System Release 7.17
ASTRO® 25
INTEGRATED VOICE AND DATA

Simulcast Site Reference

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Document History

Version	Description	Date
MN003354A01-A	Original release of the *Simulcast Site Reference* manual	November 2016

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About Simulcast Site Reference

Chapters 1 – 9 provide information on the implementation and management of components for the Simulcast Site Reference (SSR) and Global Navigation Satellite System (GNSS) receiver that provide the required time reference in ASTRO® 25 systems. Appendix A provides information relating to the implementation and management of the components of the TRAK 8835 Simulcast Site Reference.

What Is Covered In This Manual?

This manual contains the TRAK 9100 Simulcast Site Reference, 9300 Digital Distribution Unit (DDU), and TRAK 8835 Site Reference in the following chapters:

- TRAK 9100 Simulcast Site Reference Description on page 23 – provides a high-level description of the TRAK 9100 Simulcast Site Reference (SSR) and the function it serves on your system.
- TRAK 9100 Simulcast Site Reference Theory of Operations on page 29 – explains how the TRAK 9100 Simulcast Site Reference (SSR) works in the context of your system.
- TRAK 9100 Simulcast Site Reference Installation on page 47 – details installation procedures relating to TRAK 9100 Simulcast Site Reference (SSR).
- TRAK 9100 Simulcast Site Reference Configuration on page 55 – details configuration procedures relating to TRAK 9100 Simulcast Site Reference (SSR).
- TRAK 9100 Simulcast Site Reference Operation on page 71 – details tasks that you perform once the TRAK 9100 Simulcast Site Reference (SSR) is installed and operational on your system.
- TRAK 9100 Simulcast Site Reference Maintenance on page 73 – describes periodic maintenance procedures relating to TRAK 9100 Simulcast Site Reference (SSR).
- TRAK 9100 Simulcast Site Reference Troubleshooting on page 75 – provides fault management and troubleshooting information relating to TRAK 9100 Simulcast Site Reference (SSR).
- TRAK 9100 Simulcast Site Reference FRU/FRE Procedures on page 91 – lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs) and includes replacement procedures applicable to TRAK 9100 Simulcast Site Reference (SSR).
- TRAK 9100 Simulcast Site Reference LEDs on page 103 – contains LED, frequency output connectors, and terminal server cabling pinout information relating to TRAK 9100 Simulcast Site Reference (SSR).
- TRAK 8835 Site Reference on page 111 – provides high-level description, specifications, installation, configurations, maintenance, and troubleshooting for the TRAK 8835 Site Reference.

Helpful Background Information

Motorola 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 Solutions communications site.

Table continued…

Related Information	Purpose
	This manual may be purchased on CD 9880384V83, by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
System 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.
GGM 8000 Hardware User Guide *S6000 Hardware User Guide* *S2500 Hardware User Guide*	Available on the Motorola Online website (`https://businessonline.motorolasolutions.com`). To access the manual, select **Resource Center** → **Product Information** → **Manuals** → **Network Infrastructure** → **Routers and Gateways**

Chapter 1

TRAK 9100 Simulcast Site Reference Description

This chapter provides a high-level description of the TRAK 9100 Simulcast Site Reference (SSR) and 9300 Digital Distribution Unit (DDU) and the function it serves on your system.

1.1 TRAK 9100 Simulcast Site Reference Overview

The TRAK 9100 Simulcast Site Reference (SSR) is a Global Navigation Satellite System (GNSS) receiver, which supplies stratum 1 frequency and time reference for equipment at the prime site and simulcast remote sites.

At the prime site, the TRAK 9100 SSR includes the Network Time Server (NTS) option to provide Network Time Protocol (NTP) services to the prime site and remote site equipment. The NTP services ensure that fault logging services, statistics, and other time-critical procedures are synchronized.

The TRAK 9100 SSR includes a number of Digital Distribution Modules (DDMs) that can be configured for:

- 1PPS and 5 MHz frequency references to the comparators at a circuit simulcast subsystem.
- 1PPS time reference to the comparators and site controllers at an IP simulcast subsystem.
- Composite (1PPS + 5 MPPS) time and frequency reference to the standalone GTR 8000 Base Radios and MLC 8000 Comparators at a simulcast configuration.
- Separate 1PPS time reference and 5 MHz or 10 MHz frequency reference to the GTR 8000 Base Radio in each GTR 8000 Expandable Site Subsystem cabinet/rack at an IP simulcast subsystem.
- 5 MHz reference to QUANTAR® stations at an ASTRO® 25 repeater site.
- 5 MHz reference to standalone GTR 8000 Base Radios at an ASTRO® 25 repeater site.
- Composite (1PPS + 5 MHz) reference to standalone GTR 8000 Base Radios and 1PPS reference to standalone GCP 8000 Site Controllers for TDMA and Enhanced Data at an ASTRO® 25 repeater site.

The optional Motorola Supervisory Control and Data Acquisition™ (MOSCAD Network Fault Management (NFM)) equipment monitors the relay outputs from the TRAK 9100 SSR and supports Simple Network Management Protocol (SNMP). MOSCAD forwards any alarms from the TRAK 9100 SSR as events to the Unified Event Manager (UEM), which can then be viewed in the UEM alarm browser.

The TRAK 9100 supports SNMPv3 by using the new 9104-14 Fault Sensor Unit module for Unified Event Manager (UEM) management. Fault management through the UEM supports using events (SNMP traps) that TRAK devices support through the SNMPv3 interface. If using the TRAK management through the MOSCAD, UEM fault management cannot affect the ability of the MOSCAD to manage the TRAK 9100 device.

The TRAK 9100 SSR unit provides the following outputs to meet network time and network transport synchronization requirement of a simulcast subsystem:

- Coordinated Universal Time (UTC) time for network time synchronization using NTP through 10Base-T

- T1 or E1 signals for network transport synchronization (framed, RS422, and TTL) through the Telecommunications module

The modules installed in the TRAK 9100 SSR are the following:

- GNSS receiver with a Rubidium oscillator
- GNSS receiver with a double oven oscillator
- AC/DC power supplies
- Digital Distribution Modules (DDMs)
- Frequency Distribution Modules (FDMs)
- Telecommunications Modules (TEL module/Telco module)
- Fault Sense Unit (FSU) Module

Overview of TRAK 9100 in an IP Simulcast Remote Site with High Availability and Receive-Only Remote Site with TDMA for a GTR 8000 Expandable Site Subsystem

For a GTR 8000 Expandable Site Subsystem in an IP simulcast remote site with high availability and receive-only remote site with TDMA or Enhanced Data operation, an optional backup for the frequency and time references is supplied to the base radio through a TRAK. The backup SSR provides an extended holdover of at least 72 hours when redundant GNSS or certain GPB 8000 Reference Distribution Module (RDM) failures occur. If an optional TRAK SSR at the remote site is used as an extended holdover backup, the RDMs can be configured in the following configurations to either provide support or act as a replacement for the GPS units:

- Each RDM connected to a GNSS unit
- One RDM connected to a GNSS unit
- No RDMs connected to a GNSS unit.

Overview of TRAK 9100 Simulcast Site Reference and NTP Services

The TRAK 9100 SSR provides precise time and frequency output signals to support Network Time Protocol (NTP) services and simulcast site (frequency) reference functionality. The NTP services ensure that fault logging services, statistics, and other time-critical procedures are synchronized. The following NTP servers (TRAK devices) must be installed or can be installed as an option to provide NTP services based on the following zone cores:

- For an M3 zone core NTP services are mandatory and only the following TRAK devices are supported: TRAK 9100-8E or TRAK 8835-3M
- For an L1/L2/M1/M2 zone core NTP services are optional and only the following TRAK devices are supported: TRAK 9100-8E or TRAK 8835-3M
- K1/K2 core NTP services are optional and can be customer provided.

NOTICE: For details regarding the Network Time Protocol (NTP) Server and the primary and secondary NTP source for devices in your system, see the *Network Time Protocol Server* manual.

Overview of TRAK 9100 Simulcast Site Reference in a Simulcast Prime Site and Simulcast Remote Site

The TRAK 9100 SSR is used at the simulcast prime site and simulcast remote sites. If the prime site is collocated with the master site/zone core, only one TRAK 9100 SSR with one or more TRAK 9300 Distribution Units (DUs) is required to serve the master site/zone core and prime site. A maximum of four TRAK 9300 DUs can be connected to a TRAK 9100 SSR.

Overview of TRAK 9100 Simulcast Site Reference in a High Availability Configuration

To support high availability, the TRAK 9100 SSR is configured for redundant operation. The redundant configuration consists of one GNSS Rubidium oscillator module as the main frequency reference, a GNSS double oven oscillator module as standby reference unit, and two power supplies.

Overview of TRAK 9100 in an ASTRO 25 Repeater Site with Standalone GTR 8000 Base Radios

In an ASTRO® 25 repeater site with standalone GTR 8000 Base Radios with more than six base radios, the TRAK supplies a 5 MHz frequency reference to the base radios. For a site with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the base radios, and 1PPS time reference to the GCP 8000 Site Controllers.

Both the site controllers and the TRAK 9100 together can provide a redundant LAN interface and a redundant time and frequency reference interface. Base radios one through six connect directly to the site controllers. The base radio transceiver generates the station reference, which typically must be locked onto the site controller TDM clocks for time and frequency reference. The remaining base radios receive the time and frequency reference from the TRAK.

NOTICE: The TRAK 9100 must be used when more than eight base radios requiring external references are at the site.

Overview of TRAK 9100 in an ASTRO 25 Repeater Site with QUANTAR Stations With or Without Standalone GTR 8000 Base Radios

In an ASTRO® 25 repeater site with QUANTAR® stations with or without standalone GTR 8000 Base Radios:

- Standalone GCP 8000 Site Controllers controlling six or less QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device.
- Standalone GCP 8000 Site Controller controlling more than six QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device. A 5 MHz frequency reference is supplied to the GTR 8000 Base Radio by an external TRAK 9100 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios and 1PPS time reference to the site controllers.

NOTICE: The TRAK 9100 must be used when more than eight QUANTAR® stations are at the site.

Overview of TRAK 9100 in an ASTRO 25 Repeater Site with QUANTAR Stations and GTR 8000 Expandable Site Subsystem

In an ASTRO® 25 repeater site with QUANTAR® stations and a GTR 8000 Expandable Site Subsystem, the TRAK devices are used in the following configurations:

- A GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device.
- A GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device.
- A GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device.

- A GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios and 1PPS time reference to the site controllers.

NOTICE: The TRAK 9100 must be used when more than eight QUANTAR® stations are at the site.

1.2 TRAK 9100 Simulcast Site Reference

The TRAK 9100 Simulcast Site Reference (SSR), through the DDM, use GNSS satellite signals to derive a high-precision 1PPS, 5 MPPS, or composite (1PPS + 5 MPPS) references. These references are provided to all base radios, comparators, and site controllers, so that all devices involved in the audio transmission have a common timing source (GNSS).

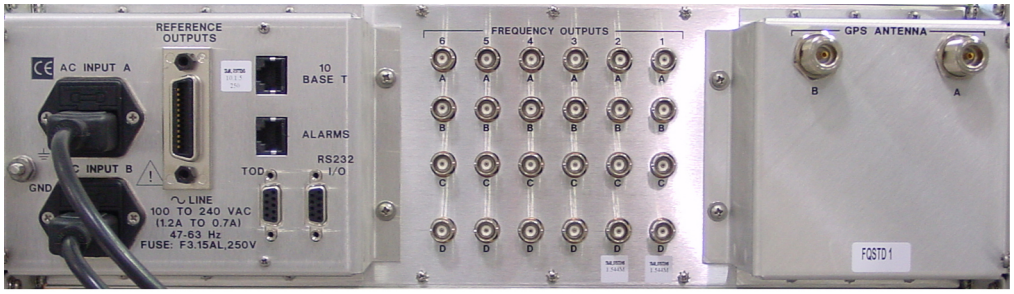
1.2.1 TRAK 9100 Simulcast Site Reference Prime Site Hardware

The modules installed in the front panels of the TRAK 9100 SSR at the Prime Site are the following:

- Global Positioning System (GPS)/PTP Rubidium Reference Module
- GPS/PTP DOCXO Reference Module
- Digital Distribution Modules (up to four modules)
- Telecom Module
- Frequency Distribution Module
- Fault Sense Unit Module
- Power Supply modules (AC/DC)

The following figure shows the TRAK 9100 Simulcast Site Reference (SSR) rear view in a prime site configuration.

Figure 1: TRAK 9100 SSR Prime Site – Rear View



TRAK9100_Rear

1.2.2 TRAK 9100 Simulcast Site Reference Remote Site Hardware

The modules installed in the front panels of the TRAK 9100 SSR at the Remote Site are the following:

- GPS/PTP Rubidium Reference Module
- GPS/PTP DOCXO Reference Module
- Digital Distribution Modules (up to four modules)

- Fault Sense Unit Module
- Power Supply Modules (AC/DC)

1.2.3
TRAK 9100 Simulcast Site Reference Operating Specifications

The following table lists physical and operating specifications for the TRAK 9100 Simulcast Site Reference (SSR).

Table 1: TRAK 9100 SSR – Physical and Operating Specifications

Specification	Value or Range
Physical Dimensions	Height: 13.34 cm (5.25 in.) (3 RU) Width: 48.26 cm (19 in.) Depth: 38.1 cm (15 in.)
Weight	Approximately 11.3 kg (25 lb) with all modules installed
Operating Temperature	–30 °C to +60 °C (–22 °F to +140 °F)
Power Requirements	100 VAC-240 VAC ± 10%, 48 Hz-63 Hz, single-phase; 20 VDC-60 VDC
Heat Dissipation	120 W at power-up; tapers to approximately 80 W within 15 minutes of power-up at 25 °C (77 °F)

1.3
GNSS Antenna Operating Specifications

The following table lists the operating specifications for the Global Navigation Satellite System (GNSS) antenna.

Table 2: GNSS Antenna Operating Specifications

Specification	Value or Range
Physical Dimensions	Diameter: 8.89 cm (3.5 in.) Height: 10.16 cm (4.0 in.)
Weight	0.32 kg (0.7 lb) (excluding mast)
Operating Temperature	–40 °C to +85 °C (–40 °F to +185 °F)

1.4
TRAK 9300 Simulcast Site Reference Distribution Unit

The TRAK 9300-1 Simulcast Site Reference (SSR) Distribution Unit (DU) is a full functioning distribution unit used to expand the number of outputs from the TRAK 9100 SSR, features include the following:

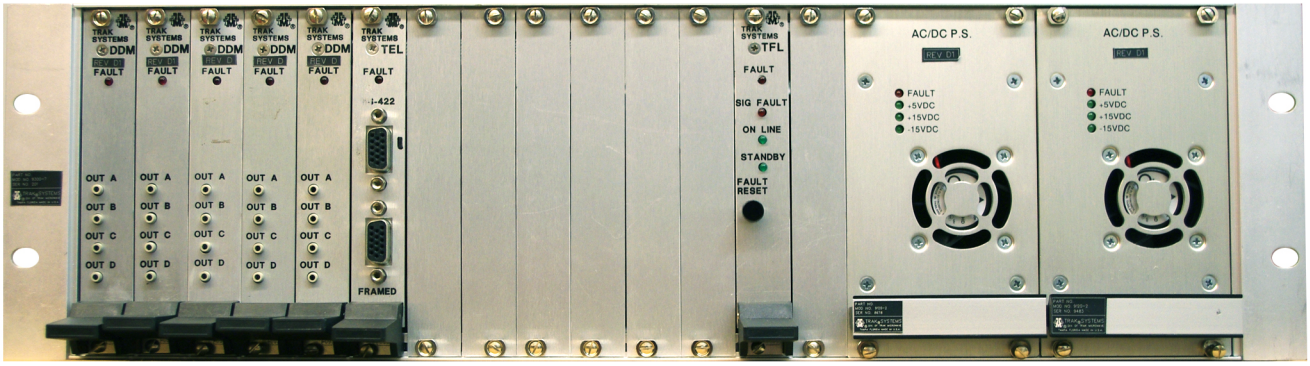
- Up to 12 Digital Distribution, Frequency Distribution, and/or Telecom modules.
- Fault/Status reporting through the Terminator and Fault Logic Module (TFL) level interface when used with the TRAK 9100 SSR
- Redundant or non-redundant power supplies.

- Input Interface Module (IIM), a rear panel plug-in module, allows a wide variety of frequency and or digital input configurations.

The TRAK 9300-1 SSR DU differs from the TRAK 9100 SSR in the following respects: no GNSS modules and the presence of a Terminal and Fault Logic (TFL) module, which serves as the controller for the TRAK 9300-1 SSR.

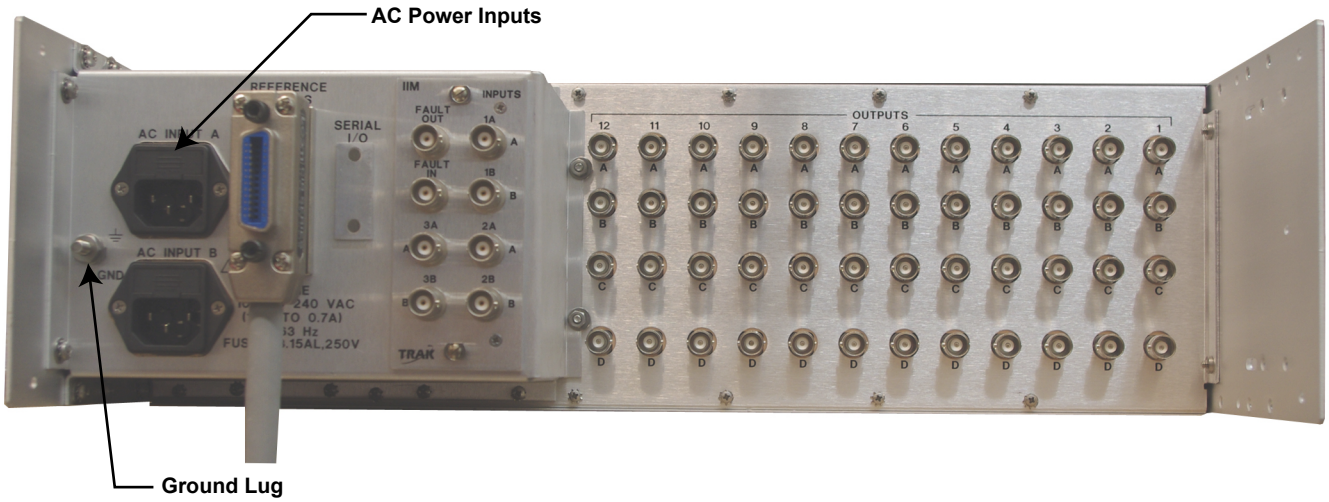
The following figures show the front and rear view of the TRAK 9300-1 SSR.

Figure 2: TRAK 9300 SSR – Front View



TRAK9300_Front1_A

Figure 3: TRAK 9300 SSR – Rear View



TRAK9300_Rear1_A

Chapter 2

TRAK 9100 Simulcast Site Reference Theory of Operations

This chapter explains how the TRAK 9100 Simulcast Site Reference (SSR) works in the context of your system.

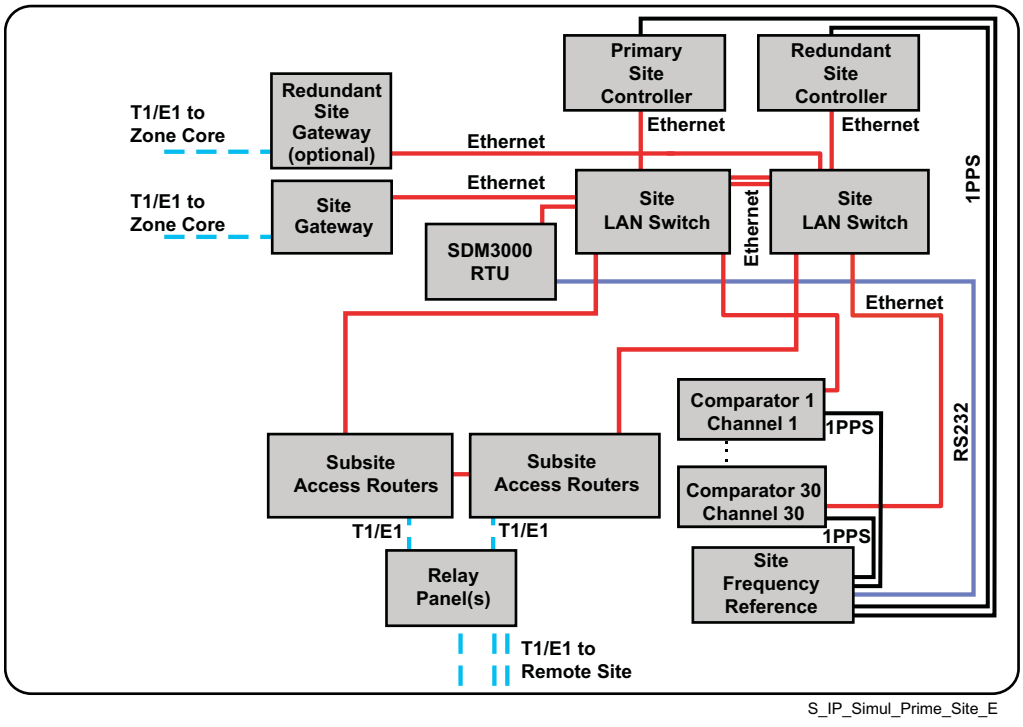
2.1 TRAK 9100 Simulcast Site Reference System Diagrams

This section provides high-level system diagrams for both prime and remote sites.

2.1.1 TRAK 9100 Simulcast Site Reference in Trunking IP Simulcast Subsystems

The following figure shows a trunked IP Simulcast Prime Site.

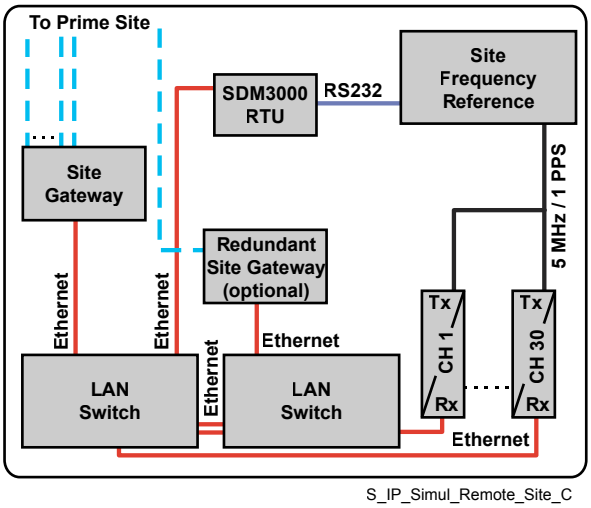
Figure 4: Trunked IP Simulcast Prime Site



NOTICE: High-level diagrams are provided as examples only and are not used for system planning purposes.

The following figure shows a trunked IP Simulcast Remote Site with standalone GTR 8000 Base Radios.

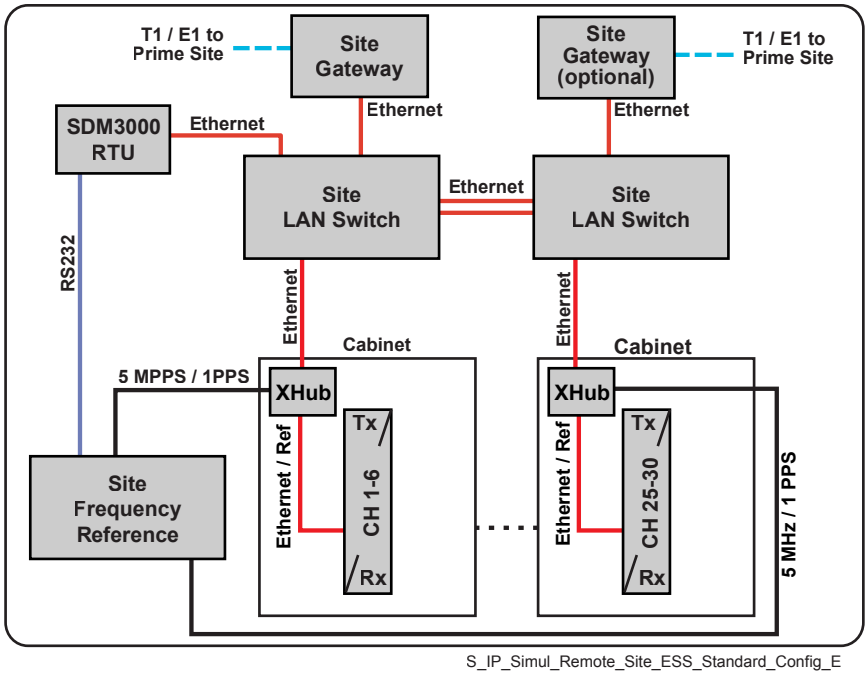
Figure 5: Trunked IP Simulcast Remote Site with standalone GTR 8000 Base Radios



NOTICE: High-level diagrams are provided as examples only and are not used for system planning purposes.

The following figure shows a trunked IP Simulcast Remote Site with a GTR 8000 Expandable Site System.

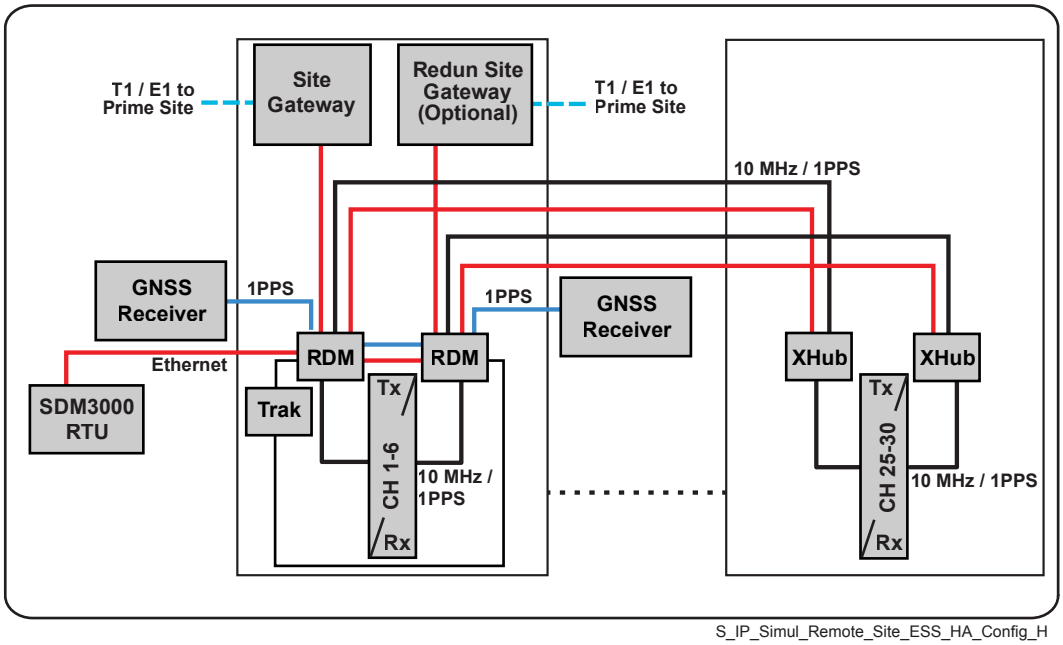
Figure 6: Trunked IP Simulcast Remote Site with a GTR 8000 Expandable Site Subsystem



NOTICE: High-level diagrams are provided as examples only and are not used for system planning purposes.

The following figure shows a trunked High Availability IP Simulcast Remote Site with a GTR 8000 Expandable Site Subsystem with Extended Holdover.

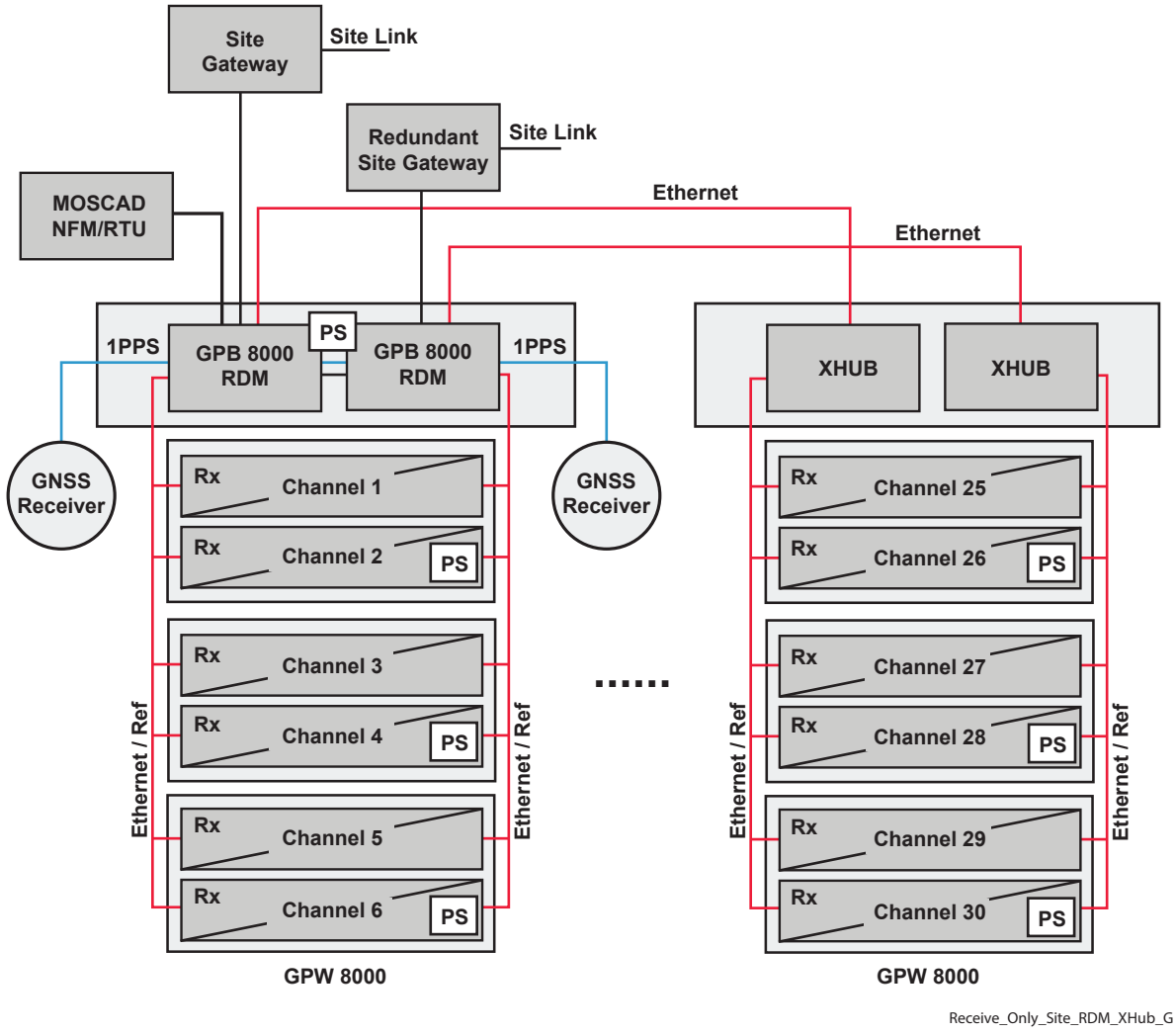
Figure 7: IP Simulcast Remote Site with GTR 8000 Expandable Site Subsystem — High Availability Configuration with Extended Holdover



NOTICE: High-level diagrams are provided as examples only and are not used for system planning purposes. “GNSS Receiver” in the diagram refers to TRAK devices.

The following figure shows a trunked IP Simulcast Receive-only Remote Site.

Figure 8: IP Simulcast Receive-only Remote Site Configuration



NOTICE: High-level diagrams are provided as examples only and are not used for system planning purposes. “GNSS Receiver” in the diagram refers to TRAK devices in the Receive-only configuration.

2.1.2

TRAK 9100 Simulcast Site Reference in Conventional IP-Based and Circuit-Based Simulcast Subsystems

Standalone conventional V.24 and analog channels can be added to IP and Circuit simulcast sites. The IP network in an ASTRO® 25 system can support digital IP, digital V.24, analog 4-wire, and mixed mode 4-wire/V.24 hybrid circuit wireline link interfaces for conventional channels using a site gateway with a Conventional Channel Interface (CCGW module on a GGM 8000 or S2500) as the interface device to the WAN links.

The IP network in an ASTRO® 25 system can also be set up to support circuit-based analog or digital (voted analog or V.24 digital) channels using channel banks. The channel bank is required to multiplex (T1/E1 grooming) the transport circuits and the IP traffic on the WAN links. The remote site can use a site router or site gateway with a serial interface to the HSU in the channel bank.

The TRAK 9100 Simulcast Site Reference already installed at a trunked subsite can be shared between conventional and trunked channels. For topologies and other information, see the *Conventional Operations* or *Quick Guide for Implementing MLC 8000s* manual.

2.1.3
TRAK 9100 Site Reference in an ASTRO 25 Repeater Site

TRAK devices are used in ASTRO® 25 repeater sites that support 10Base-T Ethernet Epic IV or Epic VI QUANTAR® stations or a mix of QUANTAR® stations with standalone GTR 8000 Base Radios or GTR 8000 Expandable Site Subsystem cabinets/racks supporting up to 28 channels (27 voice channels, 1 control channel).

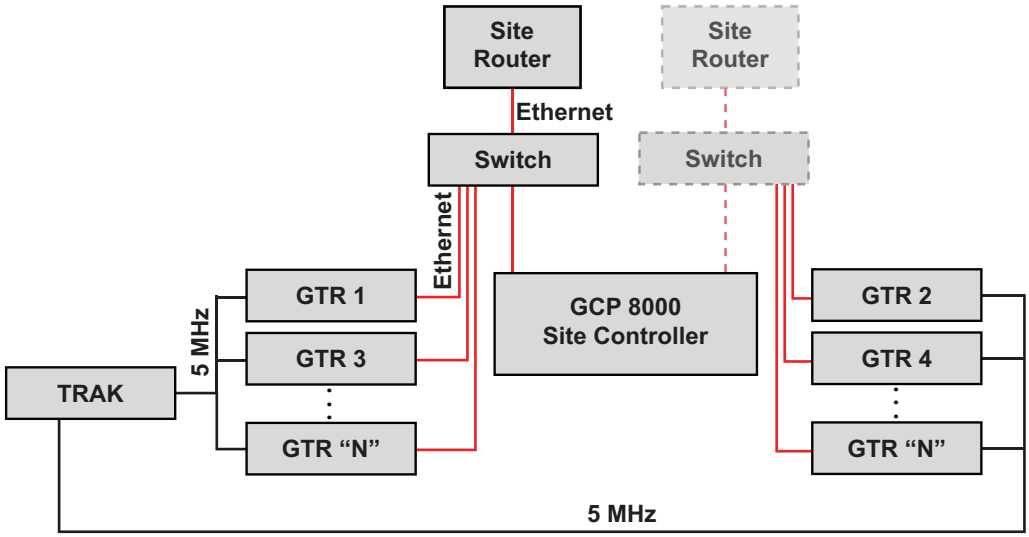
TRAK 9100 in an ASTRO 25 Repeater Site with Standalone GTR 8000 Base Radios

In an ASTRO® 25 repeater site with standalone GTR 8000 Base Radios and standalone GCP 8000 Site Controllers controlling more than six base radios, a 5 MHz frequency reference is supplied to the base radios. For a site with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the base radios, and 1PPS time reference to the GCP 8000 Site Controllers.

