



Digivance™ Long Range Coverage Solution Single Band SMR System Installation and Operation Manual

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Digivance™ Long Range Coverage Solution Single Band SMR System Installation and Operation Manual

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ABOUT THIS MANUAL

This installation and operation manual provides the following information:

- An overview of the Digivance Long Range Coverage Solution (LRCS).
- A description of the basic system components including the Host Unit (HU), Spectrum Transport Module (STM), Linear Power Amplifier (LPA), Remote Unit (RU) cabinet, and Digivance Element Management System (EMS).
- System requirements for planning the Digivance LRCS installation.
- Installation procedures for the HU.
- Procedures for tuning-up the system, verifying that the system is functioning properly, and testing the system performance.
- Procedures for maintaining the system including troubleshooting problems and replacing faulty components.
- Product warranty, repair, return, and replacement information.

The procedures for installing the remote unit and for installing and using the EMS software are provided in other publications which are referenced in the Related Publications section and at appropriate points within this manual.

RELATED PUBLICATIONS

Listed below are all the related manuals, their content, and their publication numbers. Copies of these publications can be ordered by contacting the ADC Technical Assistance Center at 1-800-366-3891 (in U.S.A. or Canada) or 952-946-3000, extension 63475 (outside U.S.A. and Canada).

Title/Description	ADCP Number
Digivance LRCS Single Band SMR Remote Unit Installation Instructions Provides instructions for installing the STM, LPA, and optional battery in the remote unit cabinet and for installing and connecting the fiber optic, coaxial, and AC power cables.	75-115
Digivance LRCS Single Band Remote Unit Cabinet Installation Instructions Provides instructions for locating and mounting the remote unit cabinet.	75-117
Digivance Element Management System User Manual Provides instructions for installing the Digivance EMS software and for using both the Graphical User Interface (GUI) and the Network Operations Center (NOC) versions of the software.	75-118

ADMONISHMENTS

Important safety admonishments are used throughout this manual to warn of possible hazards to persons or equipment. An admonishment identifies a possible hazard and then explains what may happen if the hazard is not avoided. The admonishments — in the form of Dangers, Warnings, and Cautions — must be followed at all times. These warnings are flagged by use of the triangular alert icon (seen below), and are listed in descending order of severity of injury or damage and likelihood of occurrence.



Danger: *Danger is used to indicate the presence of a hazard that **will** cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*



Warning: *Warning is used to indicate the presence of a hazard that **can** cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*



Caution: *Caution is used to indicate the presence of a hazard that **will** or **can** cause minor personal injury or property damage if the hazard is not avoided.*

GENERAL SAFETY PRECAUTIONS



Danger: *This equipment uses a Class 1 Laser according to FDA/CDRH rules. Laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not look directly into the optical transceiver of any digital unit or exposure to laser radiation may result. An optical power meter should be used to verify active fibers. A protective cap or hood **MUST** be immediately placed over any radiating transceiver or optical fiber connector to avoid the potential of dangerous amounts of radiation exposure. This practice also prevents dirt particles from entering the adapter or connector.*



Danger: *Do not look into the ends of any optical fiber. Exposure to laser radiation may result. Do not assume laser power is turned-off or the fiber is disconnected at the other end.*



Danger: *Wet conditions increase the potential for receiving an electrical shock when installing or using electrically-powered equipment. To prevent electrical shock, never install or use electrical equipment in a wet location or during a lightning storm.*



Warning: *The HU is powered by 48 VDC power which is supplied over customer-provided wiring. To prevent electrical shock when installing or modifying the HU power wiring, disconnect the wiring at the power source before working with uninsulated wires or terminals.*



Caution: *Always allow sufficient fiber length to permit routing of patch cords and pigtails without severe bends. Fiber optic patch cords or pigtails may be permanently damaged if bent or curved to a radius of less than 2 inches (50 mm).*

STANDARDS CERTIFICATION

FCC: This equipment complies with the applicable sections of Title 47 CFR Part 90.

UL/ULC: This equipment complies with UL and ULC 50 Standard for Enclosures for Electrical Equipment. This equipment provides the degree of protection specified by IP43 as defined in IEC Publication 529.

FDA/CDRH: This equipment uses a Class 1 LASER according to FDA/CDRH Rules. This product conforms to all applicable standards of 21 CFR Part 1040.

IC: This equipment complies with the applicable sections of RSS-131.

LIST OF ACRONYMS AND ABBREVIATIONS

The acronyms and abbreviations used in this manual are detailed in the following list:

AC	Alternating Current
ASCII	American Standard Code for Information Interchange
BER	Bit Error Rate
BTS	Base Transceiver Station
CAN	Controller Area Network
CDRH	Center for Devices and Radiological Health
CD-ROM	Compact Disk Read Only Memory
COM	Common
DC	Direct Current
DCE	Data Communications Equipment
DTE	Data Terminal Equipment
EIA	Electronic Industries Association
EMS	Element Management System
ESD	Electrostatic Discharge
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FSO	Free Space Optics
GFCI	Ground Fault Circuit Interrupter
GUI	Graphical User Interface
HU	Host Unit
IC	Industry Canada
LED	Light Emitting Diode
LPA	Linear Power Amplifier
LRCS	Long Range Coverage Solution
MHz	Mega Hertz
MI	Maintenance Interface
NC	Normally Closed

NEM	Network Element Manager
NO	Normally Open
NOC	Network Operations Center
PC	Personal Computer
PCS	Personal Communications System
RF	Radio Frequency
RIM	Radio Interface Module
RU	Remote Unit
RX	Receive or Receiver
SMR	Specialized Mobile Radio
STM	Spectrum Transport Module
TX	Transmit or Transmitter
UL	Underwriters Laboratories
ULC	Underwriters' Laboratories of Canada
VAC	Volts Alternating Current
VDC	Volts Direct Current
WECO	Western Electric Company
WDM	Wave Division Multiplexer

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1 INTRODUCTION

This section provides basic description, application, and configuration information about the Digivance SMR 800 MHz Long Range Coverage Solution (LRCS). Additional versions of the Digivance LRCS including a cellular 800 MHz product and a PCS 1900 MHz product are planned for future releases.

2 SYSTEM OVERVIEW

The Digivance SMR 800 MHz LRCS is an RF signal transport system that provides long-range RF coverage in areas where it is impractical to place a full Base Transceiver Station (BTS) at the antenna site. High real estate costs and community restrictions on tower and equipment locations often make it difficult to install the BTS at the same location as the antenna. The Digivance LRCS is designed to overcome equipment placement problems by allowing base stations to be hubbed at a central location while placing remote antennas at optimum locations with minimal real estate requirements. With the Digivance LRCS, RF signals can be transported to one or more remote locations to expand coverage into areas not receiving service or to extend coverage into difficult to reach areas such as canyons, tunnels, or underground roadways.

2.1 Basic Components

The basic components of a Digivance LRCS system and their functions are shown in [Figure 1-1](#). One link of a basic system consists of the Host Unit (HU) and the Remote Unit (RU). Control and monitoring functions are provided by the Digivance Element Management System (EMS). On an optional basis, each HU and RU link may be ordered either with or without reverse path diversity. In addition, two accessory items, a battery back-up kit (for the RU) and a Wave Division Multiplexer (WDM) module (for the HU and RU) are available if required by the application.

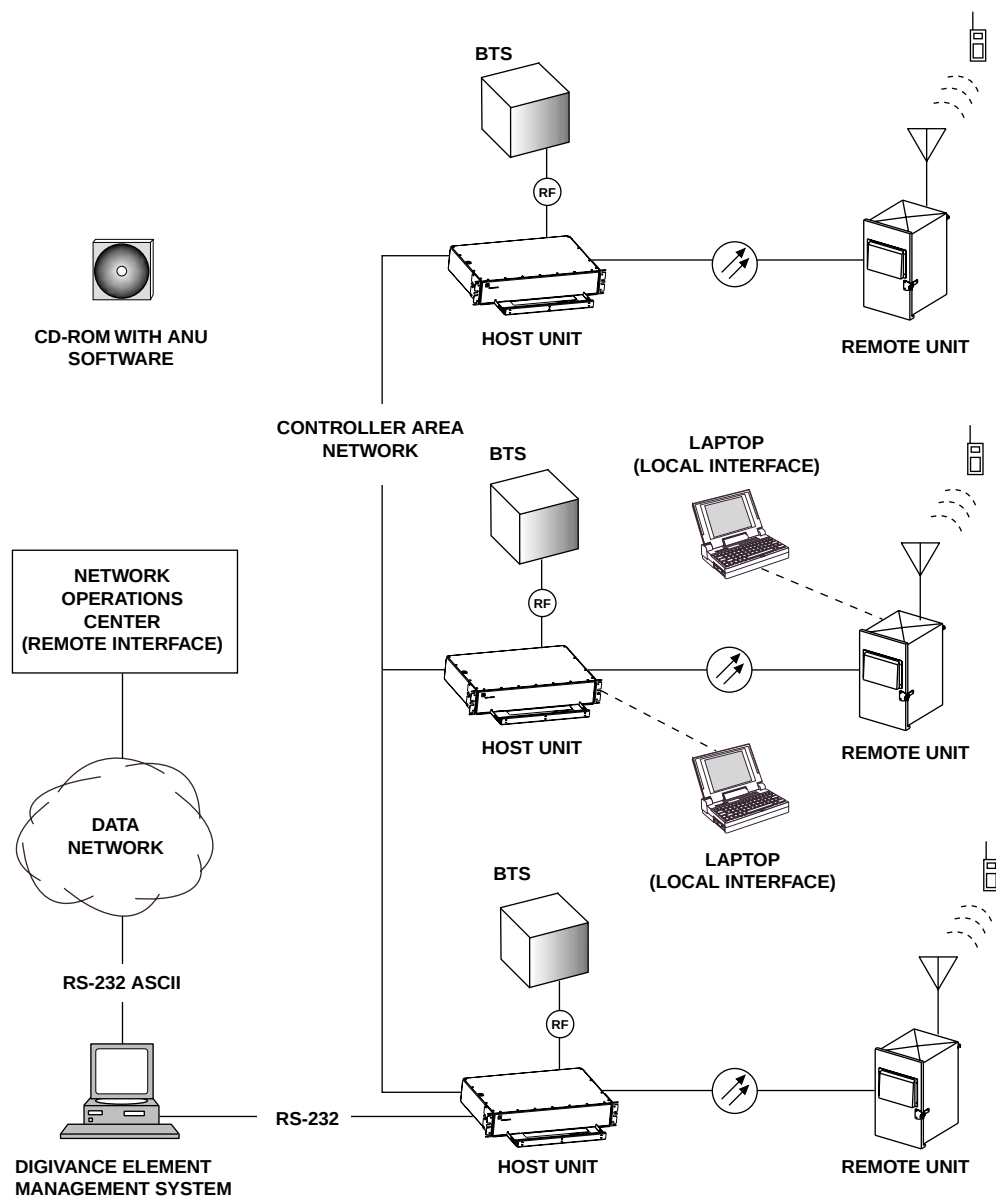


Fig 1-1-A

Figure 1-1. System Overview Diagram

2.2 Base Transceiver Station Interface

The HU is co-located with the BTS and interfaces directly with the BTS over coaxial cables. In the forward path, the HU receives RF signals from the BTS. The HU digitizes the RF signals and then converts them to digital optical signals for transport to the RU. In the reverse path, the HU receives digital optical signals from the RU. The HU converts the digital optical signals back to RF signals for transmission to the BTS.

2.3 Handset Interface

The RU interfaces with the handsets through an antenna. In the reverse path, the RU receives RF signals from each handset. The RU digitizes the RF signals and then converts them to digital optical signals for transport to the HU. In the forward path, the RU receives digital optical signals from the HU. The RU converts the optical signals to RF signals for transmission to the handsets. The RU is connected to an antenna which transmits and receives the handset RF signals.

2.4 Local Service Interface

Local communications with an individual Digivance LRCS link is supported through a local service interface capability. The primary component of the local interface is a PC-type laptop computer loaded with the Digivance Element Management System (EMS) software. The EMS provides the various control and monitoring functions required for **local** management of each LRSC system. The EMS computer can be directly connected to either the HU or RU through the computer's RS-232 port. Operation is effected through the EMS Maintenance Interface (MI). The MI is a graphical user interface that consists of a series of screens from which the user selects the desired option or function. An RS-232 service port is provided on both the HU and the RU for connecting the EMS computer.

2.5 Remote NOC Interface

Remote communications between a Network Operations Center (NOC) and a networked system of multiple Digivance LRCS links is supported by a remote NOC interface capability. The primary component of the remote NOC interface is a PC-type desktop computer loaded with the Digivance Element Management System (EMS) software. In addition to the local management functions described in the previous section, the EMS also provides the various control and monitoring functions required for **remote** management of multiple LRSC links through a NOC.

