Protec-								7.4.1

Table continued…

6. TRANSIENT VOLTAGE SURGE SUPPRESSION		Site Name:							
		Motorola Solultions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	tion Device (SPD) is installed as required.								
b.	A Type 2 MOV SPD is installed as required.								7.4.1
c.	Primary SPDs for telephone circuits are installed as required.								7.5
d.	Secondary SPDs for telephone circuits are installed as required.								7.5
e.	Primary SPDs for control circuits are installed as required.								7.5
f.	Secondary SPDs for control circuits installed as required.								7.5
g.	Primary SPDs for data network circuits								7.5

Table continued…

6. TRANSIENT VOLTAGE SURGE SUPPRESSION		Site Name:							
		Motorola Solultions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	are installed as required.								
h.	Secondary SPDs for data network circuits are installed as required.								7.5
i.	All RF transmission lines, including unused spares, have coaxial RF SPDs properly installed as required.								7.6
j.	Where a tower top amplifier has been installed, the sample port and its control cables have SPDs installed as required.								7.6
k.	Tower lighting system AC power and data/alarm circuits have SPDs properly installed as required.								7.8

Table continued…

6. TRANSIENT VOLTAGE SURGE SUPPRESSION		Site Name:							
		Motorola Solultions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
	TOTALS for Section 6						Enter Section 6 totals here and on AUDIT SUMMARY		

Table 24: Equipment Installation

7. EQUIPMENT INSTALLATION		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
a.	Equipment spacing and aisle widths conform to guidelines.								9.3
b.	Equipment is level and plumb.								9.5
c.	Equipment is square with surrounding equipment and walls.								9.5
d.	Where applicable, seismic installation practices have been observed.								9.4

Table continued…

7. EQUIPMENT INSTALLATION		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
e.	Cabinets and racks are secured as required.								9.6
f.	Cables and cable groups of different function maintain a minimum 5 cm (2 in.) separation as required. Cables and cable groups of different function maintain a minimum 5 cm (2 in.) separation as required.								9.9.1.5
g.	RF cables meet or exceed minimum bending radius requirements.								9.9.1.4, 9.9.8
h.	Plenum-rated cables are installed as required.								9.9.2
i.	Proper cable lengths used.								9.9.1.2

Table continued…

7. EQUIPMENT INSTALLATION		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
j.	Cables are properly secured at the required intervals.								9.9
k.	AC power conductors installed on cable runway systems meet installation requirements.								3.10.4, 9.9.4
l.	Cables are properly identified with a standard, double-ended system.								9.9.12
m.	Distribution frame wiring conforms to the proper punch-down or wire-wrap techniques.								9.9.11
n.	CAT-5 cables maintain the proper separation from AC power cables.								9.9.6.4

Table continued…

7. EQUIPMENT INSTALLATION		Site Name:							
		Motorola Solutions Responsibility		Customer Responsibility			Motorola Solutions	Customer	
		Passed	Failed	Passed	Failed	N/A	Date Corrected	Date Corrected	R56 Manual Reference
o.	CAT-5 cables do not have any sharp bends.								9.9.6.5
p.	CAT-5 cables meet all other installation requirements.								9.9.6
q.	Cables installed below raised flooring systems are properly installed.								3.10.2, 9.9
r.	Cables installed above suspended ceilings are properly installed.								9.9.3.3
s.	Electrostatic discharge practices are observed as required.								9.10
	TOTALS for Section 7						Enter Section 7 totals here and on AUDIT SUMMARY		

Table 25: Audit Summary

AUDIT SUMMARY	
Customer Name:	Project Name:

Table continued…

AUDIT SUMMARY						
Project Manager:				Project No.:		
Inspector Name:				Audit Date:		
Site Name:						
		Motorola Solutions		Customer		
		Number of Passed	Number of Failed	Number of Passed	Number of Failed	Total N/A
Section	Totals					
1.	General					
2.	Building Design and Instal-lation					
3.	External Grounding					
4.	Internal Grounding					
5.	Power Sources					
6.	Transient Voltage surge Suppression					
7.	Equipment Installation					
	AUDIT TOTALS					

Appendix B

Service Laptop and Software Setup for ASTRO 25 Express

If you are required to use a Service Laptop for system configuration, maintenance, or troubleshooting, download and set up the applicable software applications.