The TRAK 9100 is supported in the following configurations:

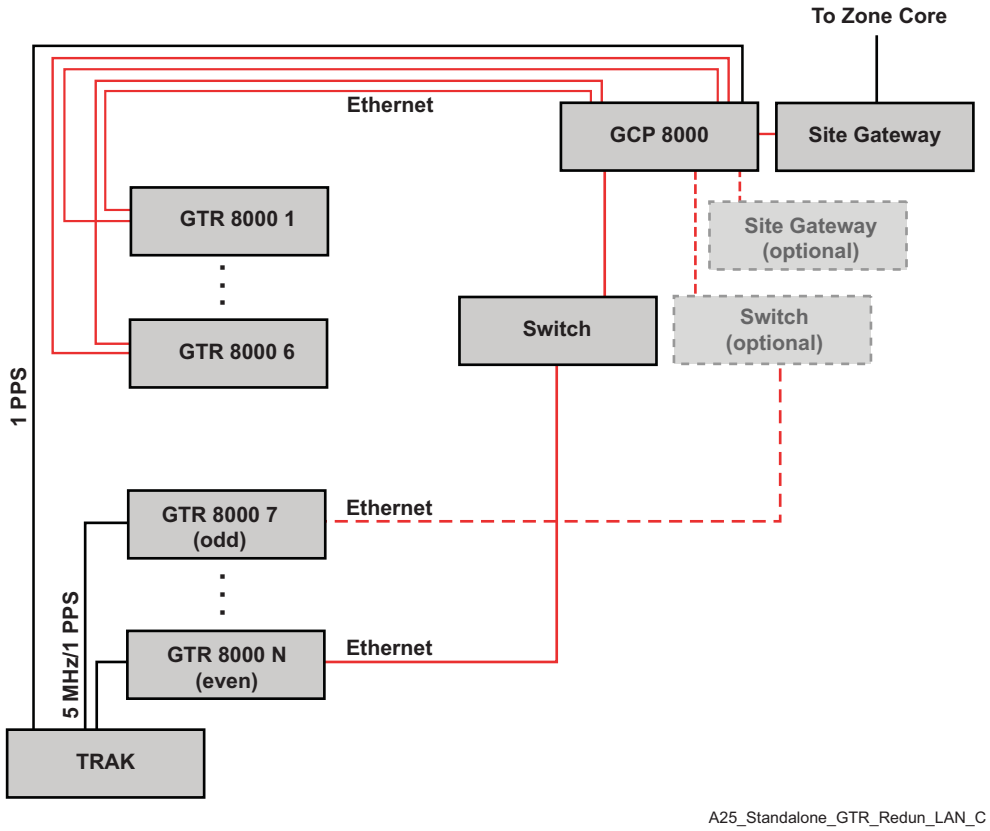
- Standalone GCP 8000 Site Controllers controlling more than six standalone GTR 8000 Base Radios – External Reference Only.
- Standalone GCP 8000 Site Controllers controlling more than six standalone GTR 8000 Base Radios – GCP 8000 Site Controllers and External Reference.

Figure 9: Standalone GCP 8000 Site Controllers with More than Six GTR 8000 Base Radios – External Reference Only



Both the site controllers and the TRAK 9100 together can provide a redundant LAN interface and a redundant time and frequency reference interface. Base radios one through six connect directly to the site controllers. The base radio transceiver generates the station reference, which typically must be locked onto the site controller TDM clocks for time and frequency reference. Base radios seven through 28 connect to the TRAK to receive the frequency reference. See the *ASTRO 25 Repeater Site – Infrastructure* manual for further details.

Figure 10: Standalone GCP 8000 Site Controllers with More than Six GTR 8000 Base Radios – GCP 8000 Site Controllers and External Reference



ASTRO 25 Repeater Site – QUANTAR Stations

The following system configurations support TRAK devices at an ASTRO® 25 repeater site with QUANTAR® stations with or without standalone GTR 8000 Base Radios:

- Standalone GCP 8000 Site Controllers controlling six or less QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device.
- Standalone GCP 8000 Site Controller controlling more than six QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device. The TRAK provides a 5 MHz frequency reference to the GTR 8000 Base Radios. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios, and 1PPS time reference to the site controllers. The following figures show the sites configured with a TRAK device.

NOTICE: The TRAK 9100 must be used when more than eight QUANTAR® stations that require external references are at the site.

Figure 11: Standalone GCP 8000 Site Controllers Controlling Six or Less QUANTAR Stations with or without Standalone GTR 8000 Base Radios

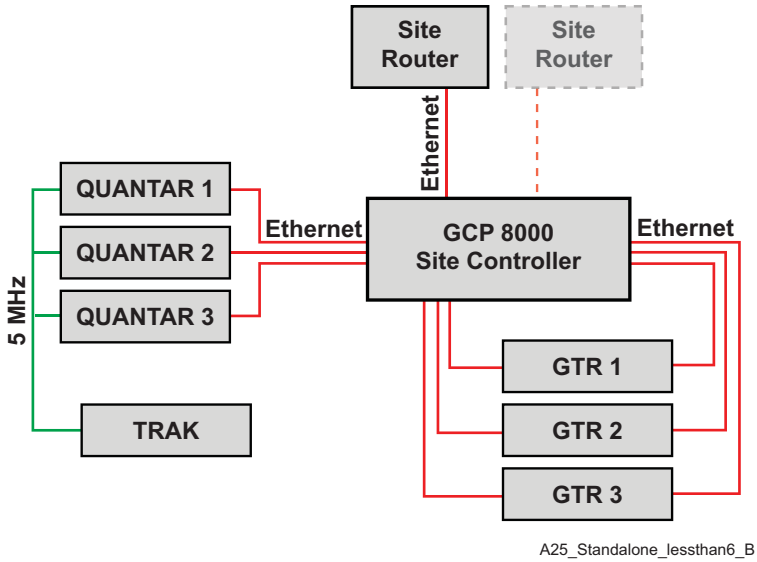
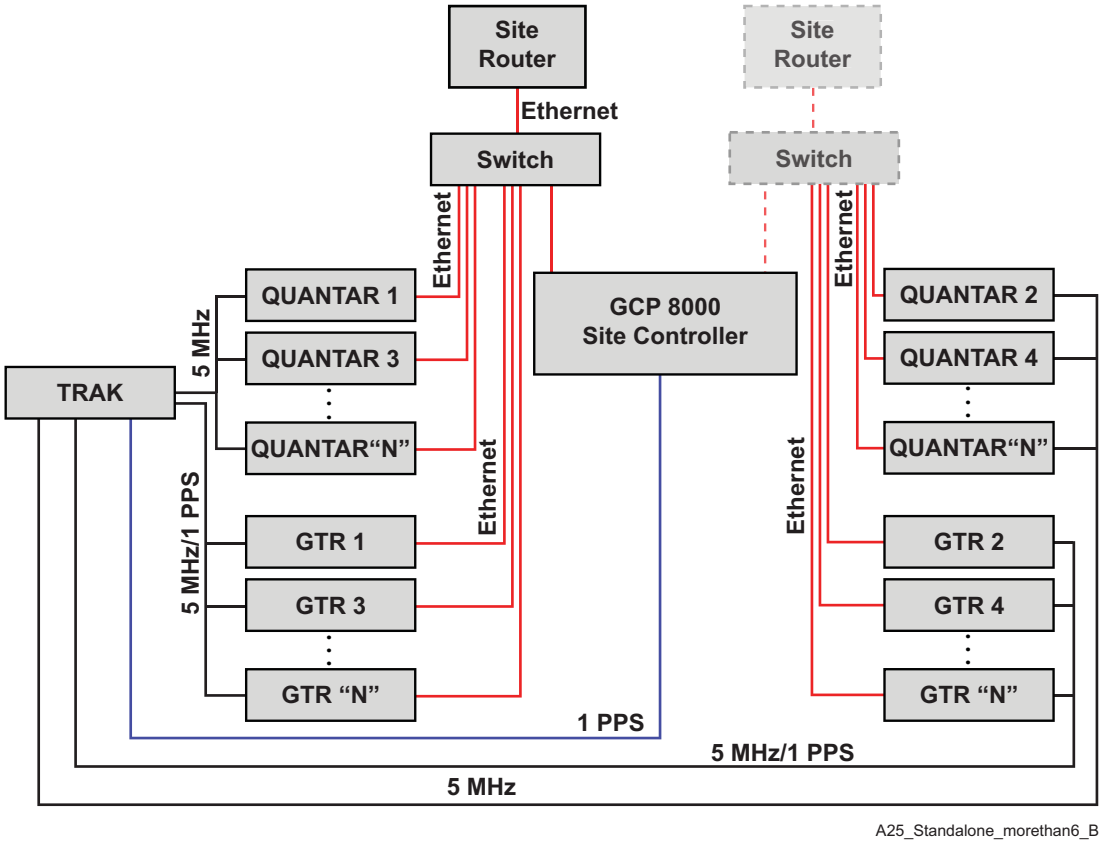


Figure 12: Standalone GCP 8000 Site Controllers Controlling More than Six QUANTAR Stations with or without Standalone GTR 8000 Base Radios



ASTRO 25 Repeater Site – QUANTAR Stations and GTR 8000 Expandable Site Subsystem

The following system configurations support TRAK devices at an ASTRO® 25 repeater site with QUANTAR® stations and GTR 8000 Expandable Site Subsystem cabinets/racks:

- GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device.
- GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device.
- GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device.
- GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios, and 1PPS time reference to the site controllers. The following figures show the sites configured with a TRAK device.

NOTICE: The TRAK 9100 must be used when more than eight QUANTAR® stations requiring external references are at the site.

Figure 13: GTR 8000 Expandable Site Subsystem with Integrated GCP 8000 Site Controllers Controlling Six or Less QUANTAR® Stations

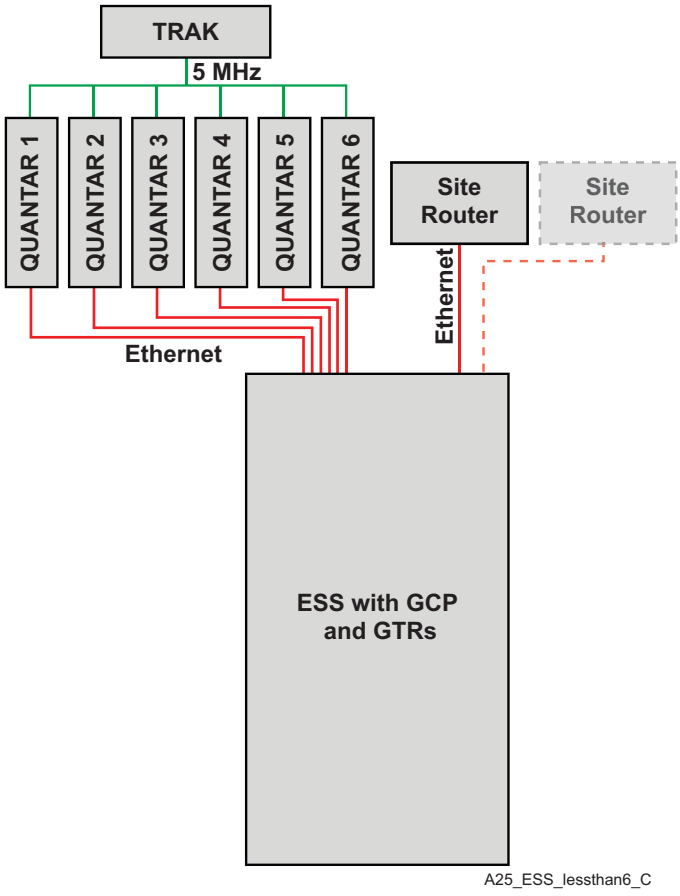


Figure 14: GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers Controlling More than Six QUANTAR® Stations

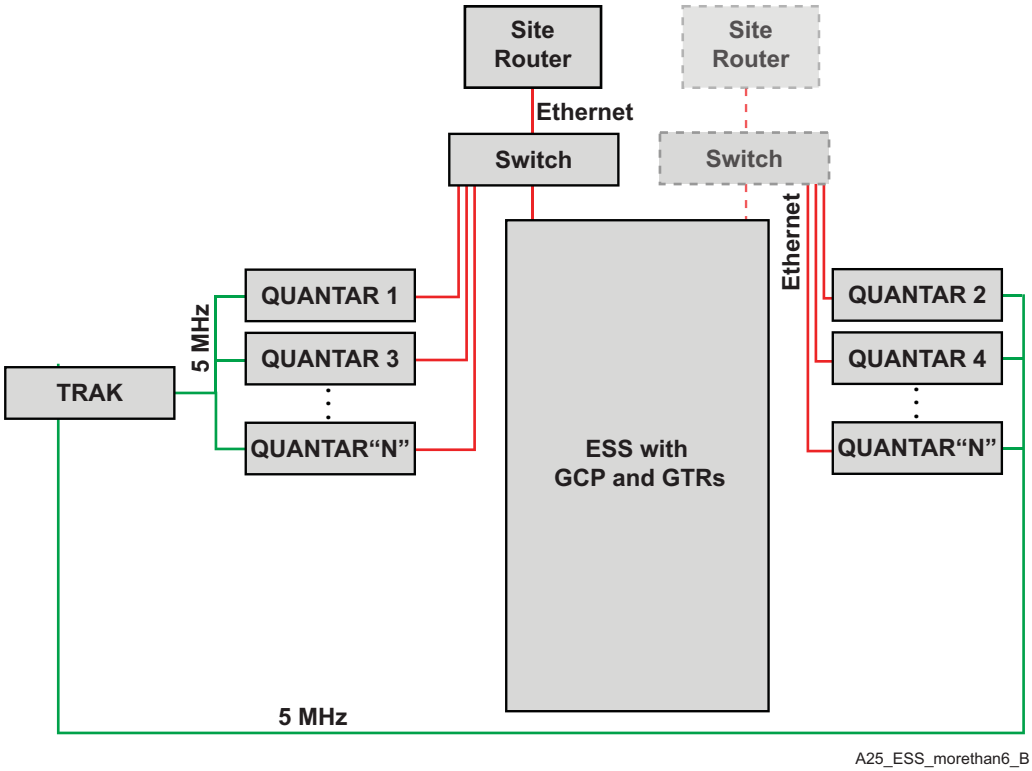


Figure 15: GTR 8000 Expandable Site Subsystem with an External Standalone GCP 8000 Site Controller Controlling Six or Less QUANTAR Stations

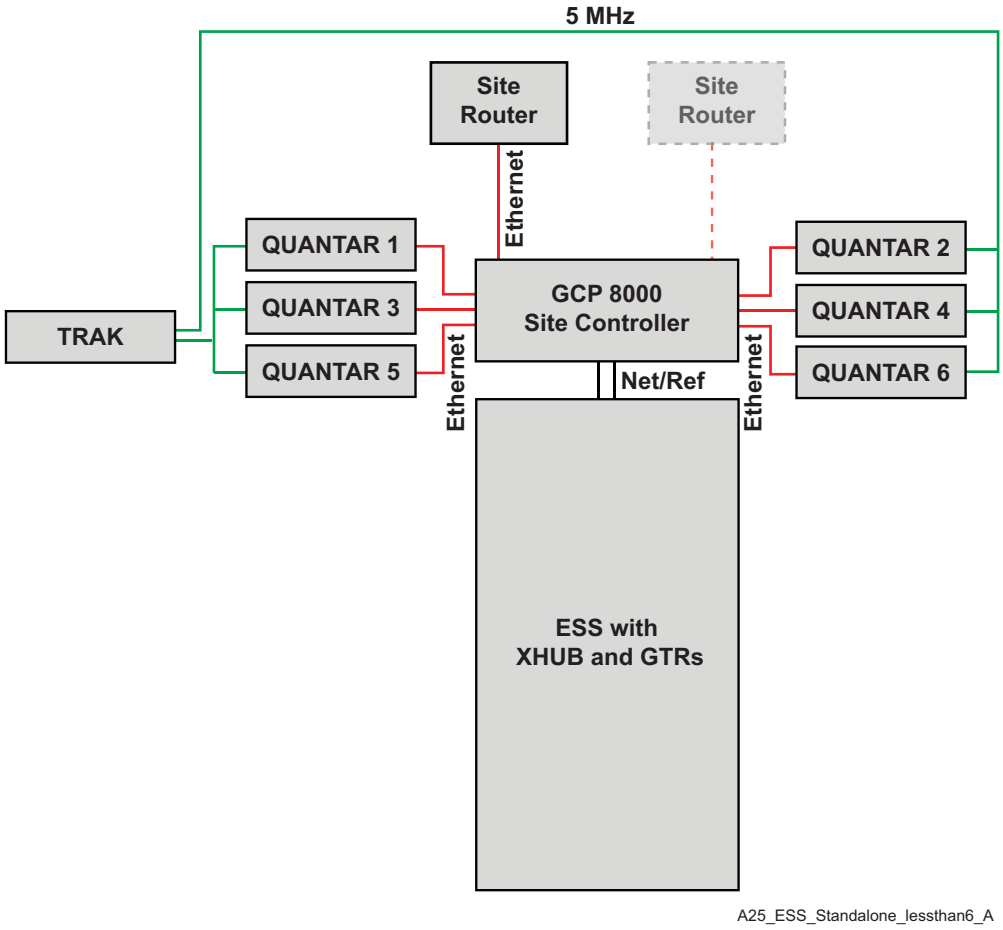
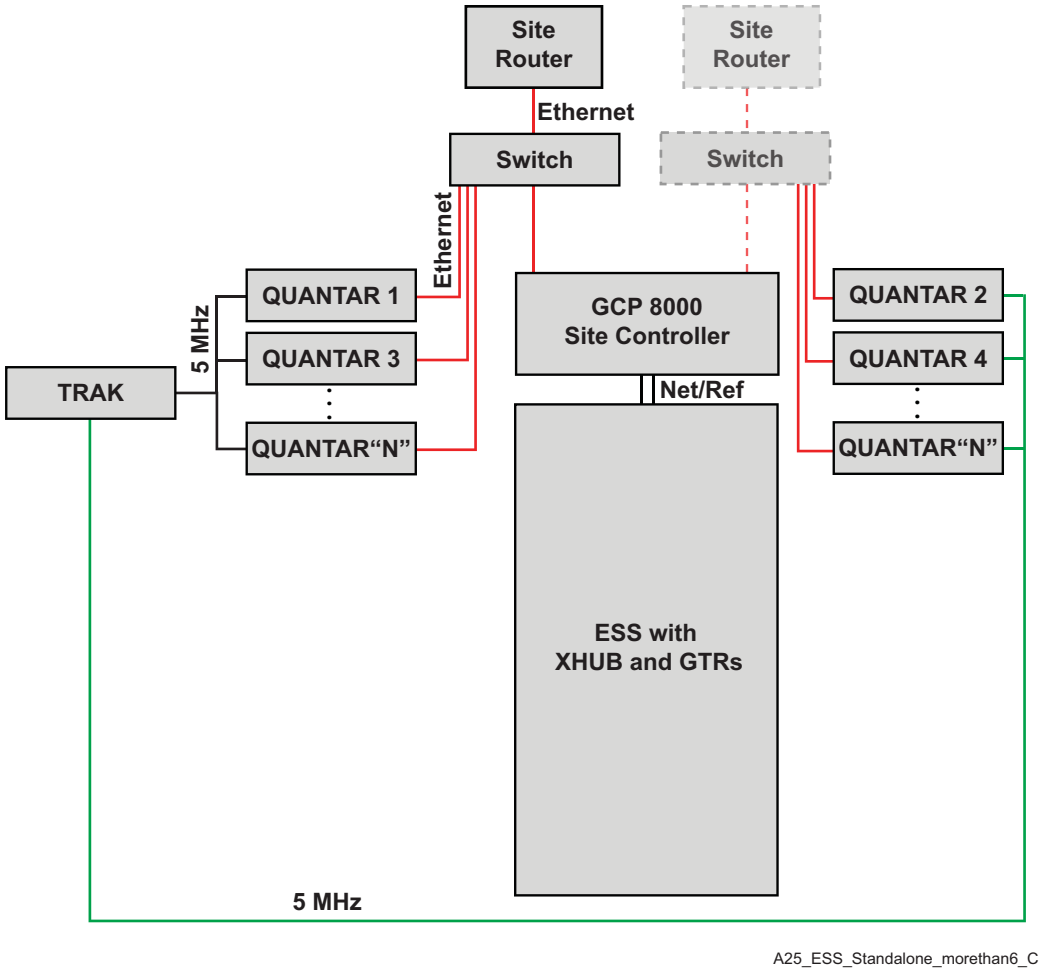


Figure 16: GTR 8000 Expandable Site Subsystem with an External Standalone GCP 8000 Site Controller controlling more than Six QUANTAR Stations



2.2 TRAK Simulcast Site Reference Modules and Slot Assignments

The following sections describe modules and typical slot assignments for a prime site TRAK Simulcast Site Reference (SSR).

2.2.1

Modules for TRAK 9100 Simulcast Site Reference

NOTICE:

- The number and type of modules vary based on the system requirements of your organization.
- The modules and slot assignments for your TRAK 9100 Simulcast Site Reference (SSR) may be different from the modules and slot assignments presented in the following table.

Table 3: Modules for TRAK 9100 Simulcast Site Reference

TRAK 9100 SSR Chassis Slot	SSR Module
A1	GPS/PTP Rubidium Reference Module 1 • 10 MHz Rubidium Oscillator • GNSS Receiver • Front-panel fan for cooling
A2	GPS/PTP DOCXO Reference Module 2 • 10 MHz Double Oven Oscillator • GNSS Receiver • No front-panel fan
A3 – A8	Digital Distribution Module (DDM) • 1 pulse per second (PPS), 5 MPPS, or Composite distribution • Four outputs of one signal type, per module Telecommunications Module (Telco Module) • Two High Density (HD) 15 pin D-sub connectors in the front Frequency Distribution Module (FDM) – Can output a 10 MHz frequency reference signal to rear BNC connectors for test equipment use.
A9	Fault Sense Unit (FSU) with Network Time Server (NTS)/NTP option • Detects system module faults • Provides switching signals to output modules • Contains alarm, RS232, and NTS/NTP circuitry
A10	blank
A11 – A12	Power Supply Modules • Provides power for modules • Two power supplies are used for redundancy

2.2.2
Modules for TRAK 9300 Simulcast Site Reference

NOTICE:

- The number and type of modules varies based on the system requirements your organization.
- The modules and slot assignments for your TRAK 9300 Simulcast Site Reference (SSR) may be different from the modules and slot assignments presented in the following table.

Table 4: Modules for TRAK 9300 Simulcast Site Reference

TRAK 9300 SSR Chassis Slot	SSR Module
A1 – A12	Digital Distribution Module (DDM) • 1 pulse per second (PPS), 5 MPPS, or Composite distribution • Four outputs of one signal type, per module Telecommunications Module (Telco Module) • Two High Density (HD) 15-pin D-sub connectors in the front
A13 – 14	Terminator and Fault Logic (TFL) Modules – Serves as the controller for TRAK 9300 SSR. Typically, only one TFL module is installed in slot A13. Slot A14 is used in redundant TFL configurations.
A15 – A16	Power Supply Modules • Provides power for modules • Two power supplies are used for redundancy • Available with AC or optional 48 VDC power supplies.

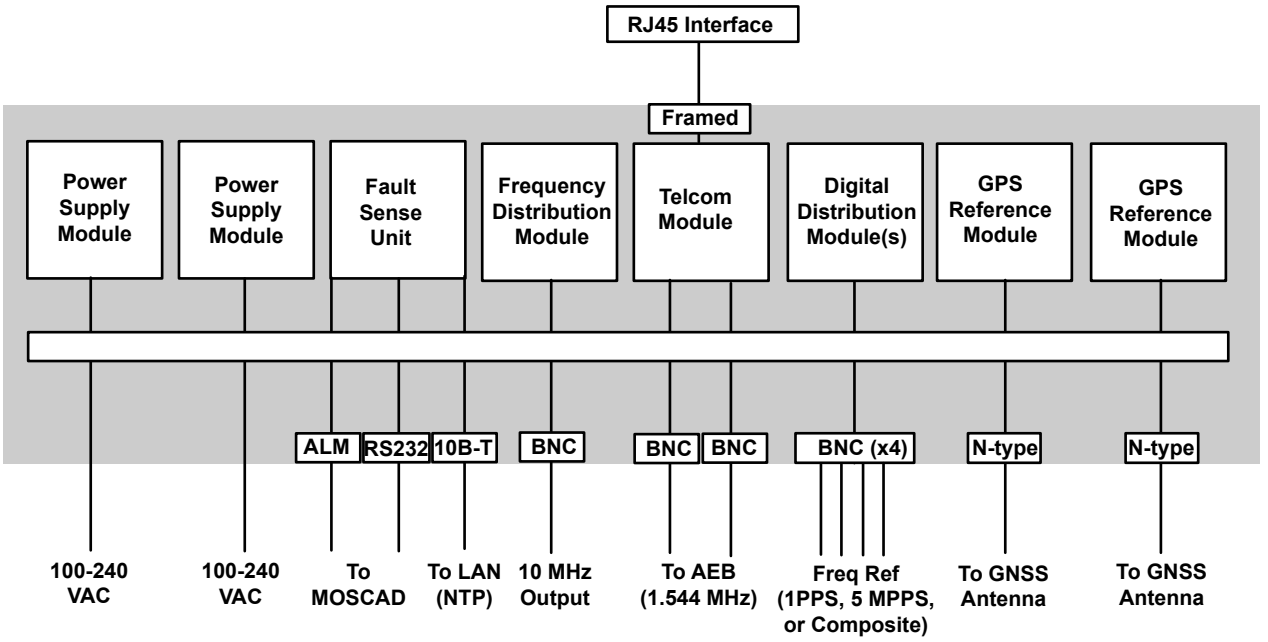
2.3
TRAK 9100 Simulcast Site Reference Components and Architecture

Each TRAK 9100 SSR includes redundant GNSS receiver modules, Fault Sense Unit (FSU), and redundant power supplies. If the TRAK 9100 is used as an SSR, it includes several Digital Distribution Modules (DDMs).

2.3.1
TRAK 9100 Simulcast Site Reference Prime Site Architecture

The following figure shows the configuration for a TRAK 9100 SSR at the prime site.

Figure 17: TRAK 9100 SSR – Architecture (Configuration for Prime Site)



B_MS_TRAK_Prime_Arch_A

2.3.1.1

TRAK 9100 Simulcast Site Reference Prime Site Components

The following table lists the various components that comprise a TRAK 9100 Simulcast Site Reference (SSR) in a prime site.

Table 5: TRAK 9100 SSR – Components for Prime Site

Component	Description
GPS Reference Module	Redundant GPS reference modules are installed in TRAK 9100 SSR. The left module includes an oscillator and built-in fan. The right module includes a 10 MHz crystal oscillator. Each GPS reference module includes a receiver, which tracks and locks onto satellites for GPS discipline of their own internal clocks. Each GPS reference module provides 1PPS, 5 MPPS, and a composite (1PPS + 5 MPPS) outputs to the backplane, for use by other modules in the chassis. The modules can be manually switched through the FSU module, or automatically switched when an output failure or other fault occurs.
Digital Distribution Module (DDM)	A number of DDMs can be configured to provide 1PPS, 5 MPPS, or composite (1PPS + 5 MPPS) references to other components in the system. These modules are used to support the ASTRO-TAC 9600 and MLC 8000 Comparators (1PPS, 5 MPPS) at a circuit simulcast subsystem, and GCM 8000 Comparators and GCP 8000 Site Controllers (1PPS) at an IP simulcast subsystem.
Telecommunications Module	Provides 1.544 MHz or 2.048 MHz signals for T1/E1 framing.

Table continued…

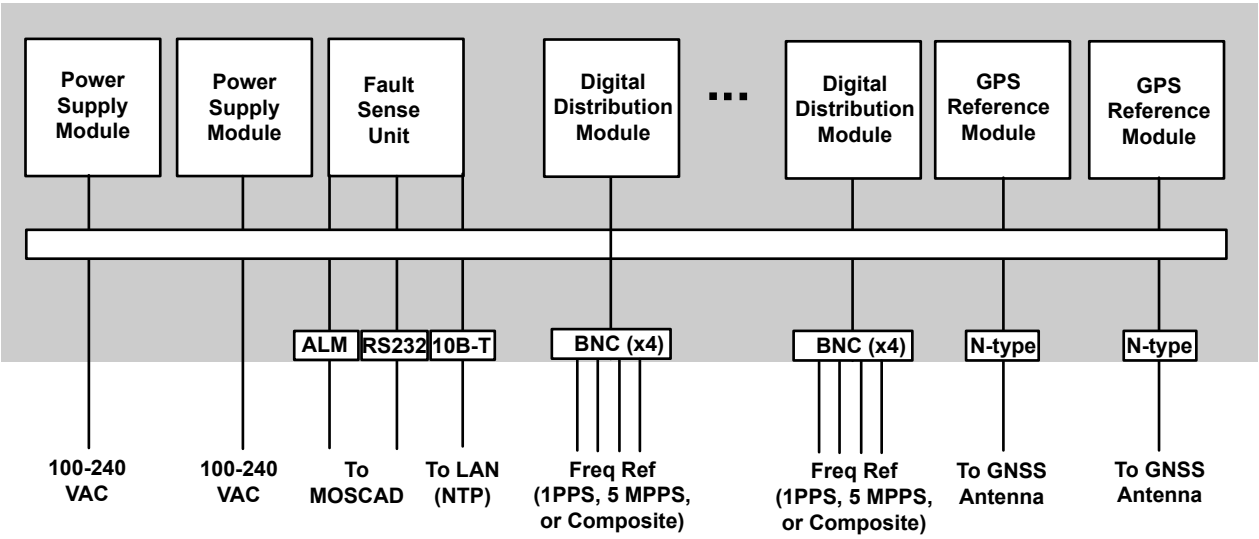
Component	Description
Frequency Distribution Module (FDM)	Can output a 10 MHz frequency reference signal to rear BNC connectors for test equipment use. Allows a service monitor for high accuracy measurements of frequency.
Fault Sense Unit (FSU)	Monitors the overall system activities within the TRAK 9100 SSR and reports any events through the RS232 I/O port or alarm relay that are present in the rear of the chassis. The FSU determines the active GPS reference module through a switch on the front of the module, which can be set to A, B, or AUTO.
Power Supply Module	Redundant 100 VAC-240 VAC input power supply modules provide +5 VDC, +15 VDC, and –15 VDC reference output to other components in the TRAK 9100 SSR. Each AC input has a 3 Amp slow blow fuse.

NOTICE: The number and type of modules varies based on the system requirements of your organization.

2.3.2
TRAK 9100 Simulcast Site Reference Remote Site Architecture

The following figure shows the configuration for a TRAK 9100 Simulcast Site Reference (SSR) at a remote site.

Figure 18: TRAK 9100 SSR – Architecture (Configuration for Remote Site)



2.3.2.1

TRAK 9100 Simulcast Site Reference Remote Site Components

The following table lists the various components that comprise a TRAK 9100 SSR in a remote site.

Table 6: TRAK 9100 SSR – Components for Remote Site

Component	Description
GPS Reference Module	Redundant GPS reference modules are installed in a TRAK 9100 SSR. The left module includes an oscillator and built-in fan. The right module includes a 10 MHz crystal oscillator. Each GPS reference module includes a receiver, which tracks and locks onto satellites for GPS discipline of their own internal clocks. Each GPS reference module provides 1PPS, 5 MPPS, and a composite (1PPS + 5 MPPS) outputs to the backplane, for use by other modules in the chassis. The modules can be manually switched through the FSU module, or automatically switched when an output failure or other fault occurs.
Digital Distribution Module (DDM)	A number of DDMs can be configured to provide 1PPS, 5 MPPS, or composite (1PPS + 5 MPPS) references to other components in the system. These modules are used to support one GTR 8000 Expandable Site Subsystem cabinet/rack (1PPS or 5 MPPS) and GTR 8000 Base Radios composite (1PPS + 5 MPPS) inputs.
Fault Sense Unit (FSU)	Monitors the overall system activities within the TRAK 9100 SSR and reports any events through the RS232 I/O port or alarm relay that are present in the rear of the chassis. The FSU determines the active GPS reference module through a switch on the front of the module, which can be set to A, B, or AUTO.
Power Supply Module	Redundant 100 VAC-240 VAC input power supply modules provide +5 VDC, +15 VDC, and –15 VDC reference output to other components in the TRAK 9100 SSR. Each AC input has a 3 Amp slow blow fuse.

NOTICE: The number and type of modules varies based on the system requirements of your organization.

2.4

TRAK 9100 Simulcast Site Reference Functional Description

The Digital Distribution Module of the TRAK 9100 SSR provides 1PPS and 5 MPPS or composite (1PPS + 5 MPPS) reference signals to various subsystem components.

The following table summarizes components receiving output signals from the TRAK 9100 SSR Digital Distribution Module.

Table 7: Components Receiving Output Signals from the TRAK 9100 SSR

		Digital Distribution Module Output	
Subsystem	Component	Separate (1PPS or 5 MPPS)	Composite (1PPS + 5 MPPS)
Circuit Simulcast Subsystem	ASTRO-TAC 9600™ Comparator	X	

Table continued...

		Digital Distribution Module Output	
Subsystem	**Component**	**Separate (1PPS or 5 MPPS)**	**Composite (1PPS + 5 MPPS)**
Circuit Simulcast Subsystem	GTR 8000 Base Radio	X	X
Circuit Simulcast Subsystem	GTR 8000 Expandable Site Subsystem	X	
Analog IP Simulcast Subsystem	MLC 8000 Comparator		X
IP Simulcast Subsystem	GCM 8000 Comparator	X	
IP Simulcast Subsystem	GTR 8000 Base Radio	X	X
IP Simulcast Subsystem	GCP 8000 Site Controller	X	
IP Simulcast Subsystem	GTR 8000 Expandable Site Subsystem	X	
ASTRO® 25 repeater site – GTR 8000 Expandable Site Subsystem with integrated or standalone GCP 8000 Site Controllers controlling QUANTAR® stations*	QUANTAR® station	X	
ASTRO® 25 repeater site – Standalone GCP 8000 Site Controllers controlling more than six GTR 8000 Base Radios	GCP 8000 Site Controller and GTR 8000 Base Radio	X	
ASTRO® 25 repeater site – Standalone GCP 8000 Site Controllers controlling six or less QUANTAR® stations with or without standalone GTR 8000 Base Radios	QUANTAR® station	X	
ASTRO® 25 repeater site – Standalone GCP 8000 Site Controllers controlling more than six QUANTAR® stations with or without standalone GTR 8000 Base Radios	QUANTAR ® station, GCP 8000 Site Controller, and GTR 8000 Base Radio	X	

*A 1PPS time reference to the site controllers is available only for sites with TDMA or Enhanced Data.

NOTICE: Frequency and Time reference can be used as either Composite or Separate sources. For example, a GTR 8000 Base Radio can accept either a Separate 1PPS and 5 MPPS reference or a Composite (5 MPPS + 1PPS) reference. ASTRO TAC 9600 can only accept Separate 1PPS and 5 MPPS sources (PPS – Pulse Per Second, MPPS Million (Mega) Pulse Per Second). See the individual manuals for each component to determine frequency and time source requirements for specific site configurations.

In addition, the TRAK 9100 SSR provides the following outputs to meet network time and network transport synchronization requirements of the system:

- Coordinated Universal Time (UTC) time for network time synchronization using NTP through the 10Base-T
- T1/E1 signals for network transport synchronization (framed, RS422, and TTL) through a Telecommunications module

NOTICE: TRAK 8835 is a typical solution on analog simulcast systems. It is a lower tier/lower priced timing and reference solution compared to the TRAK 9100.

2.5 TRAK 9100 Simulcast Site Reference Hardware Modules

The following table lists the hardware modules that comprise a TRAK 9100 SSR.

Table 8: TRAK 9100 SSR Hardware Modules

Module	Description
Antenna	Global Navigation Satellite System (GNSS) antenna.
GPS Reference (A1)	Contains a Rubidium oscillator and generates 1PPS and 5 MPPS reference signals. This module has a fan which cools and stabilizes the oscillator.
GPS Reference (A2)	Contains a double oven crystal oscillator included for redundancy.
Power Supply	Converts AC input to DC voltages that are used by all other TRAK 9100 SSR modules.
Frequency Distribution Module	Can output a 10 MHz frequency reference signal to rear BNC connectors for test equipment use.
Fault Sense Unit	Detects system failures and provides control, alarm, and status information.
Telecom Signal Generator	Provides four outputs: 1.544 MHz, 2.048 MHz, T1/E1 framed signals, and E1 framed signals that connect to the channel bank for T1/E1 or E1 synchronization.
Digital Distribution Module	Can be configured for 1PPS, 5 MPPS, or composite signals that are used by the comparators, site controllers, and base radios. As the DDMs are used for 1PPS, 5 MPPS, and composite signals, this module must be the one providing the time reference.

NOTICE: The number and type of modules varies based on the system requirements of your organization.

Chapter 3

TRAK 9100 Simulcast Site Reference Installation

This chapter details installation procedures relating to the TRAK 9100 Simulcast Site Reference (SSR).

3.1 TRAK 9100 Simulcast Site Reference Equipment Rack

The TRAK 9100 SSR is a rack-mounted assembly installed on 48.26 cm (19 inch) equipment racks. The TRAK 9100 SSR unit is secured to an equipment rack before shipment.

The TRAK 9100 SSR unit is installed in a standard 48.26 cm (19 inch) equipment rack along with a small interface panel.