A Controller Area Network (CAN) port is provided on each HU so that multiple HUs can be networked together in daisy-chain fashion and controlled through the same EMS computer. The EMS computer connects to the networked HUs through the computer's RS-232 port #1. All HUs can then be controlled through the same EMS computer.

The NOC is connected to the EMS computer through a data network or dial-up modem. The EMS computer's RS-232 port #2 interfaces with the data network equipment. The network or dial-up modem equipment must be capable of interfacing with an RS-232 ASCII interface port.

At the NOC, control and monitoring of the networked LRCS links are effected through a Network Element Manager (NEM) interface which requires only a VT100 terminal/emulator for operation. The NEM interface language consists of simple ASCII text strings. All communications are input as either SET or GET commands which result in ASCII text string responses from the specified system or systems. The EMS computer may also be used locally to manage the networked LRCS links. Local operation is through the EMS software MI.

3 SYSTEM FUNCTIONS AND FEATURES

This section describes various system level functions and features of the Digivance LRCS.

3.1 Fiber Optic Transport

On an optional basis, the Digivance LRCS is available either with or without reverse path diversity. On **non-diversity** systems that do not use a WDM module, the HU is connected to the RU over a pair of single-mode fiber optic links. One link is used to transport the forward path optical signal. The other link is used to transport the reverse path optical signal. Because the optical signal is digital, the input and output RF signal levels at the HU or the RU are not dependent on the level of the optical signal or the length of the optical link. A diagram of the fiber optic transport system for a non-diversity system that does not include the WDM module is shown in [Figure 1-2](#).

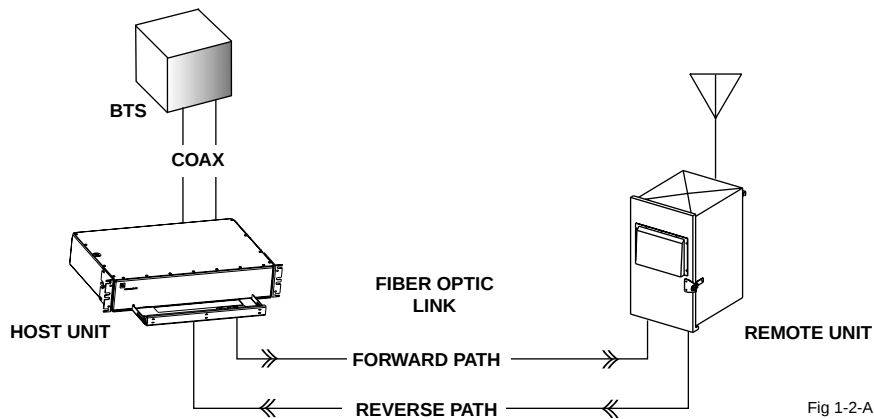


Figure 1-2. Fiber Optic Transport without Diversity and Without WDM Module

On diversity systems that do not use a WDM module, the HU is connected to the RU over three single-mode fiber optic links. One of the fiber optic links is used to transport the forward path optical signal. A second link is used to transport the primary reverse path optical signal. The third link is used to transport the diversity reverse path optical signal. A diagram of the fiber optic transport system with the diversity option is shown in [Figure 1-3](#).

The maximum length of the optical links is dependent on the loss specifications of the optical fiber and the losses imposed by the various connectors and splices. The system provides an optical budget of **19 dB** (typical) when used with 9/125 single-mode dark fiber.

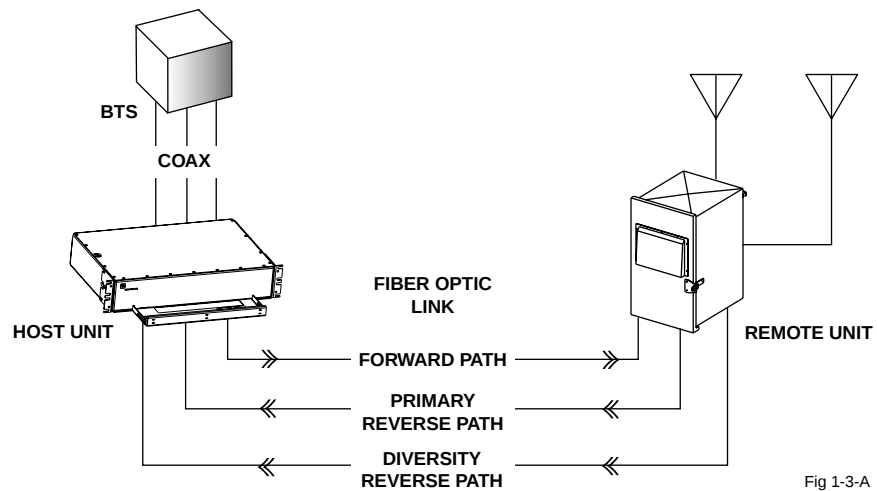


Figure 1-3. Fiber Optic Transport with Diversity and Without WDM Module

The optical wavelengths used in the system are 1550 nm for the forward path and 1310 nm for the reverse path. Because different wavelengths are used for the forward and reverse paths, a pair of bi-directional wavelength division multiplexers (WDM) may be used in applications where it is desirable to combine the forward path and reverse path optical signals on a single fiber link. One WDM may be mounted with the HU and the other WDM mounted with the RU. A diagram of a fiber optic transport system with a WDM application is shown in [Figure 1-4](#). The WDMs are available as accessory items.

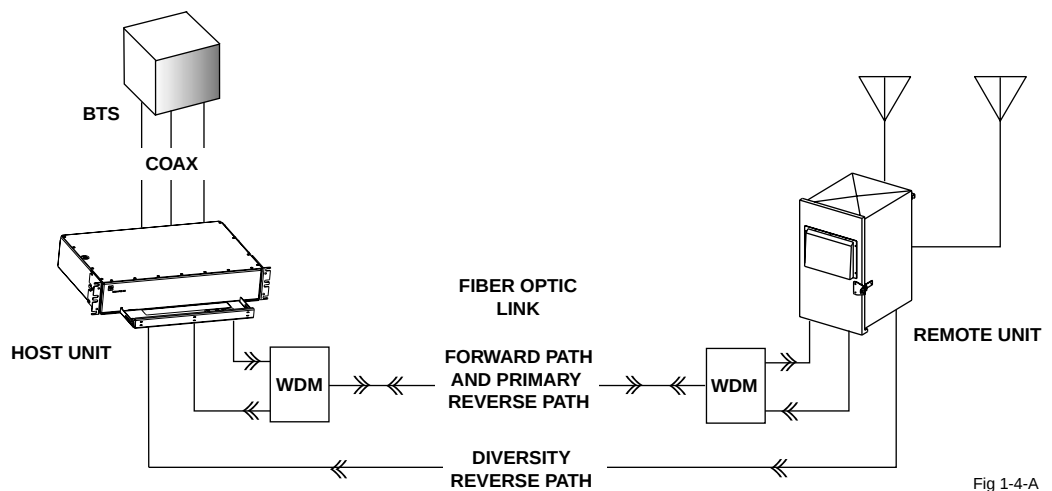


Figure 1-4. Wavelength Division Multiplexer Application

Because separate forward and reverse path optical inputs and outputs are provided at the HU and RU, a Free Space Optics (FSO) system may be used in applications where it is desirable to bridge an open span and where it is impractical to lay a fiber optic cable. One FSO transceiver unit may be mounted on the HU side of the open span and the other FSO transceiver unit may be mounted on the RU side of the open span. A system diagram of an FSO application is shown in Figure 1-5. FSO systems are available from various equipment manufacturers.

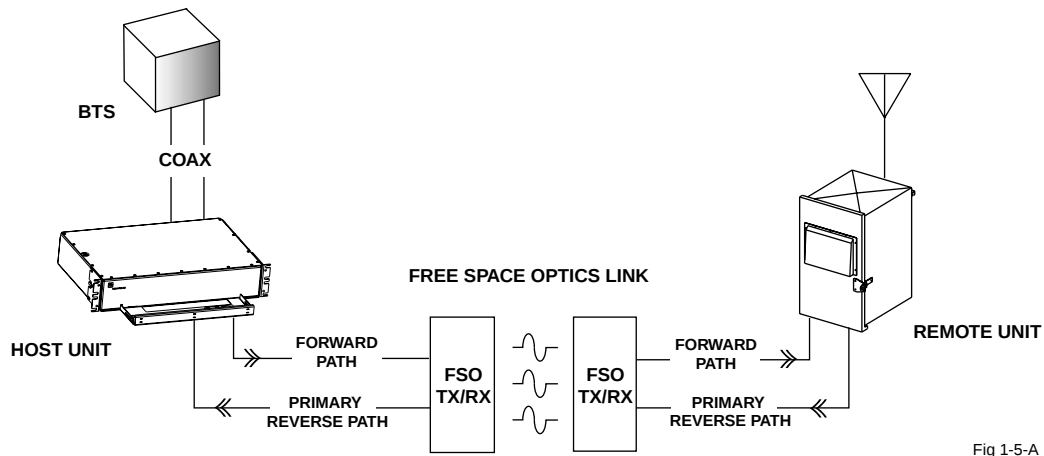


Fig 1-5-A

Figure 1-5. Free Space Optics Application

3.2 Control and Monitoring Software

The Digivance EMS software supports system control and monitoring functions for both the local and remote service interfaces. The EMS software is stored on a CD-ROM and shipped separately with each HU. Software installation consists of copying the software files from the CD-ROM to a designated directory on the hard-drive of the EMS computer. The EMS software may also be copied to the hard-drive of a laptop computer when a local service interface connection with a specific HU or RU is required.

The EMS software is used to provision and configure the system for operation. This includes selecting a sitename, setting alarm thresholds, and setting forward and reverse path RF gain adjustments. The EMS software is also used to get alarm messages (individual or summary), data measurements, or to upgrade the HU/RU system software. All control and monitor functions can be effected using either the NOC NEM interface or the EMS software MI.

3.3 Fault Detection and Alarm Reporting

LED indicators are provided on the front panel of the HU and on the front panels of the RU modules to indicate if the system is normal or if a fault is detected. In addition, normally open and normally closed alarm contacts (for both major and minor alarms) are provided at the HU for connection to a customer-provided external alarm system. All alarms can also be accessed through the NOC NEM interface or the EMS software MI.

3.4 Powering

The HU is powered by 24 to 48 Vdc and must be hard-wired to a local office battery power source through a fuse panel. The RU is powered by 120 or 240 Vac (50 or 60 Hz) and must be hard-wired to the AC power source through a 20 Amp breaker box. The RU is pre-wired for 120 Vac operation but can be converted to 240 Vac through the installation of a 240 Vac outlet kit (accessory item). The RU is equipped with a surge protector to prevent equipment damage from AC power spikes and a lighting protector to prevent equipment damage from lighting surges. A 120 Vac outlet is provided within the RU cabinet for powering for test equipment or power tools. On an optional basis, a battery back-up kit is available for the RU. The battery-backup system powers the RU if the AC power source is disconnected or fails.

3.5 Equipment Mounting and Configuration

The HU is designed for mounting in a **non-condensing indoor** environment such as inside a wiring closet or within an environmentally-controlled cabinet. The HU is intended for rack-mount applications and may be mounted in either a 19- or 23-inch WECCO or EIA equipment rack.

The RU is designed for mounting in either an **indoor or outdoor** environment. The RU consists of a Spectrum Transport Module (STM), a Linear Power Amplifier (LPA) module, and a self-contained cabinet which houses the modular components and protects them from the elements. The RU cabinet is weather-tight but should not be mounted where it will be constantly exposed to salt-air mist or direct sunlight. The cabinet can be mounted from a flat-vertical surface or from a utility pole (requires pole-mount kit). Slots are provided within the cabinet for mounting the STM and LPA modules. A storage spool is provided for storing short lengths of excess pigtail slack. A bracket is provided for mounting a WDM module (accessory item). A tray with a heated base is provided for mounting the back-up battery (accessory item).

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1 INTRODUCTION

This section describes the basic components of the Digivance LRCS including the Host Unit (HU), the Remote Unit (RU), and the Alarm Network Unit (ANU). Note that the RU is actually an assembly that consists of a cabinet, a Spectrum Transport Module (STM), and a Linear Power Amplifier (LPA) module. For clarity, the various components that comprise the RU are described separately.

2 HOST UNIT

The HU, shown in [Figure 2-1](#), serves as the BTS servicing unit for the Digivance LRCS. The HU provides the following basic functions:

- Provides an adjustable RF interface with the BTS.
- Provides an optical interface with the RU.
- Digitizes the forward path composite RF signal.
- Converts the digitized forward path RF signal to a digital optical signal.
- Converts the digitized reverse path optical signal to a digitized RF signal.
- Converts the digitized reverse path RF signal to a composite RF signal.
- Signals alarm information to an external alarm system through relay contact closures
- Provides an RS-232 interface for a local or remote management system.
- Provides a CAN interface for networking multiple HUs.