B.1 Service Laptop Overview for ASTRO 25 Express

If you require a Service Laptop for system configuration, maintenance, or troubleshooting, install the following software applications.

- Configuration/Service Software (CSS) to configure and troubleshoot the GTR 8000 Base Radios and GCP 8000 Site Controllers to back up copies of configuration information. See Configuration/ Service Software for ASTRO 25 Express on page 110.
- Software Download Manager (SWDL) to download firmware to the base radios and site controller. See Software Download Manager on page 112.
- Customer Programming Software (CPS) to program subscriber radios. See Customer Programming Software on page 113.

Laptop hardware and OS requirements depend on which software you intend to use. See requirements for specific software in the following section. Depending on your system configuration, install the following software on the Service Laptop. Follow the instructions on the installation media for each software application.

B.1.1 Service Laptop Requirements for CPS for ASTRO 25 Express

For Customer Programming Software (CPS) Service Laptop hardware and OS requirements, see `CPS_readme.txt` file on the CPS installation media or in the program installation directory.

B.1.2 Service Laptop Requirements for CSS for ASTRO 25 Express

The Configuration/Service Software (CSS) is used for GCP 8000 Site Controllers and GTR 8000 Base Radios.

Operating Systems:

- Windows 7 32 bit and 64 bit
- Windows 10 32-bit and 64-bit

Hardware Requirements:

- 1 GHz or higher Pentium grade processor
- 1 GB RAM recommended for Windows 7 32-bit
- 2 GB RAM recommended for Windows 7 64-bit
- 1 GB RAM recommended for Windows 10 32-bit
- 2 GB RAM recommended for Windows 10 64-bit

- 300 MB minimum free space for CSS Typical Installation (including Help Text and Software Download Manager) or 100 MB minimum free space for a Compact Installation
- 300 MB minimum free space for RSS Typical Installation (including Help Text and Software Download Manager) or 100 MB minimum free space (for a Compact Installation)

Peripherals:

- Serial port or a USB with a USB to serial converter as a connection device (not certified from Motorola Solutions)
- Microsoft Windows supported mouse or trackball
- Microsoft Windows supported 10 Base T Ethernet port for product communication
- Microsoft Windows supported printer port for report printing
- Software installation media

B.1.3
Service Laptop Requirements for Other Software for ASTRO 25 Express

Load the Service Laptop with the following software:

- Remote Desktop Connection or a similar utility
- PuTTY (for Serial, Secure SHell (SSH) and Telnet connections) or a similar utility
- Microsoft Internet Explorer (latest) or Firefox (latest) for Configuration/Service Software (CSS)

B.2
Configuration/Service Software for ASTRO 25 Express

The Configuration/Service Software (CSS) is a Windows-based application installed on a laptop or desktop computer used to configure, report status, and service tasks for infrastructure devices in the system. The CSS application allows a service technician to:

- Configure operating parameters for infrastructure devices.
- Retrieve status and operational information from a device.
- Perform alignment procedures for the infrastructure devices that can use the CSS.
- Set the IP address for specified devices, which requires a local serial connection.
- Perform most device configuration and servicing tasks either through a serial connection to the device or over the LAN.

Use the CSS to configure and service the parameters for the site devices in your system. The devices configured using the CSS are:

- Base radio
- Site controller

The CSS is used to configure the parameters on the GTR 8000 Base Radios and on the GCP 8000 Site Controller. CSS can access each device over the local LAN, or individually through the Ethernet service port. The DB-9 serial port connection is used to set the IP address for the GTR 8000 Base

Radio and on the GCP 8000 Site Controller. CSS also can be used to view status information, equalize batteries, and check internal logs of the equipment at the site.