The TRAK 9100 SSR provides framed T1 or E1 output signal to a High Density (HD) 15-pin female connector on the front of the Telco module. Access to the 15 pins (for use by the Digital Access Cross-connect Switch (DACS) as a clock reference when conventional channels are available) is accomplished by running a cable from this connector to a small interface panel attached to the racking equipment. The interface panel acts as an adapter to connect the RJ-45 Ext Clk ports on the DACS to the Telco module on the TRAK 9100 SSR. The HD 15-pin connector for the RS422 outputs is not used in ASTRO® 25 systems.

3.2 TRAK 9100 Simulcast Site Reference Installation

This section describes installation of the TRAK 9100 SSR, including the rack and the antenna.

3.2.1 TRAK 9100 Simulcast Site Reference Rack Installation

This section provides an overview of the TRAK 9100 SSR rack installation.

The prime site in a digital simulcast subsystem contains a TRAK 9100 SSR. The TRAK 9100 SSR provides the timing signal necessary for the comparators (circuit simulcast subsystem) or the comparators and site controllers (IP simulcast subsystem) to provide timing for the base radios to key up simultaneously.

The TRAK 9100 SSR that serves the prime site should be installed in a standard EIA/TIA 48.26 cm (19 inch) rack.

3.2.1.1 Grounding the TRAK 9100 Simulcast Site Reference Chassis

Connect the grounding cable to the ground lug. The ground lug is a screw on the back of the chassis and is located to the left of the AC power receptacles.

NOTICE: Use #6 AWG wire to connect the appropriate lug (connected to chassis ground) to the Rack Grounding Bar (RGB).

3.2.1.2
TRAK 9100 Simulcast Site Reference Power Wiring

Two AC or DC input connectors on the rear of the panel provide power to all the modules in the TRAK 9100 SSR.

3.2.2
GNSS Antenna Installation

This section provides an overview and procedures for installing the Global Navigation Satellite System (GNSS) antenna.

The TRAK 9100 SSR provides 1PPS or 5 MPPS signals to each GTR 8000 Expandable Site Subsystem cabinet/rack and composite (5 MPPS+1PPS) signal (5 MPPS signal at 1 pulse per second repetition rate) to the standalone GTR 8000 Base Radios from the GNSS antenna. These signals establish timing functions for transmit and receive frequencies at the base radios.

3.2.2.1
Installing the GNSS Antenna

When and where to use: Perform this procedure to install the GNSS antenna.

Procedure:

1. Mount the GNSS antenna with an unrestricted aerial down view to within 10 ° of the horizon in all directions.
2. Mount the antennas high enough to clear the peak of the site roof using the following guidelines:
   - For systems in the northern hemisphere, mount the GNSS antennas such that a clear view of the southern sky is maintained.
   - For systems in the southern hemisphere, mount the GNSS antennas such that a clear view of the northern sky is maintained.
3. Isolate the GNSS antennas from RF interference by mounting the antennas at a distance of at least 3.66 m (12 ft) horizontally from the other antennas.
4. Mount the GNSS antennas such that they do not have any obstructions and have a clear path.

   NOTICE: Adjacent structures (such as trees or buildings) are considered obstructions due to their wide and solid profiles. Adjacent antenna towers at the RF site which protrude into the required view (but have a minimal effect on GNSS satellite reception due to their narrow, largely open profiles) are not considered obstructions.

Postrequisites:

IMPORTANT:

- During initial startup, the simulcast system will not operate properly if the GNSS receiver is not locked onto at least four GNSS satellites. These satellites are used to establish a three-dimensional fix (latitude, longitude, and altitude) for the site.
- The TRAK free-runs for a time period defined from the configuration settings. However, after the specified period, the simulcast system will not operate without the GNSS satellite signals. The GNSS antennas must be properly positioned, and the cables and connectors must be properly maintained to ensure the operation of the simulcast system.
- If the TRAK is powered down, the simulcast system cannot operate properly until the GNSS receiver has locked onto the signals from at least four GNSS satellites. **This process takes approximately 13 minutes to 25 minutes to complete.**

3.2.2.2
GNSS Antenna Line Loss

CAUTION: Cutting the cable below a recommended minimum length can cause problems with signal strength overload.

The maximum allowable line attenuation between the antenna and the TRAK is 6 dB. This includes a 4 dB margin for attenuation from foliage. Installations in which the antenna has an unobstructed view of the sky may have a maximum line attenuation of 10 dB.

In a typical installation using 0.5 inch, low density, foam coaxial cable, the length of the cable run should never exceed 45.72 m (150 ft).

This length is sufficient for most installations. When using larger cables, allow 4.5 dB of loss at 1.5 GHz. The remaining 1.5 dB of attenuation is provided by interior site cabling and connectors.

3.2.2.3
No Lock on GNSS Signal Alarm Indication

If a system alarm indicates that the GNSS signal cannot be located, reposition the antenna.

3.2.3
Cabling the TRAK 9100 Simulcast Site Reference Digital Distribution Unit

All output signal connections interfacing to the network is made through the rear panel of the TRAK 9100 Simulcast Site Reference (SSR) Digital Distribution Unit (DDU). The connections are:

- Two power supply (AC or DC) connectors.
- Two GNSS antenna N-type connectors.
- An RJ-45 connector for 10Base-T to distribute Coordinated Universal Time (UTC) through Network Time Protocol (NTP).
- An RJ-45 connector for alarm (relay contacts) reporting.
- A DB-9 connector for Time of Day (TOD) output.
- An RS232 DB-9 connector for diagnostics (VT1/E100)
- An IEEE-488 connector for TRAK 9300 SSR Distribution Unit (DDU).
- A BNC connector board with four ports. A total of six boards can be used for a total of 24 BNC connectors depending on the number of channels. The boards are used for 1PPS, 5 MPPS, or composite (1PPS+5 MPPS) signals, framed 1.544/2.048 Mbps TTL, and IRIG-B (or 10 MHz if desired) outputs depending on the type of modules plugged at the front panel.

NOTICE: Cables providing the composite signals to a simulcast remote site are connected to the base radios with BNC T-connectors.

IMPORTANT: 50 ohm termination must be used on the open end of the last T connector.

The following tables list the front and rear connections for TRAK 9100 SSR.

Table 9: TRAK 9100 SSR – Front Connections

TRAK 9100 SSR Front Connections					
Port	**Connector Type**	**Link Type**	**Port**	**Connector Type**	**Description**
Telco Framed	DB-15 Female	Framed T1/E1	Any device requiring a framed clocking reference	Varies by device	Optional connection based on whether a Telco module was ordered. Also, there can be more than one Telco module depending on the configuration. This module could be located in either the TRAK 9100 SSR or TRAK 9300 SSR chassis.
Telco RS422	DB-15 Female	RS422	Not used	Not used	Located on the same card as the Framed output, but is not used.

Table 10: TRAK 9100 SSR – Rear Connections

TRAK 9100 SSR Rear Connections					
Port	**Connector Type**	**Link Type**	**Port**	**Connector Type**	**Description**
AC inputs: A and B	AC power	100 VAC-240 VAC	100 VAC-240 VAC	Standard AC plug	Connects to an AC mains supply.
DC inputs: A and B	DC power	20 VAC-60 VDC	20 VAC-60 VDC	DC power	Optional configuration for DC powered sites.
Frequency outputs	BNC Female	Configured for 1PPS, 5 MPPS, or composite distribution	Devices requiring reference frequencies	BNC Female	Used for the outputs of DDMs. The ports are labeled as A, B, C, and D. All four ports are configured for the same frequency output. Each port is configured for one of the following frequency outputs: 1PPS, 5 MPPS, or composite.

Table continued...

TRAK 9100 SSR Rear Connections

Port	Connector Type	Link Type	Port	Connector Type	Description
Reference output	12 Pair Female	TRAK 9100 SSR proprietary	Reference input on the TRAK 9300 SSR	12 Pair Female	Used for connecting the TRAK 9100 SSR chassis and the TRAK 9300 SSR chassis. All signals and control of the TRAK 9300 SSR chassis go through this cable. On old models, this port was called distribution I/O on both chassis.
10Base-T	RJ-45	Ethernet	LAN switch	RJ-45	Path for the NTP data. The LAN switch port number varies depending on the site type.
RS232 I/O	DB-9 Female	RS232	There are three possible connections: • To the Terminal Server • To the MOSCAD (NFM) • No connection	RJ-45	Use console port for the TRAK 9100 SSR. The typical connection is to connect an adapter DB-9 to RJ-45 and connect to the terminal server for remote access to the TRAK 9100 SSR, or connect to the MOSCAD (NFM) for routing diagnostic information (alarms). It cannot do both at the same time. It is also possible to leave this port open and only connect to it locally for service.
Alarms	RJ-45	Not used	Not used	Not used	Not used
TOD	DB-9 Female	Not used	Not used	Not used	Not used
GNSS Antennas: A and B	N-Connector	Coax	GNSS Antenna system	Dependent on GNSS antenna used	Connects the TRAK 9100 SSR with the GNSS antennas and are the antenna inputs for the GPS reference modules.

3.2.3.1

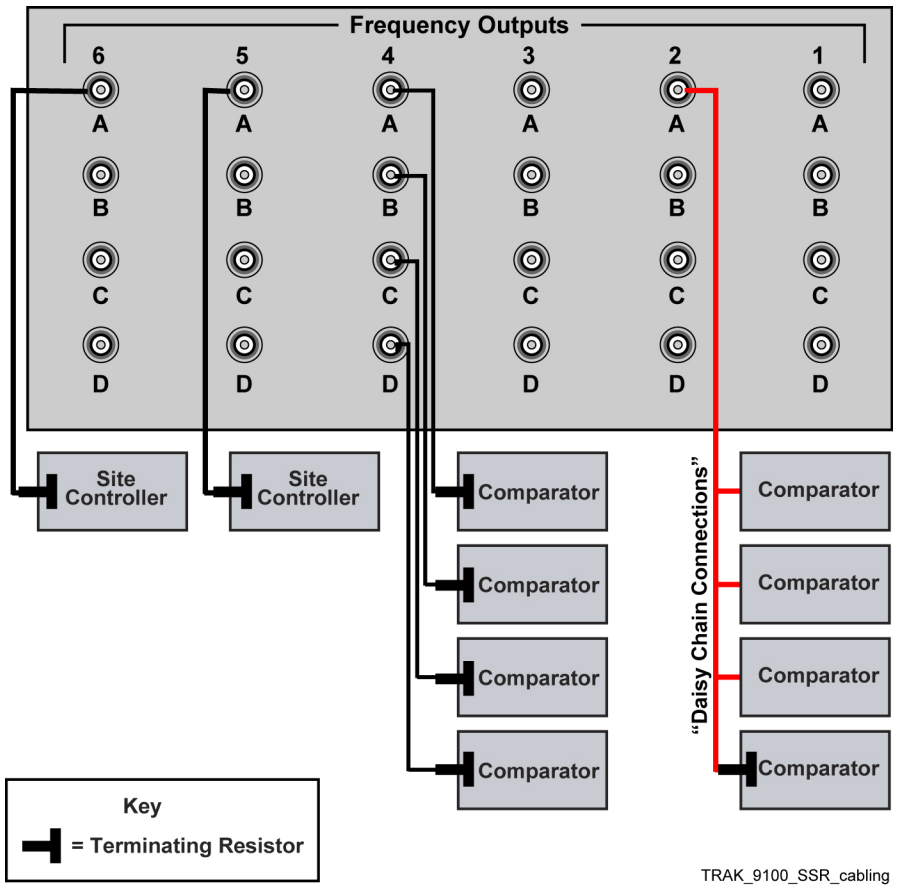
TRAK 9100 Digital Distribution Module Output

There are various alternatives methods for providing DDM output signals to components at a site based on variety of considerations including: type of equipment at a site, type of site, cost considerations, type of signal required, type of site configuration (GTR 80000 Expandable Site Subsystem with junction panels versus a standalone GTR 8000 Base Radio configuration) and DDM port availability. Depending on the type of output signal needed for the component, one method might be to route each of the output signals from a single DDM using separate cables, each with a terminating resistor at each component. Another method might be to “daisy-chain” the output signal from a DDM port using a single cable with a terminating resistor at the last component in the “chain” of components. Another alternative would be to use a combination of methods to meet performance, reliability and/or maintenance considerations for the site. Figure 19: TRAK 9100 SSR DDM – Standalone Device Cabling on page 53 shows various methods that might be used to cable the output of the TRAK 9100 SSR DDM.

NOTICE: The EXT FREQ REF input on the rear of the standalone GTR 8000 Base Radio and 1PPS input on the comparator is high impedance. An external termination is required to properly terminate the cable connected to the input. A BNC "T" and a 50 ohm BNC termination should be connected to the input to terminate the cable. The TRAK 9100 SSR DDM Rev D or later supports one TRAK/PSC output to drive up to 15 base radios or comparators connected over a distance of not more than 25 meters. This type of connection is called a “daisy-chain”. If the cable is “daisy-chained”, only the last device in the chain has the termination.

The following figure shows one DDM that provides support for the primary site controller, one DDM provides support for a redundant site controller, one DDM providing four output signals to various site components and finally one port on a DDM being “daisy-chained” to provide an output signal to various site components.

Figure 19: TRAK 9100 SSR DDM – Standalone Device Cabling



NOTICE: This figure is an example and may not be the method best suited for your application.

3.2.4
Cabling the TRAK 9300 Simulcast Site Reference Distribution Unit

The following tables list the front and rear connections for TRAK 9300 Simulcast Site Reference (SSR) Distribution Unit (DU) expansion with Terminator and Fault Logic (TFL) 9350-6 module slot.

Table 11: TRAK 9300 Simulcast Site Reference – Front Connections

TRAK 9300 SSR DU Front Connections					
Port	**Connector Type**	**Link Type**	**Port**	**Connector Type**	**Description**
Telco Frames	RJ-45	Framed T1/E1	Any device requiring a framed clocking device	Varies by device	Optional connection based on whether a Telco module was ordered. Also, there can be more than one Telco module depending on the configuration. This module could be

Table continued…

TRAK 9300 SSR DU Front Connections					
Port	**Connector Type**	**Link Type**	**Port**	**Connector Type**	**Description**
					located in either the TRAK 9100 SSR or TRAK 9300 SSR chassis.
Telco RS232	DB-15 Female	RS232	Not used	Not used	Located on the same card as the Framed output, but is not used.

Table 12: TRAK 9300 Simulcast Site Reference – Rear Connections

TRAK 9300 SSR DDU Rear Connections					
Port	**Connector Type**	**Link Type**	**Port**	**Connector Type**	**Description**
AC inputs: A and B	AC power	100 VAC-240 VAC	100 VAC-240 VAC	Standard AC plug	Connects to an AC mains supply.
DC inputs: A and B	DC power	20 VAC-60 VDC	20 VAC-60 VDC	DC power	Optional configuration for DC powered sites.
Frequency outputs	BNC Female	Configured for 1PPS, 5 MPPS, or composite distribution	Devices requiring reference frequencies	BNC Female	Used for the outputs of DDMs. The ports are labeled as A, B, C, and D. All four ports are configured for the same frequency output. Each port is configured for one of the following frequency outputs: 1PPS, 5 MPPS, or composite.
Reference input	12 Pair Female	TRAK proprietary	Reference output on the TRAK 9100 SSR	12 Pair Female	Used for connecting the TRAK 9100 SSR chassis and the TRAK 9300 SSR chassis. All signals and control of the TRAK 9300 SSR chassis go through this cable. On old models, this port was called distribution I/O on both chassis.

Chapter 4

TRAK 9100 Simulcast Site Reference Configuration

This chapter details configuration procedures relating to the TRAK 9100 Simulcast Site Reference (SSR).

4.1 Configuring TRAK 9100 Simulcast Site Reference

This section provides an overview of how to configure the TRAK 9100 Simulcast Site Reference (SSR).

The TRAK 9100 SSR requires configuration before its use by the system. See the system-specific configuration documentation from Motorola.

Few parameters need programming in a TRAK 9100 SSR. These parameters include the IP address and subnet mask of the Network Time Protocol (NTP) engine, the holdover time, daylight savings, local time, and antenna cable length in the GPS engine.

The Digital Distribution Module (DDM), Frequency Distribution Module (FDM), and Telecommunications (Telco/TEL) module are configured by jumper settings.

The TRAK 9100 SSR is used at the prime and remote sites. If a simulcast prime site is colocated at the master sit/zone core, only one TRAK 9100 SSR with one or more TRAK 9300 SSR Digital Distribution Units (DDU) is required to support the master site/zone core and a simulcast prime site. A maximum of three TRAK 9300 SSR DDUs can be daisy chained to a TRAK 9100 SSR.

4.1.1 Configuring TRAK 9100 Simulcast Site Reference Network Time Server

This section provides an overview and procedures for configuring the Network Time Server (NTS) board installed on the Fault Sense Unit (FSU) module.

NTS is an optional daughter board installed on the FSU module in the TRAK 9100 Simulcast Site Reference (SSR) to provide time synchronization for Ethernet devices using the NTP.

The default IP address and netmask address of the TRAK 9100 SSR must be changed, so that it can operate on the system network.

Follow the appropriate procedures to change the IP address of the TRAK 9100 SSR for your system, if necessary:

- Configuring TRAK 9100 Simulcast Site Reference with 9104-2 Fault Sensor Unit IP Address with Default IP on page 56, if the TRAK 9100 SSR uses its stored, factory-default IP address.
- Configuring TRAK 9100 Simulcast Site Reference with 9104-2 Fault Sensor Unit IP Address Without Default IP on page 57, in the following scenarios:
  - The factory-default IP address is in use on the network by another device.
  - A non-valid IP address is loaded into the NTS engine by mistake.
  - The IP address is unknown.

NOTICE: Address Resolution Protocol (ARP) is required to change the address in the procedure, in “Configuring TRAK 9100 Simulcast Site Reference with 9104-2 Fault Sensor Unit IP Address Without Default IP”.

4.1.1.1

Configuring TRAK 9100 Simulcast Site Reference with 9104-2 Fault Sensor Unit IP Address with Default IP

Prerequisites: Contact your system administrator for the default TRAK 9100 Simulcast Site Reference (SSR) IP address before performing this procedure.

When and where to use:
Follow these steps to configure the TRAK 9100 with the TRAK 9104-2 Fault Sense Unit. If the TRAK 9100 SSR uses its stored factory-default IP address, follow this procedure to configure the IP address of the TRAK 9100 SSR.

Procedure:

1. Establish a Telnet session with the NTS. Use the default IP address (in the format `x.Z.x.x`, where `Z` is the zone number) and enter Port `9999`.

   - For the prime site – When logged on, the following message appears:

     ```
     *** NTS ***
     Serial Number 6301542 MAC Address 00:20:4A:63:06:06
     Software version 04.52 (0112119)
     Press Enter to go into Setup Mode
     ```

   - For the remote site – When logged on, the following message appears:

     ```
     ACOLA FunkUhr Snr 126-159 V2.98”...
     ```

2. Click **Enter** within 3 seconds to enter ACOLA setup mode.

   - For the prime site – The following message appears:

     ```
      Change setup (0 Basic configuration, 1 NTS configuration,
     7 Factory defaults, 8 Exit without save, 9 Save and exit)?
     ```

   - For the remote site – The following message appears:

     ```
     Change setup (0 Basics, 1 FunkUhr, 8 Exit, 9 Save and exit)?
     ```

3. Complete one of the following:
   - For the prime site, select **Basic configuration**. Press **Enter.**
   - For the remote site, select **Basics**. Press **Enter**.
4. Type the IP address: `x.Z.x.x`. Press **Enter**.
5. Press **Enter** at the `Set Gateway IP address Default (Y)` prompt.

IMPORTANT: For the remote site, proceed to step 7.

6 Type the gateway IP address: `x.Z.x.x`. Press **Enter**.

7 Enter the number of bits used for the network class. Setting the network class requires that you know the class of the network your system is using:

- 8 for Class A network
- 16 for Class B network
- 24 for Class C network

See the system IP plan or your system-specific configuration documentation from Motorola for the appropriate number of bits.

8 At the `Telnet configuration password Default (N)` prompt, press **Enter**.

9 Enter **9** to exit and save these entries. This last command completes the IP address setup. The NTS on the FSU module of TRAK 9100 SSR is now ready for NTP.

4.1.1.2

Configuring TRAK 9100 Simulcast Site Reference with 9104-2 Fault Sensor Unit IP Address Without Default IP

Prerequisites: Contact your system administrator for the TRAK 9100 Simulcast Site Reference (SSR) IP address before performing this procedure.

When and where to use:
Follow these steps to configure the TRAK 9100 with the TRAK 9104-2 Fault Sense Unit. To configure the TRAK 9100 SSR IP address without the default IP, follow this procedure in the following scenarios:

- The factory-default IP address is in use on the network by another device
- A non-valid IP address is loaded into the NTS engine by mistake
- The IP address is unknown

Procedure:

1 Remove the FSU Model 9104 from the main frame, and then locate the serial number of the NTS engine. For example: NTS SER No. 126-159

2 Replace the FSU Model 9104.

3 Convert the serial number of the NTS engine to hex. For example: NTS SER No. 126-159 to 7e-9f

4 Calculate the TRAK 9100 SSR MAC address (00 - 20 - 4a - 01 - xx - xx, where xx - xx is the hex number calculated in step 3). For example: 00 - 20 - 4a - 01 - 7e - 9f

5 Locate the IP address assigned from the system IP plan or the system-specific configuration documentation from Motorola.

6 At the DOS prompt, change to `C:\windows` directory and run the following command: `<arp -% <IP address> 00-20-4a-01-7e–9f>`

7 Run `trak`.

The TRAK window appears.

8 Select **Connect, Remote System**.

9 Enter the following:

- Host: `<IP address>`

- Port: `1`
- Term Type: `VT100`

10 Press **Enter**.

Connection fails.

11 Select **OK**. Click **Connect, Remote System**.

12 Enter the following:

- Host: `<IP address>`
- Port: `9999`
- Term Type: `VT100`

When logged on, the following message appears:

```
*** NTS ***
Serial Number 6301542 MAC Address 00:20:4A:63:06:06
Software version 04.52 (0112119)
Press Enter to go into Setup Mode
```

13 Press **Enter** within 3 seconds to enter ACOLA setup mode.

The following message appears:

```
 Change setup (0 Basic configuration, 1 NTS configuration,
7 Factory defaults, 8 Exit without save, 9 Save and exit)?
```

14 Select **Basic configuration**. Press **Enter**.

15 Enter ***<IP address>***. Press **Enter**.

16 Press **Enter** at the `Set Gateway IP address (N)` prompt.

17 Select **1 (FunkUhr)**.

18 Select **1** to enter the NTS Setup.

19 Press **0** to disable the UDP port.

20 Type **000** to send the block every n minute.

21 Type **N** to send UDP broadcast (N).

22 Enter up to eight target addresses for the UDP block (0.0.0.0).

23 Enter **9** to exit and save these entries. This last command completes the IP address setup. The NTS on the FSU module of the TRAK 9100 SSR is now ready for NTP.

Postrequisites:

- See the System IP plan for the correct IP addresses.
- Consult the system administrator for the IP address and subnet mask assignments for your system.

4.1.2
Configuring TRAK 9100 Simulcast Site Reference with Fault Sense Unit

The TRAK 9104-9 Fault Sense Unit (FSU) is set up to replace the existing TRAK 9104-2 FSU module in the TRAK 9100 Simulcast Site Reference (SSR). The new FSU 9104-9 module has the same functionality as the existing FSU module.

NOTICE: The TRAK 9100 SSR may have TRAK 9104-2 or TRAK 9104-9 FSU module. Identify the FSU module by the label in front of the module, which indicates REV D or REV D-1 for TRAK 9104-2 and REV-9 for TRAK 9104-9 FSU modules respectively.

4.1.2.1
Configuring TRAK 9104-9 Fault Sense Unit

Prerequisites: Contact the system administrator for the IP address, netmask address, and gateway address before performing this procedure.

When and where to use: Follow these steps to configure the TRAK 9104-9 Fault Sense Unit.

Procedure:

1. Connect the PC/laptop to the RS232 I/O port at the rear of the TRAK 9100 SSR unit, using a DB-9 to DB-9 straight-through cable.
2. Start **ProComm** or **HyperTerm** session with data rate of 9600 baud, 8, 1, and N.
3. Press **Enter**.

   The following prompt appears:

   ```
   9100>
   ```

4. Type **CFG**. Press **Enter**.

   When logon is completed, the following message appears:

   ```
   ******************************************
   * CONFIGURATION SETTINGS *
   ******************************************
   NETWORK SETTINGS
   ================
   IPADDR x.x.x.x
   NETMASK x.x.x.x
   GATEWAY *
   INETD PROTOCOLS
   ===============
   IDLE-TIMEOUT (MINS)
   ON/OFF DISCONNECT DISABLE
   ------ ---------- -------
   SSH ON 30 --
   TELNET OFF 30 0
   TFTP OFF -- 0
   HTTP OFF
   SYSTEM SETTINGS
   ----------------
   RQFS ON
   SYSLOG SETTINGS
   ----------------
   REMOTE *
   LOG_MASK 7F -> (7) LOG_DEBUG OFF
   (6) LOG_INFO ON
   (5) LOG_NOTICE ON
   (4) LOG_WARNING ON
   (3) LOG_ERR ON
   (2) LOG_CRIT ON
   (1) LOG_ALERT ON
   (0) LOG_EMERG ON
   ```

5. To configure the IP address, enter:

```
9100> CFG IPADDR <IP address>
```

6 To configure the netmask address, enter:

```
9100> CFG NETMASK <IP address>
```

7 To configure the gateway address, enter:

```
9100> CFG GATEWAY <x.Z.x.x>
```

where **Z** is the zone number.

8 To change the default Telnet idle time, enter:

```
9100> CFG TELNET IDISCONN 30
```

Enable the Telnet with 30 minutes of idle time.

9 To change the default Telnet disconnect setup, enter:

```
9100> CFG TELNET IDISABLE 0
```

This permits the Telnet to disconnect the session after time-out without disabling.

Postrequisites:

- To remove a setting, enter asterisk (*) for an IP address, netmask address, or gateway address.
- When the TELNET is set to ON, the IDLE-TIMEOUT DISCONNECT time can be set from 1 minute to 99 minutes. Once this time expires, the Telnet session is disconnected. However, it is possible to Telnet once the DISABLE time is set to 0. If the DISABLE time (up to 99 minutes) is set to other than 0, then the Telnet is disabled after the DISABLE time is expired.
- Consult with your system administrator for the IP address and subnet mask assignments for your system.

4.1.2.2

Configuring TRAK 9104-14 Fault Sense Unit and TRAK 8835 in the Command Line

Prerequisites:
Perform this procedure to configure the TRAK 9104–14 (Fault Sense Unit (FSU) card of TRAK 9100 Network Time Protocol (NTP) Server), TRAK 8835-8M, or TRAK 8835-3M to enable SNMPv3.

Obtain the following passwords and account information:

- username/password.
- Authentication and Privacy passwords for the SNMPv3.
- System Contact, System Name, and System Location required for System Information Setup.
- The SNMPv3 trap user password length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9).
- Simple Network Management Protocol (SNMP) password length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z), numeric characters (0-9), and any of the allowed special characters (! % & ( ) * + , - . / : ; < = >?).
- SNMPv3 Manager addresses, for example, 10.x.233.20.
- Consult the *System IP Plan* or System Administrator.

Obtain the following hardware:

- Command-line configuration supported on the following TRAK models only: TRAK 9100 NTP Server (with FSU TRAK 9104-14), TRAK 8835-3M, and TRAK 8835-8M.
- Computer with Internet Browser (Internet Explorer), ProCom, or HyperTerm Terminal Emulator, and a PuTTY application for a Secure SHell (SSH) logon.

- RS232 DCE to DTE cable to connect the computer to the TRAK devices console port. The cable is a straight through DB9 to DB9 (M-F) cable. The regular RSR232 Null modem cable does not work.
- Ethernet cable.

CAUTION: The existing TRAK 9100 Time and Frequency reference device uses an FSU TRAK 9104–9 to communicate with the entire device. This FSU card must be replaced with the FSU TRAK 9104–14 model before proceeding to deployment of new configurations.

Procedure:

1. Install the TRAK 9104-14 FSU card for the TRAK 9100. See Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module on page 96. For TRAK 8835 device, go to step 2.
2. Connect the computer/laptop to the RS232 I/O port at the rear of the TRAK 9100 and through the dongle RS-232 connector of the TRAK 8835 devices using a DB-9 to DB-9 straight-through cable.
3. For TRAK 9100 NTP Server and 8835 devices, start ProComm or HyperTerm session with data rate of 9600 baud, 8, 1, and N. Press ENTER.
4. Set the IP/Netmask address for the TRAK 9100 NTP Server and 8835 devices. Perform the following actions:
   - At the command line, enter `9100>ip4 <IP address><subnet mask>` (for example: 10.1.233.88/24).
   - At the command line, enter `8835>ip4 <IP address><subnet mask>` (for example: 10.1.233.88/24)

   To verify the exact IP address, see your system IP plan or contact your system administrator.
5. Set the gateway address for the TRAK 9100 NTP Server and 8835 devices. Perform the following actions:
   - At the command line, enter `9100>ip4 gw <gateway address>` (for example: 10.1.233.254).
   - At the command line, enter `8835>ip4 gw <gateway address>` (for example: 10.1.233.254).

   To verify the exact gateway address, see your IP plan or contact your system administrator.
6. Enable SNMP. Perform the following actions.
   - For TRAK 9100 NTP Server: At the command line, enter `9100>SNMP on`. Press ENTER. The success message appears after the command-line entry for the TRAK 9100 NTP Server.
   - For TRAK 8835 device, at the command line, enter `8835>SNMP on`. Press ENTER. A successful message appears after the command-line entry for the TRAK 8835.
7. Set up System Information for the TRAK 9100 NTP Server. Perform the following actions.
   a. Enter `9100>snmp contact<contact name>`. Press ENTER.
   b. Enter `9100>snmp name<system name>`. Press ENTER.
   c. Enter `9100>snmp location<location name>`. Press ENTER.

   A successful message appears after each command-line entry for the TRAK 9100 NTP Server.
8. Set up System Information for the TRAK 8835 device. Perform the following actions.
   a. Enter `8835>snmp contact<contact name>`. Press ENTER.
   b. Enter `8835>snmp name<system name>`. Press ENTER.

c Enter `8835>snmp location<location name>`. Press ENTER.

A successful message appears after each command-line entry for the TRAK 8835.

9 Enable SNMP Trap for TRAK 9100 NTP Server. Perform the following actions.

a Enter `9100>snmp trap fault on`. Press ENTER.

b Enter `9100>snmp trap login on`. Press ENTER.

c Enter `9100>snmp trap cfg on`. Press ENTER.

d Enter `9100>snmp trap ntp on`. Press ENTER.

e Enter `9100>snmp trap tu <Trap username>`. Press ENTER

f Enter `9100>snmp trap FSU on`. Press ENTER

g Enter `9100>snmp trap GPS on`. Press ENTER.

h Enter `9100>snmp trap DISTMOD on`. Press ENTER.

i Enter `9100>snmp trap PS on` . Press ENTER.

A successful message appears after each command-line entry for the TRAK 9100 NTP Server.

The SNMPv3 user authentication or encryption passphrase **<*Trap username*>** must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9).

10 Enable SNMP Trap for TRAK 8835 device. Perform the following actions.

a Enter `8835>snmp trap fault on` Press ENTER.

b Enter `8835>snmp trap login on` Press ENTER.

c Enter `8835>snmp trap cfg on` Press ENTER.

d Enter `8835>snmp trap ntp on` Press ENTER.

e Enter `8835>snmp trap tu <Trap username>` Press ENTER.

A successful message appears after each command-line entry for the TRAK 8835.

11 Enable Secure SHell (SSH). Perform the following action.

a At the command line, enter `9100>SSH on`. Press ENTER.

b At the command line, enter `8835>SSH on`. Press ENTER.

A successful message appears after the command-line entry for the TRAK 9100 NTP Server or TRAK 8835.

12 Customize the Login Banner Message. Perform the following actions.

a At the command line, enter `9100>banner` and edit the text of the banner. Press ENTER.

b At the command line, enter `8835>banner` and edit the text of the banner. Press ENTER.

Use `"\n"` for sentence breaks when necessary.

13 Enable HTTP/HTTPS. Perform the following actions.

a For TRAK 9100 NTP Server: At the command line, enter `9100>HTTP` Press ENTER.

b For TRAK 9100 NTP Server: At the command line, enter `9100>HTTPS` . Press ENTER.

c For TRAK 8835 device: At the command line, enter `8835>HTTP` Press ENTER.

d For TRAK 8835 device: At the command line, enter `8835>HTTPS` Press ENTER.

A successful message appears after each command-line entry for the TRAK 9100 NTP Server or TRAK 8835.

14 Enable Telnet (if Information Assurance (IA) system Telnet is disabled). Perform the following actions.

a For TRAK 9100 NTP Server: At the command line, enter `9100>telnet on` Press ENTER.

b For TRAK 8835 device: At the command line, enter `8835>telnet on` Press ENTER.

A successful message appears after the command-line entry for the TRAK 9100 NTP Server or TRAK 8835.

15 Generate SSH Key using the key size 2048 bits. Perform the following actions.

a For TRAK 9100 NTP Server: At the command line, enter `9100>SSHKEY GEN Fortitoken 2048` Press ENTER.

b For TRAK 8835 device: At the command line, enter `8835>SSHKEY GEN Fortitoken 2048` Press ENTER.

A successful message appears after each command-line entry for the TRAK 9100 NTP Server or TRAK 8835.

The SSH key generation depends key length (1024, 2048, 4096). The “success” response completes within a few minutes up to 45 minutes. Verify SSH Key is generated by entering SSHKEY at the prompt of the TRAK 9100 NTP Server or TRAK 8835.

16 Configure User and SNMPv3 trap account with Authentication and Privacy setup. Perform the following actions:

a Add User Account for the TRAK 9100/TRAK 8835. Enter `9100>user` or `8835>user add` ***<username>*** `pwd` ***<password>*** `AP sha` ***<Authentication_Passphrase>*** `pp AES` ***<Privacy_Passphrase>*** `ro` Press ENTER.

For example:
`9100>user add` ***<S&h 1umBurgH>*** `pwd` ***<S&h 1umBurgH>*** `ap sha` ***<SHA PQtQ $Qla>*** `pp AES` ***<MzFt!6qst>*** `ro`

Obtain the username, Authentication_Passphrase, and Privacy_Passphrase from your System Administrator. Username and password passphrase length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9).

b Modify User Account for the TRAK 9100/TRAK 8835. Enter `9100>user mod` or `8835>user mod` ***<username>*** `pwd` ***<password>*** `ap sha` ***<Authentication_Passphrase>*** `pp AES` ***<Privacy_Passphrase>*** `ro` Press ENTER.

Obtain the username, Authentication_Passphrase, and Privacy_Passphrase from your System Administrator. Username and password passphrase length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9).

c Configure SNMPv3 trap account for the TRAK 9100/TRAK 8835. Enter `9100>snmp tap SHA tapw` or `8835>snmp tap SHA tapw` ***<trap_Auth_Passphrase>*** `tpp AES tppw` ***<trap_privacy_Passphrase>***
Press ENTER.

For example: Enter `9100>snmp tap SHA tapw` or `8835>snmp tap SHA tapw` ***<PQtQ $Qla>*** `tpp AES tppw` ***<MzFt!6qst>***

- Obtain the username, Authentication_Passphrase, and Privacy_Passphrase from your System Administrator.
- SNMP passphrase length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z), numeric characters (0-9), and any of the allowed special characters (! % & ( ) * + , - . / : ; < = >?).

17 Configure SNMP Get requests and Trap clients.

a For SNMP Get requests, enter `gc`***<get client number 0 – 3><ip (v6 or v4) addr>/<netmask>***

b For Trap clients enter `tc`***<trap client number 0 – 3><ip (v6 or v4) addr>***

The following Get requests and Trap client configuration and IP addresses are provided as an example:

- `Client 1`
- `gc0 10.1.233.20/24`
- `tc0 10.1.233.20`

The following Get requests and Trap client configuration and IP addresses are provided as an example:

- `Client 2`
- `gc1 10.1.237.20/24`
- `tc1 10.1.237.20`

Locate the IP addresses used. Contact your system administrator for assistance.

4.1.2.3

Configuring the TRAK 9104-14 Fault Sense Unit and TRAK 8835 Through Web Browser

Prerequisites:
Perform this procedure for configuring the TRAK 9104-14 Fault Sense Unit (FSU) card of TRAK 9100 Network Time Protocoa (NTP) Server, TRAK 8835-8M, or TRAK 8835-3M to enable SNMPv3.