2.1 Primary Components

The HU consists of an electronic circuit board assembly and a fan assembly that are mounted within a powder-coated sheet metal enclosure. The enclosure provides a mounting point for the circuit board and fan assemblies and controls RF emissions. The only user-replaceable component is the fan assembly. The HU is designed for use within a non-condensing indoor environment such as inside a wiring closet or cabinet. All controls, connectors, and indicators (except the power terminal strip) are mounted on the HU front panel for convenient access. Cable management functions for the coaxial and fiber optic cables are provided by a cable management tray that extends outward from the HU front panel.

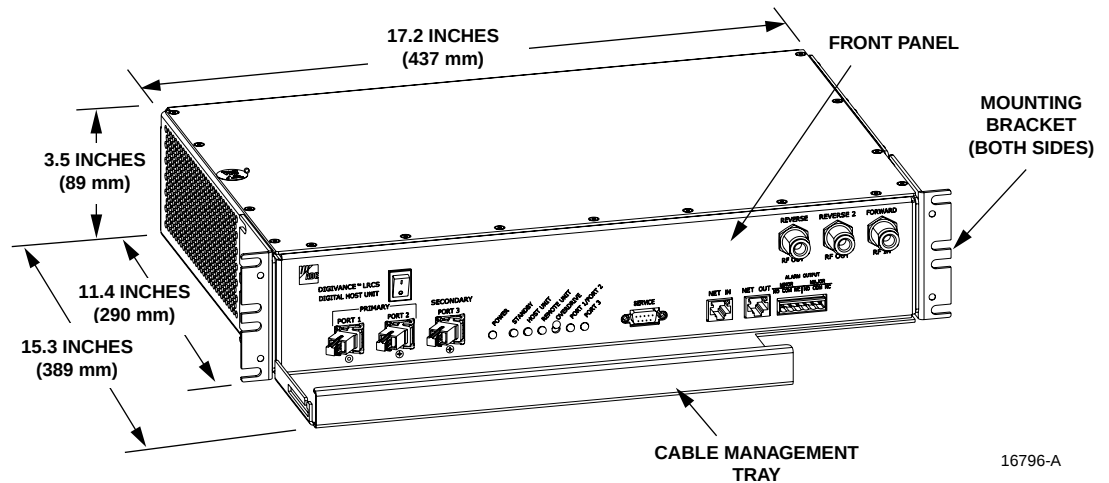


Figure 2-1. Host Unit

2.2 Mounting

The HU is intended for rack-mount applications. A pair of reversible mounting brackets is provided that allow the HU to be mounted in either a 19-inch or 23-inch EIA or WECCO equipment rack. When installed, the front panel of the HU is flush with the front of the rack. The cable management tray extends 3.9 inches (99 mm) beyond the front panel. Fasteners are provided for securing the HU to the equipment rack.

2.3 Fault Detection and Alarm Reporting

The HU detects and reports the following faults: host unit fault, optical fault, power fault, temperature fault, and RF fault. Various front panel Light Emitting Diode (LED) indicators turn from green to red or yellow if a fault is detected. A set of alarm contacts (normally open and normally closed) are provided for reporting an alarm to an external alarm system when a fault is detected. Both major alarm (system operation seriously affected) and minor alarm (system operation not affected or only slightly degraded) contacts are provided.

The state of the various LEDs, the alarm state (major or minor), and other more detailed alarm information is summarized and reported over the service interface, the CAN interface, and also over the fiber optic link to the RU. In addition, the state of the RU is received over the fiber link and reported over the service interface and the CAN interface. This detailed information may be accessed remotely through the NOC NEM interface or locally through the ANU software MI.

2.4 RF Signal Connections

The RF signal connections between the HU and the BTS are supported through either two (non-diversity unit) or three (diversity unit) N-type female connectors. On non-diversity units, one connector is used for the forward path RF signal. The other connector is used for the primary reverse path RF signal. On diversity units, a third connector is used for the diversity path RF

signal. In SMR installations, the HU can be connected directly to the BTS without a LRCS Interface Unit. The HU should be as close as possible to the BTS to minimize cable losses.

2.5 RF Signal Adjustments

The HU is equipped with two digital attenuators for adjusting the signal levels of the forward and reverse path RF signals. The attenuators provide an attenuation adjustment range of 0 to 30 dB and can be set in 1 dB increments.

The **forward path** attenuator adjusts the level of the input RF signal. Any input signal with a level of -10 dBm (attenuator set to 30 dB) to -40 dBm (attenuator set to 0 dB) can be adjusted to the required level of **-40 dBm** using the forward path attenuator. An external attenuator is required if more than 30 dB of attenuation is required to adjust the input RF signal to the required level. An overdrive limiter protects the system against excessive inputs but does not function during normal operation.

The **reverse path** attenuator adjusts the level of the output RF signal and will add from 0 dBm of gain (attenuator set to 30 dB) to 30 dBm of gain (attenuator set to 0 dB) to the output signal. The attenuators are software controlled and are adjusted through the NOC NEM interface or the EMS software MI.

The HU forward and reverse path propagation delay may be adjusted in 1 μ s increments within a range of 0–63 μ s. The propagation delay is software controlled and may be adjusted through the NOC NEM interface or the EMS software MI.

2.6 Optical Link Connection

Optical link connections between the HU and the RU (STM) are supported through either two (non-diversity unit) or three (diversity unit) SC-type optical connector ports. On non-diversity units, one port is used for connecting the forward path optical signal and the other port is used for connecting the primary reverse path optical signal. On diversity units, a third optical port is used for connecting the diversity reverse path optical signal.

2.7 Controller Area Network Interface Connection

Controller Area Network (CAN) interface connections between multiple HUs are supported by a pair of RJ-45 jacks. One of the jacks is designated as the network IN port and the other jack is designated as the network OUT port. The CAN interface allows up to 15 HUs to be connected together (in daisy-chain fashion) and controlled through a single Digivance EMS computer.

2.8 Service Interface Connection

The service interface connection between the HU and the Digivance EMS computer is supported by a single DB-9 female connector. The service connector provides an RS-232 DTE interface. When multiple HUs are networked together, the supporting EMS computer may be connected to the service connector on any one of the networked HUs. The unused service connectors on networked HUs may also be used to provide a direct connection between a laptop computer (loaded with the EMS software) and the corresponding HU.

2.9 Powering

The HU is powered by 24 to 48 Vdc power. The power is fed to the HU through a screw-down type terminal strip located on the rear side of the unit. Power to the HU must be supplied through a fuse panel such as the 20 position PowerWorx fuse panel (available separately) and the power circuit must be protected with a 3 Amp GMT fuse. An On/Off switch is provided on the HU front panel.

2.10 Cooling

Continuous airflow for cooling is provided by dual fans mounted on the right side of the HU housing. A minimum of 3 inches (76 mm) of clearance space must be provided on both the left and right sides of the HU for air intake and exhaust. An alarm is provided if a high temperature condition ($>50^{\circ}\text{C}/122^{\circ}\text{F}$) occurs. The fans may be field-replaced if either fan fails.

2.11 User Interface

The HU user interface consists of the various connectors, switches, terminals, and LEDs that are provided on the HU front and rear panels. The HU user interface points are indicated in [Figure 2-2](#) and described in [Table 2-1](#).

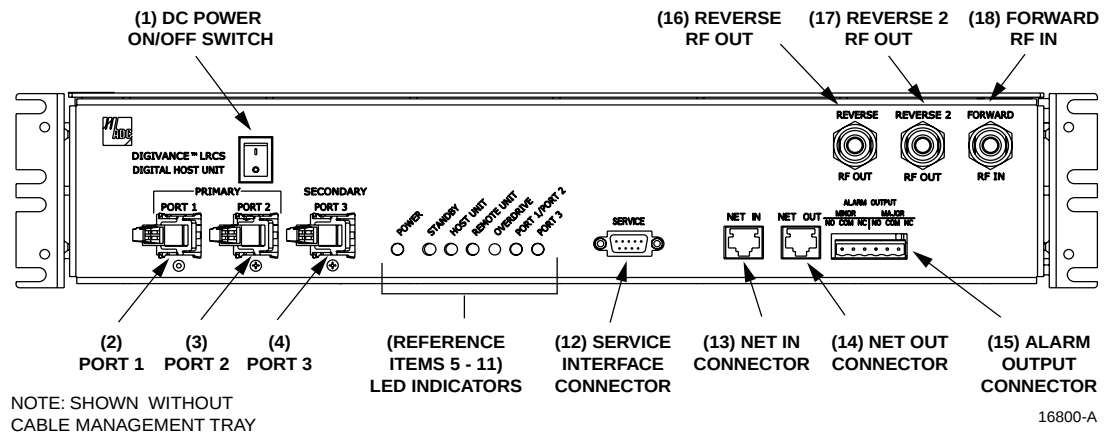


Figure 2-2. Host Unit User Interface

Table 2-1. Host Unit User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	O/I	On/Off rocker switch	Provides DC power on/off control.
2	PRIMARY PORT 1	SC connector	Connection point for the forward path fiber optic link.

Table 2-1. Host Unit User Interface, continued

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
3	PRIMARY PORT 2	SC connector	Connection point for the reverse path primary fiber optic link.
4	SECONDARY PORT 3	SC connector	Connection point for the reverse path diversity fiber optic link.
5	POWER	Multi-colored LED (green/yellow)	Indicates if the HU is powered (green) or unpowered (off). See Note.
6	STANDBY	Multi-colored LED (green/yellow/red)	Indicates if the system is in the Normal (off), Standby (blinking green), Test (blinking red), or Program Load (blinking yellow) state. See Note.
7	HOST UNIT	Multi-colored LED (green/yellow/red)	Indicates if the HU is normal (green) overheated (yellow) or faulty (red). See Note.
8	REMOTE UNIT	Multi-colored LED (green/yellow/red)	Indicates if the RU is normal (green) or faulty (red). See Note.
9	OVERDRIVE	Multi-colored LED (green/yellow/red)	Indicates if the level of the RF input signal to the HU is normal (green), low (yellow), or high (red). See Note.
10	PORT 1/PORT 2	Multi-colored LED (green/yellow/red)	Indicates if the primary reverse path optical signal received from the STM is normal (green), if no signal is detected (red), or if errors are detected (red). See Note.
11	PORT 3 (diversity unit only)	Multi-colored LED (green/yellow/red)	Indicates if the secondary reverse path optical signal received from the STM is normal (green), if no signal is detected (red), or if errors are detected (red). See Note.
12	SERVICE	DB-9 connector (female)	Connection point for the RS-232 service interface cable.
13	NET IN	RJ-45 jack (female)	Connection point for the CAN interface input cable.
14	NET OUT	RJ-45 jack (female)	Connection point for the CAN interface output cable.
15	ALARM OUTPUT	Screw-type terminal connector (14–26 AWG)	Connection point for an external alarm system. Includes normally open (NO), normally closed (NC), and common (COM) wiring connections.
16	REVERSE RF OUT	N-type female RF coaxial connector	Connection point for the primary reverse path RF coaxial cable.
17	REVERSE 2 RF OUT	N-type female RF coaxial connector	Connection point for the diversity reverse path RF coaxial cable.
18	FORWARD RF IN	N-type female RF coaxial connector	Connection point for the forward path RF coaxial cable.
	POWER 24–48 VDC (Rear side - not shown)	Screw-type terminal strip	Connection point for the DC power wiring.
Note: A more detailed description of LED operation is provided in Section 5.			

3 REMOTE UNIT CABINET

The RU cabinet, shown in [Figure 2-3](#), is a NEMA-3R enclosure (with removable dust filter) that provides the following basic functions:

- Houses the various electronic modules (STM and LPA) and accessories (battery back-up kit and WDM kit) and protects them from the weather.
- Provides electrical interface connections for the STM and LPA modules.
- Provides ventilation openings to allow the entry of cool air and the escape of heated air.
- Provides a point for terminating the coaxial antenna cable, the fiber optic cable, the AC power cable, and ground cable.
- Provides AC power surge protection
- Provides lightning protection
- Provides access to an AC power outlet for test equipment and power tools.
- Provides limited storage for fiber optic pigtails.