Table 26: Installing and Upgrading the CSS

Activity	Description	Reference
Install CSS	Install the CSS on the service laptop. The Software Download Manager (SWDL) application is included on the same software installation media. After installation, two icons appear on the desktop:  Launches the CSS application  Launches the SWDL application	*CSS Getting Started Guide*

B.2.1

CSS Guidelines for ASTRO 25 Express

The Configuration/Service Software (CSS) application enables you to use a laptop or other client computer to configure, service, and maintain various Motorola Solutions devices in an ASTRO® 25 radio system. CSS supports devices that include the base radio and site controller equipment.

To install CSS, see the *Configuration/Service Software (CSS) Getting Started Guide* provided with the software installation media. These instructions also include a procedure for configuring the CSS computer network connection

To access the online help, select **Help** → **CSS Help** from the menu. Before performing any procedure or process established in the online help, review the following *CSS Online Help* topics to ensure that you are familiar with and have access to the appropriate topics:

CSS Main Window
To become familiar with the CSS elements and navigation components.

Overview of CSS
To become familiar with using CSS locally or through the network management subsystem.

CSS Help Links
For specific online help supporting base radio configuration and site controller configuration.

For GTR 8000 Base Radios, select **Trunking Site** → **ASTRO 25 Express System**.

For GCP 8000 Site Controller, select **Site Controller Configuration and Service Help** → **ASTRO 25 Express System**.

B.2.1.1
Reading/Writing Configuration Files From/To a Device

When Configuration/Service Software (CSS) is installed, the online help feature provides information, and instructional procedures to read/write a configuration file from/to a device. Perform this procedure to read/write a configuration file from/to a device using CSS.

Procedure:

1. Access the online help. From the CSS menu, select **Help** → **CSS Help**.
2. From the list of **CSS Online Help** topics, expand **CSS Procedures** (list of procedures).
3. Select the appropriate help topic. From the CSS procedure list, select one of the following options:
   - **Connecting to a Device Through an Ethernet Connection**
   - **Connecting to a Device Through a Serial Connection**
   - **Reading the Configuration File from a Device**
   - **Writing the Configuration File to a Device**
4. Follow the instructions provided to perform the task selected from the online help.

B.3
Software Download Manager

The Software Download Manager (SWDL) transfers and installs new firmware in RF site components (base radios and site controllers).

NOTICE: For detailed information on uploading firmware to the base radios and site controller, see the *Software Download Manager User Guide*.

The SWDL allows you to perform the following tasks:

- Download software to site devices.
- Download software to an instance of a device (such as one base station) that has been disconnected from the radio network.
- Update the software on newly added channels or subsites.
- Determine software and hardware versions on target devices.
- Purge (delete) a software version from selected target devices.
- Obtain device IP information.
- Query the site controller for the number of channels and/or subsites in the system.
- Audit a session using historical information recorded from Software Download Manager.

To download software to an ASTRO® 25 System, you can do one of the following:

- Software download to the entire site – site controllers and base radios.
- Software download to either of the device types in the system – base radios or site controllers.

Table 27: Installing and Upgrading the Software (SDWL)

Activity	Description	Reference
Upgrade factory-installed software	Launch the Software Download Manager (SWDL) application and upgrade the factory-installed software on the equipment to the latest version. All base radios and all site	*Software Download Manager User Guide*

Activity	Description	Reference
	controllers have consistent versions of software.  Launches the SWDL application	

B.4

Customer Programming Software

Subscriber radios are configured through Customer Programming Software (CPS). A computer running CPS is connected to the universal connection port on the subscriber radio and the codeplug is loaded. The configuration settings in CPS are categorized into different types, such as radio-wide settings, controls, display, and menu settings, and secure settings. Parameters must be set according to the services used by the radio. CPS is used to configure each radio with a system ID, the unique individual radio ID, and as many talkgroup IDs as needed.

For subscriber radio programming details, see the subscriber radio user guide and *Customer Programming Software Online Help*.

This page intentionally left blank.