Using Web GUI to configure the TRAK devices is optional. To configure using Web GUI using HTTPS, disconnect the Ethernet from the network and connect to the laptop/computer. Do not attempt to access the TRAK device from a remote computer/Network Management (NM) client.

The following passwords and account information is required:

- username/password
- Authentication and Privacy passwords for the SNMPv3
- System Contact, System Name, and System Location required for System Information Setup
- The SNMPv3 trap user password length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z) and numeric characters (0-9).
- SNMP password length must be 8-16 characters long and may contain uppercase and lowercase alphabetic characters (A-Z) and (a-z), numeric characters (0-9), and any of the allowed special characters (! % & ( ) * + , - . / : ; < = >?).
- SNMPv3 Manager addresses for example, 10.x.233.20.
- When setting up the preceding parameters see the system requirement setup for the Universal Element Manager being used in the system.

- Consult the *System IP Plan* or System Administrator.

The following hardware is required:

- Web browser configuration is supported on the following TRAK models only: TRAK 9100 NTP Server (with FSU TRAK 9104-14), TRAK 8835-3M, and TRAK 8835-8M.
- Computer with Internet Browser (Internet Explorer), ProCom, or HyperTerm Terminal Emulator, and a PuTTY application for a Secure SHell (SSH) login.
- RS232 DCE to DTE cable to connect the computer to the TRAK devices console port. Cable is a straight through DB9 to DB9 (M-F) cable. The regular RSR232 Null modem cable does not work.
- A straight through or crossover Ethernet cable

CAUTION: The existing TRAK 9100 Time and Frequency reference device uses an FSU TRAK 9104-9 to communicate with the entire device. This FSU card must be replaced with the new FSU TRAK 9104-14 model before proceeding to deployment of new configurations.

Procedure:

1. Install the TRAK 9104-14 FSU card for the TRAK 9100 NTP Server. See Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module on page 96.
2. Connect the computer/laptop using a DB-9 to DB-9 straight-through cable to:
   a. The RS232 I/O port at the rear of the TRAK 9100 NTP Server.
   b. The dongle RS-232 connector of the TRAK–8835.
3. Open **Internet Explorer** on the client computer.
4. In the browser address field, enter the URL of the TRAK device, `https://10.1.233.88`, and press ENTER. Each time the **Security Alert** dialog box appears, select **Yes**. The Windows 7 login banner appears.
5. In the Windows 7 login banner, enter the valid TRAK 9100 NTP Server or TRAK 8835 user name and password. Click **Connect**.

   The TRAK client GUI appears.
6. Setup user name and password for Universal Element Manager. In the **TRAK Microwave** navigation window, in the first **User Name** section in the **Settings** field, specify the required criteria.
   a. **User Name** and **Password** field, the default username/password is already set (do not delete the default username/password).
   b. **Public Key** field, leave empty.
   c. **SNMP Authentication Protocol** field, select **None** from the drop-down menu. A password is not required.
   d. **Privacy Protocol** field, select **None** from the drop-down menu. A password is not required.
   e. **SNMP Access** field, select **None** from the drop-down menu.
   f. Select **Save**

   Modification of a user causes Simple Network Management Protocol (SNMP) to generate a cold trap.
7. In the **TRAK Microwave** navigation window in the second **User Name** section, specify the required criteria.
   a. **User Name** field, enter ***<user name>*** (for example: SystemMaster).
   b. **Password** field, enter ***<password>*** (for example: SystemPass12).
   c. **Public Key** field, leave empty.

d **SNMP Authentication Protocol** field, select **SHA** from the drop-down menu. Enter the password (for example enter “Motorola1234”).

e **SNMP Privacy Protocol** field, select **AES** from the drop-down menu. Enter the password (for example enter “Motorola1234”).

f **SNMP Access** field, select `RO` from the drop-down menu.

g Select **Save**

- Leave the remaining two username/password fields empty.
- User Name can be clear (noAuth/NoPriv), AuthOnly, AutPriv, and username/access must match the Universal Element Manager being used in the system.
- Modification of a user causes SNMP to generate a cold trap.

8 Enable SNMP. Specify the required fields.

a **SNMP** field, select on

b **System Contact** field, enter **<*`contact name`*>**.

c **System Name** field, enter `8835–8m-Zone1` or `8835-3m-Zone1` or `9100-Zone1`.

d **System Location** field, enter `PRNE_Lab`.

e **Get Client 1, 2, 3, 4** fields, enter **<*`addresses`*>**. For example: `10.1.233.20/24, 10.1.237.20/24, 10.z.233.20.24, .....`

f **Set Client 1, 2, 3, 4** field, leave blank.

g **Trap Client 1, 2, 3, 4** fields, enter **<*`addresses`*>** For example: `10.1.233.20, 10.1.237.20, 10.z.233.20,...`

h **Trap SNMP Authentication Protocol** field, select **SHA** from the drop-down field and enter **<*`password`*>**.

i **Trap SNMP Privacy Protocol** field, select **AES** from the drop-down field and enter **<*`password`*>**

j Select **Save**

The Trap username MotoMaster must match with Universal Element Manager.

9 Verify the configured Get and Trap clients in the TRAK device using Telnet/SSH. See Verifying the Configurations of the TRAK 9100 and TRAK 8835 Through Telnet on page 67.

Example of Get and Trap clients.

- Get Client 0: ::ffff:`10.2.237.20/120`
- Get Client 1: ::ffff:`10.1.233.20/120`
- Get Client 2: ::fffff:`10.1.237.20/120`
- Get Client 3: ::fffff:`10.2.233.20/120`
- Trap Client 0: ::ffff:`10.2.237.20`
- Trap Client 1: ::ffff:`10.1.233.20`
- Trap Client 2: ::ffff:`10.1.237.20`
- Trap Client 3: ::ffff:`10.2.233.20`

10 Verify that Fortitoken key Fingerprint in the TRAK devices supports SSH-Fortitoken with 2048 key length. See “Verifying Fingerprint in SSH Session Warning Banner” in the *Securing Protocols with SSH* manual.

11 The following password change procedures are common to all the TRAK devices. Only maintenance personnel can use or change these passwords. To change the password on the TRAK devices, log on as the user at the console port using Web Browser.

a In the navigation panel **SERAUTH Server**, select **off**.

b In the **Idle Disconnect** field, enter 25.

c Select **Save** after making selections.

CAUTION: Use caution when enabling this feature. When passwords are changed from the factory default settings and are misplaced or forgotten, they cannot be recovered. If this situation occurs, return the TRAK device to the vendor so it can be reset to its factory defaults.

4.1.2.4

Verifying the Configurations of the TRAK 9100 and TRAK 8835 Through Telnet

After the configuration changes, perform this procedure for verification.

Prerequisites:
Contact your system administrator for the administrator ID and TRAK 9100 Simulcast Site Reference (SSR) and 8835 Site Reference device IP address.

For non-secure systems, enable Telnet by performing the following actions:

- **For TRAK 9100 NTP Server:** At the command line, enter: `9100>telnet on`
- **For TRAK 8835 device:** At the command line, enter: `8835>telnet on`

Procedure:

1 Start a Telnet session with TRAK 9100 SSR or 8835 Site Reference using the IP address from your system administrator.

2 Enter a user name and a password:

a Remote login: ***<administrator ID>***

b Password: ***<password>***

3 At the `9100> or 8835>` prompt, enter: `CFG` and verify that the configuration is changed.

4.1.3

Configuring TRAK Digital Distribution Module

The output selector switch on the Digital Distribution Module (DDM) must be configured appropriately for your system. The following table provides the switch settings that are used to configure the DDM to the appropriate reference output value.

Table 13: DDM Reference Output Configuration – Switch Settings

SW1 Setting	Reference Output
0	1PPS
1	Composite (1PPS + 5 MPPS)
2	5 MPPS

4.1.4
Configuring TRAK Frequency Distribution Module

Jumper settings on the Frequency Distribution Module (FDM) should be configured appropriately for your system.

NOTICE: Not all systems use the FDM.

4.1.4.1
TRAK Simulcast Site Reference FDM Settings

If your system includes an FDM, use the following table when configuring the FDM for the appropriate output signal.

Table 14: FDM Output Signal Configuration – Jumper Settings

Output	Jumper Positions
10 MHz	E1: Jumper 1 and 2, E2: Jumper 1 and 2
IRIG-B	E1: Jumper 3 and 4, E2: Jumper 3 and 4

NOTICE: If necessary, use the Output Level Trim adjustment to equalize the module to module output levels from the factory adjustment.

4.1.5
Configuring TRAK Simulcast Site Reference Telecommunications Module

This section includes the information for configuring the Telecommunications module (Telco module). The Telco module has an eight pole, two-position (ON or OFF) switch (S1) and four strap options, which enable the operator to select between several different T1 and E1 options, allowing for flexibility in the way the board may be used.

The Telco module is factory configured for either T1 or E1 telecommunication outputs and cannot be changed in the field. This module includes both clock and framed signals.

- T1 or E1 framing configuration (factory configure only):
  - Output ground isolation: R33 – R36, 0 Ω resistors not installed (isolated)
  - Clock select: J3, jumper pins 1 and 2 (1.544 Mbps)
  - Output transformer impedance selection: J5 – J8, jumper pins 1 and 2 (120 Ω)
- E1 framing configuration (factory configure only):
  - Output ground isolation:
    + R33 – R36, 0 Ω resistors not installed (isolated), for balanced 120 Ω output
    + R33 – R36, 0 Ω resistors installed (non-isolated), for unbalanced 75 Ω output
  - Clock select: J3, jumper pins 2 and 3 (2.048 Mbps)
  - Output transformer impedance selection:
    + J5 – J8, jumper 1 and 2 (120 Ω)
    + J5 – J8, jumper 2 and 3 (75 Ω)

4.1.5.1

Configuring TRAK Simulcast Site Reference Telco Module – T1 Framing Format

The T1 options for switch S1, positions 4 through 8, allow for enabling or disabling “Transmit Yellow Alarm,” selecting “193E” or “193S” framing modes, 193S framing mode S-bit insertion through “internal” or “external,” enabling or disabling “B8ZS,” and “transparent” or “bit 7” Zero Suppression stuffing. The factory settings are S1-2, S1-3, and S1-7 are “OFF,” and all others are “ON.” This option provides a 0 ft –133 ft line length and 193E Framing Mode select.

Use the following table to configure the T1 framing format parameters for the Telco module.

Table 15: TEL Framing Format Switch Positions for T1

S1 Settings	On	Off
S1-4	B8ZS Disabled	B8ZS Enabled
S1-5	Transparent Zero Suppression	Bit 7 Stuffing Zero Suppression
S1-6	Yellow Alarm Transmit Disabled	Yellow Alarm Transmit Enabled
S1-7	193S Select	193E Select
S1-8	Internal 193S Bit Selection	External 193S Bit Selection

4.1.5.2

Configuring TRAK Simulcast Site Reference Telco Module – E1 Framing Format

The E1 (CEPT) options for switch S1, positions 4 through 8, allow for Transmit Remote Alarm “enabled” or “normal” operation, Transmit Distant Multiframe Alarm “enabled” or “normal” operation, I/O data either “AMI” or “HDB3” coded, Transmit, and Receive CRC4 Multiframe “enabled” or “disabled,” and Transmit and Receive CAS Multiframe “enabled” or “disabled”. The factory settings are S1-2, S1-3, and S1-7 are “OFF,” and all others are “ON.” This option provides a 0 ft – 133 ft line length and 193E Framing Mode select.

Use the following table to configure the E1 framing format parameters for the Telco module.

Table 16: TEL Framing Format Switch Positions for E1

S1 Settings	On	Off
S1-4	Transmit CAS M frame enabled	Transmit CAS M frame disabled
S1-5	Transmit CRC4 M frame disabled	Transmit CRC4 M frame enabled
S1-6	Data AMI encoded	Data HDB3 encoded
S1-7	Transmit Distant Multiframe Alarm normal	Transmit Distant Multiframe Alarm enable
S1-8	TRA normal	TRA alarm enable

4.1.5.3

TRAK Simulcast Site Reference Telco Module – T1 or E1 Line Length Compensation

Switch positions S1-1 through S1-8 settings allow for different T1 and E1 modes, as well as selecting different line lengths (0 ft – 655 ft). These line length settings (of switch S1 positions 1, 2, and 3) allow you to select the appropriate output pulse shape to meet DSX-1 or CSU templates.

Use the following table to configure the T1 line length compensation parameters for the Telco module.

Table 17: TEL Line Length Compensation Switch Positions for T1 or E1

S1-1 Settings	S1-2 Settings	S1-3 Settings	Line Length
On	Off	Off	1 ft – 133 ft
Off	On	On	133 ft – 266 ft
Off	On	Off	266 ft – 399 ft
Off	Off	Off	399 ft – 533 ft
Off	Off	Off	533 ft – 655 ft

4.1.6
Terminal and Fault Logic Module

The Terminal and Fault Logic (TFL) module cannot be configured.

4.1.7
Network Management and the TRAK 9100

The TRAK 9100 can be managed through the UEM directly and also provides full SNMPv3 interface capabilities as other ASTRO devices. See Unified Event Manager for TRAK 9100 on page 75 for management details.

It provides major and minor alarms relay contacts, which are transported through Motorola Supervisory Control and Data Acquisition (MOSCAD NFM) Remote Terminal Unit (RTU) (optional) to the Unified Event Manager (UEM) for fault management.

The TRAK 9100 SSR provides diagnostic output through the RS232 connection to the MOSCAD (NFM) RTU. This output is in addition to providing major and minor alarms through the relay contacts of the RJ-45 connection. The main fault management activity is done through the MOSCAD (NFM) alarm management system in addition to the limited fault management of the UEM.

Chapter 5

TRAK 9100 Simulcast Site Reference Operation

This chapter details the tasks that you perform once the TRAK 9100 Simulcast Site Reference (SSR) is installed and operational on your system.

5.1 Powering Up the TRAK 9100/9300 Simulcast Site Reference

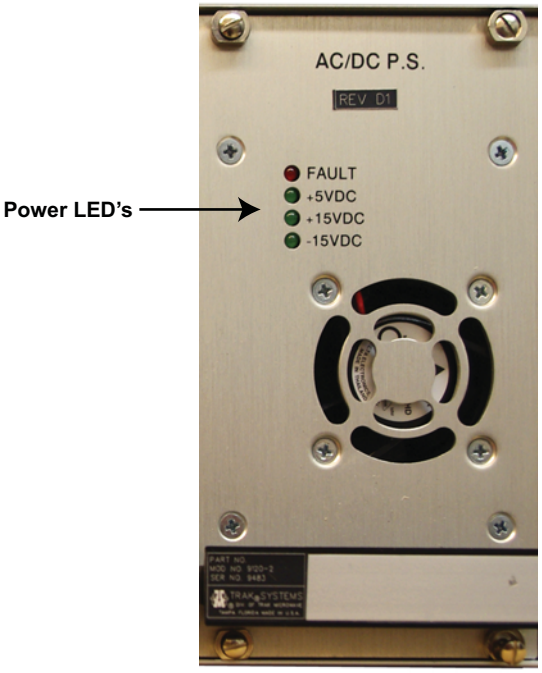
The TRAK 9100/9300 Simulcast Site Reference (SSR) has the following three power outputs:

- +5 VDC
- +15 VDC
- –15 VDC

The +5 VDC is applied to the logic devices. The +15 VDC/–15 VDC uses the analog (audio) circuitry.

All the three power outputs have an LED indicator that turns green after the TRAK 9100/9300 SSR powers up. The following figure shows the power supply LEDs.

Figure 20: LEDs on the Power Supply Module



PowerSupplyModule_A

The GNSS receiver has to lock onto the signals from at least four GNSS satellites for proper operation of the TRAK 9100 SSR only. Allow sufficient time, approximately 13 minute to 25 minutes, for the GNSS initialization to complete before checking the operation of the simulcast subsystem.

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Chapter 6

TRAK 9100 Simulcast Site Reference Maintenance

This chapter describes periodic maintenance procedures relating to the TRAK 9100 Simulcast Site Reference (SSR).

6.1 Managing the TRAK 9100 Simulcast Site Reference

Managing the TRAK 9100 Simulcast Site Reference (SSR) includes viewing the configuration, and backup and restore procedures for this unit.

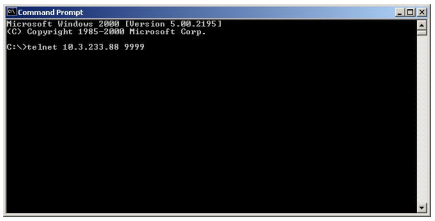
6.1.1 TRAK 9100 Simulcast Site Reference Configuration View

When and where to use: This procedure describes how to Telnet into the port to view the configuration.

Procedure:

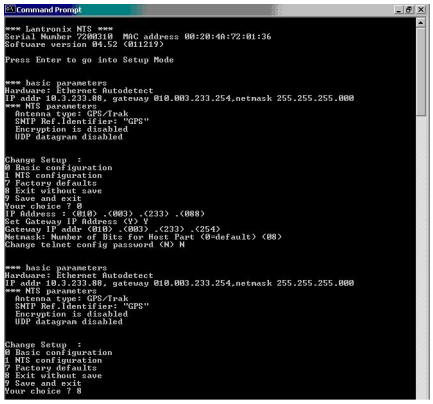
1 Establish a Telnet session with the NTS. Use the default IP address (in the format `x.Z.x.x`, where **Z** is the zone number), and then type Port 9999 as shown in the following figure.

Figure 21: Telnet Screen



2 Press **Enter** to access setup mode. You can view the IP address, gateway address, and netmask address as shown in the following figure.

Figure 22: Setup Mode Screen



6.1.2

No Backup for TRAK 9100 SSR Configuration

You cannot back up or restore the TRAK 9100 Simulcast Site Reference (SSR) configuration. The configuration is stored in nonvolatile memory and can be viewed even after a power cycle.

If the configuration is lost, reenter the configuration.

Chapter 7

TRAK 9100 Simulcast Site Reference Troubleshooting

This chapter provides fault management and troubleshooting information relating to the TRAK 9100 Simulcast Site Reference (SSR).

7.1 TRAK 9100 Troubleshooting Applications Overview

This section provides an overview of various troubleshooting applications for the TRAK 9100 SSR.

IMPORTANT: The Network Time Protocol (NTP) source must be synchronized to the Global Navigation Satellite System (GNSS) before connecting it to the system to avoid data loss. The system rejects files with future dates (relative to the current time).

7.2 Unified Event Manager for TRAK 9100

The Unified Event Manager (UEM) is a fault management application designed to handle the following critical fault management functions:

- Discovering devices
- Handling faults
- Detecting and reporting loss of communication and synchronization

The UEM supports TRAK generated alarms and events for the 9100 devices. The TRAK 9100 supports SNMPv3 by using the new 9104-14 Fault Sensor Unit module for UEM management. Fault management through the UEM supports using events (SNMP traps) that TRAK devices support through the SNMPv3 interface.

The TRAK 9100 supports the following distinct GNSS events (SNMP traps):

- **ssReceiver** – GNSS Receiver failure Not tracking satellites and user timeout.
- **ss10MHz/RB** – 10 MHz Frequency dropout Low-power level or Rubidium oscillator unlocked.
- **ss5MHz** – 5 MHz Frequency dropout TTL output signal failure.
- **ssComp** – Composite Clock Output Signal failure.
- **ssIRIGB** – Output Signal failure.
- **ss1PPS** – 1PPS Output failure.
- **ssCPU** – GPS reference module, no communication.
- **ssAntenna** – Under or over current.
- **ssOscillator** – Tuning near upper or lower limit.

The TRAK interface cable to the GTR 8000 Expandable Site Subsystem (ESS) has three possible connections for managing network management:

- Connection #1: The “Primary Sub-Panel #1” in a Simulcast High Availability ESS subsystem, provides the port required for the TRAK devices to access the Network Management network. As shown in the following figure, an Ethernet cable from the TRAK device connects to one of the available Gateway ports to enable the TRAK device to report SNMP events and alarms to the UEM.

- Connection #2: The “Primary Sub-Panel #1” in a Simulcast High Availability ESS subsystem, provides the port required for the TRAK devices to access the Network Management network. As shown in the following figure, an Ethernet cable from the TRAK device connects to one of the available Network Aux ports to enable the TRAK device to report SNMP events and alarms to the UEM.
- Connection #3: Service Ports on the RDMs in a Simulcast High Availability ESS subsystem, are used if there are no ports available on the Junction Panel.

If using the TRAK management through the MOSCAD, UEM fault management cannot impact the ability of the MOSCAD to manage the TRAK 9100 device.

NOTICE: Customer Service Software (CSS) cannot receive events from the TRAK 9100 SSR.

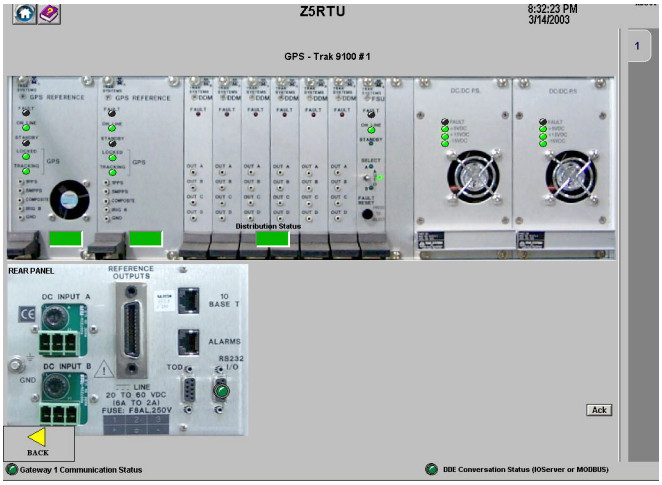
For any TRAK reported events provided at the UEM, see TRAK 9100 Simulcast Site Reference Troubleshooting on page 75 for specific troubleshooting applications for the TRAK 9100.

For more information, see the *Fault Management – System Perspective* and *Unified Event Manager* manuals.

7.3 MOSCAD Network Fault Management

MOSCAD (NFM) fault management application provides a graphical interface for the TRAK 9100 SSR component status, and provides local alarm information from the MOSCAD (NFM) Remote Terminal Unit (RTU), locally connected to the TRAK 9100 SSR (see Figure 23: MOSCAD Network Fault Management – Interface for TRAK 9100 SSR on page 76). The MOSCAD (NFM) collects many of the alarms and is reported to UEM. The MOSCAD (NFM) application and MOSCAD (NFM) RTU hardware are optional.

Figure 23: MOSCAD Network Fault Management – Interface for TRAK 9100 SSR



7.4 TRAK 9100 Simulcast Site Reference Interface Commands

A number of interface commands can be run through MOSCAD (NFM) application or through a local connection to the RS232 I/O port (9600, 8, N, 1) or by using the Out of Band Management (OB Man.) terminal connection. These commands can be used to check the status and configuration of different TRAK 9100 SSR attributes. When connected to the TRAK 9100 Simulcast Site Reference (SSR), press **Enter** three times to access the command line. Table 18: TRAK 9100 SSR Interface Commands—Requests on page 77 lists the interface command requests that can be used to check the different status and configuration settings for the TRAK 9100 SSR.

For example, typing RQFS at the command line gives the overall status of the TRAK 9100 SSR through a series of indicator bits, such as RQFS GA GPS GGGGGGGGGA PWR G DST GGGG. This status response includes information for the active GPS reference module, various GPS reference status indicators, power supply status, and frequency output status.

NOTICE: A Telnet connection through the NTP connection causes all NTP output to cease. Use a connection through MOSCAD (NFM) or the RS232 I/O port.

The following table lists the interface commands and the description for the TRAK 9100 SSR.

Table 18: TRAK 9100 SSR Interface Commands—Requests

Command	Description
<A or B>. RQAP	Request results of average position computation for GPS reference module (A or B). The following response appears for this command: `A.RQAP <latitude>, <longitude>, <height>`

<A or B>. RQBT	Request bit status for GPS reference module (A or B). Ten individual bit positions are listed in the response, indicating Good or Fail. The following response appears for this command:
	`A.RQBT <1><2><3><4><5><6><7><8><9><10>`
	`A.RQBT FGGGGGGFGN`
	1 GPS status (Good or Fail)
	2 Rubidium clock or 10 MHz status (Good or Fail)
	3 5 MPPS status (Good or Fail)
	4 Composite status (Good or Fail)
	5 IRIG-B status (Optional output)
	6 1PPS status (Good or Fail)
	7 CPU status (Good or Fail)
	8 Antenna status (Good or Fail)
	9 Oscillator calibration (Good or Fail)
	10 Module online (Yes or No)

<A or B>. RQDR	Request oscillator DAC value for GPS reference module (A or B). The display shows: `A.RQDR <DAC setting (0-65535)>`
<A or B>. RQIR	Request difference between internal 1PPS and selected time reference for GPS reference module (A or B). The display shows: `A.RQIR <time ref> REF GPS <status message>`
<A or B>. RQLK	Request 1PPS locked status for GPS reference module (A or B). The display shows: `A.RQLK <lock status and time affected>`

Table continued…

Command	Description
<A or B>. RQLN	Request navigation solution for GPS reference module (A or B). The display shows: `A.RQLN <latitude>, <longitude>, <height>`
<A or B>. RQLP	Request user-selected position for GPS reference module (A or B). The display shows: `A.RQLP <latitude>, <longitude>, <height>` **NOTICE:** This command is used only if the position source is set to “User entered position” (U).
<A or B>. RQLS	Request leap second status for GPS reference module (A or B). The display shows: `A.RQLS <yy,mm,dd>`
<A or B>. RQSS	Request list of selected satellites for GPS reference module (A or B). The display shows: `A.RQSS <list of satellites or NONE>`
<A or B>. RQST	Request list of satellites being tracked by GPS reference module (A or B). The display shows: `A.RQST <list of satellites or NONE>`
<A or B>. RQTO	Request current time offset values for GPS reference module (A or B). The display shows: `A.RQTO UTC<+/-><hours>, <minutes> DST+h`
RQFS	Request fault status from FSU module. The display shows: `RQFS <1><2> GPS <3><4><5><6><7><8><9><10><11><12>PWR <13> DST <14><15><16><17>` **1** CPU status on Fault Sense Unit (FSU) (Good or Fail) **2** Online FSU status (A or B) **3** GPS status (Good or Fail) **4** Rubidium clock or 10 MHz status (Good or Fail) **5** 5 MPPS status (Good or Fail) **6** Composite status (Good or Fail) **7** IRIG-B status (Optional output) **8** 1PPS status (Good or Fail) **9** CPU status (Good or Fail) **10** Antenna status (Good or Fail) **11** Oscillator calibration (Good or Fail)

Table continued...

Command	Description
	12 Module online (A or B) **13** Power supply status (Good or Fail) **14** Distribution frequency output status (Good or Fail) **15** TTL output status (Good or Fail) **16** TAFL status (Good or Fail) **17** TEL output status (Good or Fail)
RQSW	Request software version and compile data.

7.5
LED Indicators for Troubleshooting

This section provides information on LED indicators for the GPS reference module, Digital Distribution Module (DDM), Telecommunications module, Fault Sense Unit (FSU), and the power supply module.

7.5.1
GPS Reference Module LEDs

The GPS reference module tracks and locks onto a set of satellites and synchronizes its internal clock to supply a stratum 1 frequency reference and NTP services to system devices. Redundant GPS reference modules provide high-availability of time reference and NTP services to the network and components. The left GPS reference module includes a built-in fan. The GPS reference module includes LEDs that indicate the condition of the module and the tracking and locking status for the GPS satellites. One GPS reference module must be online, while the other module is in standby mode. The GPS reference module also includes test points for 1PPS, 5 MPPS, composite (1PPS + 5 MPPS), and ground.

The following table lists the different status of GPS reference module LEDs.

Table 19: GPS Reference Module Troubleshooting

IF	Then
If Fault LED is red...	perform the following action: The GPS reference module is reporting a failure. See Troubleshooting GPS Reference Module Failure on page 80.
If Online LED is green...	perform the following action: The GPS reference module is online (not standby). No action necessary.
If Online LED is off...	perform the following action: The GPS reference module is not online (the standby LED is illuminated). The online LED for the other GPS reference module should be illuminated. To force the module to come online, set the FSU select switch to the appropriate module (A or B). Typically, the FSU select switch must be set to Auto.
If Standby LED is green...	perform the following action: The GPS reference module is in standby mode. No action necessary.

Table continued…

IF	Then
If Standby LED is off...	perform the following action: The GPS reference module is in active mode. No action necessary.
If Locked LED is green...	perform the following action: The GPS reference module has locked onto the satellites and is operating within appropriate reference tolerance. No action necessary.
If Locked LED is off...	perform the following action: The GPS reference module is not locked onto the satellites. If the GPS reference module was recently installed, it may take up to one hour for the receiver to lock onto the satellites. See procedure, see Troubleshooting Satellite Lock Failure on page 81 for troubleshooting actions.
If Tracking LED is green....	perform the following action: The satellites are currently being tracked. No action necessary.
If Tracking LED is off...	perform the following action: The satellites are not successfully being tracked. If the GPS reference module was recently installed, it may take up to ten minutes to successfully begin tracking satellites. If there is a tracking problem, see procedure Troubleshooting Satellite Lock Failure on page 81 for troubleshooting actions.

7.5.1.1

Troubleshooting GPS Reference Module Failure

When and where to use: Follow these steps to troubleshoot a GPS reference module failure.

Procedure:

1. In the network fault management system, check the status of the TRAK 9100 SSR objects and traps. Also, check the condition of the TRAK 9100 SSR in MOSCAD (NFM) Graphic Master Central.
2. Visually inspect the condition of the GNSS antenna input cable and connection on the rear of the chassis.
3. Verify that the GNSS antenna is cleared from obstruction. If the antenna is obstructed, the GPS reference module may occasionally lose its locking status, which can eventually result in a failure if it exceeds the selected time-out interval.
4. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
5. Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command `<A or B>. RQBT`. Press **Enter** to check the GPS bit status, for GPS reference module A or B. The system reports a string of ten different status indicators for the GPS reference module, such as the following (`G` indicates a good condition, `F` indicates a failed condition).

   Example: `A.RQBT FGGGGGGFGN` The ten status bits indicate the status of the following (in order):

   1. GPS receiver
   2. Rubidium clock

3 5 MPPS

4 Composite

5 IRIG-B (Optional)

6 1PPS

7 CPU

8 Antenna

9 Oscillator calibration

10 Module online

The proceeding example indicates a GPS receiver problem and an antenna problem, and reveals that the GPS reference module is not online. Check the possible cause for any troubled indicator bits.

6 Check the antenna input cabling for continuity, attenuation, and crosstalk.

7 Replace the GPS reference module, antenna cable, or GNSS antenna, as necessary.

8 Press the fault reset switch on the FSU module to clear all fault LEDs.

7.5.1.2
Troubleshooting Satellite Lock Failure

When and where to use: Follow these steps to troubleshoot a satellite lock failure.

Procedure:

1 In the network fault management system, check the status of the TRAK 9100 SSR objects and traps. Also, check the condition of the TRAK 9100 SSR in MOSCAD (NFM) Graphic Master Central.

2 Visually inspect the condition of the GNSS antenna input cable and connection on the rear of the chassis.

3 Verify that the GNSS antenna is cleared from obstruction. If the antenna is obstructed, the GPS reference module may occasionally lose its locking status, which can eventually result in a failure if it exceeds the selected time-out interval.

4 Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.

5 Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command `<A or B>. RQBT`, and then press **Enter** to check the GPS bit status, for GPS reference module A or B. The system reports a string of ten different status indicators for the GPS reference module, such as the following (`G` indicates a good condition, `F` indicates a failed condition).

Example: `A.RQBT FGGGGGGFGN`
The ten status bits indicate the status of the following (in order):

a GPS receiver

b Rubidium clock

c 5 MPPS

d Composite

e IRIG-B (Optional)

f 1PPS

g CPU

h Antenna

i Oscillator calibration

j Module online

The proceeding example indicates a GPS receiver problem and an antenna problem, and reveals that the GPS reference module is not online. Check the possible cause for any troubled indicator bits.

6 Type `<A or B>. RQST` to check the list of satellites tracked by the GPS reference module.

7 Type `<A or B>. RQLK` to check the 1PPS reference locked status, which may indicate the time when locking started or ended. For example: `A.RQLK NO LOCK SINCE POWERUP`

8 Check the antenna input cabling for continuity, attenuation, and crosstalk.

9 Replace the GPS reference module, antenna cable, or GNSS antenna, as necessary. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.5.2
TRAK 9100 Digital Distribution Module LEDs

The TRAK 9100 SSR includes a number of Digital Distribution Modules (DDMs) that can be configured for:

- 1PPS and 5 MPPS frequency references to the comparators at a circuit simulcast subsystem.
- 1PPS time references to the comparators and site controllers at an IP simulcast subsystem.
- 1PPS or 5 MPPS frequency reference to each GTR 8000 Expandable Site Subsystem cabinet/rack, and composite (1PPS +5 MPPS) frequency reference to the standalone GTR 8000 Base Radios.

The DDM includes four outputs which all output the same reference signal as configured by an on-board switch (SW1). Each DDM has a fault LED to indicate a general fault on the module. The module also includes test points for the four outputs on the rear of the module (A, B, C, and D). The fault LED can be cleared by pressing the fault reset button on the FSU module.

If the fault LED is red, a fault condition is detected on the DDM.

7.5.2.1
Troubleshooting Faults on the TRAK 9100 DDM

When and where to use: This procedure describes how to troubleshoot faults on the DDM.

Procedure:

1 In the network fault management system, check the status of the TRAK 9100 SSR objects and traps. Also, check the condition of the TRAK 9100 SSR in MOSCAD (NFM) Graphic Master Central.

2 Check the LEDs on the FSU module, GPS reference modules, and power supply modules for other problems.

3 Visually inspect the condition of the four DDM input connections on the rear of the chassis.

4 Remove and inspect the failed module and the interior of the chassis. Verify that the rate selection switch (SW1) is set to the appropriate setting (1PPS, 5 MPPS, or composite). Fully reinsert the module into the chassis.

5 Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command `RQFS`. Press **Enter** to check the fault status. The last portion of

the response indicates DST <1><2><3><4>. The first bit indicates the DDM output status, which should be G (good).

6 Remove the output cabling from the troubled DDM. Press the fault reset button on the FSU module. If the fault LED goes out on the DDM, then the cable or remotely connected device has a problem. Check the cabling for continuity, attenuation, and crosstalk. Also, check the connection and termination at the remote device.

7 Replace the DDM or cabling, as necessary. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.5.3
Telecommunications Module LEDs

The Telecommunications (Telco) module outputs 1.544 MHz or 2.048 MHz square wave output signaling as a reference for T1 and E1 framing by networking equipment. The Telco module has a single fault LED to indicate module failure.

If the fault LED is red, a fault condition is detected on the Telco Module.

7.5.3.1
Troubleshooting Faults on the TRAK Simulcast Site Reference Telco Module

When and where to use: This procedure describes how to troubleshoot faults on the Telco module.

Procedure:

1 In the network fault management system, check the status of the TRAK 9100 SSR objects and traps. Also, check the condition of the TRAK 9100 SSR in MOSCAD (NFM) Graphic Master Central.

2 Check the LEDs on the FSU module, GPS reference modules, and power supply modules for other problems.

3 Visually inspect the condition of the Telco module connection and the connection to the junction box.

4 Remove and inspect the failed module and the interior of the chassis. Verify the jumper and switch settings on the module according to your system documentation. Fully reinsert the module into the chassis.

5 Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command RQFS. Press **Enter** to check the fault status. The last portion of the response indicates DST <1><2><3><4>. The second bit indicates the RS422 output status on the Telco module, which should be G (good).

6 Remove the output cabling from the Telco module. Press the fault reset button on the FSU module. If the fault LED goes out on the Telco module, then the cable or remotely connected device has a problem. Check the cabling for continuity, attenuation, and crosstalk. Also, check the connection and termination at the remote device.

7 Replace the Telco module or cabling, as necessary. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.5.4

Frequency Distribution Module LEDs

The Frequency Distribution Module (FDM) is configured for 10 MHz output. The FDM has a fault LED to indicate a general fault on the module. The module also includes test points for the five outputs on the rear of the module (Input A, B, C, and D). The fault LED can be cleared by pressing the fault reset button on the FSU module.

If the fault LED is red, a fault condition is detected on the FDM.

7.5.4.1

Troubleshooting Faults on the TRAK Simulcast Site Reference Frequency Distribution Module

When and where to use: This procedure describes how to troubleshoot faults on the FDM.