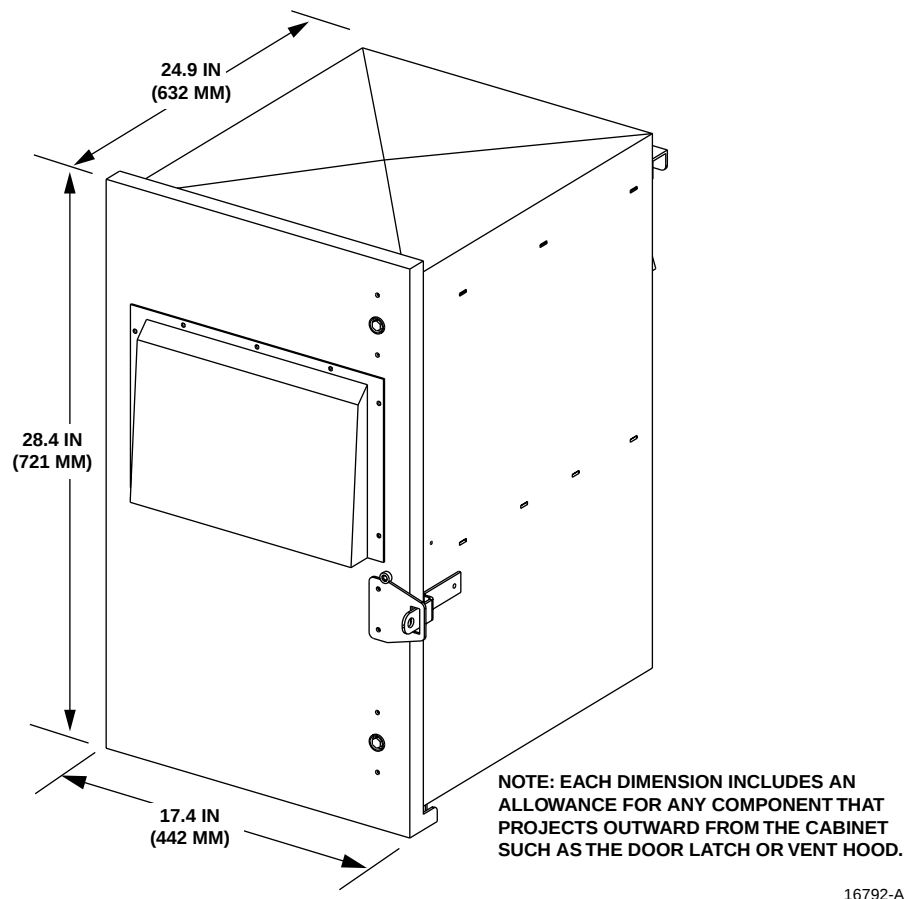


Figure 2-3. Remote Unit Cabinet

3.1 Primary Components

The RU cabinet consists of the enclosure, a mounting shelf for the STM and LPA modules, an AC power interface, a lightning protector, a mounting shelf for the battery back-up accessory, a fiber storage spool, and a mounting bracket for the WDM accessory. The RU cabinet is designed for use in either an outdoor or indoor environment. Opening the hinged door provides full height and width access to the interior of the enclosure to facilitate module and cable installation.

The enclosure is constructed of heavy gauge aluminum and is painted putty white for corrosion protection. Connection and entry points are provided in the bottom of the enclosure for the antenna coaxial cable, fiber optic cable, and AC power cable. Vent openings are provided in the door and the rear side of the enclosure to permit air exchange for cooling. Drain holes in the bottom of the cabinet allow any moisture that does enter the cabinet to drain out. The cabinet door is equipped with a sturdy latch so that the enclosure may be padlocked to prevent unauthorized entry. A door open switch is provided so that a major alarm is generated whenever the cabinet door is opened.

3.2 Mounting

The RU cabinet may be mounted on a flat vertical surface (such as the side of building) or on a utility pole. A special mounting bracket is provided with each enclosure. Installation consists of securing the bracket to the mounting surface and then hanging the enclosure from the bracket. The mounting bracket may be attached to a variety of surfaces such as wood, concrete, or masonry. Various fasteners including hex-head capscrews, tee-nuts, and concrete anchors are provided. A separate pole-mounting kit (accessory item) is available for attaching the mounting bracket to a utility pole.

3.3 Module Installation

A mounting shelf is provided within the RU cabinet for installing the STM and LPA modules. The mounting shelf includes tracks that guide each module into the installed position. Separate mounting locations are provided for each type of module. Two D-sub connectors (one male, one female) are located at the rear of the mounting shelf. Each mounting shelf connector mates with a corresponding D-sub connector located on the rear side of each module. A wiring harness links the mounting shelf connectors together. The connectors and the attached wiring harness provide the electrical interface between the STM and LPA modules. The modules are held in the installed position with captive screws.

3.4 Fiber Optic Cable Entry

A plastic cord connector is provided in the exterior bottom side of the RU cabinet for routing a fiber optic cable into the enclosure. The cord connector provides cable strain relief and a watertight seal at the fiber optic cable entry point. As the connector nut is tightened, a soft neoprene bushing compresses to tightly grip the cable without applying excessive force to the fibers. The cord connector can accommodate cables that range from 0.375 to 0.875 inches (10 to

23 mm) in diameter. A spool is provided directly above the fiber optic cable entry hole for storing excess pigtail slack.

In a typical installation, the connectorized end of a multi-fiber outside plant cable is routed into the enclosure through the cord connector and the individual fibers are broken out into pigtails. The pigtails are connected to the optical ports on the STM and the excess pigtail slack is stored on the fiber storage spool. The stub end of the cable is routed to an external splice enclosure (not provided) for splicing to the fiber optic link cable.

3.5 Antenna Cable Connection

An N-type female connector is provided on the exterior bottom side of the RU cabinet for connecting the primary antenna coaxial cable. The exterior connector is on the surge side of a lightning protector that is mounted on the interior bottom side of the enclosure. On the inside of the enclosure, a second N-type female connector is provided on the protected side of the lightning protector. A coaxial jumper cable (included with the enclosure) is used for connecting the protected side N-type connector to the primary RF port on the STM.

A lightning protector kit (accessory item) is available if a diversity STM is mounted in the enclosure. An additional lightning protector is required if a diversity antenna is installed. A hole is provided in the bottom of the enclosure for mounting an additional lightning protector.

3.6 AC Power Wiring Entry and Grounding

A 3/4-inch NPT threaded hole is provided in the exterior bottom side of the RU cabinet for connecting a standard 3/4-inch AC conduit fitting to the enclosure. A 3/4-inch to 1/2-inch reducer is also included with the enclosure if 1/2-inch conduit is preferred over 3/4-inch conduit. The conduit should be installed between the enclosure and an external 20 Amp breaker box (not provided) and all AC power wiring (three wires required) should be run within the conduit. Three pigtail leads (Hot, Neutral, and Ground) are provided within the enclosure for connection to the AC wiring. Three wire nuts are included with the enclosure for completing the connection. A grounding lug is provided on the underside of the enclosure for connecting the RU cabinet to an earth ground source.

The standard RU cabinet is equipped with a 120 VAC Ground Fault Circuit Interrupter (GFCI) outlet and should only be wired for operation on 120 VAC current. A 240 VAC outlet kit (accessory item) must be installed if operation on 240 VAC current is required.

3.7 Battery Back-Up Kit

A battery back-up kit (accessory item) is available when the application requires that the system remain operational during an AC power outage. A tray is provided within the enclosure for mounting the battery. The battery tray includes a heating pad that keeps the battery warm during cold weather. A temperature sensor regulates the operation of the heating pad and a circuit breaker provides overcurrent protection. The battery back-up kit includes a wiring harness for connecting the battery to the STM. During normal operation, the STM provides charging current to maintain the battery charge level. During an AC power outage, the battery provides

DC power to the STM to maintain system operation. The battery can maintain operation of the RU for approximately 1 hour at 50 Watts.

3.8 Ventilation

Vent openings are provided in the door and the rear side of the RU cabinet to permit air exchange for cooling. Air enters the enclosure through the opening in the door. A filter on the inside of the door removes dirt particles so that only clean air enters the enclosure. Both modules have cooling fans. The STM has a rear mounted fan that pulls air through the module and exhausts it toward the rear of the enclosure. The heated air exits through an opening in the rear side of the enclosure. The LPA works in a similar manner except it also has a fan on the front to help pull air into the module.

3.9 User Interface

The RU cabinet user interface consists of the various connectors, fittings, outlets, and switches that are provided on both the interior and exterior of the enclosure. The RU cabinet user interface points are described in [Table 2-2](#) and indicated in [Figure 2-4](#).

Table 2-2. Remote Unit Cabinet User Interface

REF NO	DEVICE	FUNCTIONAL DESCRIPTION
1	Air inlet filter	A reusable filter that prevents the entry of dirt particles when outside air is pulled into the cabinet for cooling.
2	AC power cord	Provides AC power to the STM.
3	Circuit breaker reset switch	Used to reset the battery heater circuit following correction of an overcurrent condition.
4	Door switch	Indicates to the fault detection and alarm reporting system if the cabinet door is open (major alarm) or closed.
5	Module mounting shelf	Provides a mounting point for the STM and LPA modules.
6	Battery tray	Provides a mounting point for the back-up battery (when used).
7	120 Vac GFCI outlet (standard)	Standard 120 Vac GFCI outlet for connecting AC power tools or test equipment.
8	Fiber slack spool	Provides a storage place for excess fiber pigtail slack.
9	Antenna connector	Provides lightning surge protection for the antenna connection.
10	Fiber cable connector	Provides both an entry point and strain relief for the fiber optic cable.
11	3/4-inch NPT threaded hole	Provides a connection point for a 3/4-inch AC conduit fitting.
12	Grounding lug	Provides a connection point for an external grounding cable.

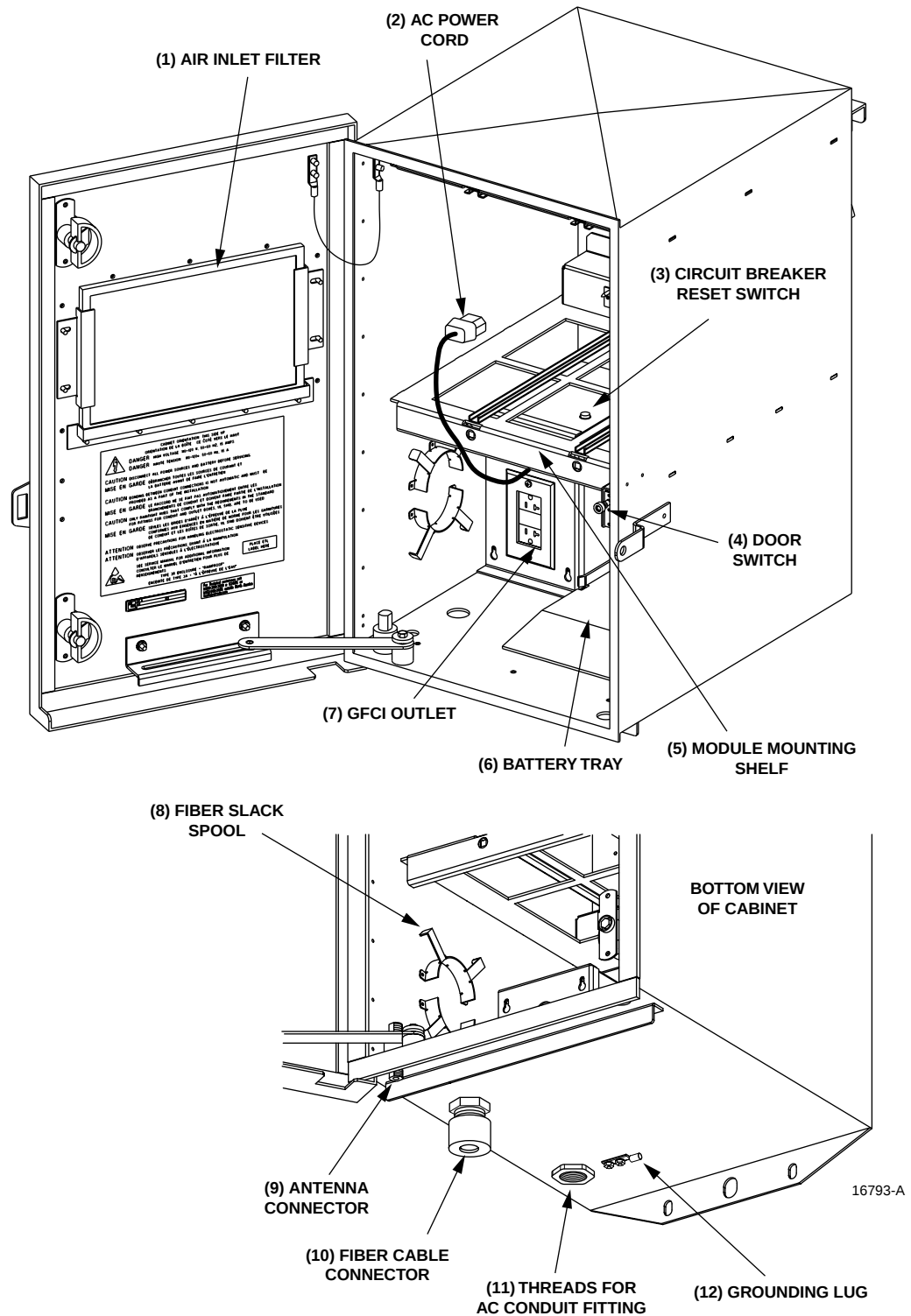


Figure 2-4. Remote Unit Cabinet User Interface

4 SPECTRUM TRANSPORT MODULE

The Spectrum Transport Module (STM), shown in [Figure 2-5](#), serves as the handset servicing device for the Digivance LRCS. The STM provides the following basic functions:

- Provides an RF interface to the handsets via the LPA and an external antenna.
- Provides an optical interface to the HU.
- Converts the digitized forward path optical signal to a digitized RF signal.
- Converts the digitized RF signal to a composite RF signal.
- Digitizes the reverse path composite RF signal.
- Converts the digitized reverse path RF signal to a digitized optical signal.
- Provides an RS-232 interface for a local management system.
- Transports alarm, control, and monitoring information via the optical link.

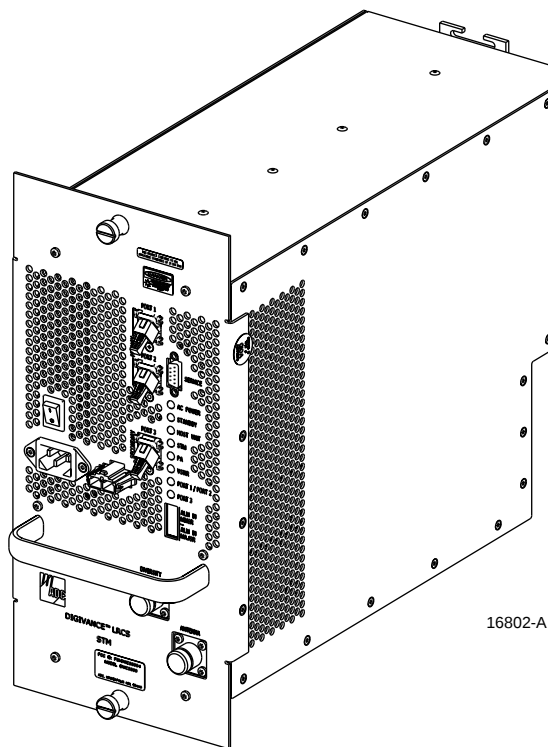


Figure 2-5. Spectrum Transport Module

4.1 Primary Components

The STM consists of an electronic circuit board assembly, power supply, duplexer, and fan assembly that are mounted within a powder-coated sheet metal enclosure. The metal enclosure provides a mounting point for the electronic components and controls RF emissions. Except for the fan unit, the electronic components are not user replaceable. The STM is designed for use within the RU cabinet. Except for the LPA interface connector, all controls, connectors, indicators, and switches are mounted on the STM front panel for easy access. A carrying handle is provided on the front of the STM to facilitate installation and transport.

4.2 Mounting

The STM mounts on a shelf within the RU cabinet. A runner on the bottom of the STM meshes with a track on the mounting shelf. The runner and track guide the LPA into the installed position. The electrical interface between the STM and LPA is supported by a D-sub female connector located on the rear side of the STM. A corresponding D-sub male connector mounted at the rear of the RU cabinet mounting shelf mates with the STM connector. Captive screws are provided for securing the STM to the mounting shelf.

4.3 Fault Detection and Alarm Reporting

The STM detects and reports the following faults: remote unit fault, optical fault, power fault, temperature fault, power amplifier fault, and external (door open) fault. Various front panel Light Emitting Diode (LED) indicators turn from green to red or yellow if a fault is detected. The state of the various LEDs, the alarm state (major or minor), and other more detailed alarm information is summarized and reported over the fiber optic link to the HU and also over the service interface. In addition, the state of the HU is received over the fiber optic link and reported to the service interface. This detailed information may be accessed remotely through the NOC NEM interface or locally through the EMS software MI.

4.4 Antenna Cable Connection

The antenna cable connections between the STM and the antenna are supported through either one (non-diversity unit) or two (diversity unit) N-type female connectors. On non-diversity units, a single connector is used for the primary antenna cable which carries both the forward and primary reverse path RF signals. On diversity units, a second connector is used for the diversity antenna cable which carries only the diversity reverse path RF signals. The STM does not connect directly to the antenna but instead connects to a lightning protector that is mounted on the bottom of the RU cabinet (see [Section 3.5](#)). A coaxial jumper cable is provided (included with the enclosure) for connecting the STM connector to the lightning protector.

4.5 RF Signal Level Adjustment

The STM is equipped with a digital attenuator for adjusting the signal level of the forward path RF output signal. The attenuator provides an attenuation adjustment range of 0 to 30 dB and can be set in 1 dB increments. The attenuator is software controlled and is adjusted through the NOC-NEM interface or the EMS software MI.

4.6 Optical Link Connection

Optical link connections between the STM and the HU are supported through either two (non-diversity unit) or three (diversity unit) SC-type optical connector ports. On non-diversity units, one port is used for connecting the forward path optical signal and the other port is used for connecting the primary reverse path optical signal. On diversity units, a third optical port is used for connecting the diversity reverse path optical signal.

4.7 Service Interface Connection

The service interface connection between the STM and a local laptop computer loaded with the ANU software is supported by a single DB-9 female connector. The service interface connector provides an RS-232 DTE interface. The STM service interface connector supports local communications with both the STM and the corresponding HU.

4.8 Powering

The STM is powered by 120 or 240 Vac (50 or 60 Hz) power which is supplied through a three-conductor AC power cord. The power cord is provided with the RU cabinet. One end of the cord is hard-wired to the AC power outlet box and the other end is terminated with a molded-on plug cap. The power cord connects to a 3-wire AC cord connector mounted on the STM front panel. A switch on the STM front panel provides AC power On/Off control.

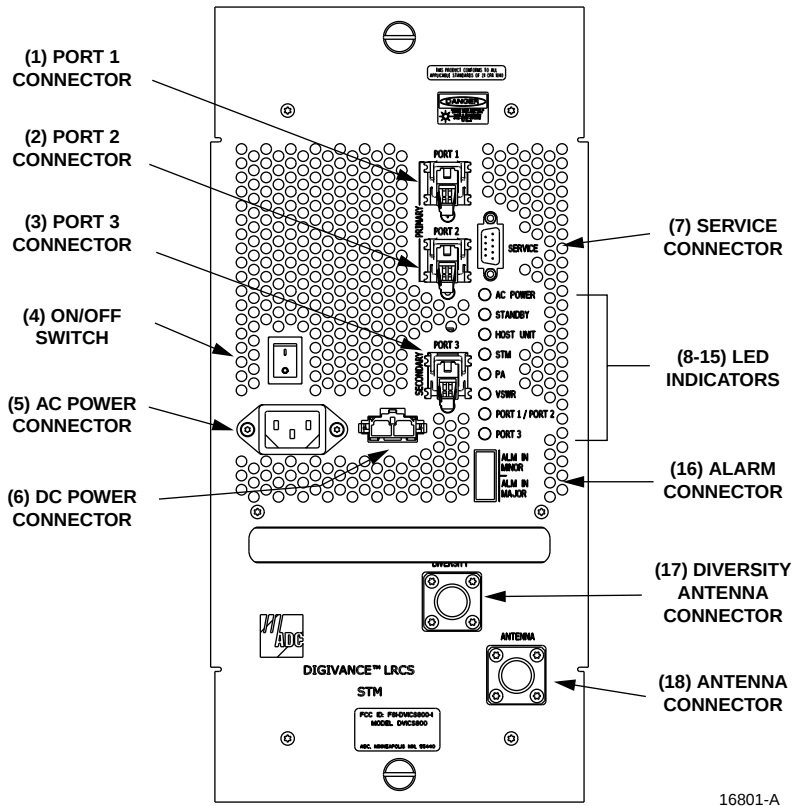
The STM (and the connected LPA) may be powered by a 12 Vdc battery back-up system which is available as an accessory kit. A connector is provided on the STM front panel for connecting the wiring harness for the battery back-up system.

4.9 Cooling

Continuous air-flow for cooling is provided by a single fan mounted on the rear side of the STM housing. An alarm is provided that indicates if a high temperature condition ($>50^{\circ}\text{C}/122^{\circ}\text{F}$) occurs. The fan may be field replaced if it fails.

4.10 User Interface

The STM user interface consists of the various connectors, switches, and LEDs that are provided on the STM front panel. The STM user interface points are indicated in [Figure 2-6](#) and described in [Table 2-3](#).



16801-A

Figure 2-6. Spectrum Transport Module User Interface

Table 2-3. Spectrum Transport Module User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	PORT 1	SC connector	Connection point for the forward path fiber optic link.
2	PORT 2	SC connector	Connection point for the reverse path primary fiber optic link.
3	PORT 3 (diversity unit only)	SC connector	Connection point for the reverse path diversity fiber optic link.
4	I/O	On/Off rocker switch	Provides AC power on/off control.
5	No designation	3-wire AC power cord connector	Connection point for the AC power cord.
6	No designation	2-wire DC power cord connector	Connection point for the battery back-up power cord.
7	SERVICE	DB-9 connector (female)	Connection point for the RS-232 service interface cable.

Table 2-3. Spectrum Transport Module User Interface, continued

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
8	AC POWER	Multi-colored LED (green/red)	Indicates if the STM is powered by the AC power source (green) or the battery back-up system (red). See Note.
9	STANDBY	Multi-colored LED (green/yellow/red)	Indicates if the system is in the Normal state (off) Standby state (blinking green), Test state (blinking red), or Program Load state (blinking yellow). See Note.
10	HOST UNIT	Multi-colored LED (green/yellow/red)	Indicates if the HU is normal (green) or faulty (red). See Note.
11	STM	Multi-colored LED (green/yellow/red)	Indicates if the STM is normal (green) or faulty (red). See Note.
12	PA	Multi-colored LED (green/yellow/red)	Indicates if the power amplifier is normal (green), over temperature (yellow), has a fan failure (yellow), or is faulty (red). See Note.
13	VSWR	Multi-colored LED (green/yellow/red)	Indicates if the forward path VSWR is above (red) or below (green) the fault threshold.
14	PORT 1/PORT 2	Multi-colored LED (green/yellow/red)	Indicates if the forward path optical signal received from the HU is normal (green), if no signal is detected (red), or if errors are detected (red). See Note.
15	PORT 3 (diversity unit only)	Multi-colored LED (green/yellow/red)	Indicates if the diversity reverse path optical signal received by the HU is normal (green), if no signal is detected (red), or if errors are detected (red). See Note.
16	ALARM IN MINOR ALARM IN MAJOR	Screw-type terminal connector (14–26 AWG)	Connection point for two external alarm inputs. The door-open switch lead wires are typically connected to the major alarm terminals.
17	DIVERSITY (diversity unit only)	N-type female RF coaxial connector	Connection point for the diversity antenna.
18	ANTENNA	N-type female RF coaxial connector	Connection point for the primary antenna.
Note: A more detailed description of LED operation is provided in Section 5.			

5 LINEAR POWER AMPLIFIER

The Linear Power Amplifier (LPA), shown in [Figure 2-7](#), works in conjunction with the STM to amplify the forward path RF output signal. The STM is interfaced with the LPA through the D-sub connectors and wiring harness located at the rear of the RU cabinet. The RF signal is passed to the LPA for amplification and then passed back to the STM for output via the STM's ANTENNA port. The LPA provides 57 dB of gain to the composite forward path RF signal.

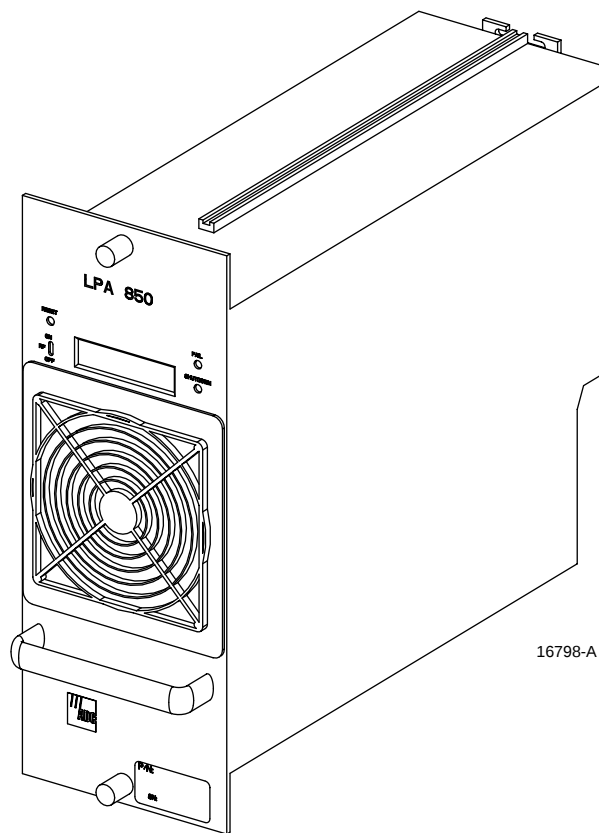


Figure 2-7. Linear Power Amplifier

5.1 Primary Components

The LPA consists of several electronic circuit board assemblies and two fan assemblies that are mounted within a powder-coated sheet metal enclosure. The metal enclosure provides a mounting point for the electronic components and controls RF emissions. Except for the fan units, the electronic components are not user replaceable. The LPA is designed for use within the RU cabinet. Except for the STM interface connector, all controls, indicators, and switches are mounted on the LPA front panel for easy access. A carrying handle is provided on the front of the LPA to facilitate installation and transport.