Procedure:

1. In the network fault management system, check the status of the TRAK 9100 SSR objects and traps. Also, check the condition of the TRAK 9100 SSR in MOSCAD (NFM) Graphic Master Central.
2. Check the LEDs on the FSU module, GPS reference modules, and power supply modules for other problems.
3. Visually inspect the condition of the five FDM input connections on the rear of the chassis.
4. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
5. Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command `RQFS`. Press **Enter** to check the fault status. The last portion of the response indicates `DST <1><2><3><4>`. The first bit indicates the FDM output status, which should be `G` (good).
6. Remove the output cabling from the troubled FDM. Press the fault reset button on the FSU module. If the fault LED goes out on the FDM, then the cable or remotely connected device has a problem. Check the cabling for continuity, attenuation, and crosstalk. Also, check the connection and termination at the remote device.
7. Replace the FDM or cabling, as necessary. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.5.5

TRAK Simulcast Site Reference Fault Sense Unit Module LEDs

The Fault Sense Unit (FSU) monitors overall system operations within the TRAK 9100 SSR. The FSU communicates alarm information out the rear of the chassis through the RS232 I/O port and alarm port. The FSU module has a switch for setting a GPS reference module to active mode (A, B, or Auto). The FSU module also has a fault reset button used to clear all the fault LEDs throughout the chassis.

This table lists the different status of FSU LEDs.

Table 20: Fault Sense Unit Troubleshooting

IF	Then
If Fault LED is red...	perform the following action:

Table continued…

IF	Then
	A fault condition is detected on the FSU. See Troubleshooting Faults on the TRAK Simulcast Site Reference Fault Sense Unit on page 85 for troubleshooting actions.
If Online LED is green...	perform the following action: The FSU is online (not standby). No action necessary.
If Online LED is off...	perform the following action: The FSU module is not online. If the FSU module cannot be brought online, troubleshoot the FSU module with the instructions for the red fault LED.
If Standby LED is green...	perform the following action: The FSU is in standby mode. The FSU should always be online. If the FSU cannot be brought online, see Troubleshooting Faults on the TRAK Simulcast Site Reference Fault Sense Unit on page 85 for troubleshooting actions.
If Standby LED is off...	perform the following action: The GPS reference module is in active mode. No action necessary.
If any of the Select LEDs (A, B, or Auto) is green...	perform the following action: reference module A or B is manually selected, or the GPS reference module is automatically selected by the FSU. Typically, the select switch must be set to Auto. If a particular GPS reference module must be made active, then select A or B as necessary.

NOTICE: The TRAK 9100 SSR may have TRAK 9104-2 or TRAK 9104-9 FSU module. Identify the FSU module by the label in front of the module, which indicates REV D or REV D-1 for TRAK 9104-2 and REV-9 for TRAK 9104-9 FSU modules respectively.

7.5.5.1

Troubleshooting Faults on the TRAK Simulcast Site Reference Fault Sense Unit

When and where to use: Thus procedure describes how to troubleshoot faults on the FSU module.

Procedure:

1. In the network fault management system, check the status of the TRAK 9100 SSR objects and check for any traps in the alarm log. Also, check the condition of the TRAK 9100 Simulcast Site Reference (SSR) in MOSCAD (NFM) Graphic Master Central.
2. Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command `RQFS` to check the fault status. The first portion of the response indicates `RQFS FSU <FSU CPU status><FSU online status>`. The FSU CPU status should indicate `G` (good), and the FSU online status should indicate `Y`.
3. Check the LEDs on the power supply modules for other problems.
4. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
5. Replace the FSU module.

7.5.6
TRAK 9100 Simulcast Site Reference Power Supply Module LEDs

Redundant AC input power supply modules are installed in the TRAK 9100 SSR chassis to supply +5 VDC, +15 VDC, and –15 VDC output reference voltages to the other modules in the chassis. Each power supply includes a built-in fan. The power supply LEDs indicate the DC voltage output status for the module and a fault LED to indicate a power supply failure.

This table lists the different status of power supply module LEDs.

Table 21: Power Supply Module Troubleshooting

IF	Then
If Fault LED is red...	perform the following action: A fault condition is detected on the power supply module. See Troubleshooting Faults on the TRAK 9100 Power Supply Module on page 86 for troubleshooting actions.
If any of the voltage LEDs (+5 VDC, +15 VDC, or –15 VDC) is green...	perform the following action: The voltage reference outputs are within appropriate tolerance. No action necessary.
If any of the voltage LEDs (+5 VDC, +15 VDC, or –15 VDC) are off...	perform the following action: The voltage reference outputs are not within appropriate tolerance for operation. See Troubleshooting Faults on the TRAK 9100 Power Supply Module on page 86 for troubleshooting actions.

7.5.6.1
Troubleshooting Faults on the TRAK 9100 Power Supply Module

When and where to use: This procedure describes how to troubleshoot faults on the power supply module.

Procedure:

1. In the network fault management system, check the status of the TRAK 9100 SSR objects and traps. Also, check the condition of the TRAK 9100 SSR in MOSCAD (NFM) Graphic Master Central.
2. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
3. Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command `RQFS`. Press **Enter** to check the fault status. A portion of the response indicates `PWR <G or F>`. The bit can indicate `G` (good) or `F` (fail).
4. Check the power cable and connections between the power supply and outlet. Try plugging into a different outlet.

   NOTICE: If possible, maintain the two power supplies on separate circuits to guard against a single point of failure.
5. Check circuit breakers, verify grounding, and see if any other equipment is experiencing power problems.
6. Remove and inspect the power supply and interior of the chassis, then fully reinsert the power supply into the chassis.

7 Check the power input fuse in the rear of the chassis. Replace with a 3 A slow blow fuse, if necessary (a spare fuse may be located in the fuse compartment).

8 Replace the power supply or power cable as necessary.

7.6 GPS Alarms

MOSCAD (NFM) RTU collects the TRAK 9100 Simulcast Site Reference (SSR) alarm information through the RS232 I/O and alarm ports on the rear of the TRAK 9100 SSR. A set of these traps is forwarded to the centralized fault management application and appears in the Alarm Browser. Check the UEM or the MOSCAD (NFM) application for the alarms mentioned in the following table.

Table 22: GPS Alarms

Object	State	Severity / Values	Description
Power	Power OK	Normal	All power supply modules are OK. No action necessary.
	Secondary Power	Minor	One power supply module has failed. See Troubleshooting Failure in a TRAK Simulcast Site Reference Power Supply Module on page 88 for troubleshooting actions.
	Power Fail	Critical	All power supply modules have failed (or communication error). Troubleshoot the power supply modules as explained for the secondary power in the proceeding row.
GPS	GPS OK	Normal	Both GNSS reference modules are OK. No action necessary.
	Secondary GPS	Minor	One GNSS reference module has failed. See the procedure Troubleshooting Failure in a TRAK Simulcast Site Reference GPS Reference Module on page 88 for troubleshooting actions.
	GPS Fail	Critical	Both GNSS reference modules have failed. Troubleshoot both GNSS reference modules as explained in Troubleshooting Failure in a TRAK Simulcast Site Reference GPS Reference Module on page 88.
DST	DST OK	Normal	All distribution outputs are OK. No action necessary.
	DST Fail	Major	One of the distribution devices failed. See Troubleshooting Failure in a TRAK Simulcast Site Reference Distribution Device on page 89.
Comm. Status	Comm OK	Normal=0	Communication between TRAK 9100 SSR and MOSCAD (NFM) is normal. No action necessary.
	Comm Fail	Critical=1	MOSCAD (NFM) has lost communication with the TRAK 9100 SSR. See Troubleshooting TRAK Simulcast Site Reference Loss of Communication on page 90.

7.6.1

Troubleshooting Failure in a TRAK Simulcast Site Reference Power Supply Module

When and where to use: Follow these steps to troubleshoot a power supply module failure.

Procedure:

1. Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command RQFS. Press **Enter** to check the fault status. A portion of the response indicates PWR <G or F>. The bit can indicate G (good) or F (fail).
2. Check the power supply LEDs.
3. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
4. Check the power cable and connections between the power supply and outlet. Try plugging into a different outlet.

   NOTICE: If possible, maintain the two power supplies on separate circuits to guard against a single point of failure.
5. Check circuit breakers, verify grounding, and see if any other equipment is experiencing power problems.
6. Remove and inspect the power supply and interior of the chassis, then fully reinsert the power supply into the chassis.
7. Check the power input fuse in the rear of the chassis. Replace with a 3 A slow blow fuse if necessary (a spare fuse may be located in the fuse compartment).
8. Replace the power supply or power cable as necessary.

7.6.2

Troubleshooting Failure in a TRAK Simulcast Site Reference GPS Reference Module

When and where to use: Follow these steps to troubleshoot a GPS reference module failure.

Procedure:

1. Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command <A or B>. RQBT. Press **Enter** to check the GPS bit status, for GPS reference module A or B. The system reports a string of ten different status indicators for the GPS reference module, such as the following (G reflects good condition, F reflects failed condition).

   Example: A.RQBT FGGGGGGFGN
   The 10 status bits indicate the status of the following (in order):

   1. GPS receiver
   2. Rubidium clock
   3. 5 MPPS
   4. Composite
   5. IRIG-B (Optional)
   6. 1PPS

7 CPU

8 Antenna

9 Oscillator calibration

10 Module online

The proceeding example indicates a GPS receiver problem and an antenna problem, and reveals that the GPS reference module is not online. Check the possible cause for any troubled indicator bits.

2. Check the LEDs for the failed GPS reference module and check the LEDs for the FSU module and power supplies.
3. Visually inspect the condition of the GNSS antenna input cable and connection on the rear of the chassis.
4. Verify that the GNSS antenna is cleared from obstruction. If the antenna is obstructed, the GPS reference module may occasionally lose its locking status, which can eventually result in a failure if it exceeds the selected time-out interval.
5. Remove and inspect the failed module and the interior of the chassis. Fully reinsert the module into the chassis.
6. Check the antenna input cabling for continuity, attenuation, and crosstalk.
7. Replace the GPS reference module, antenna cable, or GNSS antenna, as necessary.
8. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.6.3
Troubleshooting Failure in a TRAK Simulcast Site Reference Distribution Device

When and where to use: Follow these steps to troubleshoot a distribution device failure.

Procedure:

1. Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS-232 I/O port (9600, 8, N, 1), type the command `RQFS`. Press **Enter** to check the fault status. The last portion of the response indicates `DST <1><2><3><4>` . The first bit indicates the DDM output status, which should be `G` (good). The second bit indicates the RS422 output status on the Telco module, which should be `G` (good).
2. Check the LEDs on the DDM modules, Telco module, FSU module, GPS reference modules, and power supply modules.
3. Visually inspect the condition of the connections on the failed module.
4. Remove and inspect the failed module and the interior of the chassis. Verify that the switches and jumpers on the Telco module or DDM are properly configured. Fully reinsert the module into the chassis.
5. Remove the output cabling from the troubled module. Press the fault reset button on the FSU module. If the fault LED goes out on the troubled module, then the cable or remotely connected device has a problem. Check the cabling for continuity, attenuation, and crosstalk. Also, check the connection and termination at the remote device.
6. Replace the DDM, the Telco module, or the cabling as necessary.
7. Press the fault reset switch on the FSU module to clear all fault LEDs.

7.6.4

Troubleshooting TRAK Simulcast Site Reference Loss of Communication

When and where to use: Follow these steps to troubleshoot loss of communication.

Procedure:

1. Through MOSCAD (NFM) Graphic Master Central, or through a local connection to the RS232 I/O port (9600, 8, N, 1), or by using the Out of Band Management (OB Man.) terminal connection, type the command `RQFS`. Press **Enter** to check the fault status. The first portion of the response indicates `RQFS FSU <FSU CPU status><FSU online status>`. The FSU CPU status should indicate `G` (good), and the FSU online status should indicate `Y`.
2. Verify that the TRAK 9100 Simulcast Site Reference (SSR) is powered. Verify that other services are operating properly. Check the condition and LEDs for the FSU module. The FSU module supplies the relay control for the RS232 I/O and alarm outputs.
3. Visually inspect the RS232 I/O and alarm connections on the rear of the TRAK 9100 SSR. Use a cable tester to check the continuity and pinouts for the cabling.
4. Check the LEDs and connections on the MOSCAD (NFM) RTU or MOSCAD (NFM) MUX units.
5. Replace the FSU module or cabling as required.

Chapter 8

TRAK 9100 Simulcast Site Reference FRU/FRE Procedures

This chapter lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs), and includes replacement procedures applicable to the TRAK 9100 Simulcast Site Reference (SSR).

8.1

Required TRAK 9100 FRU/FRE Tools and Equipment

The following items should be taken to the replacement site when replacing any equipment in the TRAK 9100 Simulcast Site Reference (SSR):

- Electrostatic Discharge (ESD) strap (Motorola part number RSX4015A or equivalent)
- Phillips and slotted screwdrivers
- Set of TORX ® drivers

8.2

Field Replaceable Units in the TRAK 9100 Simulcast Site Reference

The following table lists each FRU available for the TRAK 9100 Simulcast Site Reference and 9300 SSR along with its FRU part number and the appropriate procedure for replacing the FRU. The vendor number is also listed to help identify the parts. Use the FRU part number for the item while ordering.

WARNING: The TRAK 9100 SSR and the 9300 expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

Table 23: SSR Field Replaceable Units

Component Type	Part Number	Vendor Number	Replacement Procedure
Global Positioning Satellite (GPS) Reference Module with Rubidium Oscillator		DSTRAK910115	Replacing the TRAK 9100 Simulcast Site Reference GPS Reference Module on page 92
GPS Reference Module with Double Oven Oscillator		DSTRAK910116	Replacing the TRAK 9100 Simulcast Site Reference GPS Reference Module on page 92
Digital Distribution Module (DDM)	RLN5359A	DSTRAK91061	Replacing the TRAK Simulcast Site Reference Digital Distribution Module on page 94
Telecom Signal Generator Module, T1	RLN5361A	DSTRAK91111	Replacing the TRAK Simulcast Site Reference Tele-

Table continued…

Component Type	Part Number	Vendor Number	Replacement Procedure
			com Signal Generator Module on page 95
Telecom Signal Generator Module, E1	RLN5362A	DSTRAK91112	Replacing the TRAK Simulcast Site Reference Telecom Signal Generator Module on page 95
Frequency Distribution Module (FDM)	RLN5360A	DSTRAK91071	Replacing the TRAK Simulcast Site Reference Frequency Distribution Module on page 96
Fault Sense Unit (FSU) Module with Network Time Server (NTS) Option	RLN5358A	DSTRAK91042	Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module on page 96
Fault Sense Unit (FSU) with NTS/NTP Module (TRAK 9104-14)		DSTRAK910414	Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module on page 96
Terminator and Fault Logic Module		DSTRAK93507	Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module on page 96
Power Supply, 85-260 VAC (for TRAK 9100 / 9300 SSR)	RLN5363A	DSTRAK91202	Replacing the TRAK Simulcast Site Reference Power Supply Module on page 98
Power Supply, 48 VDC (for TRAK 9100 / 9300 SSR)	RLN5370A	DSTRAK91211	Replacing the TRAK Simulcast Site Reference Power Supply Module on page 98
TRAK 9100 SSR Chassis	RLN5365A	DSTRAK9100MF	Replacing the TRAK Simulcast Site Reference Server Chassis on page 99
TRAK 9100/9300 SSR Chassis for AC (Distribution Shelf)		DSTRAK93007	Replacing the TRAK Simulcast Site Reference Server Chassis on page 99
TRAK 9100/9300 SSR Chassis for DC (Distribution Shelf)		DSTRAK93007DC	Replacing the TRAK Simulcast Site Reference Server Chassis on page 99

NOTICE: The new kit (TRAK 9104-14) is available after November 2013.

8.2.1
Replacing the TRAK 9100 Simulcast Site Reference GPS Reference Module

Prerequisites:

The TRAK 9100 Simulcast Site Reference (SSR) includes redundant Global Positioning Satellite (GPS) reference modules. The GPS reference module receives the GPS signals and generates the reference signals (1PPS and 5 MPPS), which are used to support the time reference output through the FSU module, and the T1/E1 clocking output through the Telecommunications module.

The primary GPS reference module in the left-most slot has a Rubidium oscillator and includes a cooling fan on the front of the module. The backup GPS reference module in the chassis has a double oven crystal oscillator and does not include a cooling fan.

WARNING: The TRAK 9100 SSR and the 9300 expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

IMPORTANT: The GPS reference module can be replaced while the TRAK 9100 SSR is powered. As the TRAK 9100 SSR includes redundant GPS reference modules, removing a single GPS reference module does not cause a disruption in radio services or network services.

When and where to use: Follow these steps to replace a GPS reference module (RLN5356A or RLN5357A) in the SSR.

Procedure:

1. If the Online LED on the GPS reference module to be replaced is illuminated, switch to the redundant module:
   a. Press and hold the **Fault Reset** button on the FSU module.
   b. Set the **Select** switch to the redundant module (A is the left module, B is the right module).
   c. Release the **Fault Reset** button.

   The Standby LED should be illuminated on the GPS reference module being replaced. The Online LED should now be illuminated on the other GPS reference module.
2. Wear an Electrostatic Discharge (ESD) strap, and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
3. Remove the GPS reference module:
   a. Remove the four screws securing the GPS reference module.
   b. Gently pull down the handle to unlock the module.
   c. Pull the module out from the chassis.
4. Verify that the jumpers and switches are set correctly on the replacement module:
   a. Note any jumper or switch settings on the removed module.
   b. Verify that the jumper of the replacement module and the switch settings match those sets on the removed module.
5. Install the replacement GPS reference module:
   a. Slide the module into the chassis.
   b. Firmly seat the module connectors into the backplane. Do not force the module in.
   c. Press up on the handle to lock the module in place.
   d. Secure the GPS reference module into the chassis with the four retaining screws.
6. Press and release the **Fault Reset** button on the FSU module.
7. Allow up to one hour for the SSR GPS reference module to track and lock onto satellites.

   After approximately 10 minutes, the Tracking LED illuminates on the new GPS reference module. After 30 minutes to 60 minutes, the Locked LED illuminates on the module.

8 After the Tracking LED and Locked LED are illuminated on the new GPS reference module, switch to automatic switchover mode:
   a Press and hold the **Fault Reset** button on the FSU module.
   b Set the **Select** switch to **Auto**.
   c Release the **Fault Reset** button.
9 Verify that the SSR is operating properly. See Verifying TRAK Simulcast Site Reference Serviced Equipment on page 100 for tests and verifications that can be performed for the device.

8.2.2
Replacing the TRAK Simulcast Site Reference Digital Distribution Module

Prerequisites:
The Digital Distribution Module (DDM) can be configured for 1PPS, 5 MPPS, or composite (1PPS + 5 MPPS) reference signals and distributes these references through the ports on the rear of the chassis to the supported simulcast equipment.

WARNING: The TRAK 9100 SSR and the 9300 expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

IMPORTANT: The DDM can be replaced while the TRAK 9100 SSR is powered. Any reference signal ports on the rear of the chassis, which are supported by the DDM, are inoperable while the DDM is removed. Any supported equipment loses its reference signals until the DDM is replaced in the chassis. Supported devices revert to their secondary or internal clocking source.

When and where to use: Follow these steps to replace a DDM (RLN5359A) in the SSR.

Procedure:

1 Wear an Electrostatic Discharge (ESD) strap, and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2 Remove the DDM:
   a Loosen the two screws securing the DDM.
   b Gently pull down the handle to unlock the module.
   c Pull the module out from the chassis.
3 Verify that the jumpers and switches are set correctly on the replacement module:
   a Note any jumper or switch settings on the removed module.
   b Verify that the replacement jumper for the module and the switch settings match those sets on the removed module.
4 Install the replacement DDM:
   a Slide the module into the chassis.
   b Firmly seat the module connectors into the backplane. Do not force the module in.
   c Press up on the handle to lock the module in place.
   d Secure the DDM into the chassis with the two retaining screws.
5 Press and release the **Fault Reset** button on the FSU module.

6 Verify that the SSR is operating properly. See the procedure “Verifying Serviced Equipment,” for tests and verifications that can be performed for the device.

8.2.3
Replacing the TRAK Simulcast Site Reference Telecom Signal Generator Module

Prerequisites:
The Telecom Signal Generator (Telco) module generates and distributes clocking signals for T1/E1 multiplexing. The Telco module supports T1/E1 clocking in the Wide Area Network (WAN) switch (and Cooperative WAN Routing in the prime site only), Digital Access Cross-connect Switch (DACS), and Ambassador Electronics Bank (AEB).

WARNING: The TRAK 9100 SSR and the 9300 expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

IMPORTANT: The Telco module can be replaced while the TRAK 9100 SSR is powered. Any reference signal ports on the rear of the chassis, which are supported by this module, are inoperable while the module is removed. Any supported equipment loses its reference signals until the Telco module is replaced in the chassis. All supported equipment reverts to their secondary or internal clocking source.

When and where to use: Follow these steps to replace a T1 Telco module (RLN5361A) or E1 Telco module in the SSR.

Procedure:

1 Wear an Electrostatic Discharge (ESD) strap, and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

2 Remove the Telco module:

- **a** Disconnect the DB-15 cable from the FRAMED port on the front of the module.
- **b** Loosen the two screws securing the Telco module.
- **c** Gently pull down the handle to unlock the module.
- **d** Pull the module out from the chassis.

3 Verify that the jumpers and switches are set correctly on the replacement module:

- **a** Note any board jumper or switch settings on the removed board.
- **b** Verify that the jumper for the replacement board and the switch settings match those sets on the removed board.

4 Install the replacement Telco module:

- **a** Slide the module into the chassis.
- **b** Firmly seat the module connectors into the backplane. Do not force the module in.
- **c** Press up on the handle to lock the module in place.
- **d** Secure the Telco module into the chassis with the two retaining screws.
- **e** Connect the DB-15 cable to the FRAMED port on the module.

5 Press and release the **Fault Reset** button on the FSU module.

6 Verify that the SSR is operating properly. See Verifying TRAK Simulcast Site Reference Serviced Equipment on page 100 for tests and verifications that can be performed for the device.

8.2.4

Replacing the TRAK Simulcast Site Reference Frequency Distribution Module

Prerequisites:
The Frequency Distribution Module (FDM) distributes 10 MHz or IRIG-B signals.

WARNING: The TRAK 9100 SSR and the 9300 expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

IMPORTANT: The FDM can be replaced while the TRAK 9100 SSR is powered. Any supported equipment loses its reference signals while the FDM is removed from the chassis. Loss of reference signals to supported equipment will cause the equipment to revert to their secondary or internal clocking source.

NOTICE: IRIG-B is optional for a prime site.

When and where to use: Follow these steps to replace an FDM (RLN5360A) in the SSR.

Procedure:

1. Wear an Electrostatic Discharge (ESD) strap, and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2. Remove the FDM:
   a. Loosen the two screws securing the FDM.
   b. Gently pull down on the handle to unlock the module.
   c. Pull the module out from the chassis.
3. Install the replacement FDM:
   a. Slide the module into the chassis.
   b. Firmly seat the module connectors into the backplane. Do not force the module in.
   c. Press up on the handle to lock the module in place.
   d. Secure the FDM into the chassis with the two retaining screws.
4. Press and release the **Fault Reset** button on the FSU module.
5. Verify that the SSR is operating properly. See Verifying TRAK Simulcast Site Reference Serviced Equipment on page 100 for tests and verifications that can be performed for the device.

8.2.5

Replacing the TRAK Simulcast Site Reference Fault Sense Unit Module

Follow these steps to replace a Fault Sense Unit (FSU) module (RLN5358A) in the Simulcast Site Reference (SSR).

The FSU module supports Network Time Protocol (NTP) server functions, reports faults, and provides redundancy switchover for the GPS reference modules. The FSU module delivers the NTP time reference packets through the 10Base-T port on the rear of the chassis.

WARNING: The TRAK 9100 SSR and the 9300 expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

CAUTION: Wear an Electrostatic Discharge (ESD) strap, and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

IMPORTANT: The FSU module can be replaced while the TRAK 9100 SSR is powered. When the FSU module is removed from the chassis, the SSR stops sending references, including network time. Radio services are affected, the NTP server function is inoperable, and any NTP clients that use the frequency or time reference (such as the base radios, comparators, and site controllers) do not transmit until the FSU module is back in service.

The SSR may have TRAK 9104-2 or TRAK 9104-9 or TRAK 9104-14 FSU module. Identify the FSU module by the label in front of the module, which indicates REV D or REV D-1 for TRAK 9104-2, and REV-9 for TRAK 9104-9 FSU modules, respectively.

Procedure:

1. Remove the FSU module:
   a. Loosen the two screws securing the FSU module.
   b. Gently pull down the handle to unlock the module.
   c. Pull the module out from the chassis.
2. Verify that the jumpers and switches are set correctly on the replacement module:
   a. Note any board jumper or switch settings on the removed board.
   b. Verify that the jumper for the replacement board and the switch settings match those settings on the removed board.
3. Install the replacement FSU module:
   a. Slide the module into the chassis.
   b. Firmly seat the module connectors into the backplane. Do not force the module in.
   c. Press up on the handle to lock the module in place.
   d. Secure the FSU module into the chassis with the two retaining screws.
4. On the FSU module, press and release the **Fault Reset** button.
5. Re-configure the NTP connection:
   a. From the keyboard on the client computer, press the WINDOWS ICON key + R to access the **Run** command prompt.
   b. In the dialog box, type `telnet <IP address> 9999`. Press ENTER until the introductory message is displayed.
   c. Press ENTER for setup mode. Press ENTER to select basic setup.
   d. When prompted for an IP address, type the proper ***<IP address>*** for the NTP server (according to the information supplied with your system). Press ENTER.
   e. When prompted for the gateway IP address, type the proper gateway ***<IP address>***. Press ENTER.
   f. When prompted for the netmask address, type the appropriate number of bits used in the mask. Press ENTER.
   g. Choose the option to save the changes and quit.

6 Verify that the SSR is operating properly. See Verifying TRAK Simulcast Site Reference Serviced Equipment on page 100 for tests and verifications that can be performed for the device.

8.2.6
Replacing the TRAK Simulcast Site Reference Power Supply Module

Prerequisites:
The power supply module provides power to the TRAK Simulcast Site Reference (SSR) chassis. Both AC and DC input power supply modules are available, and the same power supply modules are used for the TRAK 9100 SSR and the 9300 SSR expansion chassis.

WARNING: The TRAK 9100 SSR and the 9300 SSR expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.

IMPORTANT: A power supply module can be replaced while the SSR is powered. As the power supply modules are in a redundant configuration in the chassis, the chassis switches to the secondary power supply module. Radio services are not affected.

When and where to use: Follow these steps to replace a power supply module (RLN5363A, RLN5364A, RLN5369A, or RLN5370A) in the TRAK 9100 SSR or 9300 SSR chassis.

Procedure:

1 Wear an Electrostatic Discharge (ESD) strap, and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

2 Remove the power input for the impaired power supply:

NOTICE: Input A is the left power supply module and Input B is the right power supply module (as viewed from the front of the chassis).

a If the chassis is using AC power, disconnect the AC power cable for the impaired power supply module.

b If the chassis is using DC power, note the wiring and disconnect the DC power wires for the impaired power supply module.

3 Remove the power supply module:

a Loosen the four screws securing the impaired power supply module.

b Gently pull down on the handle to unlock the module.

c Pull the module out from the chassis.

4 Install the replacement power supply module:

a Slide the module into the chassis.

b Firmly seat the module connectors into the backplane. Do not force the module in.

c Press up on the handle to lock the module in place.

d Secure the power supply module into the chassis with the four retaining screws.

5 Connect the power input for the replaced power supply module:

a If the chassis is using AC power, reconnect the AC power cable for the replaced power supply module.

b If the chassis is using DC power, reconnect the DC power wires for the replaced power supply module.

6 Verify that the SSR is operating properly. See Verifying TRAK Simulcast Site Reference Serviced Equipment on page 100 for tests and verifications that can be performed for the device.

8.3 Replacing the TRAK Simulcast Site Reference Server Chassis

Prerequisites:
The main NTP server chassis is the TRAK 9100 SSR. This chassis supports the normal time reference functions at the prime site. If additional ports are required other than those that are available on the TRAK 9100 SSR or TRAK 9300 SSR unit is used in addition to the TRAK 9100 SSR, to supply the additional ports.

WARNING:

- The TRAK 9100 SSR and the 9300 SSR expansion chassis contain dangerous voltages that can cause electrical shock or damage to equipment. Turn off the equipment, and remove the power cabling when instructed to do so. Avoid contact with voltage sources while the unit is powered.
- An empty chassis weighs approximately 20 lb (9 kg). Have another person help you support, and carry the chassis as you remove and replace the chassis in the rack.

IMPORTANT: The TRAK 9100 SSR must be powered down to replace the chassis. Powering down the simulcast site reference (for a prime site)/site reference (for a remote site) cause all supported devices to revert to their secondary or internal clocking mechanism. Radio services should remain in wide area trunking during the replacement.

When and where to use: Follow this procedure to replace a TRAK 9100 SSR chassis (RLN5365A) or TRAK 9300 SSR expansion chassis (RLN5366A).

Procedure:

1 Power down the unit:
   - **a** If the chassis is using AC power, disconnect the AC power cables from the rear of the chassis.
   - **b** If the chassis is using DC power, note the wiring and disconnect the DC power wires from the rear of the chassis.
   - **c** Disconnect the ground cabling from the chassis.
2 Wear an Electrostatic Discharge (ESD) strap, and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
3 Label and disconnect all cabling from the chassis.
4 Remove the modules from the chassis, and install them in the replacement chassis.
5 With another person supporting the chassis, remove the screws securing the chassis to the rack. Remove the chassis from the rack.
6 With the help of another person, lift the replacement chassis into the rack and secure the chassis with the screws previously removed.
7 Reconnect the GPS units to the GNSS antenna.
8 Power up the unit:
   - **a** Reattach the ground cable to the grounding connection on the rear of the chassis.
   - **b** If the chassis is using AC power, reconnect the AC power cables to the chassis.

c If the chassis is using DC power, reconnect the DC power wires into the rear of the chassis.

The GPS performs automatic synchronization. During this activity, the GPS unit seeks out and locks onto GPS satellites. Allow up to one hour for the GPS reference module to track and lock onto the satellites. When the GPS is locked onto the satellites, both the Tracking LED and the Locked LED light up.

IMPORTANT: Wait for the GPS unit to find and lock onto a GPS satellite signal before you continue connecting the TRAK 9100 SSR to the ASTRO® 25 system. It may take up to an hour for the GPS unit to lock onto the satellite signals.

d After the Tracking LED and Locked LED are illuminated on the new GPS reference module, continue with step 9.

9 Reattach the communication cabling to the chassis.

10 Switch the GPS unit to automatic switchover:

a Press and hold the **Fault Reset** button on the FSU module.

b Set the **Select** switch to **Auto**.

c Release the **Fault Reset** button.

11 Verify that the SSR is operating properly. See the procedure “Verifying Serviced Equipment,” for tests and verifications that can be performed for the device.

8.4

Verifying TRAK Simulcast Site Reference Serviced Equipment

When and where to use:
After the equipment is serviced and restored to normal operation, verify that the original problem is resolved, and that all other components are working properly. This procedure explains several verification methods that can be applied to the serviced equipment. Use any applicable steps in the procedure to verify the equipment that has been serviced.

If a device cannot be restored to normal operation, see the “Troubleshooting” chapter to determine the problem, or contact the Motorola Solution Support Center (SSC).

NOTICE: When verifying equipment, some devices which have been serviced may take some time before they are operational and back in service.

Procedure:

1 Check the physical condition of the unit:

a Verify that all affected components are fully and appropriately installed.

b Verify that all cabling is securely connected to the correct ports and that there are no stray wires near the unit.

c Verify that there are no tools or hardware (including nuts, bolts, or screws) located in or around the unit.

d Listen to verify that all mechanical equipment such as hard drives, fans, and other equipment are operating properly in the unit.

2 Check LED indicators:

a Verify that the LEDs are indicating each component is in good condition and operating properly. Indicators should show that the device is powered, enabled, and performing operations.

b For equipment such as processor cards, networking cards, and hard drives, verify that the activity LEDs are neither fully on nor fully off, but that they appear to fluctuate as traffic is being handled or as processes are taking place.

NOTICE: Detailed LED descriptions are listed in the “Reference” chapter.

3 Verify the configuration and condition of the unit:

a Use the network fault management system, to verify that the device is managed. Observe the condition of the device and its components and take note of any reported events for the device. Also, observe the condition and events for any other associated devices and upper-level objects.

b Use the optional Motorola Supervisory Control and Data Acquisition (MOSCAD NFM) manager application to observe the condition of the device and its components and take note of any reported events for the device.

c Use switch and router management applications, such as the UNC and UEM, to verify the configuration and condition of the device.

d If available, access the administration environment of the device and verify that the configuration is set appropriately. Verify that the device is able to access any required resources from the network such as Network Time Protocol (NTP) services, or database downloads.

4 Verify that the device is operating properly:

a Verify that the device is supporting its intended function in the system. To determine that the call services or network services supported by the device are working, use a subscriber radio, client PC, or other applicable device.

b For fixed-radio equipment, use the appropriate test equipment and applications such as Configuration/Service Software (CSS) to run transmission tests and determine signal integrity.

c Verify that other related equipment at the site, which may have been affected by the serviced device are now operating properly.

NOTICE: Detailed diagnostic procedures for equipment are listed in the “Troubleshooting” chapter.

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Chapter 9

TRAK 9100 Simulcast Site Reference LEDs

This chapter contains supplemental reference information relating to the TRAK 9100 Simulcast Site Reference (SSR).

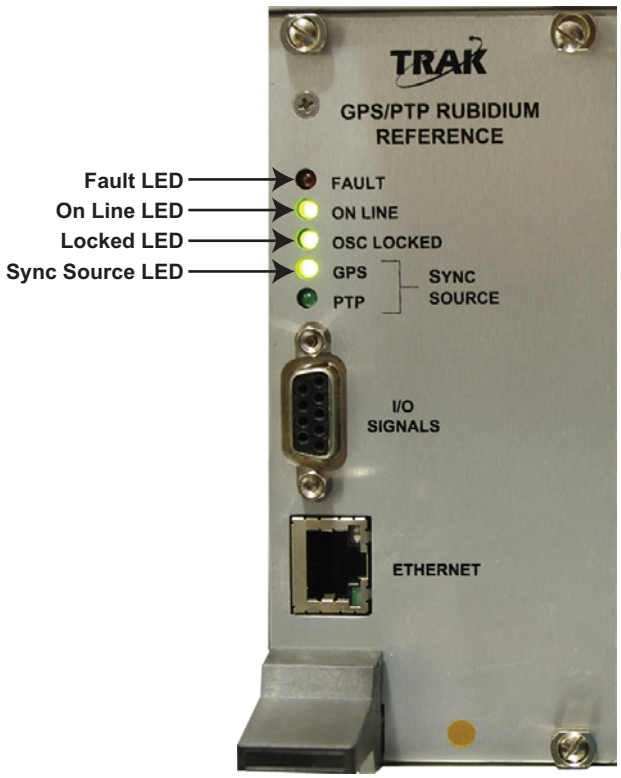
9.1 LED Indicators

This section provides LED reference information for the GPS reference module, Digital Distribution Module (DDM), Telecommunications module (Telco module), Fault Sense Unit (FSU), and the power supply module.

9.1.1 TRAK 9100 Simulcast Site Reference GNSS Reference Module

The following figure indicates the various LEDs in the Global Navigation Satellite System (GNSS) reference module for the TRAK 9100 Simulcast Site Reference:

Figure 24: GPS/PTP Rubidium Reference Module LEDs (DSTRAK910115/910116)



RubidiumDOXCO_GPS_Modules_A

The following table provides a description of the various LEDs for the GNSS reference module.