5.2 Mounting

The LPA mounts on a shelf within the RU cabinet. A runner on the bottom of the LPA meshes with a track on the mounting shelf. The runner and track guide the LPA into the installed position. The electrical interface between the STM and LPA is supported by a D-sub female connector located on the rear side of the LPA. A corresponding D-sub male connector mounted at the rear of the RU cabinet mounting shelf mates with the LPA connector. Captive screws are provided for securing the LPA to the mounting shelf.

5.3 Fault Detection and Alarm Reporting

The LPA in conjunction with the STM detects and reports the following faults: power amplifier fault, output power fault, temperature fault, and fan fault. Various Light Emitting Diode (LED) indicators located on the front panels of both the STM and LPA turn from green to red or yellow if an LPA fault is detected. In addition, a digital display located on the LPA front panel provides various fault messages. The state of the various LEDs, the alarm state (major or minor), and other more detailed information is summarized and reported (by the STM) over the fiber optic link to the HU and also to the service interface. This detailed information may be accessed remotely through the NOC NEM interface or locally through the EMU software MI.

5.4 Powering

The LPA is powered by various DC voltages which are supplied by the STM over the electrical interface provided by the D-sub connectors and wiring harness mounted within the RU cabinet. Four DC supply voltages are required for operation of the LPA electronics.

5.5 Cooling

Continuous air-flow for cooling is provided by a pair of fans mounted at the front and the rear side of the LPA housing. The front fan pulls cool air into the module and the rear fan exhausts heated air out of the module. An alarm is provided that indicates if a high temperature condition (>50° C/122° F) occurs or if a fan failure occurs. Either fan may be field replaced if it fails.

5.6 User Interface

The LPA user interface consists of the various LEDs, message displays, and switches that are provided on the LPA front panel. The LPA user interface points are described in [Table 2-4](#) and indicated in [Figure 2-8](#).

Table 2-4. Linear Power Amplifier User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	RESET	Momentary contact push button switch	Momentarily pressing the switch push button clears all alarms and restarts the amplifier
2	RF ON OFF	2-position switch	Placing the switch in the OFF position puts the LPA in a standby state with RF output disabled. Placing the switch in the ON position puts the LPA in the normal state with RF output enabled.
3	FAIL	LED indicator (yellow)	Indicates the LPA is normal (off) or faulty (yellow).
4	SHUTDOWN	LED indicator (red)	Indicates the LPA is in service (off) or shutdown (red).
5	No designation	Digital display	Provides status and alarm messages. See Note.
Note: A more detailed description of the digital display messages is provided in Section 5.			

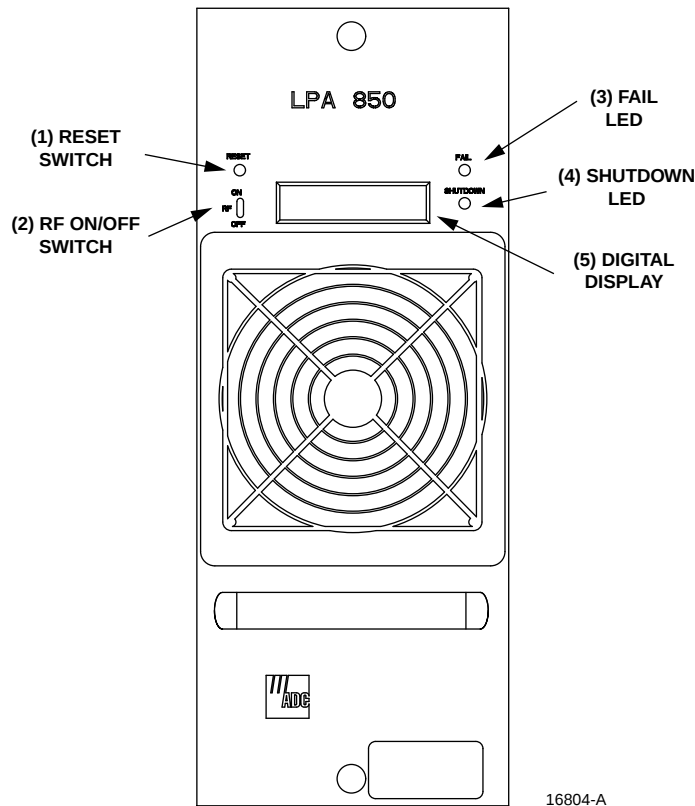


Figure 2-8. Linear Power Amplifier User Interface

6 DIGIVANCE ELEMENT MANAGEMENT SYSTEM

The Digivance Element Management System (EMS) is a network management tool that provides control and monitoring functions for the Digivance LRCS system. The EMS is used to provision and configure new systems for operation, set system operating parameters, get system alarm and status messages, and upgrade the system software. The EMS supports both local control by an on-site service technician and remote control by a Network Operations Center (NOC).

6.1 Primary Components

The EMS, shown in [Figure 2-9](#), consists of a PC-type desk-top computer (not provided) that is loaded with the EMS software. The EMS software is stored on a CD-ROM that is shipped with the HU. The EMS software must be installed on the EMS computer along with the Java 2 Version 1.3.1 Runtime Environment software which is also provided. Installation consists of inserting the CD-ROM into the computer's CD-ROM drive and then running the software install programs. This places the Java 2 Runtime Environment and EMS software files in assigned folders on the computer's hard drive.

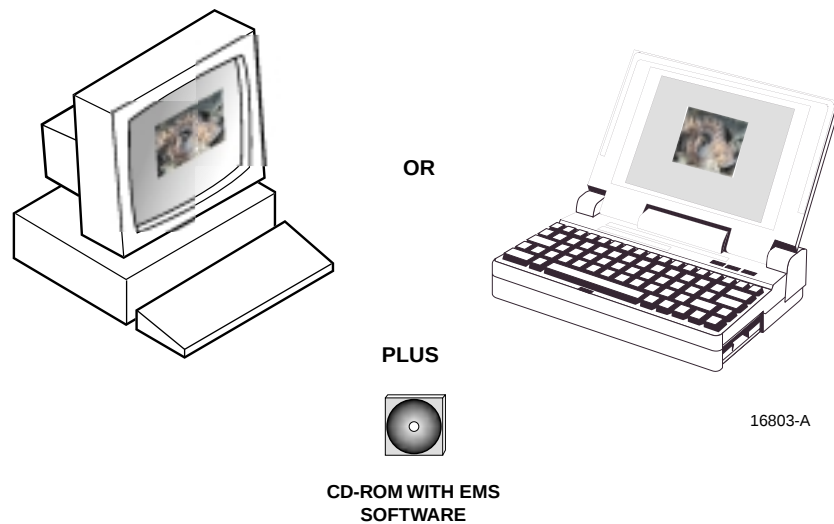


Figure 2-9. Alarm Network Unit

The EMS software may also be installed on a PC-type lap-top computer (not provided). A lap-top version of the EMS computer can be used as a portable network management tool for service and maintenance purposes. A laptop EMS can be connected temporarily to a system to enter the initial configuration data or to trouble-shoot problems and then removed when the task is completed. Permanent control and monitoring functions would be provided by the desk-top EMS computer.

6.2 Service Interface Connection

The service interface connection between the EMS computer and the HU or RU requires that the EMS computer be equipped with a DB-9 connector that is configured to provide an RS-232 DCE interface. A straight-through RS-232 interface cable equipped with a male DB-9 connector on one end and a PC-compatible connector on the other end is provided to link the EMS computer to the HU. When multiple HUs are networked together, the EMS computer may be connected to the service connector on any one of the networked HUs.

6.3 NOC Interface Connection

The NOC interface connection between the EMS computer and the NOC requires that the EMS computer be equipped with a connector that is configured to provide an RS-232 ASCII interface. The link between the EMS computer and the NOC would generally be supported by a data network or dial-up modem. Cables and equipment (not provided) to support the RS-232 interface connection between the EMS computer and the data network or dial-up modem are required.

6.4 EMS Software User Interface

The EMS software provides two user interfaces: the Maintenance Interface (MI) and the Network Operation Center-Network Element Manager (NOC-NEM) interface. Both interfaces provide essentially the same functionality except only the MI can upgrade the HU/RU system with new system software. In addition, only the NOC-NEM interface can record and playback alarm data.

The MI is a graphical user interface that is presented at the EMS computer or on a laptop computer. The MI is used for **local** control and monitoring operations. The MI presents a series of displays and screens, such as the one shown in Figure 2-10, to provide the user with alarm and status information and to allow the user to set various operating parameters.

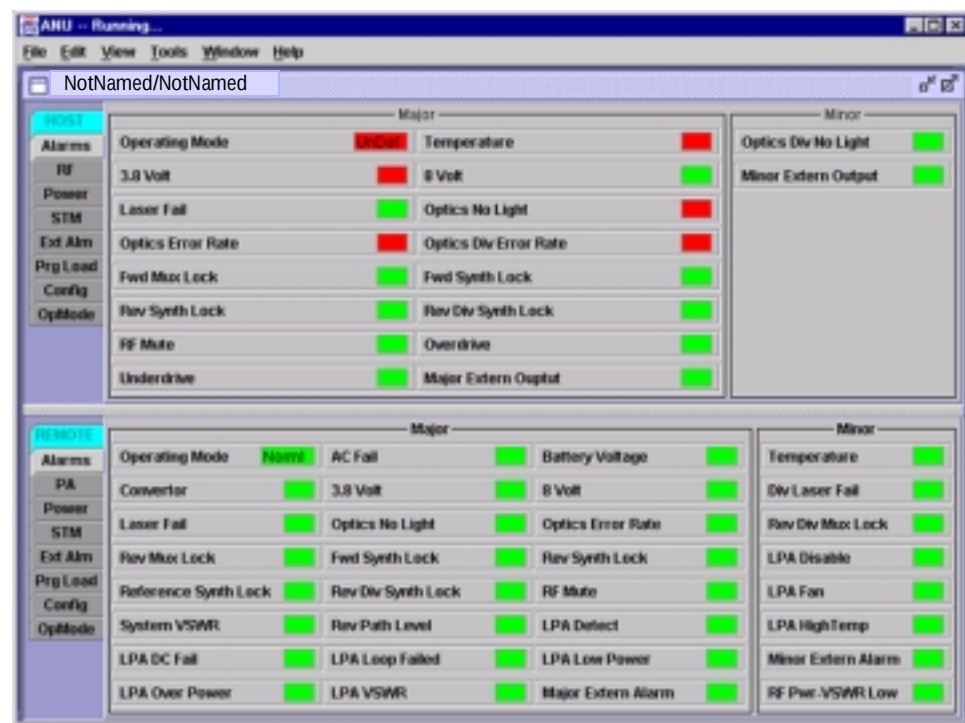


Figure 2-10. ANU Maintenance Interface Host/Remote Display

The NOC-NEM interface is a command line interface that is presented at an NOC terminal. The NOC-NEM interface is used for **remote** control and monitoring operations. The NOC-NEM interface consists of ASCII text strings that are input as SET or GET commands which are followed by the action or information required. A text string response is received from the specified system or systems to confirm the requested action or to report the requested information. Examples of several typical NOC-MEM interface commands and the responses received are shown in Figure 2-11. The NOC-NEM interface requires only a VT100 terminal/emulator or a PC-type computer that is loaded with a communication software such as Procomm Plus. While primarily intended for use at the NOC, the NOC-NEM interface commands may also be input from the EMS computer.

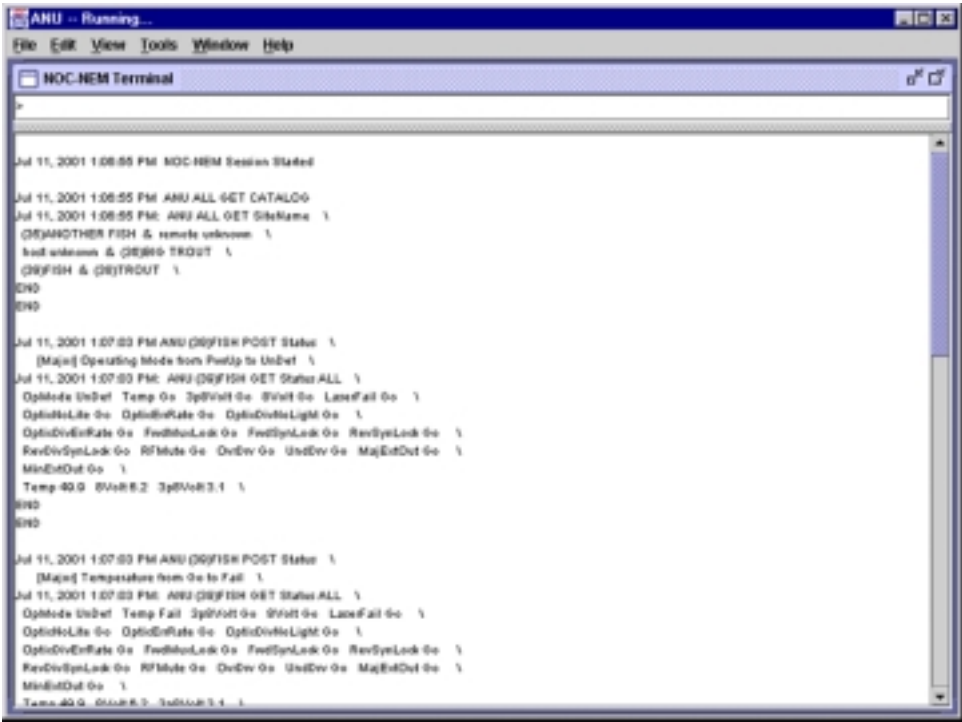


Figure 2-11. NOC NEM Interface Typical Commands

7 SPECIFICATIONS

Refer to [Table 2-5](#) for the Digivance LRCS system specifications. All specifications apply after a five minute warm-up period.

Table 2-5. System Specifications

PARAMETER	SPECIFICATION	REMARKS
Optical - All Units		
Fiber type	9/125, single-mode, dark	
Number of fibers required		The wavelength division multiplexer (WDM) is an accessory item.
Non-diversity with WDM	1	
Diversity with WDM	2	
Non-diversity without WDM	2	
Diversity without WDM	3	
Forward path wavelength	1550 ± 20 nm	
Reverse path wavelength	1310 ± 20 nm	
Diversity path wavelength	1310 ± 20 nm	
Optical budget	19 dB typical, 17 dB for 10 ⁻⁶ BER	
System optical loss	10 dB minimum	
Optical connectors	Industry standard SC	Both host and remote

Table 2-5. System Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
RF Forward Path - SMR 800 MHz System bandwidth	15 MHz	
Frequency range	851 to 866 MHz	
Gain of host/remote link	85 ± 3 dB at band center and room temperature	Includes power amplifier.
Gain flatness	$\leq \pm 1.5$ dB across freq. range $\leq \pm 1$ dB variation across any 1.25 MHz channel	
Gain variation	$\leq \pm 3$ dB over temp and unit-to-unit	
Gain adjustment	Software adjustable in 30 steps of 1 ± 0.25 dB	
Out-of-band rejection	-40 dB bandwidth ≤ 30 MHz	
Propagation delay	< 6 μ s maximum	Excludes fiber delay.
Variable propagation delay adjustability	Software adjustable in 1 μ s increments over a 0 to 60 μ s range	
Spurious (self generated)	≤ -13 dBm at remote output	
Spurious free dynamic range	< -60 dBc	
Tx peak to average	> 10 dB	
Intermodulation	≤ -55 dBc at remote output	
Maximum composite RF input signal level	-10 to -40 dBm, adjustable in 1 dB increments (The host requires a -40 dB input signal level)	-40 dBm with host attenuator at 0 dB -10 dBm with host attenuator at 30 dB
Tx path insertion loss	2.5 dB maximum	
Output power	≥ 50 Watts at power amplifier output 30 Watts (45 dBm) at remote antenna port	
RF Reverse Path - SMR 800 MHz System bandwidth	15 MHz	
Frequency range	806 to 821 MHz	
Gain	30 ± 2 dB at band center	
Gain flatness	$\leq \pm 1.5$ dB across frequency range ≤ 1 dB variation across any 1.25 MHz channel	
Gain variation	$\leq \pm 3$ dB over temperature and unit-to-unit	
Out-of-band rejection	-40 dB bandwidth ≤ 30 MHz	

Table 2-5. System Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Propagation delay	< 6 μ s maximum	Excludes fiber delay
Variable propagation delay adjustability	Software adjustable in 1 μ s increments over a 0 to 60 μ s range	
Spurious	≤ -110 dBm referred to input	
Intermodulation	≤ -62 dBc	
System noise figure	≤ 8 dB	
Composite RF output level	-10 to -40 dBm, adjustable in 30 steps of 1 ± 0.25 dB increments	With -40 dBm maximum composite input signal level at the remote unit.
Dynamic range	≥ 70 dB (two carriers)	
Level limiting AGC threshold	-40 dBm ± 3 dB	
Level limiting AGC range	≥ 30 dB	
Physical/Environmental/ Electrical - Host Unit Dimensions (H×W×D)	3.5 × 17.2 × 15.3 inches (89 × 437 × 389 mm)	Dimension for width does not include the mounting brackets.
Mounting	19- or 23-inch rack	EIA or WECO
Weight	???	
Weather resistance	Indoor installation only	
Operating temperature	0° to 50° C (32° to 122° F)	
Storage temperature	-40° to 70° C (-40° to 158°F)	
Humidity	10% to 90%	No condensation
External alarm connector	Screw-type terminals	NO and NC relay contacts
DC power connector	Screw-type terminal strip	
RF coaxial cable connectors	N-type (female)	
Service connector	DB-9 (female)	RS-232 DTE interface
CAN connectors	RJ-45 jack	
Power input	± 24 to 48 Vdc	
Power consumption	2 Amps at 27.5 Vdc	
Current rating	48 VDC, ??? Amp input	
Reliability at 25°C	MTBF 80,000 hours	Excluding fans
Physical/Environmental/ Electrical - Remote Unit Cabinet dimensions (H×W×D)	28.4 × 17.4 × 24.9 inches (721 × 442 × 632 mm)	
Mounting	Wall or pole	Pole mounting requires the pole mount kit. (accessory)
Weight	140 lbs (63.5 kg)	Includes modules but not battery

Table 2-5. System Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Weather resistance	NEMA-3R, removable dust filter	
Operating temperature	–30° to 50° C (–22° to 122° F)	
Storage temperature	–40° to 70° C (–40° to 158°F)	
Humidity	10% to 90%	No condensation
External alarm connector	Screw-type terminals	External alarm inputs
AC power connection	3/4- or 1/2-inch conduit	Per local code or practice.
Antenna cable connector	N-type (female)	
Fiber optic cable size	0.375 to 0.875 inch (10 to 22 mm) diameter cable	
Lightning protection	20 kA IEC 1000-4-5 8/20 μ s waveform	
Service connector	DB-9 (female)	RS-232 DTE interface
Battery backup operation	1 hour	
Power input	120 or 240 VAC, 50 or 60 Hz	Operation on 240 VAC requires installation of the 240 VAC outlet (accessory)
Power consumption	10 Amps at 120 Vac	
Current rating	85–250 VAC, ??? Amp input	
Reliability at 25°C	MTBF 50,000 hours	Excluding fans, battery, and filter

SECTION 3: HOST UNIT INSTALLATION

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10 DC POWER CONNECTIONS	3-3

This section under construction

1 BEFORE STARTING INSTALLATION

1.1 System Plan Review

1.2 Tools and Materials

1.3 Unpacking and Inspection

2 MOUNTING PROCEDURE

Rack-mount only
19-inch or 23-inch racks

Reverse brackets for 23-inch racks

Provide clearance for cooling

3 CHASSIS GROUND CONNECTION

Stud on rear side of chassis

Use #18 stranded copper wire

Connect to approved earth ground source

4 COAXIAL CABLE CONNECTIONS

With and without diversity

N-type female connectors provided on unit

5 WAVE DIVISION MULTIPLEXER INSTALLATION (ACCESSORY ITEM)

Rack mount

Chassis and WDM module(s)

6 OPTICAL CONNECTIONS

Installations with the WDM (with and without diversity)

Installations without the WDM (with and without diversity)

SC connectors

Route patch cords from HU to fiber distribution panel

7 CONTROLLER AREA NETWORK CONNECTIONS

RJ-45 jacks

Cables provided

Include diagram of multiple unit connections

8 SERVICE INTERFACE CONNECTION

RS-232 Interface (connects to Digivance Element Management System computer)

DB-9 female connector

Straight-through cable provided

9 EXTERNAL ALARM SYSTEM CONNECTIONS

Normally open and Normally closed dry contacts for major and minor alarms

Six-terminal plug provided (screw terminals)

Cat 3 or 5 wire

10 DC POWER CONNECTIONS

Fuse panel required (ADC PowerWorx) - See fuse panel manual for installation procedures

± 24 to 48 Vdc power

3 Amp GMT fuse

#18 stranded copper wire

SECTION 4: OPERATION

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1 BEFORE STARTING OPERATION

This section provides guidelines for turning-up the Digivance LRCS, verifying that all units are operating properly, testing to ensure that all performance requirements are satisfied, and correcting any installation problems. This process assumes that the various units have been installed in accordance with the system design plan.

1.1 Tools and Materials

The following tools and materials are required in order to complete the procedures in this section:

- Portable spectrum analyzer or RF power meter
- AC/DC voltmeter
- External attenuators (if specified in system design plan)
- PC-type computer with Digivance Element Management System (EMS) software installed
- Straight-through RS-232 DB-9 interface cable (ADC part # 1192835)
- Handset
- Pencil or pen
- Writing pad

1.2 Readiness Check

Before starting the turn-up process, inspect the complete LRCS system to verify that all components of the system are ready to be powered-up. This will ensure that no units of the system will be damaged during turn-up and that all existing systems will continue to function properly.

1.2.1 Host Unit Installation Checks

Complete the following checks at the HU prior to starting the turn-up process:

1. Verify that the ON/OFF switch on the HU is in the **OFF** position (press **0**).
2. At the fuse panel, install a 3 Amp GMT fuse in the circuit that supplies DC power to the HU.
3. Using a DC voltmeter, verify that the DC voltage level at the HU power terminals is between 24 and 48 Vdc.
4. Verify that all electrical and optical connections have been completed and that all optical fibers, coaxial cables, and wires are properly routed and secured.

1.2.2 Remote Unit Installation Checks

Complete the following checks at the RU prior to starting the turn-up process:

1. Verify that the ON/OFF switch on the STM is in the **OFF** position (press **0**).
2. Verify that the RF ON/OFF switch on the LPA is in the **OFF** position.
3. At the AC breaker box, close the circuit breaker for the circuit that supplies AC power to the RU.
4. Using an AC voltmeter, verify that the AC voltage level at the GFCI outlet is between 110 and 120 Vac (for 120 Vac powered systems) or between 220 and 240 Vac (for 240 Vac powered systems).
5. Verify that all electrical and optical connections have been completed and that all optical fibers, coaxial cables, and wires are properly routed and secured.

2 TURN-UP SYSTEM AND VERIFY OPERATION

The process of turning-up the system and verifying operation involves powering up the various system components, verifying that the LED indicators show normal operation, setting the site number and name, adjusting the RF signal levels, and adjusting the path delay.

2.1 Turn-Up Procedure

Use the following procedure to turn-up the system:

1. Temporarily disconnect the external alarm system or notify the alarm system provider that testing is in progress.
2. If turning-up multiple HU and RU systems that have not been configured for operation before, temporarily disconnect the CAN cables from the NET IN and NET OUT ports of each HU.
- **Note:** By default, all HU's and RU's are programmed with the same site number and name. This can cause problems for the Digivance EMS if multiple HU's with the same site number and site name are networked together through the CAN interface. It is therefore advisable to temporarily disconnect the CAN interface cables from the HU until a unique site number and name can be entered for each HU and its corresponding RU.
3. Determine if the forward path input signal level at the Host Unit FORWARD RF IN port is between -25 and -35 dBm (baseline input signal level) and adjust level if required. Refer to [Section 2.2](#) for the calculation and adjustment procedure.
4. Connect the EMS computer (if not already connected) to the SERVICE connector on the HU or STM front panel. If necessary, a separate laptop computer loaded with the EMS software can be temporarily connected and used to initially configure the system.
5. Place the ON/OFF switch on the HU in the **ON** position (press **I**).
6. Place the ON/OFF switch on the STM in the **ON** position (press **I**).
7. Wait 6 to 8 seconds for the HU and the RU modules to initialize and then observe the LED indicators on the HU, STM and LPA. Refer to Section 5 for the troubleshooting procedures if the indicators do not respond as specified.

HOST UNIT	SPECTRUM TRANSPORT MODULE	LINEAR POWER AMPLIFIER
POWER – Green	AC POWER – Green	FAIL – Off
STANDBY – Off	STANDBY – Off	SHUTDOWN – Red
HOST UNIT – Green	HOST UNIT – Green	Digital Display – FORCED SHUTDOWN
REMOTE UNIT – Green	STM – Green	
DRIVE – Green or Red	PA – Green	
PORT 1/PORT 2 – Green	VSWR – Green	
PORT 3 – Green (diversity unit only)	PORT 1/PORT 2 – Green	
	PORT 3 – Green (diversity unit only)	

8. Start up the Digivance EMS software program. The EMS main window will open as shown in [Figure 4-1](#). For complete information about the EMS software, refer to the Digivance Element Management System Software User Manual (ADCP-75-118).