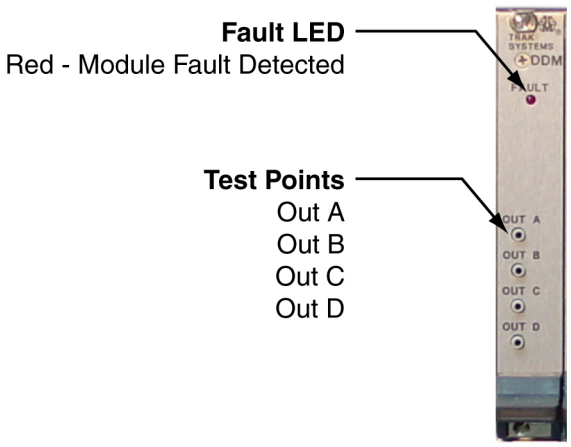
Table 24: GPS/PTP Rubidium Reference Module LEDs (DSTRAK91015/910116) Description

LED	Description	Indication	Status
Fault LED	Indicates that a fault is detected for the GNSS reference module.	Red	The GNSS reference module is reporting a failure. See the “Troubleshooting” chapter for troubleshooting actions.
Online LED	Indicates whether the module is online or in standby mode (as selected through the FSU module).	Green	The GNSS reference module is online (not standby). No action necessary.
		Off	The GNSS reference module is not online (the standby LED is illuminated). See the “Troubleshooting” chapter for troubleshooting actions.
OSC Locked LED	Indicates that the GNSS receiver is tracking the satellites and its internal oscillator is within 1 µs of GNSS.	Green	The GNSS reference module has locked onto the satellites and is operating within appropriate reference tolerance. No action necessary.
		Off	The GNSS reference module is not locked onto the satellites. If the GNSS reference module was recently installed, it may take up to one hour for the receiver to lock onto the satellites. See the “Troubleshooting” chapter for troubleshooting actions.
GPS LED	Indicates that the GNSS is tracking.	Green	GNSS is selected but is not tracking (LED blinks once every 5 seconds). Tracking GNSS but time is not valid (LED blinks once per second). Tracking GNSS and time are valid (LED is ON).
		Off	GNSS is not selected (LED is off).
PTP LED	Indicates the PTP Master is tracking.	Green	PTP is selected but not synchronizing to PTP Master (Blinks once every 5 seconds). PTP Master is synchronizing to but not locked (Blinks once per second). PTP Master is synchronized to (PTP On).
		Off	PTP is not selected (LED OFF).

9.1.2
TRAK Simulcast Site Reference Digital Distribution Module

The following figure indicates the LED in the Digital Distribution Module (DDM).

Figure 25: Digital Distribution Module LED



The following table provides a description of the LED for the DDM and the status information indicated by the LED.

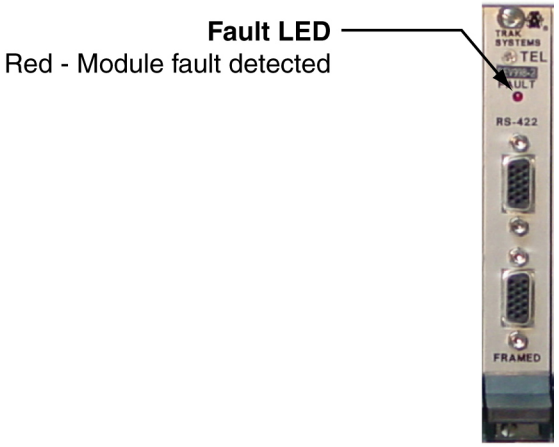
Table 25: Digital Distribution Module LED

LED	Description	Indication	Status
Fault LED	Indicates a DDM failure is detected.	Red	A fault condition is detected on the DDM. See the “Troubleshooting” chapter for troubleshooting actions.

9.1.3
TRAK Simulcast Site Reference Telecommunications Module

The following figure indicates the LED in the Telecommunications module.

Figure 26: Telecommunications Module LED



The following table provides a description of the LED for the Telecommunications module and the status information indicated by the LED.

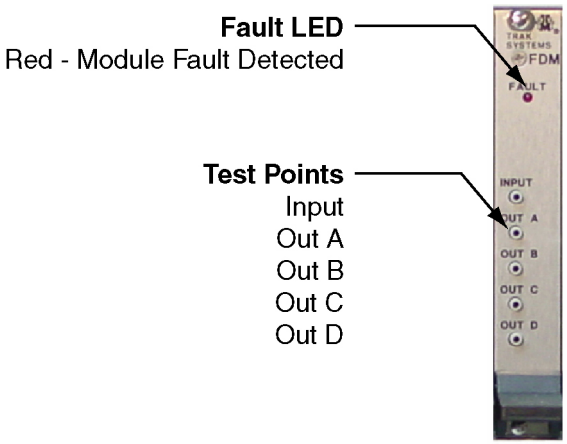
Table 26: Telecommunications Module LED

Type LED	Description	Indication	Status
Fault LED	Indicates a failure is detected for this module.	Red	A fault condition is detected on the Telecommunications module. See the “Troubleshooting” chapter for troubleshooting actions.

9.1.4
TRAK Simulcast Site Reference Frequency Distribution Module

The following figure indicates the LED in the Frequency Distribution Module (FDM).

Figure 27: Frequency Distribution Module LED



The following table provides a description of the LED for the FDM and the status information indicated by the LED.

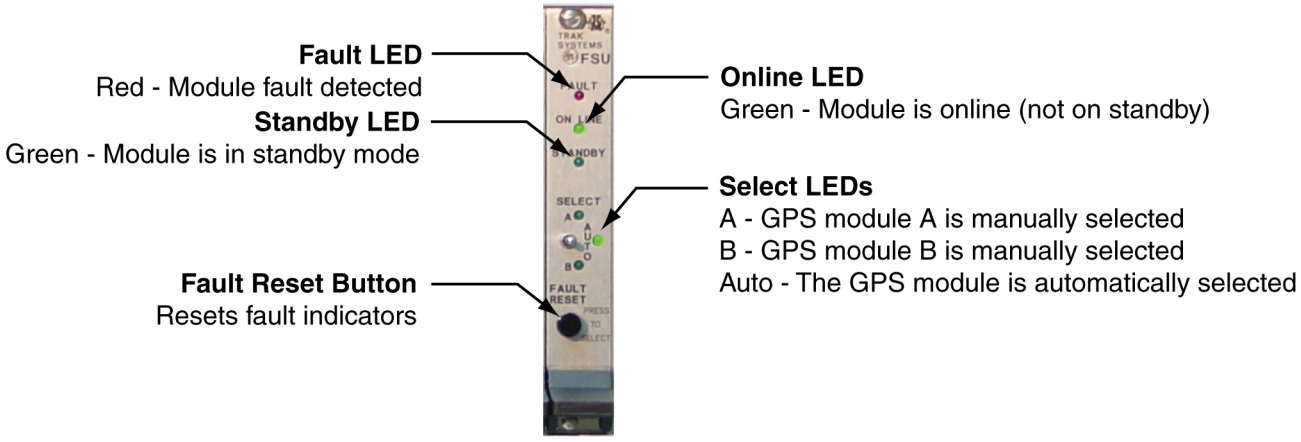
Table 27: Frequency Distribution Module LED

Type LED	Description	Indication	Status
Fault LED	Indicates an FDM failure is detected.	Red	A fault condition is detected on the FDM. See the “Troubleshooting” chapter for troubleshooting actions.

9.1.5
TRAK Simulcast Site Reference Fault Sense Unit Module

The following figure indicates the various LEDs in the FSU module.

Figure 28: Fault Sense Unit LEDs



The following table provides a description of the LEDs for the Fault Sense Unit (FSU) module and the status information indicated by the LEDs.

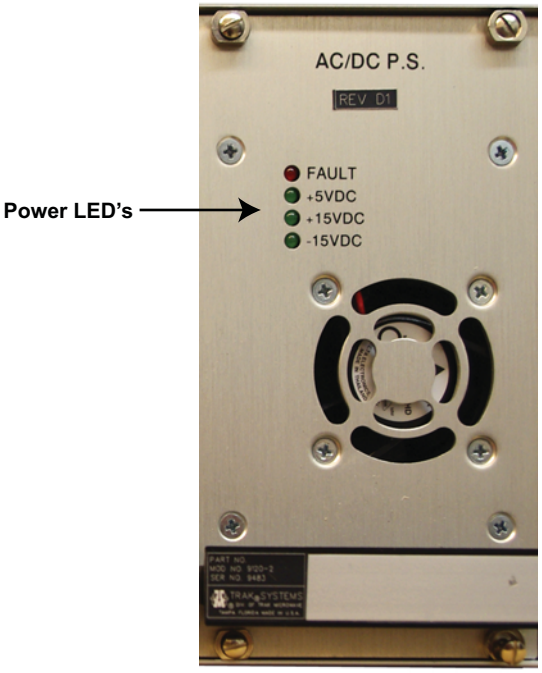
Table 28: Fault Sense Unit LEDs

Type LED	Description	Indication	Status
Fault LED	Indicates an FSU module failure is detected.	Red	A fault condition is detected on the FSU module. See the “Troubleshooting” chapter for troubleshooting actions.
Online LED	Indicates the online status of the FSU module.	Green	The FSU module is online. No action necessary.
		Off	The FSU module is not online. If the FSU module cannot be brought online, troubleshoot the FSU module with the instructions for the fault LED mentioned in the “Troubleshooting” chapter.
Standby LED	Indicates that the FSU module is in standby mode.	Green	The FSU module is in standby mode. The FSU module should always be online.
Select LEDs (A, B, Auto)	Indicates the selected active GPS reference module.	Green	GPS reference module A or B is manually selected, or automatically selected by the FSU module. Typically, the select switch must be set to Auto. If a particular GPS reference module must be made active, select A or B as necessary.

9.1.6
TRAK Simulcast Site Reference Power Supply Module

The following figure indicates the various LEDs in the power supply module for the TRAK 9100 devices.

Figure 29: Power Supply Module LEDs for TRAK 9104-14



PowerSupplyModule_A

The following table provides a description of the LEDs for the power supply module and the status information indicated by the LEDs.

Table 29: Power Supply Module LEDs

Type LED	Description	Indication	Status and Troubleshooting Action
Fault LED	Indicates that the power supply has failed.	Red	A fault condition is detected on the power supply module. See the "Troubleshooting" chapter for troubleshooting actions.
+5 VDC, +15 VDC, and -15 VDC LEDs	Indicates the status of the voltage reference output (+5 VDC, +15 VDC, or –15 VDC).	Green	The voltage reference outputs (+5 VDC, +15 VDC, or –15 VDC) are within appropriate tolerance. No action necessary.
		Off	The voltage reference outputs (+5 VDC, +15 VDC, or –15 VDC) are not within appropriate tolerance for operation.

9.2 TRAK Simulcast Site Reference Frequency Output Connectors

Front panel modules in the TRAK 9100 Simulcast Site Reference (SSR) share relative position for a column of BNC connectors found on the rear panel.

For example, frequency outputs for a module installed in slot A3 are accessible from BNC connectors found in the first column on the rear panel of the TRAK 9100 SSR labeled Frequency Output 1A through 1D (the right-most column of BNC connectors), when facing the rear panel.

The following table provides a module to output (BNC connector) reference list.

Table 30: Frequency Output Connectors for SSR Modules

TRAK 9100 SSR – Front Slot	TRAK 9100 SSR BNC Connectors (Rear)
Module in Slot A3	Frequency Output 1A through 1D
Module in Slot A4	Frequency Output 2A through 2D
Module in Slot A5	Frequency Output 3A through 3D
Module in Slot A6	Frequency Output 4A through 4D
Module in Slot A7	Frequency Output 5A through 5D
Module in Slot A8	Frequency Output 6A through 6D

9.3 TRAK 9100 Simulcast Site Reference Terminal Server Cabling and Pinout

The following table lists the cabling and pinout reference for the terminal server to TRAK 9100 Simulcast Site Reference (SSR).

Table 31: Terminal Server to SSR

Terminal Server Serial Port RJ-45	TRAK 9100 SSR Device Console Port DB-9 M
3 – Tx	3 – Tx
Tx & Rx GND 4 & 5	GND 5
6 – Rx	2 – Rx

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Appendix A

TRAK 8835 Site Reference

A.1
TRAK 8835 Site Reference Introduction, Description, and Specification

This chapter provides a high-level description of the TRAK 8835-8M and TRAK 8835-3M Site Reference and the function it serves on your system.

A.1.1
TRAK 8835 Site Reference Introduction

Overview of the TRAK 8835 Site Reference

The TRAK 8835 Site Reference is used in a conventional analog subsystem, high availability, receive-only (optional) remote site and ASTRO® 25 repeater sites that support 10Base-T Ethernet Epic IV or Epic VI QUANTAR® stations or a mix of QUANTAR® stations with standalone GTR 8000 Base Radios or GTR 8000 Expandable Site Subsystem cabinets/racks configurations.

IMPORTANT: The TRAK 8835 Site Reference device is certified only for use at an ASTRO® 25 repeater site and circuit-based or IP-based analog-only voting subsystems.

The TRAK 8835 functions as a:

- Network Timing Protocol (NTP) services (TRAK 8835-3M)
- Global receiver, that supplies stratum 1 frequency and time reference for equipment at the prime/hub site and remote base radio site in an analog-only conventional distributed subsystem (TRAK 8835-2M/8M and TRAK 8835-3M)
- The GNSS receiver that supplies stratum 1 frequency and time reference for equipment at the remote base radio site in a digital-only conventional distributed subsystem (with QUANTAR® stations) (TRAK 8835-2M/8M and TRAK 8835-3M)
- Backup 1PPS signal frequency holdover at both trunked IP simulcast remote high availability sites and trunked receive-only remote sites with Time Division Multiple Access (TDMA) or Enhanced Data operation (TRAK 8835-3M)
- 5 MHz reference to QUANTAR® stations at an ASTRO® 25 repeater site
- 5 MHz reference to standalone GTR 8000 Base Radios at an ASTRO® 25 repeater site
- Composite (1PPS + 5 MHz) reference to standalone GTR 8000 Base Radios and 1PPS reference to standalone GCP 8000 Site Controllers for TDMA and Enhanced Data at an ASTRO® 25 repeater site

The TRAK 8835-8M and TRAK 8835-3M Site Reference hardware with a dongle adapter provides:

- Time and frequency stability (Stratum 1 accuracy when tracking GNSS)
- DOCXO or Rubidium Oscillator
- 48 VDC option: [36 to 72 VDC]
- 10 MHz on a BNC connector
- 1PPS on a BNC connector
- RS–232 and 10 / 100 base-T Ethernet Port

- Dongle Adapter:
  - Composite on a BNC connector (1PPS + 5 MPPS) signal
  - 5 MHz signal on a BNC connector
  - RS-232 I/O on a 9-Pin “D” Connector

TRAK 8835-8M and TRAK 8835-3M Site Reference devices support SNMPv3 and send Simple Network Management Protocol (SNMP) traps to the Unified Event Manager (UEM) to provide centralized fault management.

TRAK 8835-2M devices are not certified for Secure SHell (SSH), Telnet, SNMP, or NTP. TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.

Overview of TRAK 9100 Simulcast Site Reference and NTP Services

The TRAK 8835-3M Site Reference provides precise time and frequency output signals to support NTP services and simulcast site (frequency) reference functionality. The NTP services ensure that fault logging services, statistics, and other time-critical procedures are synchronized. The following NTP servers (TRAK devices) can be installed as an option based on the following zone cores:

- For an M3 zone core, NTP services are mandatory and only the following TRAK devices are supported: TRAK 9100-8E or TRAK 8835-3M.
- For an L1, L2, M1, or M2 zone core, NTP services are optional and only the following TRAK devices are supported: TRAK 9100-8E or TRAK 8835-3M.
- K1 or K2 core, NTP services are optional, and simulcast site reference devices are customer provided.

For additional information on NTP services, see the *Network Time Protocol Server* manual.

Overview of TRAK 8835 in an IP Simulcast Remote Site with High Availability in a GTR 8000 Expandable Site Subsystem and Receive-only Remote Site with TDMA

For a GTR 8000 Expandable Site Subsystem at an IP simulcast remote site with high-availability, and a receive-only remote site with TDMA or Enhanced Data operation, an optional backup for the frequency and time references is supplied to the base radios and is available through a TRAK 8835-3M Site Reference. The backup Simulcast Site Reference (SSR) provides an extended holdover of at least 72 hours when redundant GNSS or certain GPB 8000 Reference Distribution Module (RDM) failures occur. If an optional TRAK SSR at the remote site is used as an extended holdover backup, the RDM can be configured in the following configurations to either provide support or act as a replacement for the GNSS units:

- Each RDM connected to a GNSS unit
- One RDM connected to a GNSS unit
- No RDMs connected to a GNSS unit

Overview of TRAK 8835 in a Receive-only or Single Transmitter Receiver Voting Remote Site Subsystem with TDMA or Enhanced Data

In a receive-only or Single Transmitter Receiver Voting (STRV) remote site subsystem with TDMA or Enhanced Data operation, two GNSS receivers and a TRAK (optional) are used for a longer duration frequency holdover to provide reference through the RDM. An optional backup for the frequency and time references supplied to the receiver is available either through a TRAK 8835-3M or TRAK 9100 Site Reference. The backup TRAK 8835-3M or TRAK 9100 Site Reference provides an extended holdover of at least 72 hours when redundant GNSS or certain RDM failures occur.

Overview of TRAK 8835 in an ASTRO 25 Repeater Site with Standalone GTR 8000 Base Radios

In an ASTRO® 25 repeater site with standalone GTR 8000 Base Radios, and standalone GCP 8000 Site Controllers controlling more than six base radios, a 5 MHz frequency reference is supplied to the base radios. For a site with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the base radios, and 1PPS time reference to the GCP 8000 Site Controllers.

The TRAK 8835 is supported in the following configurations:

- Standalone GCP 8000 Site Controllers controlling more than six standalone GTR 8000 Base Radios – External Reference Only
- Standalone GCP 8000 Site Controllers controlling more than six standalone GTR 8000 Base Radios – GCP 8000 Site Controllers and External Reference

Both the site controllers and the TRAK 8835 together can provide a redundant LAN interface and a redundant time and frequency reference interface. Base radios one through six connect directly to the site controllers. The base radio transceiver generates the station reference, which typically must be locked onto the site controller TDMA clocks for time and frequency reference. Base radios seven through 28 connect to the TRAK 8835 to provide a 5 MHz frequency reference. See the *ASTRO 25 Repeater Site Infrastructure Reference Guide* for further details.

NOTICE: The TRAK 9100 must be used when more than eight base radios requiring external references are at the site.

Overview of TRAK 8835 in an ASTRO 25 Repeater Site with QUANTAR Stations With or Without Standalone GTR 8000 Base Radios

In an ASTRO® 25 repeater site with QUANTAR® stations with or without standalone GTR 8000 Base Radios:

- Standalone GCP 8000 Site Controllers controlling six or less QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal Ultra-High Stability Oscillator (UHSO) or an external TRAK 8835 device.
- Standalone GCP 8000 Site Controllers controlling more than six QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios, and 1PPS time reference to the site controllers.

NOTICE: The TRAK 9100 must be used when more than eight channels are at the site.

Overview of TRAK 8835 in an ASTRO 25 Repeater Site with QUANTAR Stations and GTR 8000 Expandable Site Subsystem

In an ASTRO® 25 repeater site with QUANTAR® stations and GTR 8000 Expandable Site Subsystem, TRAK devices are used in the following configurations:

- A GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device.
- A GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device.
- A GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device.

- A GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external or TRAK 8835 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios, and 1PPS time reference to the site controllers.

NOTICE: The TRAK 9100 must be used when more than eight QUANTAR® stations requiring external references are at the site.

A.1.2
TRAK 8835 Site Reference Description

The TRAK 8835-8M Site Reference incorporates a multi-channel GPS receiver, disciplined oven crystal oscillator, time, and frequency signal generation, in compact form factor enclosuresand the TRAK 8835-3M incorporates a multi-channel GPS receiver, rubidium oscillator, time, and frequency signal generation, in a compact form factor enclosure. The following outputs are available:

- 10 MHz on the BNC connector (front panel)
- 1PPS on the BNC connector (front panel)
- 5 MHz on the BNC connector (dongle adapter)
- composite (1PPS + 5 MPPS) on the BNC connector (dongle adapter)

NOTICE: During initial power-up and until the unit locks, the 1PPS, 5 MHz and composite (1PPS + 5 MPPS) outputs are muted.

TRAK 8835-8M Site Reference oscillator includes a DOXCO oscillator and the TRAK 8835-3M includes a Rubidium oscillator. The DOXCO and Rubidium oscillator provide Stratum 1 stability, when disciplined by GPS, and a low phase noise 10 MHz frequency reference signal. When tracking GPS, a propriety discipline algorithm steers the oscillators to the GPS reference. See the *TRAK Microwave Model 8835 GPS Clock* manual, Table 1–2 for “TRAK 8835 Oscillator Characteristics” table for DOXCO oscillators.

The TRAK 8835-3M Site Reference use GPS satellite signals to drive a high-precision 1PPS, 5 MHz, or composite (1PPS + 5 MPPS) references. These references are provided to all base radios, comparators, and site controllers, so that all devices involved in the audio transmission have a common timing source (GPS).

The following TRAK 8835 models are available:

Table 32: TRAK 8835 Models

Models	General Description
TRAK 8835-8M	Double Ovenized Crystal Oscillator (DOXCO), 48 VDC power inputs*, Standard model. Replaces the TRAK 8835-2M; Includes Ethernet port with support for Telnet, SSH, FTP and SNMP.
TRAK 8835-3M	Rubidium Oscillator, 48 VDC power inputs*, Extended model. Includes Ethernet port with support for Telnet, SSH, FTP, SNMP and NTP

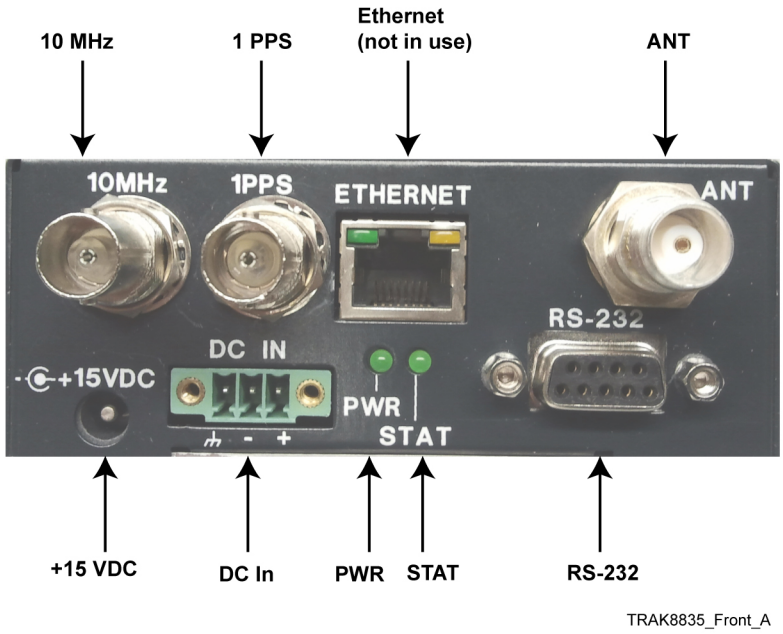
*Optional, external AC/DC power supply is available to operate the unit at AC power.

A.1.2.1
TRAK 8835 Site Reference Front View

The Network Ethernet interface port supports 10 / 100 Base T Protocols: Telnet, Secure SHell (SSH), FTP, Simple Network Management Protocol (SNMP), and Network Time Protocol (NTP). TRAK

8835-2M devices are not certified for SSH, Telnet, FTP, SNMP, or NTP. TRAK 8835-8M devices are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support. All TRAK 8835-3M devices are fully certified for SSH, Telnet, SNMP, or NTP.

Figure 30: TRAK 8835 Front View



A.1.2.1.1

TRAK 8835 Site Reference Front Connections

This table provides descriptions of the TRAK 8835 connections and their functions.

Table 33: TRAK 8835 Connections

Port Label	Connector Type	Port Function	Mating Connection
10 MHz	BNC female	10 MHz signal	BNC male
1PPS	BNC female	1PPS time reference	BNC male
ETHERNET	RJ-45	10 / 100 Base T Protocols: Telnet, SSH, FTP, SNMP, and NTP. TRAK 8835-2M devices are not certified for Secure SHell (SSH), Telnet, Simple Network Management Protocol (SNMP), or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.	RJ-45
ANT	TNC-female	Global Navigation Satellite System (GNSS) antenna input and antenna +5 VDC power	TNC-male

Table continued…

Port Label	Connector Type	Port Function	Mating Connection
+15 VDC	2.5 mm jack	+15 VDC power input from external AC/DC power supply	2.5 mm plug
DC IN	Header	DC power input, 48 VDC, customer supplied voltage	Terminal block
RS-232	DB-9 female	RS-232 port is configured for 9600 baud, 8 data bits, 1 stop bit, and no parity. Additional ports are available through the Dongle Adapter: • Composite (1PPS + 5 MHz) time and frequency reference • 5 MHz signal • RS-232 I/O	Dongle adapter mating connections: • BNC male • BNC male • DB-9 male

A.1.2.1.2
TRAK 8835 Site Reference LEDs

The two status indicator LEDs on the front of the TRAK 8835 Site Reference are:

PWR
Power indicator, green shows the state of the TRAK 8835 power supply.

STAT
Status indicator, green shows the state of the TRAK 8835 Global Navigation Satellite System (GNSS) signal

A.1.2.2
TRAK 8835 Site Reference Dongle Adapter Connections

An RS-232 dongle adapter is available for the TRAK 8835 Site Reference and provides connections for devices requiring a 5 MHz signal, composite (1PPS + 5 MHz) time and frequency reference and an RS-232 I/O for remote setup and monitoring.

Figure 31: TRAK 8835 Dongle

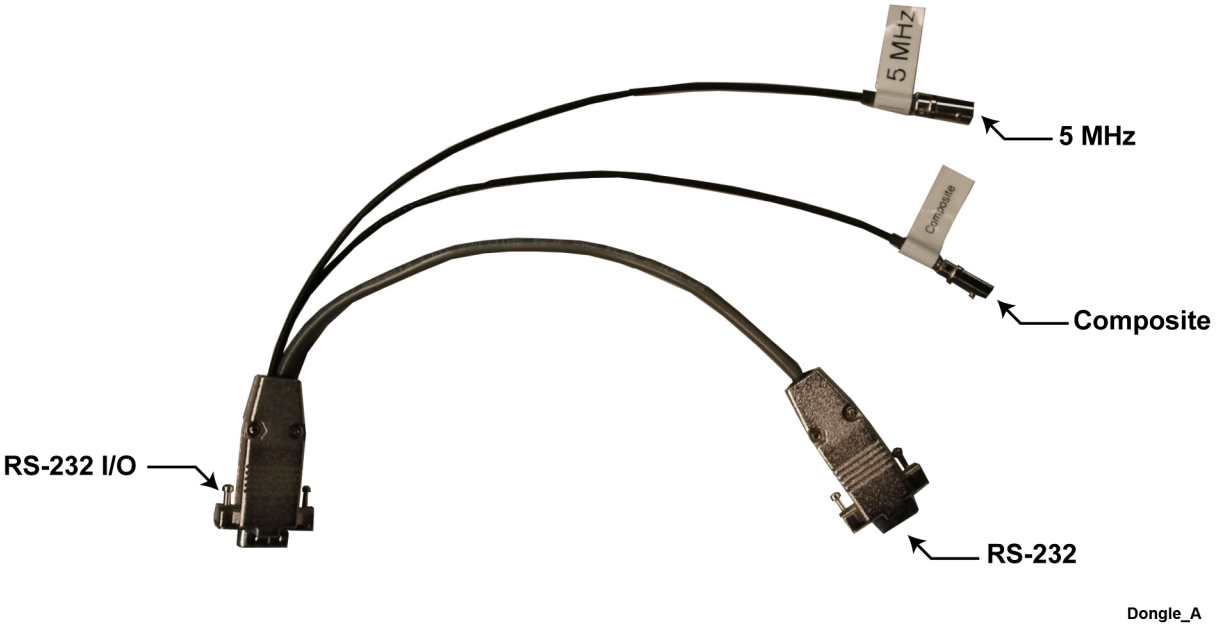


Table 34: TRAK 8835 Dongle Adapter Connections

Port Label	Dongle Adapter Connector	Mating Connection	Function
5 MHz	DB-9 female	BNC male	Dongle Adapter connection through the RS-232 port provides a 5 MHz signal through the BNC connector.
COMPOSITE	DB-9 female	BNC male	Dongle Adapter connection through the RS-232 port provides a composite (1PPS + 5 MHz) time and frequency reference through the BNC connector.
RS-232	DB-9 female	DB-9 male	Dongle Adapter connection through the RS-232 port is configured for 9600 baud, 8-data bits, 1-stop bit, and no parity and used for remote setup and monitoring through the DB-9 connector.

Table 35: TRAK 8835 Dongle Adapter Wiring Connections

Pin Number	Signal
1	Alarm Relay (common)
2	Tx data RS-232 I/O
3	Rx data RS-232 I/O
4	Alarm Relay (Normally closed)
5	Ground
6	5 MHz output

Table continued…

Pin Number	Signal
7	Ground
8	COMPOSITE output
9	Ground

A.1.2.3
TRAK 8835 Site Reference Power Supply

The TRAK 8835 Site Reference is supplied with an internal DC/DC converter option for 48 VDC operation. Power input floats with respect to ground, therefore can be connected to a positive or negative supply voltage. The 48 VDC operates for 36 to 72 VDC.

Power consumption for an optional, external AC/DC power supply is available for the TRAK 8835 Site Reference to operate the unit from AC power. This power supply operates from 100 to 240 VAC, 47 to 63 Hz, and supplies 15 VDC at a maximum power output of 30 W.

A.1.2.4
TRAK 8835 Site Reference Oscillator Characteristics

The TRAK 8835 Site Reference has a discipline oscillator, with nonvolatile digital storage of its center frequency. When the unit is synchronized by GPS, the oscillator is automatically disciplined and the last-stored center frequency value is retained whenever GPS synchronization or power is removed. There are two oscillator types available for the Model 8835: double oven crystal oscillator and rubidium oscillator. For oscillator characteristics, see “Chapter 1” in the *TRAK Technical Manual (D001571) Model 8835 GPS Clock* manual.

A.1.3
TRAK 8835 Site Reference Operating Specifications

This table provides physical and operating specifications for the TRAK 8835 Site Reference.

Table 36: TRAK 8835 Physical and Operating Specifications

Specification	TRAK 8835-8M Value or Range	TRAK 8835-3M Value or Range
Physical Dimensions, Models TRAK 8835	Crystal Oscillators (inches): 5 L x 4 W x 1.6 H	Rubidium Oscillators (inches): 10.4 L x 4.04 W x 1.6 H
Weight	approximately 1.5 lb	
Mounting	Six #6–32 screw holes in a base. For mounting screw locations, see Chapter 2 in the *TRAK Technical Manual (D001571) Model 8835 GNSS Clock* manual.	
Optional Mounting	1 U rack mounting adapter	
Operating Temperatures	– 30 ºC to +60 ºC	
Storage Temperatures	– 45 ºC to +85 ºC	
Humidity	95% non-condensing	

Table continued…

Specification	TRAK 8835-8M Value or Range	TRAK 8835-3M Value or Range
DC power operating range	48 VDC (source); 36 to 72 VDC (maximum) DOCXO options: 15 W at power-up / 7.5 W steady state	48 VDC (source); 36 to 72 VDC (maximum) Rubidium option: 23 W at power-up / 12.5 W steady state
DC power current draw	Less than 1.0 A at 48 VDC	
AC power operating range	100 to 240 V, 47 – 63 Hz	
Power Consumption	15 – 80 W	

A.1.3.1 TRAK 8835 Site Reference Dongle Adapter Operating Specifications

Table 37: TRAK 8835 Dongle Adapter – Physical and Operating Specifications

Specification	Dongle Adapter Assembly
Connector Specifications	5 MPPS on BNC (1PPS + 5 MPPS) composite on BNC RS-232 I/O

A.1.3.2 GNSS Antenna Operating Specifications

The following table lists the operating specifications for the Global Navigation Satellite System (GNSS) antenna.

Table 38: GNSS Antenna Operating Specifications

Specification	Value or Range
Physical Dimensions	Diameter: 8.89 cm (3.5 in.) Height: 10.16 cm (4.0 in.)
Weight	0.32 kg (0.7 lb) (excluding mast)
Operating Temperature	–40 °C to +85 °C (–40 °F to +185 °F)

A.1.3.3 GNSS Receiver Operating Specifications

Table 39: GNSS Receiver Operating Specifications

Specification	Value or Range
Frequency	L1 (1575.42 MHz) C / A code
Channels	50 channels, independent and continuous tracking

Table continued…

Specification	Value or Range
Acquisition time	< 1 minute, cold start
External gain	15 dB to 50 dB
Antenna power	+ 5 VDC (5 – 80 mA)
Connector	TNC female

A.1.3.4
TRAK 8835 Site Reference Power Supply Operating Specifications

This table provides the operating specifications for the TRAK 8835 AC-DC power supply. For additional Input, Output, General, EMC, and Safety specifications for the AC-DC Power Supply, see the *TRAK Technical Manual (D001571) Model 8835 GNSS Clock* manual.

Table 40: TRAK 8835 AC-DC Power Supply Operating Specifications

Specification	AC-DC Power Supply
Input Voltage	90 – 264 VAC
Input Frequency	46 – 63 Hz
Operating Tempera-ture	–20 °C to +70 °C, derate linearly from 100% power at +40 °C to 50% power at +70 °C
Watts	15 – 80 W
Storage Temperature	–40 °C to +85 °C
Cooling	Convection cooled
Operating Humidity	5 – 95% RH, non-condensing
Operating Altitude	3000 m
Shock	10 g. 10 ms on 3 axes

A.1.3.5
TRAK 8835 Site Reference DC In Connector Wiring

Table 41: TRAK 8835 +15 VDC In Connector Wiring

Pin Number	Signal
1	Ground
2	– DCV (not ground referenced)
3	+ DCV (not ground referenced)

A.1.3.6
TRAK 8835 Site Reference 15 VDC In Connector Wiring

Table 42: TRAK 8835 +15 VDC In Connector Wiring

Pin	Signal
Center	+15 VDC

Table continued…

Pin	Signal
Shell	Ground

For additional Input, Output, General, EMC, and Safety specifications for the AC-DC Power Supply, see *TRAK Technical Manual (D001571) Model 8835 GNSS Clock* manual.

A.2 TRAK 8835 Site Reference Installation

This section explains how the TRAK 8835 Site Reference works in the context of your system.

A.2.1 TRAK 8835 Site Reference Equipment Installation

For unpacking, mounting procedures and installation instructions for the TRAK 8835 equipment, see “Chapter 2” in the *TRAK Technical Manual (D001571) Model 8835 GPS Clock* manual.

Observe the following general safety precautions during all phases of operation, service, and repair of the equipment described in this manual. Follow the safety precautions listed and all other warnings and cautions necessary for the safe operation of all the equipment. See the appropriate section of the product service manual for more pertinent safety information. Because of the danger of introducing extra hazards, do not install substitute parts or perform any unauthorized modifications of equipment.

NOTICE: The installation process requires preparation and knowledge of the site before installation begins. Review installation procedures and precautions in the Motorola R56 *Standards and Guidelines for Communications Sites* before performing any site or component installation.

Always follow all applicable safety procedures, such as Occupational Safety and Health Administration (OSHA) requirements, National Electrical Code (NEC) requirements, local code requirements, safe working practices, and good judgment.

General Safety Precautions include the following:

- Read and follow all warning notices and instructions marked on the product or included in this manual before installing, servicing, or operating the equipment. Retain these safety instructions for future reference.
- If troubleshooting the equipment while power is on, be aware of the live circuits.
- Do not operate the radio transmitters unless all RF connectors are secure and all connectors are properly terminated.
- All equipment must be properly grounded in accordance with the Motorola R56 manual *Standards and Guidelines for Communications Sites* and specified installation instructions for safe operation.
- Slots and openings in the cabinet are provided for ventilation. Do not block or cover openings that protect the devices from overheating.
- Only a qualified technician familiar with similar electronic equipment must service the equipment.
- Some equipment components can become extremely hot during operation. Turn off all power to the equipment and wait until sufficiently cool before touching.
- Maintain emergency first aid kits at the site.
- Have personnel call in with their travel routes to help ensure their safety while traveling between remote sites.
- Institute a communication routine during certain higher risk procedures where the on-site technician continually updates management or safety personnel of the progress so that help is dispatched if needed.

- Never store combustible materials in or near equipment racks. The combination of combustible material, heat, and electrical energy increases the risk of a fire safety hazard.
- Equipment must be installed in the site meeting the requirements of a “restricted access location” per *UL60950-1*, defined as follows: “Access is available to service persons or users who are warned about the possible burn hazard on equipment metal housing and hazardous energy level at the ‘BATT/DC’ port. Access to the equipment is by using a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.”
- This equipment must be connected directly to the DC supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus in which the DC supply system earthing electrode conductor is connected.
- This equipment must be located in the same immediate area (such as adjacent cabinets) as any other equipment that has a connection between the earthed conductor of the same DC supply circuit and the earthing conductor, and also the point of earthing of the DC system. The DC system must not be earthed elsewhere.
- The DC supply source is located within the same premises as the equipment.
- Switching or disconnecting devices must not be in the earthed circuit conductor between the DC source and the point of connection of the earthing electrode conductor.

A.2.2
TRAK 8835 Site Reference GNSS Antenna Installation

This section provides an overview and procedures for installing the Global Navigation Satellite System (GNSS) antenna.

The TRAK 8835 Site Reference provides composite (5 MPPS + 1PPS) signal (5 MPPS signal at 1 pulse per second repetition rate) to the standalone MLC 8000 Site Link Converter in Analog IP Simulcast configuration from the GNSS antenna. These signals establish timing functions for transmit and receive frequencies at the base radios.

For installation of the TRAK 8835 GNSS Antenna, see Installing the GNSS Antenna on page 48.

A.2.3
GNSS Antenna Line Loss

CAUTION: Cutting the cable below a recommended minimum length can cause problems with signal strength overload.

The maximum allowable line attenuation between the antenna and the TRAK is 6 dB. This includes a 4 dB margin for attenuation from foliage. Installations in which the antenna has an unobstructed view of the sky may have a maximum line attenuation of 10 dB.

In a typical installation using 0.5 inch, low density, foam coaxial cable, the length of the cable run should never exceed 45.72 m (150 ft).

This length is sufficient for most installations. When using larger cables, allow 4.5 dB of loss at 1.5 GHz. The remaining 1.5 dB of attenuation is provided by interior site cabling and connectors.

A.2.4
No Lock on GNSS Signal Alarm Indication

If a system alarm indicates that the GNSS signal cannot be located, reposition the antenna.

A.2.5
TRAK 8835 Site Reference Cabling

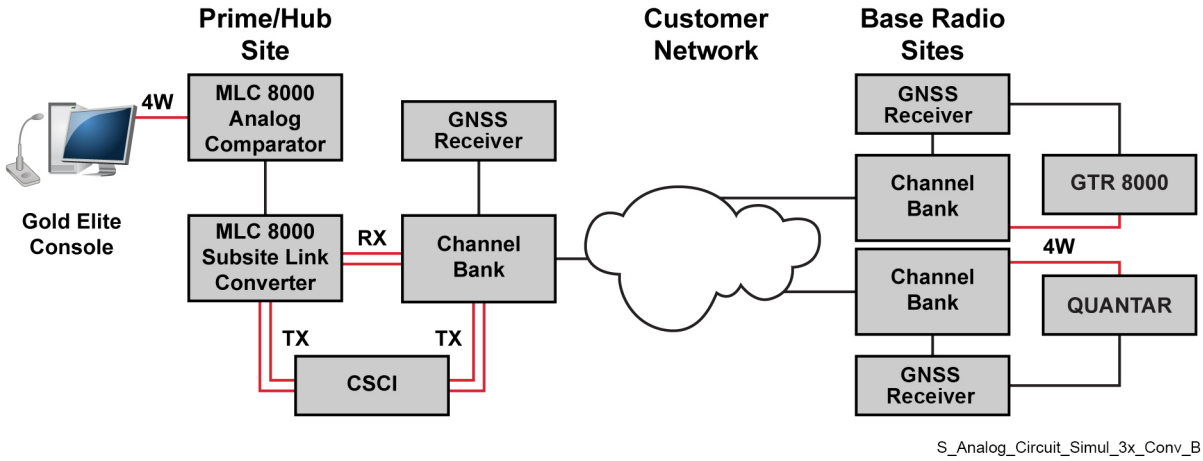
All output signal connections interfacing to other devices are made through the front panel. The TRAK 8835 Site Reference connections are:

- Two power supply (AC or DC) connectors.
- One GNSS antenna N-type connector.
- One DB–9 connector supports dongle adapter connection used for 5 MPPS (5 MHz) signal, Composite (1PPS + 5 MPPS) time and frequency reference and RS-232 I/O for a remote setup and monitoring (RQBT Request BIT Status).
- Two BNC connectors – 10 MHz signal and 1PPS signal.
- RJ-45 connector for device connections.
- A network interface port that provides Secure SHell (SSH), Telnet, Simple Network Management Protocol (SNMP), and Network Time Protocol (NTP) is available on the TRAK 8835-3M and TRAK 8835-8M.

A.2.5.1
TRAK 8835 Cabling for ASTRO 25 Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem

The TRAK 8835 Site Reference in an ASTRO® 25 Circuit-Based Conventional Analog-only Simulcast Voting Subsystem are employed in both the Base Radio Sites and Prime/Hub Sites.

Figure 32: Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem



NOTICE: High-level diagrams are provided as examples only and are not to be used for system planning purposes. “GNSS Receiver” in the diagram refers to TRAK 8835 Site Reference in both the Prime/Hub Site and the Base Radio Sites. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices.

Table 43: TRAK 8835 Cabling for ASTRO 25 Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem Prime Site

From TRAK 8835 (Prime Site):		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	Channel Bank	BNC male	Connects to the Channel Bank at the Prime site.
ETHERNET	RJ-45 jack	MOSCAD NFM	RJ-45	For status indication to UEM via SNMPv3. **NOTICE:** TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GPS Antenna System	Dependent on GPS antenna used	Connects the TRAK 8835 with the GPS antennas. These are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.

Table continued…

From TRAK 8835 (Prime Site):		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring .
RS-232 with Dongle Adapter: • RS-232 • composite • 5 MHz	DB-9 female	RS-232 Dongle Adapter connects to: • Laptop • Not used • Not used	RS-232 Dongle Adapter connectors: • DB-9 male • Not used • Not used	RS-232 Dongle Adapter provides: • Optional connection to laptop for remote setup and monitoring. • Not used • Not used

Table 44: TRAK 8835 Cabling for ASTRO 25 Circuit-Based Conventional Analog-Only Simulcast Voting Base Radio Site

From TRAK 8835 (Remote Site):		To Destination Device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	Channel Bank	BNC male	Connects to the Channel Bank at the Base Radio Site.
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued…

From TRAK 8835 (Remote Site):		To Destination Device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GPS Antenna System	Dependent on GPS antenna used	Connects the TRAK 8835 with the GPS antennas. These are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring .

Table continued…

From TRAK 8835 (Remote Site):		To Destination Device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
RS-232 with Dongle Adapter: • RS-232 • composite • 5 MHz	DB-9 female	RS-232 with Dongle Adapter connects to: • Laptop • Not used • GTR 8000 and or QUANTAR® devices*	RS-232 with Dongle Adapter connectors: • DB-9 male • Not used • BNC male	RS-232 with Dongle Adapter provides: • Optional connection to laptop for remote setup and monitoring. • Not used • Dongle adapter attached to the RS-232 ports provides a 5 MHz signal through the BNC connector to the GTR 8000 and or QUANTAR devices.*

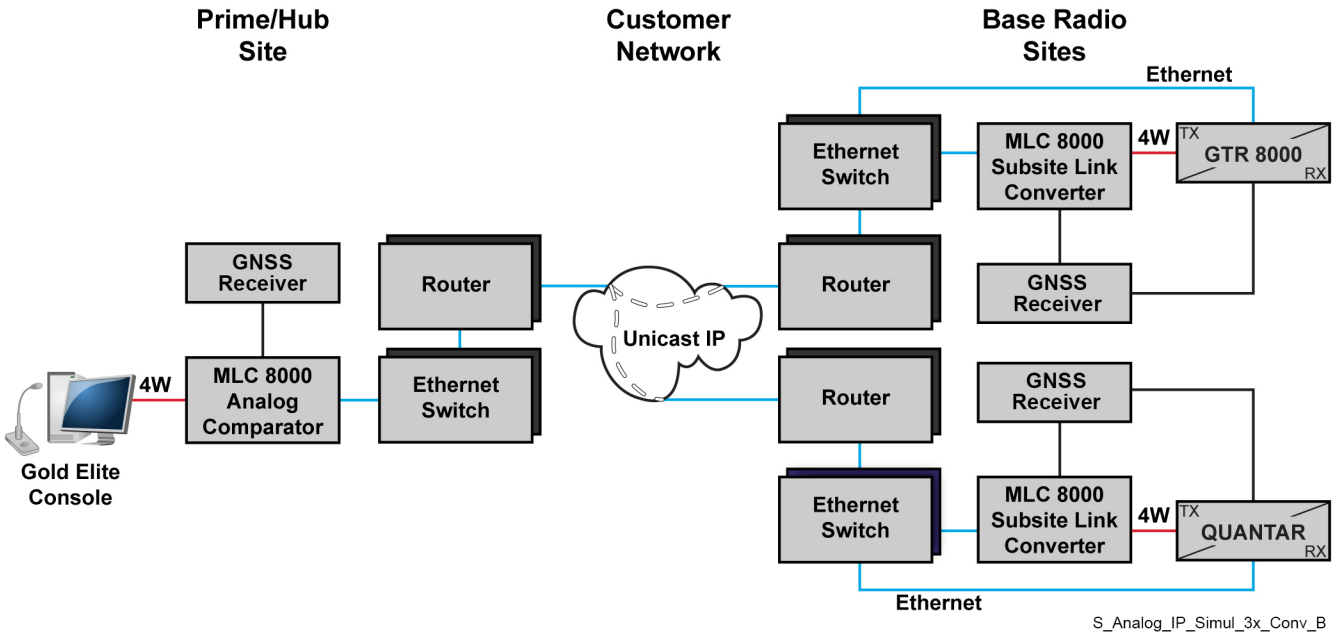
*The Dongle Adapter with the 5 MHz input is high impedance. An external termination is required to properly terminate the cable connected to the input. It is recommended that a BNC "T" and a 50 Ohm BNC termination connect to the input to terminate the cable. If the cable is daisy chained (up to 8 base radios and or QUANTARs are connected together and driven by one TRAK 8835 output with Dongle Adapter), only the last base radio or QUANTAR in the chain has the termination. For configuration details, see the *GTR 8000 Base Radio* manual.

A.2.5.2

TRAK 8835 Cabling for ASTRO 25 IP-Based Conventional Analog-only Simulcast Voting Subsystem

The TRAK 8835 Site Reference in an ASTRO® 25 IP-based Conventional Analog-only Simulcast Voting Subsystem are employed in both the Base Radio Sites and Prime/Hub Sites. To ensure that the correct TRAK device is installed on your subsystem, see TRAK Device Support Overview on page 159 before beginning installation of your subsystem.

Figure 33: IP-Based Conventional Analog-Only Simulcast Voting Subsystem



NOTICE: High-level diagrams are provided as examples only and are not to be used for system planning purposes. “GPS” in the diagram refers to TRAK 8835 Simulcast Reference in both the Prime/Hub Site and the Base Radio Sites. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices.

Table 45: TRAK 8835 Cabling for IP-Based Conventional Analog-Only Simulcast Voting Prime Site

From TRAK 8835 (Prime Site):		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	ESS Junction Panel	BNC	External Site Reference
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued...

From TRAK 8835 (Prime Site):		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GPS Antenna System	Dependent on GPS antenna used.	Connects the TRAK 8835 with the GPS antennas. These are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).

Table continued…

From TRAK 8835 (Prime Site):		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
RS-232 with Dongle Adapter: • RS-232 • composite • 5 MHz	DB-9 female	RS-232 Dongle Adapter connects to: • Laptop • MLC 8000 Subsite Link Converter • Not used	RS-232 Dongle Adapter connector: • DB-9 male • BNC male • Not used	RS-232 Dongle Adapter provides: • Optional connection to laptop for remote set-up and monitoring. • Dongle Adapter attached to the RS–232 port provides a (1PPS + 5 MPPS) time and frequency reference through the BNC connector. • Not used

NOTICE: Interface the TRAK 8835 Site Reference or TRAK 9100 1 PPS BNC connector (front panel) to the Junction Panel on the GTR 8000 Expandable Site Subsystem, however it can also be connected to the EXT FREQ REF port on the GTR 8000 Expandable Site Subsystem Rear Backplane. See the *GTR 8000 Expandable Site Subsystem* manual for details.

Table 46: TRAK 8835 Cabling for IP-Based Conventional Analog-Only Simulcast Voting Base Radio Site

From TRAK 8835: Port	Connector Type	To Destination device: Device	Connector Type	Description
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	Not used	Not used	Not used
1PPS	BNC female	ESS Junction Panel	BNC	External Site Reference
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued…

From TRAK 8835: Port	Connector Type	To Destination device: Device	Connector Type	Description
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GPS Antenna System	Dependent on GPS antenna used.	Connects the TRAK 8835 with the GPS antennas. These are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).

Table continued…

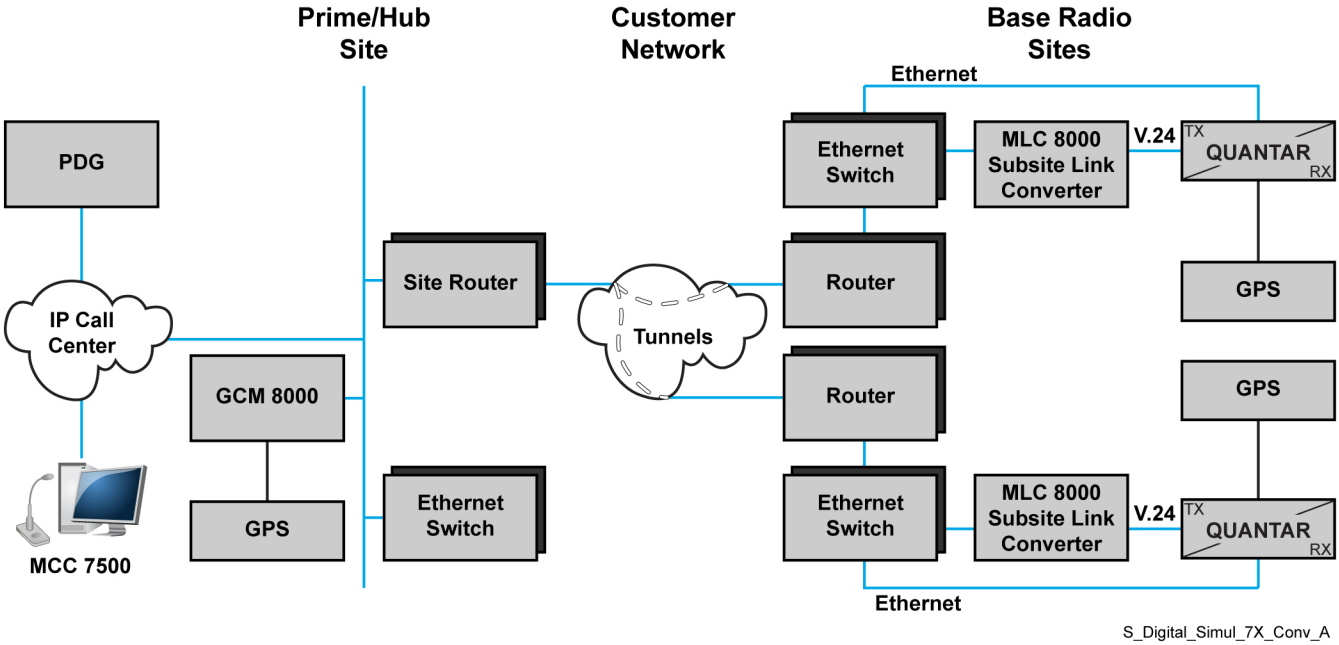
From TRAK 8835: Port	Connector Type	To Destination device: Device	Connector Type	Description
RS-232 with Dongle Adapter: • RS-232 • composite • 5 MHz	DB-9 female	RS-232 Dongle Adapter connects to: • Laptop • MLC 8000 Subsite Link Converter • GTR 8000 and or QUANTAR® devices*	RS-232 Dongle Adapter connector: • DB-9 male • BNC male • BNC male	RS-232 Dongle Adapter provides: • Optional connection to laptop for remote setup and monitoring. • Dongle Adapter attached to the RS–232 port provides a (1PPS + 5 MPPS) time and frequency reference through the BNC connector. • Dongle adapter attached to the RS-232 ports provides a 5 MHz signal through the BNC connector to the GTR 8000 and or QUANTAR® devices.*

*The Dongle Adapter with the 5 MHz input is high impedance. An external termination is required to properly terminate the cable connected to the input. It is recommended that a BNC "T" and a 50 Ohm BNC termination connect to the input to terminate the cable. If the cable is daisy chained (up to 8 base radios and or QUANTAR® stations are connected together and driven by one TRAK 8835 output with Dongle Adapter), only the last base radio or QUANTAR® stations in the chain has the termination. For configuration details, see the *GTR 8000 Base Radio* manual.

A.2.5.3
TRAK 8835 Cabling for ASTRO 25 Digital-Only Conventional Simulcast Voting Subsystem (With QUANTARs)

The TRAK 8835 Site Reference in an ASTRO® 25 Digital-Only Conventional Simulcast Voting Subsystem (with QUANTAR® stations) are only employed in the Base Radio Sites and the TRAK 9100 Simulcast Site Reference is employed at the Prime/Hub Site for Digital-Only Conventional Simulcast sites. To ensure that the correct TRAK device is installed on your subsystem, see TRAK Device Support Overview on page 159 before beginning installation of your subsystem.

Figure 34: Digital-Only Conventional Simulcast Voting Subsystem (With QUANTAR)



NOTICE: High-level diagrams are provided as examples only and are not to be used for system planning purposes. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices. “GPS” in the diagram refer to TRAK 9100 Simulcast Site Reference in the Prime/Hub Site and TRAK 8835 Site Reference in the Base Radio Sites.

Table 47: TRAK 8835 Cabling for Digital-Only Conventional Simulcast Voting Base Radio Site

From TRAK 8835: Port	Connector Type	To Destination device: Device	Connector Type	Description
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	Not used	Not used	Not used
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	Status indication to UEM.

Table continued…

From TRAK 8835: Port	Connector Type	To Destination device: Device	Connector Type	Description
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GPS Antenna System	Dependent on GPS antenna used.	Connects the TRAK 8835 with the GPS antennas. These are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).
RS-232 with Dongle Adapter: • RS-232 • composite • 5 MHz	DB-9 female	RS-232 Dongle Adapter connects to: • Laptop • Not used • GTR 8000 and or QUANTAR® devices*	RS-232 Dongle Adapter connector: • DB-9 male • BNC male • BNC male	RS-232 Dongle Adapter provides: • Optional connection to laptop for remote setup and monitoring. • Not used. • Dongle adapter attached to the RS-232 ports provides a 5 MHz sig-

From TRAK 8835: Port	Connec-tor Type	To Destination device: Device	Connector Type	Description
				nal through the BNC connector to the GTR 8000 and or QUAN-TAR® devices.*

*The Dongle Adapter with the 5 MHz input is high impedance. An external termination is required to properly terminate the cable connected to the input. It is recommended that a BNC "T" and a 50 Ohm BNC termination connect to the input to terminate the cable. If the cable is daisy chained (up to 8 base radios and or QUANTAR® stations are connected together and driven by one TRAK 8835 output with Dongle Adapter), only the last base radio or QUANTAR® station in the chain has the termination. For configuration details, see the *GTR 8000 Base Radio* manual.

A.2.5.4

TRAK 8835 Cabling for ASTRO 25 IP Simulcast Remote Site with GTR 8000 Expandable Site Subsystem with High Availability

At a Trunked IP Simulcast Subsystem Remote Site with GTR 8000 Expandable Site Subsystem (ESS) with High Availability, an optional backup for the frequency and time references is supplied to the base radios either through a TRAK 8835-3M. TRAK 8835-8M, or a TRAK 9100. The backup TRAK device provides an extended holdover of at least 72 hours when redundant GPS or GPB 8000 Reference Distribution Module (RDM) failure occurs.

The RDM devices provide redundant integrated site reference distribution through two GPS units as timing reference sources to all the base radios at the site, eliminating the need for the TRAK 9100 Simulcast Site Reference (SSR) at the site. An optional backup for the frequency and time references supplied to the base radios is available either through a TRAK 8835-3M, TRAK 8835-8M, or a TRAK 9100 SSR.

Both the TRAK 8835-3M, TRAK 8835-8M, or TRAK 9100 SSR is cabled to the Trunked ESS and provide signals using an enabled signal input port. To support the TRAK GNSS source, the RDM devices are configured through the Customer Service Software (CSS) to allow the user to designate which GNSS source is the primary and secondary source.

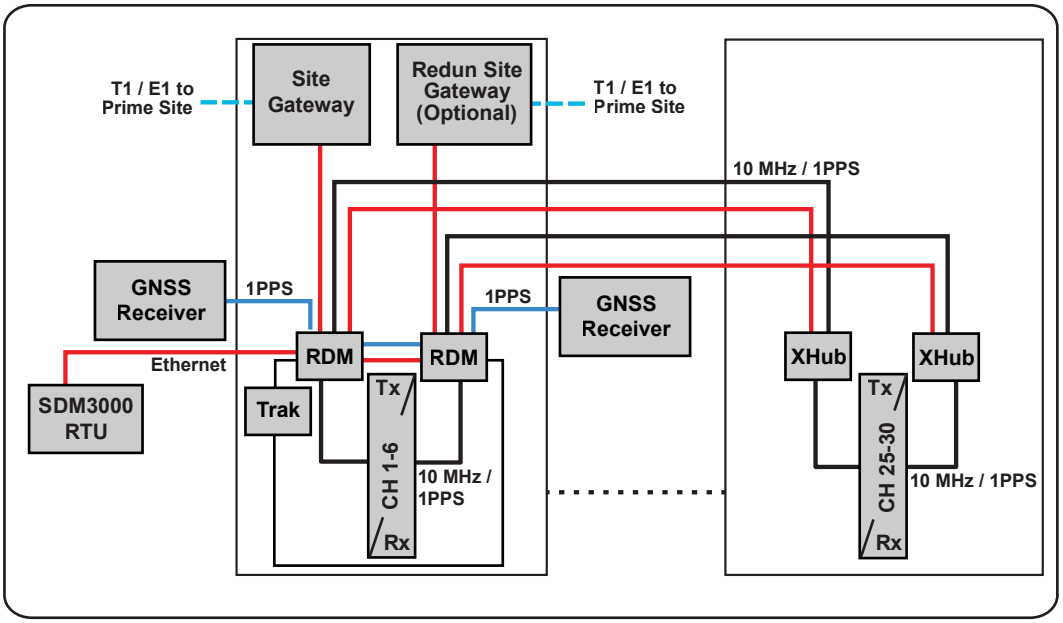
The following are supported configurations to provide a frequency reference source that can supply a stable signal for at least 72 hours following a GNSS failure:

- GTR 8000 ESS, redundant RDM devices, one TRAK 8835-3M, and one GPS receiver.
- GTR 8000 ESS, redundant RDM devices, one TRAK 8835-3M, and two GPS receivers.
- GTR 8000 ESS, redundant RDM devices, one TRAK 9100.
- GTR 8000 ESS, redundant RDM devices, one TRAK 9100, and one GPS receiver.
- GTR 8000 ESS, redundant RDM devices, one TRAK 8835-3M.

When using the TRAK for extended holdover use the 1PPS input. The 1PPS input must have a BNC “T” connected to it. A 50 Ohm termination is on one leg of the “T” and the cable to the junction panel is on the other side of the “T”. For specific information on the TRAK devices cabling connections for frequency and timing reference, see “Junction Panel Connections – Trunked IP Simulcast (High Availability Configuration)” section in the *GTR 8000 Expandable Site Subsystem* manual.

NOTICE: The RDMs do not provide site reference to base radios located outside of the GTR 8000 Expandable Site Subsystems cabinets or racks. A TRAK Simulcast Site Reference is required at the site to provide for the external base radios. If there are no available Ethernet ports in the RDMs for the external base radios, an external Ethernet LAN switch is required at the site.

Figure 35: IP Simulcast Remote Site with GTR 8000 Expandable Site Subsystem – High Availability Configuration with Extended Holdover



NOTICE: High-level diagrams are provided as examples only and should not be used for system planning purposes.

Table 48: TRAK 8835 Cabling for IP Simulcast Remote Site with GTR 8000 Expandable Site Subsystem – High Availability Configuration

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	ESS Junction Panel	BNC	External Site Reference
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued…

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GPS Antenna System	Dependent on GPS antenna used.	Connects the TRAK 8835 with the GPS antennas. These ports are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).
RS-232 with Dongle Adapter: • RS-232 • composite • 5 MHz	DB-9 female	RS-232 Dongle Adapter connects to: • Laptop • RDM devices • Not used	RS-232 Dongle Adapter connector: • DB-9 male • BNC male • Not used	RS-232 Dongle Adapter provides: • Optional connection to laptop for remote setup and monitoring. • Dongle Adapter attached to the RS–232 port provides a (1PPS

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				+ 5 MPPS) time and frequency reference through the BNC connector. • Not used

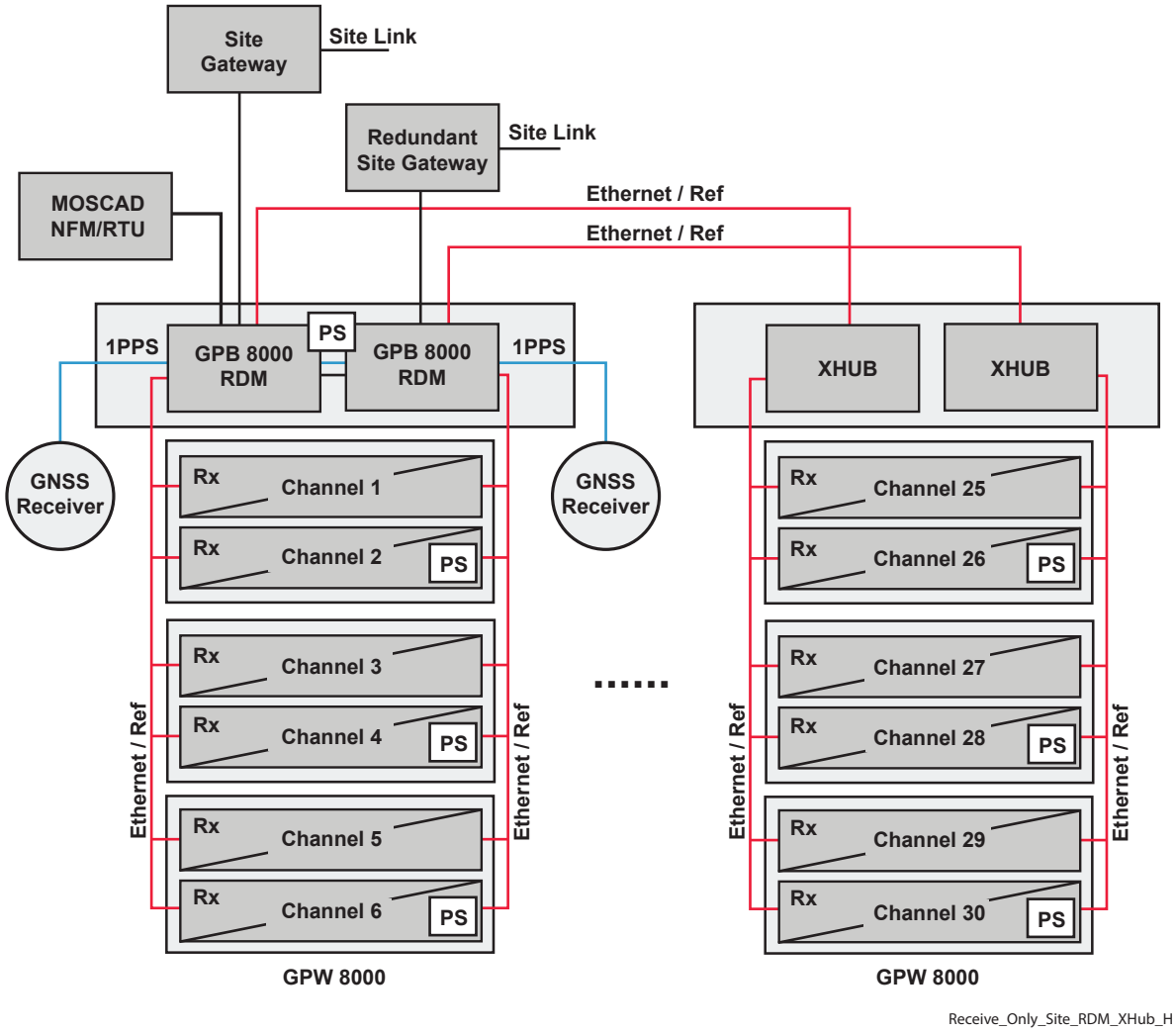
NOTICE: Interface the TRAK 8835-3M or TRAK 9100 1 PPS BNC connector (front panel) to the Junction Panel on the GTR 8000 Expandable Site Subsystem, however it can also be connected to the EXT FREQ REF port on the GTR 8000 Expandable Site Subsystem Rear Backplane. See the *GTR 8000 Expandable Site Subsystem* manual for details.

A.2.5.5
TRAK 8835 Cabling for ASTRO 25 IP Simulcast Trunked Receive-only Remote Site

For an IP simulcast receive-only remote site with TDMA or Enhanced Data operation, an optional backup for the frequency and time references is supplied to the receiver and is available either through a TRAK 9100 Simulcast Site Reference or TRAK 8835-3M device. The backup SSR provides an extended holdover of at least 72 hours when redundant GPS or certain GPB 8000 Reference Distribution Module (RDM) failures occur. If an optional TRAK SSR at the remote site is used as an extended holdover backup, the RDMs can be configured in the following configurations to either provide support or act as a replacement for the GPS units:

- Each RDM connected to a GPS unit.
- One RDM connected to a GPS unit.
- No RDMs connected to a GPS unit.

Figure 36: IP Simulcast Receive-only Remote Site Configuration



NOTICE: High-level diagrams are provided as examples only and are not to be used for system planning purposes.

Table 49: TRAK 8835 Cabling for IP Simulcast Receive-only Remote Site Configuration

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female		BNC	External Site Reference
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued…

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GPS Antenna System	Dependent on GNSS antenna used.	Connects the TRAK 8835 with the GNSS antennas. These ports are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).
RS-232 with Dongle Adapter: • RS-232 • composite • 5 MHz	DB-9 female	RS-232 Dongle Adapter connects to: • Laptop • RDM devices • Not used	RS-232 Dongle Adapter connector: • DB-9 male • BNC male • Not used	RS-232 Dongle Adapter provides: • Optional connection to laptop for remote setup and monitoring. • Dongle Adapter attached to the RS–232 port provides a (1PPS

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				+ 5 MPPS) time and frequency reference through the BNC connector. • Not used

A.2.5.6

TRAK 8835 Cabling for an ASTRO 25 Repeater Site

TRAK devices are used in ASTRO® 25 repeater sites that support standalone GTR 8000 Base Radios only, 10Base-T Ethernet Epic IV or Epic VI QUANTAR® stations, or a mix of QUANTAR® stations with standalone GTR 8000 Base Radios or GTR 8000 Expandable Site Subsystem cabinets/racks, supporting up to 28 channels (27 voice channels, 1 control channel).

ASTRO 25 Repeater Site – Standalone GCP 8000 Site Controllers with More than Six Standalone GTR 8000 Base Radios

In an ASTRO® 25 repeater site with standalone GTR 8000 Base Radios and standalone GCP 8000 Site Controllers controlling more than six base radios, a 5 MHz frequency reference is supplied to the base radios. For a site with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the base radios, and 1PPS time reference to the GCP 8000 Site Controllers.

NOTICE: The TRAK 9100 must be used when more than eight base radios that require external references are at the site.

Figure 37: Standalone GCP 8000 Site Controllers with More than Six GTR 8000 Base Radios – External Reference Only

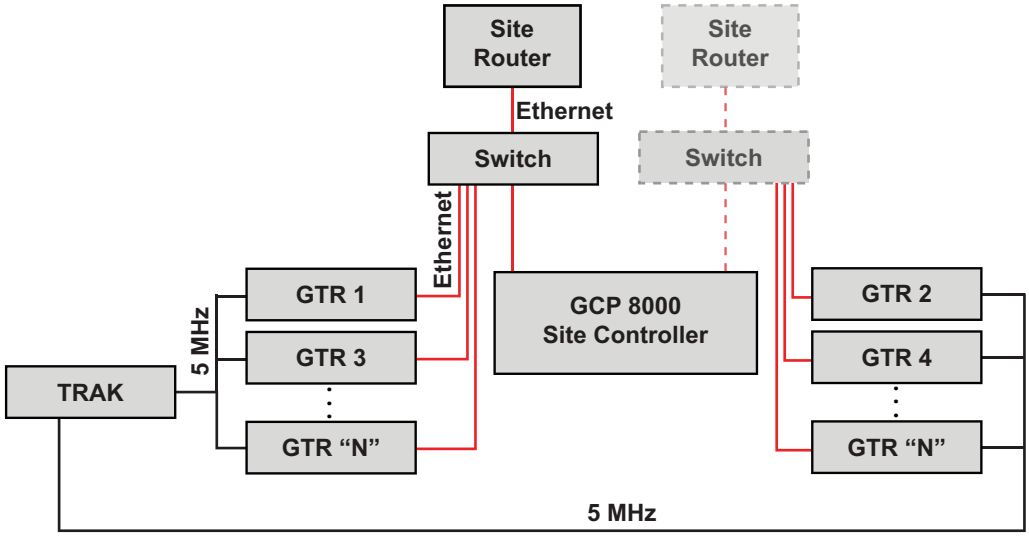


Figure 38: Standalone GCP 8000 Site Controllers with More than Six Standalone GTR 8000 Base Radios – External Reference Only

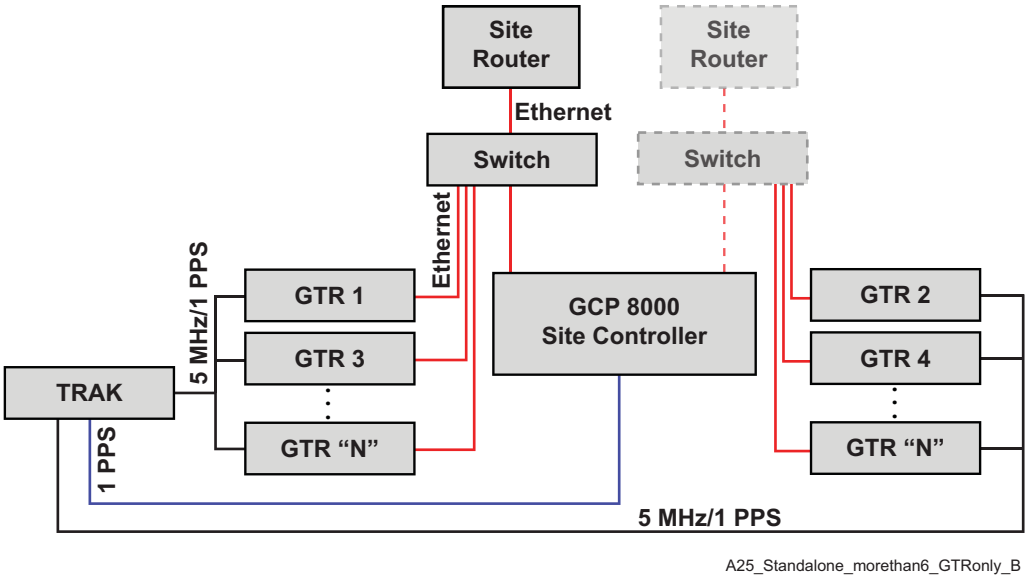


Figure 39: Standalone GCP 8000 Site Controllers with More than Six GTR 8000 Base Radios – GCP 8000 Site Controllers and External Reference

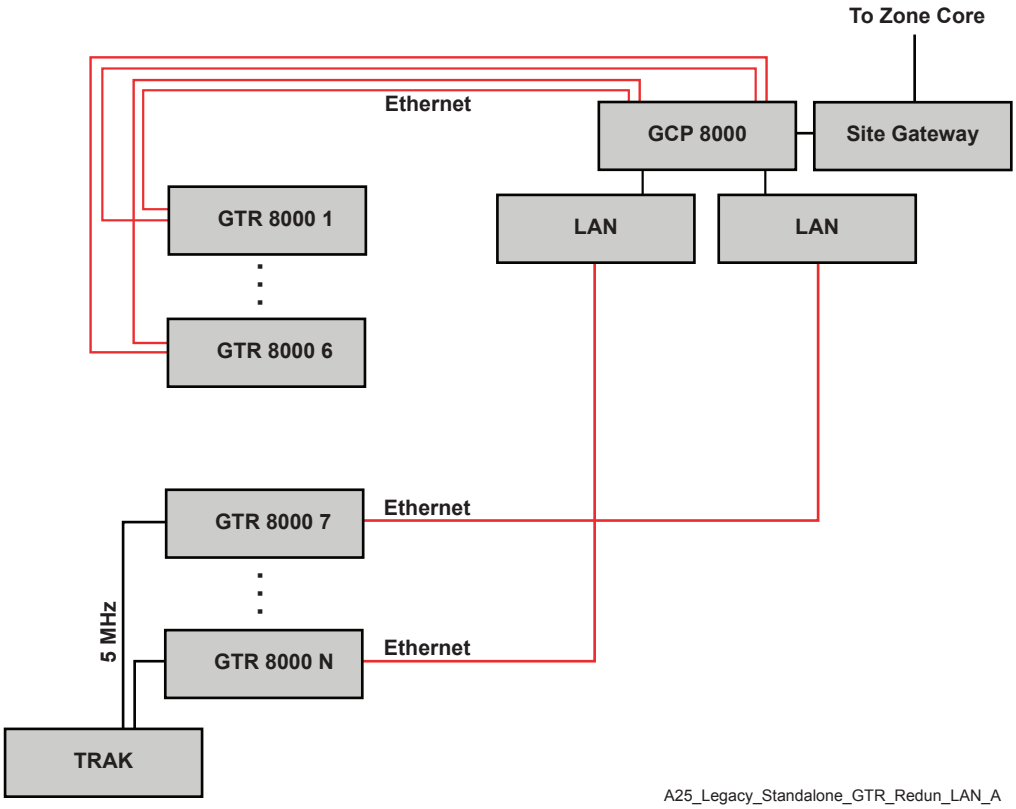


Figure 40: Standalone GCP 8000 Site Controllers with More than Six GTR 8000 Base Radios – GCP 8000 Site Controllers and External Reference

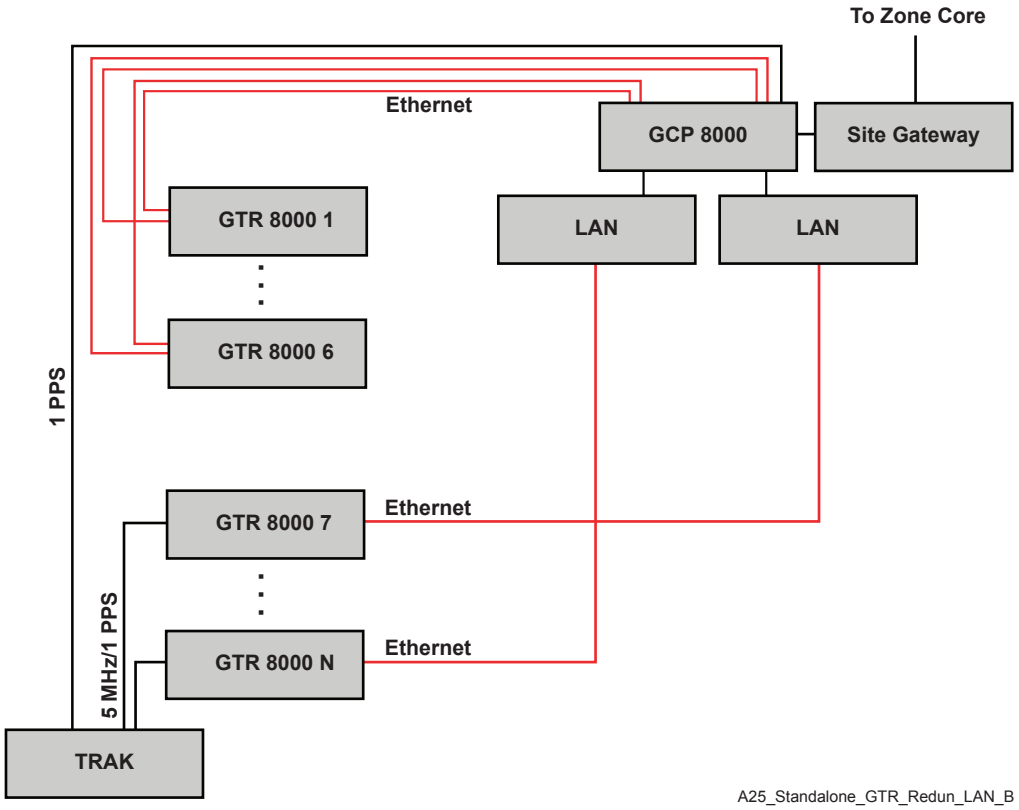


Table 50: Standalone GCP 8000 Site Controllers with More than Six Standalone GTR 8000 Base Radios

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	Site Controller	BNC male	Timing reference.
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued…

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GNSS Antenna System	Dependent on GNSS antenna used.	Connects the TRAK 8835 with the GNSS antennas. These ports are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).

Table continued…

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
RS-232 with Dongle Adapter: **1** RS-232 **2** composite **3** 5 MHz	DB-9 female	RS-232 Dongle Adapter connects to: **1** Laptop **2** GTR 8000 Base Radio **3** GTR 8000 Base Radios	RS-232 Dongle Adapter connector: **1** DB-9 male **2** BNC male **3** BNC male	RS-232 Dongle Adapter provides: **1** Optional connection to laptop for remote set-up and monitoring. **2** Dongle Adapter attached to the RS–232 port provides a (1PPS + 5 MPPS) time and frequency reference through the BNC connector. **3** 5 MHz signal

ASTRO 25 Repeater Site – QUANTAR Stations

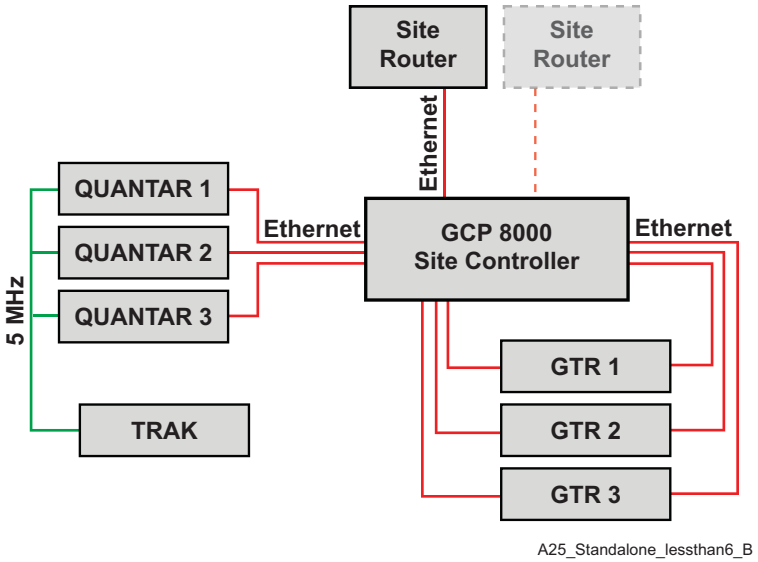
The following system configurations support TRAK devices at an ASTRO® 25 repeater site with QUANTAR® stations with or without standalone GTR 8000 Base Radios:

Standalone GCP 8000 Site Controllers controlling six or less QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device.

Standalone GCP 8000 Site Controller controlling more than six QUANTAR® stations with or without standalone GTR 8000 Base Radios, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 8835 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios, and 1PPS time reference to the site controllers. The following figures show the sites configured with a TRAK device.

NOTICE: The TRAK 9100 must be used when more than eight QUANTAR® stations that require external references are at the site.

Figure 41: Standalone GCP 8000 Site Controllers Controlling Six or Less QUANTAR Stations with or without Standalone GTR 8000 Base Radios



Up to eight QUANTAR® stations can be used with the TRAK 8835.

Table 51: Standalone GCP 8000 Site Controllers Controlling Six or Less QUANTAR Stations with or without Standalone GTR 8000 Base Radios

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	Site Controller	BNC male	Timing reference.
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued…

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GNSS Antenna System	Dependent on GNSS antenna used.	Connects the TRAK 8835 with the GNSS antennas. These ports are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).
RS-232 with Dongle Adapter: **1** RS-232 **2** composite **3** 5 MHz	DB-9 female	RS-232 Dongle Adapter connects to: **1** Laptop **2** Not used **3** QUANTAR® stations	RS-232 Dongle Adapter connector: **1** DB-9 male **2** Not used **3** BNC male	RS-232 Dongle Adapter provides: **1** Optional connection to laptop for remote setup and monitoring. **2** Not used **3** 5 MHz signal

Figure 42: Standalone GCP 8000 Site Controllers Controlling More than Six QUANTAR Stations with or without Standalone GTR 8000 Base Radios

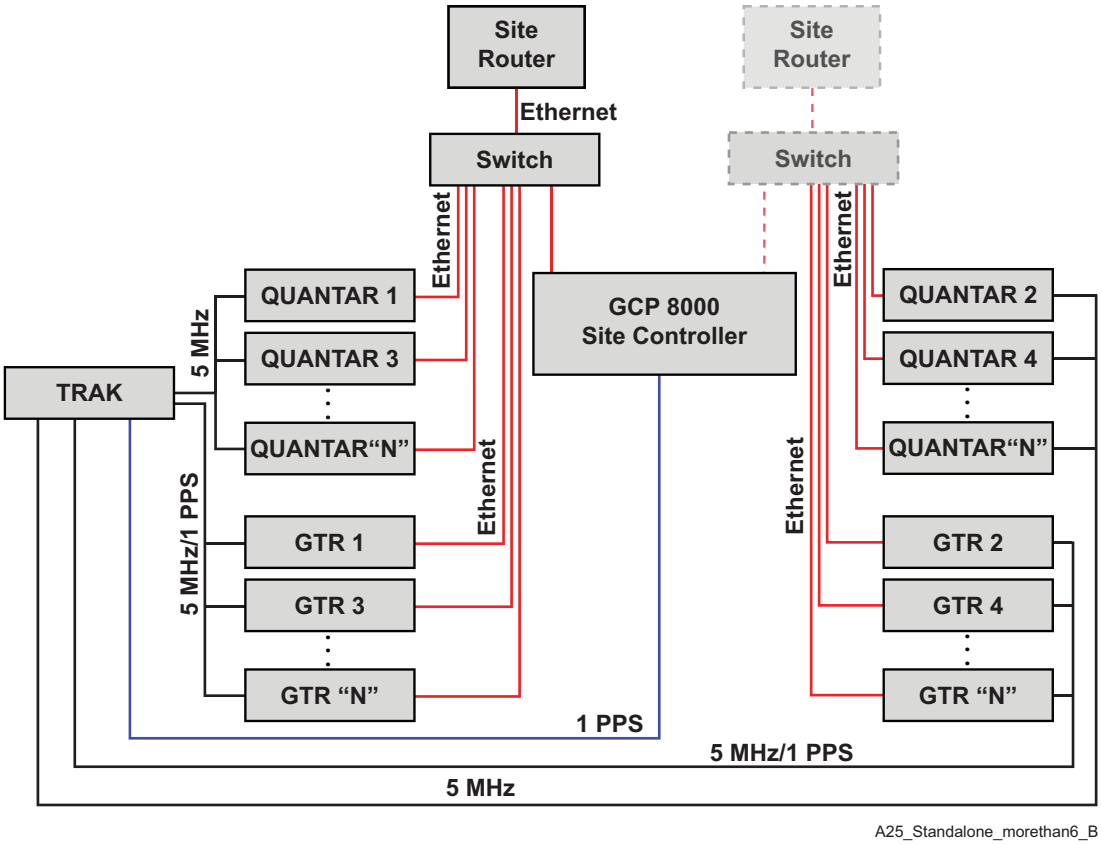


Table 52: TRAK 8835 Cabling for Standalone GCP 8000 Site Controllers Controlling More than Six QUANTAR Stations with or without Standalone GTR 8000 Base Radios

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	Not used	BNC male	Not used
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued…

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GNSS Antenna System	Dependent on GNSS antenna used.	Connects the TRAK 8835 with the GNSS antennas. These ports are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).

Table continued…

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
RS-232 with Dongle Adapter: **1** RS-232 **2** composite **3** 5 MHz*	DB-9 female	RS-232 Dongle Adapter connects to: **1** Laptop **2** Base Radios **3** QUANTAR® stations	RS-232 Dongle Adapter connector: **1** DB-9 male **2** BNC male **3** BNC male	RS-232 Dongle Adapter provides: **1** Optional connection to laptop for remote set-up and monitoring. **2** Provides composite 5 MHz + 1PPS signal sourcing. **3** 5 MHz signal

*Up to eight QUANTAR® stations can be used with the TRAK 8835. A TRAK 9100 must be used when more than eight QUANTAR® stations that require external references are at the site.

ASTRO 25 Repeater Site – QUANTAR Stations and GTR 8000 Expandable Site Subsystem

The following system configurations support TRAK devices at an ASTRO® 25 repeater site with QUANTAR® stations and GTR 8000 Expandable Site Subsystem cabinets/racks:

- In a GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 or TRAK 8835 device.
- In a GTR 8000 Expandable Site Subsystem with integrated GCP 8000 Site Controllers controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 or TRAK 8835 device.
- In a GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling six or less QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 or TRAK 8835 device.
- In a GTR 8000 Expandable Site Subsystem with an external standalone GCP 8000 Site Controller controlling more than six QUANTAR® stations, a 5 MHz frequency reference is supplied to the QUANTAR® stations by either an internal UHSO or an external TRAK 9100 or TRAK 8835 device. For sites with TDMA or Enhanced Data, the TRAK provides composite 5 MHz + 1PPS signal sourcing to the GTR 8000 Base Radios, and 1PPS time reference to the site controllers. The following figures show the sites configured with a TRAK device.

NOTICE: The TRAK 9100 must be used when more than eight QUANTAR® stations are at the site.

Figure 43: GTR 8000 Expandable Site Subsystem with Integrated GCP 8000 Site Controllers Controlling Six or Less QUANTAR Stations

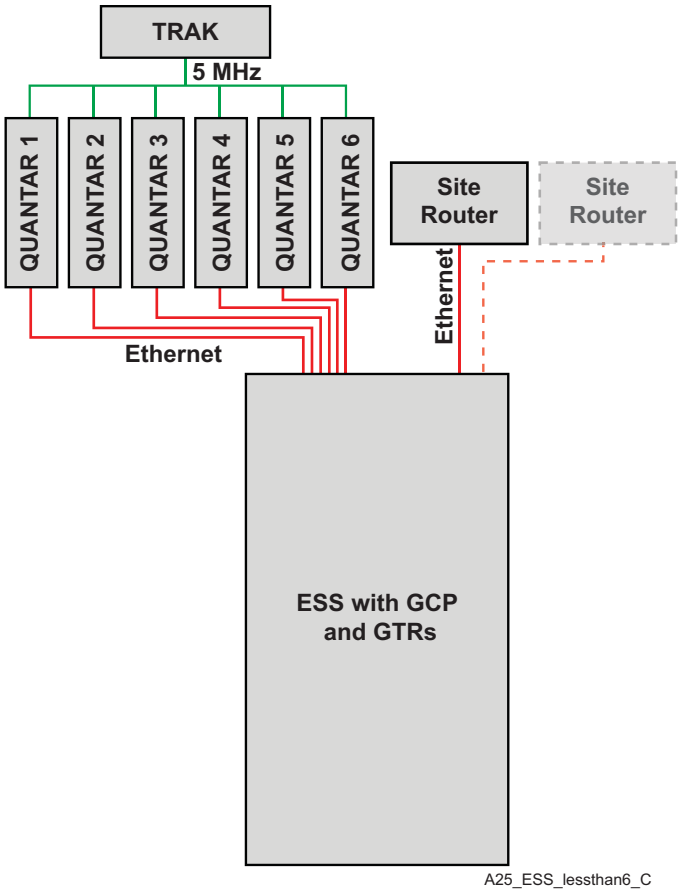


Figure 44: GTR 8000 Expandable Site Subsystem with Integrated GCP 8000 Site Controllers Controlling More than Six QUANTAR Stations

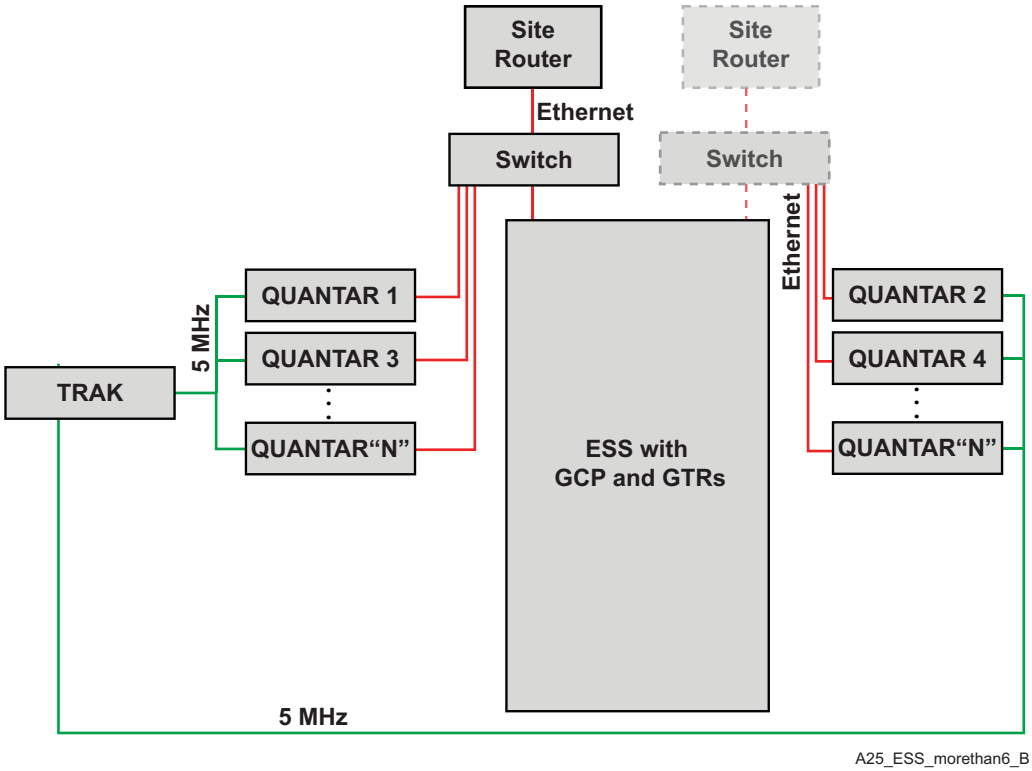


Figure 45: GTR 8000 Expandable Site Subsystem with an External Standalone GCP 8000 Site Controller Controlling Six or Less QUANTAR Stations

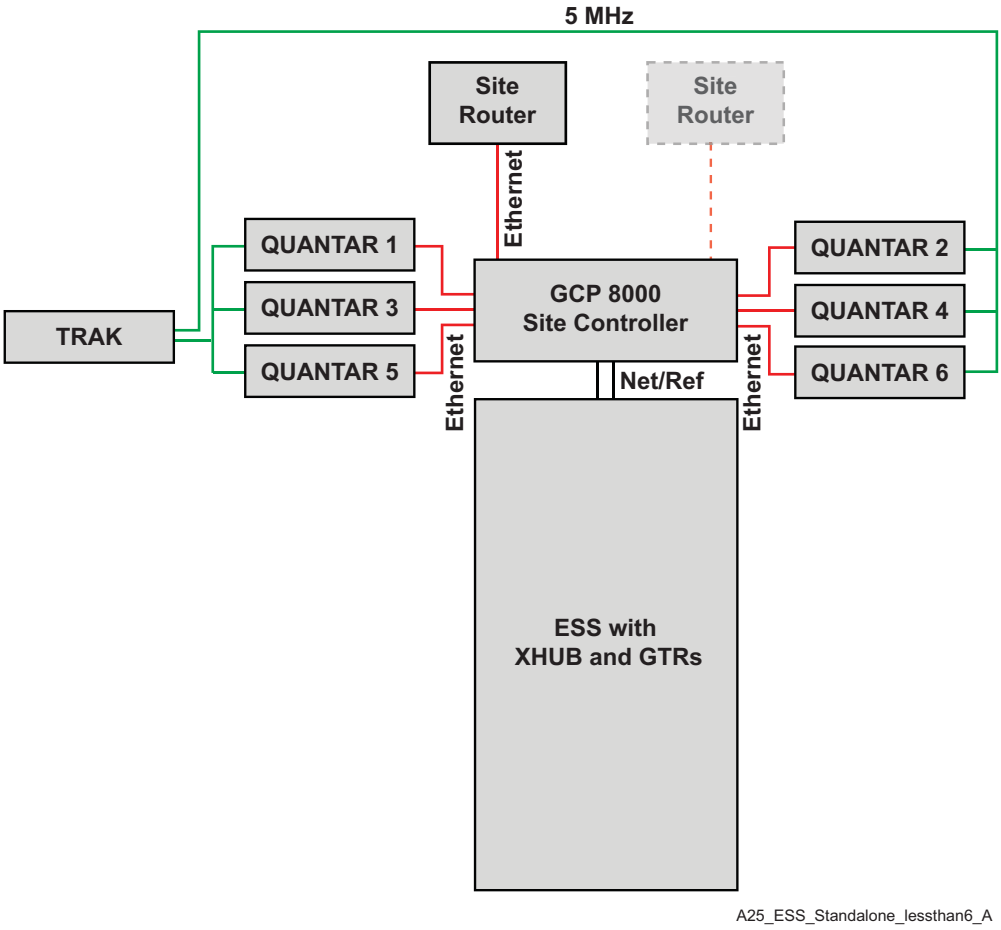


Figure 46: GTR 8000 Expandable Site Subsystem with an External Standalone GCP 8000 Site Controller Controlling More than Six QUANTAR Stations

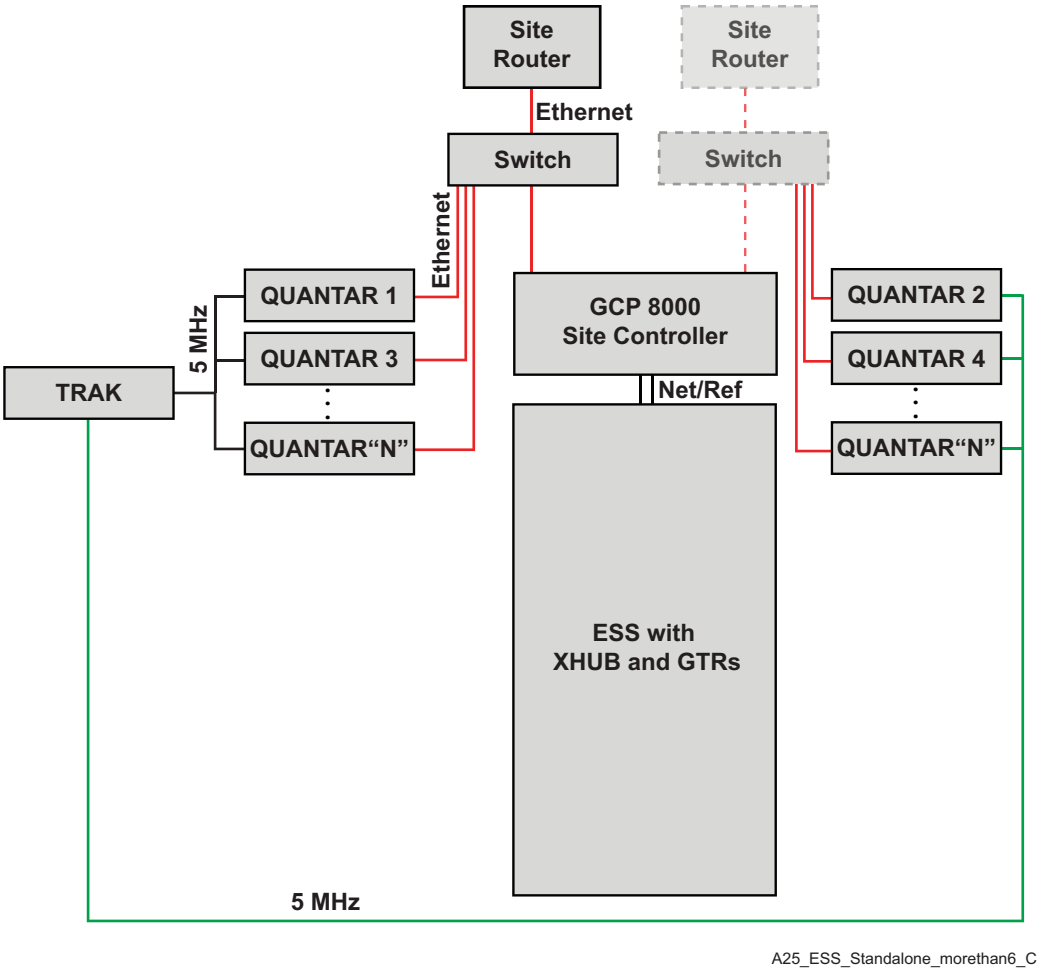


Table 53: TRAK 8835 Cabling for ASTRO 25 Repeater Site – QUANTAR Stations and GTR 8000 Expandable Site Subsystem

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
10 MHz	BNC female	Service Monitor	BNC male	Optional connection to a Service Monitor.
1PPS	BNC female	Not used	BNC male	Not used
ETHERNET	RJ-45 jack	Ethernet Switch	RJ-45	For status indication to UEM.

Table continued…

From TRAK 8835:		To Destination device:		
Port Label	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: TRAK 8835-2M Conventional Site Reference devices are not certified for SSH, Telnet, SNMP, or Network Time Protocol (NTP). TRAK 8835-8M devices (introduced in November 2013) are a direct replacement for TRAK 8835-2M devices with the added benefit of SSH, Telnet, and SNMP support.
ANT	TNC-female	GNSS Antenna System	Dependent on GNSS antenna used.	Connects the TRAK 8835 with the GNSS antennas. These ports are the antenna inputs for the GPS reference modules.
+15 VDC	DC Power Jack	120–240 VAC Power Supply	AC In-line Adapter Power Supply Unit	Supplies +15 VDC at a maximum power output of 30 watts.
DC IN	DC power	48 VDC	DC power	Optional configuration for DC powered sites.
RS-232	DB-9 female	Laptop	DB-9 male	Optional connection to a laptop with customer supplied DB-9 cable for remote setup and monitoring (Dongle Adapter not required).
RS-232 with Dongle Adapter: **1** RS-232 **2** composite **3** 5 MHz*	DB-9 female	RS-232 Dongle Adapter connects to: **1** Laptop **2** Not used **3** QUANTAR® stations	RS-232 Dongle Adapter connector: **1** DB-9 male **2** BNC male **3** BNC male	RS-232 Dongle Adapter provides: **1** Optional connection to laptop for remote setup and monitoring. **2** Not used **3** 5 MHz signal

*Up to eight QUANTAR® stations can be used with the TRAK 8835. A TRAK 9100 must be used when more than eight QUANTAR® stations that require external references are at the site.

A.3
TRAK 8835 Site Reference Configuration

This chapter details configuration procedures relating to the TRAK 8835 Site Reference.

A.3.1
TRAK 8835 Site Reference Configuration

This section provides an overview of how to configure the TRAK 8835 Site Reference. These parameters include the IP address, subnet mask, SSH, Telnet, SNMP, and NTP. To configure the TRAK 8835 device, see Configuring TRAK 9104-14 Fault Sense Unit and TRAK 8835 in the Command Line on page 60 or Configuring the TRAK 9104-14 Fault Sense Unit and TRAK 8835 Through Web Browser on page 64.

A.4
TRAK 8835 Site Reference Maintenance

This chapter provides maintenance information relating to the TRAK 8835 Site Reference.

A.4.1
Powering Up the TRAK 8835 Site Reference

The TRAK 8835 Site Reference has a +15 VDC and or 48 VDC power output. The power outputs have an LED indicator that runs green after the device powers up. LED Indicators on page 103 shows the power supply LED.

The GNSS receiver has to lock onto the signals from at least four GNSS satellites for proper operation of the TRAK 8835 device. Allow sufficient time, approximately 13 minute to 25 minutes, for the GNSS initialization to complete before checking the operation of the simulcast subsystem.

A.4.2
Managing the TRAK 8835 Site Reference

There are no serviceable parts in the TRAK 8835 Site Reference that require maintenance or calibration. Exterior cleaning using a clean, lint-free cloth, or a soft brush is sufficient. Monitor the LEDs periodically to ensure that the device is operating properly. If there is a gateway failure, see *TRAK Technical Manual (D001571) Model 8835 GPS Clock* manual or contact Motorola Solutions for support.

A.4.3
TRAK 8835 Site Reference Field Replacement Units and Parts

This table lists the Field Replaceable Units (FRUs) and replacement parts for the TRAK 8835 Site Reference. When replacing a FRU or part, obtain the precise FRU Kit Number or Part Number and review the replacement procedures provided, including all safety precautions and system impact information.

To place an order for replacement parts, contact Motorola Solutions Solutions America Parts Organization at:

- Phone: 1-800-422-4210 and (302) 444–4892 for international calls
- TTY Phone: 1-866-522-5210

- Motorola Solutions Online users: https://businessonline.motorolasolutions.com
- Fax: 1-800-622-6210

To place an order for an FRU, contact Motorola Solutions Support Center (SSC) at: Phone: (800) 221-7144 for domestic calls and (302) 444–9800 for international calls.

Table 54: TRAK 8835 Field Replacement (FRE)

Component Type	FRE Kit Number
Simulcast Site Reference GNSS Clock, Rubidium, 48 VDC, 10 MHz BNC, 1PPS on BNC Ethernet	DSTRAK88353M
Simulcast Site Reference GNSS Clock, DOXCO, 48 VDC, 10 MHz BNC, 1PPS on BNC Ethernet	DSTRAK88358M

Table 55: TRAK 8835 Parts Replacement

Component Type	Part Number
Mounting Shelf for GNSS Clock	DSTRAK4008245101
AC Power Supply for GNSS Clock	DSTRAKP001134
Dongle Adapter Cable provides composite, 5 MHZ, and RS-232 connections	DSTRAKP002220
Enhanced Filter Antenna (N Conn) for TRAK 9100	DSTRAKP002111
Lightening / Surge Suppressor (N-N) for TRAK GNSS	DSTRAK4702354
Molex connector for DC power in	DSTRAK4702727T
100 ft LMR 400 Coaxial Cable with two N-Connectors for TRAK 9100	DSTRAK100LMR400

A.5 TRAK 8835 Site Reference Troubleshooting

This section provides troubleshooting for the TRAK 8835 Site Reference.

A.5.1 TRAK 8835 Site Reference Remote Operation

The RQBT Request BIT Status is the only remote operation command available for the TRAK 8835 Site Reference.

The TRAK 8835 Site Reference can be set up and monitored remotely through the RS-232 or Ethernet port. Two modes can be set:

Local Echo
A mode where each character input is echoed back to the host.

Computer
A mode where the input characters are not echoed. This mode is the default mode.

Before using the RS-232 port, ensure that the remote computer or terminal is set to 9600 baud, eight data bits, 1-stop bit, and no parity.

For configuration and instructions on remote operation, computer mode, and remote interface commands, see Chapter 3, in the *TRAK Technical Manual (D001571) Model 8835 GPS Clock* manual.

A.5.2
Unified Event Manager for TRAK 8835 Site Reference

The Unified Event Manager (UEM) is a fault management application designed to handle the following critical fault management functions:

- Discovering devices
- Handling faults
- Detecting and reporting loss of communication and synchronization

The UEM supports TRAK generated alarms and events for the TRAK 8835-8M and TRAK 8835-3M (TRAK 8835-2M is not supported). The TRAK 8835-8M and TRAK 8835-3M devices support the following GNSS fault management events (traps):

- ssReceiver – GPS Receiver failure. Not tracking satellites and user timeout.
- ss10MHz – FrequGPS Antenna failure. Under or over current.ency Dropout failure.
- ssAntennaGPS – 10 MHz TTL output signal failure.
- ssOscillator – Oscillator Calibration. Tuning near upper or lower limit.

The TRAK 8835 interface cable to the GTR 8000 Expandable Site Subsystem (ESS) has three possible connections for managing network management:

- Connection #1: The “Primary Sub-Panel #1” in a Simulcast High Availability ESS subsystem, provides the port required for the TRAK devices to access the Network Management network. An Ethernet cable from the TRAK device connects to one of the available Gateway ports to enable the TRAK device to report SNMP events and alarms to the UEM.
- Connection #2: The “Primary Sub-Panel #1” in a Simulcast High Availability ESS subsystem, provides the port required for the TRAK devices to access the Network Management network. An Ethernet cable from the TRAK device connects to one of the available Network Aux ports to enable the TRAK device to report SNMP events and alarms to the UEM.
- Connection #3: Service Ports on the RDMs in a Simulcast High Availability ESS subsystem, are used if there are no ports available on the Junction Panel.

If using the TRAK 8835-8M and TRAK 8835-3M management through the MOSCAD, UEM fault management cannot impact the ability of the MOSCAD to manage the TRAK devices.

NOTICE: Customer Service Software (CSS) cannot receive events from the TRAK 8835 devices.

For more information, see the *Fault Management – System Perspective* and *Unified Event Manager* manuals.

Appendix B

TRAK Devices

This appendix lists all TRAK models and explains where the devices are used.

B.1 TRAK Device Support Overview

These tables list the configuration in which TRAK devices are supported, and provide a comparison of the TRAK models.

Table 56: TRAK Device Support Overview

	Analog Conventional (Circuit or IP)	Digital Conventional (Circuit or IP)	P25 Circuit Trunking No TDMA	P25 IP Trunking No TDMA	P25 IP Trunking With TDMA	3600 Circuit Trunking
Master Site - M1	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - M2	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - M3	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - L1	N/A	N/A	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - L2	N/A	N/A	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M	TRAK 9100-8E TRAK 8835-3M
Master Site - K1	–	-	N/A	N/A	N/A	N/A
Master Site - K2	-	-	N/A	N/A	N/A	N/A
Prime Site Voting/Simul-	TRAK 9100-8E	TRAK 9100-8E	N/A	TRAK 9100-8E	TRAK 9100-8E	N/A

Table continued…

	Analog Conventional (Circuit or IP)	Digital Conventional (Circuit or IP)	P25 Circuit Trunking No TDMA	P25 IP Trunking No TDMA	P25 IP Trunking With TDMA	3600 Circuit Trunking
cast (GCP 8000/GCM 8000/MLC 8000)	TRAK 8835-2M/8M					
Remote Site TX/RX Voting/Simulcast (GTR 8000/GTR 8000 ESS)	TRAK 8835-2M/8M TRAK 8835-3M	TRAK 9100-9E TRAK 8835-2M/8M TRAK 8835-3M	TRAK 9100-9E	TRAK 9100-9E	TRAK 9100-9E	TRAK 9100-9E
Remote Site High Availability TX/RX Voting/Simulcast (GTR 8000 ESS)	N/A	N/A	N/A	RDM+GNSS TRAK 9100-9E TRAK 8835-3M	RDM+GNSS TRAK 9100-9E TRAK 8835-3M	N/A
Remote Site RX-only Voting/Simulcast (GPW 8000)	Internal or External Freq. Reference (5 MHz or 10 MHz)	Internal or External Freq. Reference (5 MHz or 10 MHz)	RDM (GNSS optional) TRAK 9100-9E TRAK 8835-3M	RDM (GNSS optional) TRAK 9100-9E TRAK 8835-3M	RDM (GNSS optional) TRAK 9100-9E TRAK 8835-3M	N/A
Repeater Site with Standalone GCP 8000 + GTR 8000/QUANTAR)	Internal or External Freq. Reference (5 MHz or 10 MHz)	Internal or External Freq. Reference (5 MHz or 10 MHz)	N/A	For GTR #1-6: GCP 8000 TRAK 9100-8E TRAK 8835-3M For GTR #7-28 and QUANTAR: TRAK 9100-8E TRAK 8835-3M UHSO (QUANTARs only)	For GTR #1-6: GCP 8000 TRAK 9100-8E TRAK 8835-3M For GCP 8000, GTR #7-28 and QUANTAR: TRAK 9100-8E TRAK 8835-3M UHSO (QUANTARs only)	N/A

Table 57: TRAK Model Comparison Matrix

	Redundant GNSS Receivers	Redundant Oscillators	72 hr holdover	Network Time Server	UEM Support(M & L Core Only)	GMC Manager Support (M & L Core Only)
TRAK 9100-8E (includes distribution modules)	X	X	X	X	X (through RS232 interface to SDM3000)	X (through RS232 interface to SDM3000)
TRAK 9100-9E (distribution modules available as add-on)	X		X	X	X (through RS232 interface to SDM3000)	X (through RS232 interface to SDM3000)
TRAK 8835-3M			X	X	X	
TRAK 8835-2M						
TRAK 8835-8M				Not certified	X	

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