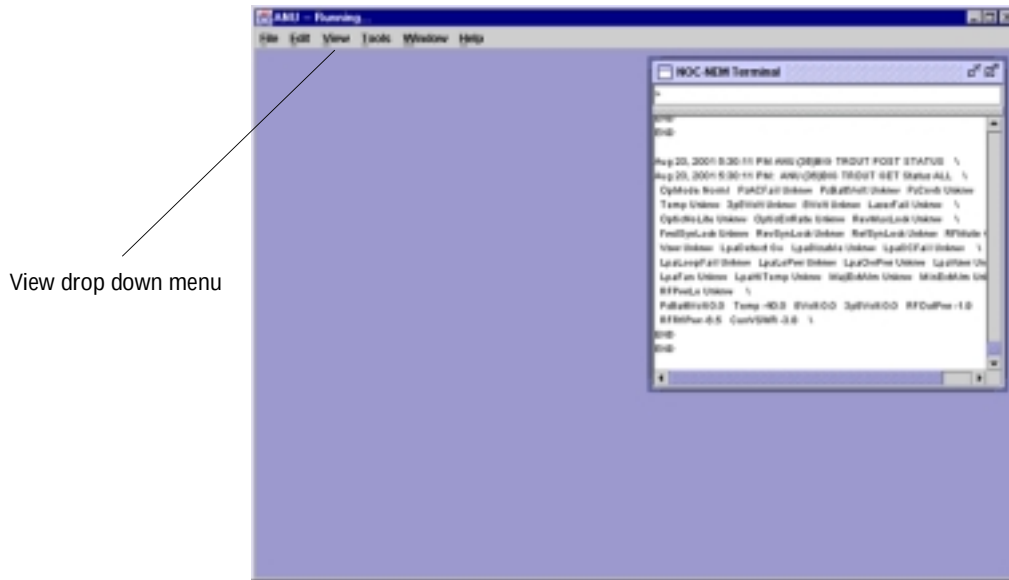


Figure 4-1. Digivance Element Management System Main Window

9. Open the **View** drop down menu and select the “NotNamed/NotNamed” Host and Remote pair. The **HOST Alarms** display and the **REMOTE Alarms** display will open within the main window as shown in Figure 4-2.
10. Verify that no Major (except Major Extern Alarm) or Minor alarms are being reported in either the **HOST Alarm** displays and that all alarm fields (except Major Extern Alarm) are green.

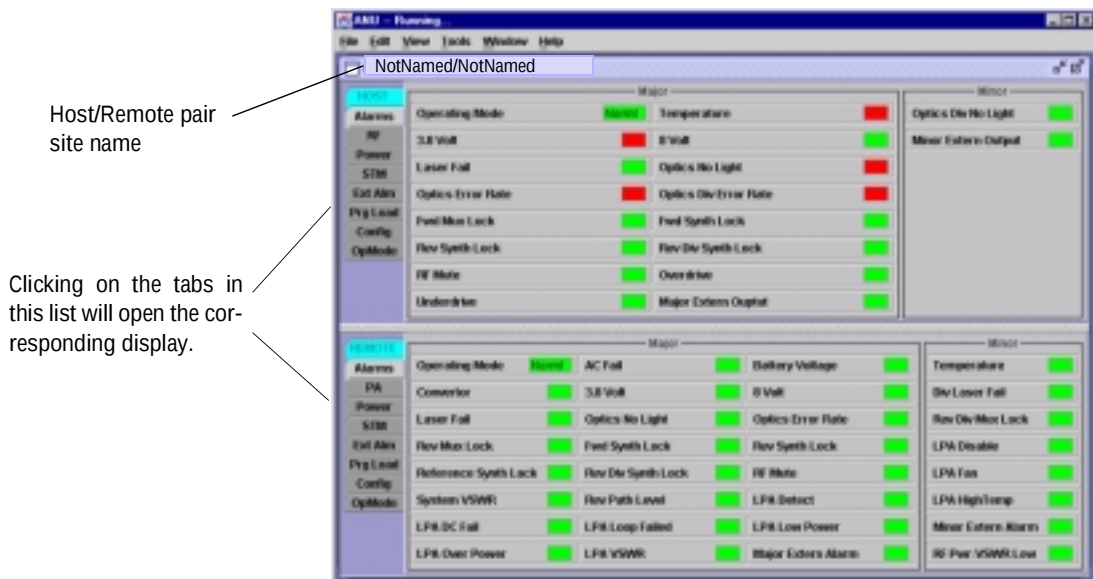


Figure 4-2. Selecting Display Tabs

11. Click on the **HOST Config** tab and on the **REMOTE Config** tab (see [Figure 4-2](#)). The **HOST Config** display and the **REMOTE Config** display will open within the main window.
12. Enter the **Site Number** and **Site Name** for both the HOST and the REMOTE unit. Refer to [Section 2.3](#) for details.
13. Click on the **HOST RF** tab (see [Figure 4-2](#)). The **HOST RF** display will open within the main window.
14. Enter the **Host Fwd Att** (Forward Attenuation) values. This sets the forward input RF signal level at the HU. Refer to [Section 2.4](#) for details. By default, this value is set to 0 dB. If the DRIVE LED on the HU front panel was red, it should turn green when this step is completed.
15. If a delay adjustment is required per the system design plan, enter the **Host Fwd Delay**, **Host Rev Delay**, and **Host Div Rev Delay** values. By default, the delay values are set to 0. Refer to [Section 2.5](#) for details.
16. Determine if the RF output power at the STM ANTENNA is at the correct level of 5 watts per channel up to a maximum of 30 watts. Refer to [Section 2.6](#) for details.
17. Click on the **REMOTE PA** tab (see [Figure 4-2](#)). The **REMOTE PA** display will open within the main window.
18. Enter the **Remote Fwd Att** value. This adjusts the RF output signal level at the STM ANTENNA port. Refer to [Section 2.7](#) for details. By default this value is set to 0 dB.
19. Place the RF ON/OFF switch (on LPA front panel) in the **ON** position.
20. Verify that the SHUTDOWN LED indicator (on LPA front panel) turns from red to off and the Digital Display message changes from FORCED SHUTDOWN to NORMAL OPERATION.
21. Click on the **HOST RF** tab (see [Figure 4-2](#)). The **HOST RF** display will open within the main window.
22. Enter the **Host Rev Att** (Reverse Attenuation), and **Host Div Rev Att** (Diversity Reverse Attenuation) values. This sets the reverse output RF signal levels at the HU. Refer to [Section 2.8](#) for details.
23. If a separate laptop computer loaded with the EMS software was used to initially configure the system, disconnect the laptop computer from the SERVICE connector on the HU front panel.
24. Reconnect the CAN cables to the HU's NET IN and NET OUT ports.
 - **Note:** Each HU and RU pair will generally remain permanently connected to a PC-type desktop computer loaded with the EMS software. When two or more systems are connected together through the CAN interface, only one EMS computer is required to manage the networked HU and RU systems. The EMS computer may be connected to the SERVICE power on any one of the HUs in the network.
25. Reconnect the external alarm system or notify the alarm system provider that the turn-up process has been completed.

2.2 Determine Baseline Forward Path Input Signal Level

The level of the composite RF output signal at the FORWARD RF IN port at the HU will vary depending on the type of BTS, the cable loss, and the number of channels present. To interface with the HU, the baseline signal level of the composite forward path RF signal must be adjusted to fall within a range of **–25 to –35 dBm**. If the signal level is not within this range, it must be adjusted to this level through the use of an external attenuator. Use the following procedure to measure and adjust the input RF signal level at the HU:

1. Connect a spectrum analyzer or power meter to the forward path output port at the BTS. The required signal levels and test points are shown in [Figure 4-3](#).
2. Measure the RF level of a single carrier, such as the control channel, in dBm. Make sure the resolution bandwidth of the spectrum analyzer or power meter is narrow enough to measure the power of the single 30 kHz channel only.
3. Verify that all carriers are coming in at equal power at bandwidth and adjust to the same level if necessary.
4. Calculate the total composite signal power from the BTS using the following formula:

$$P_{\text{tot}} = P_c + 10\text{Log } N$$

Where,

P_{tot} is the total composite power in dBm

P_c is the power per carrier in dBm as measured in step 2, and

N is the total number of channels.

5. Determine the total cable loss that is imposed by the forward path coaxial cable that links the BTS to the HU and also any insertion loss imposed by splitters or combiners.
6. Subtract the total cable loss and any insertion losses from the total composite power calculated in step 4.
7. Subtract –30 (the preferred baseline input signal level) from the value determined in step 6. The difference (which should be positive) equals the value of the external attenuator that is required to reduce the forward path signal level to the preferred baseline input signal level of –30 dBm level. The following formula outlines the required calculations for steps 6 and 7:

$$P_{\text{tot}} - (\text{Cable and insertion loss}) - (-30) = \text{Value of external attenuator required}$$

- **Note:** If the input signal level is already within the preferred range of –25 to –35 dBm, then no external attenuator is required.

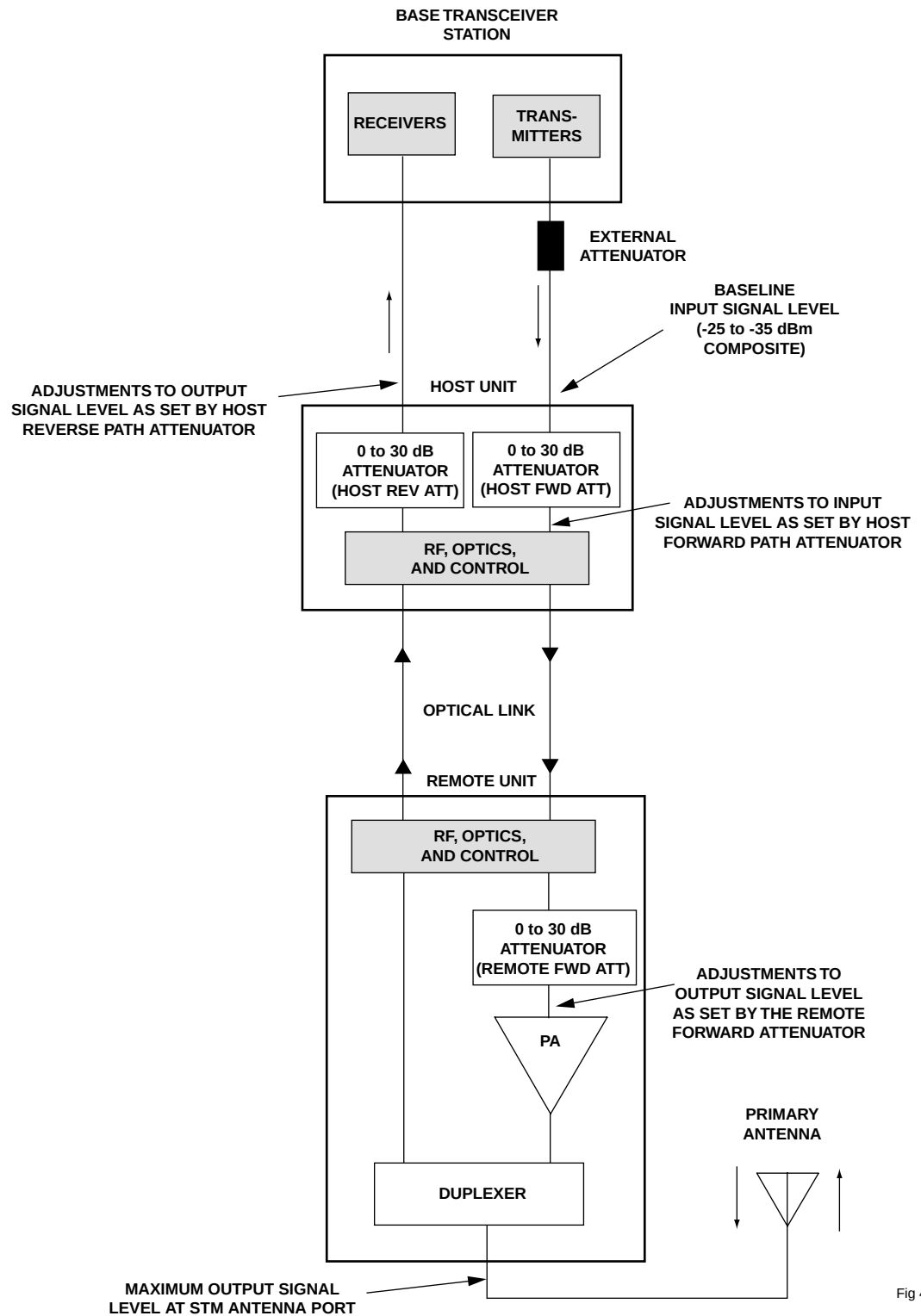


Fig 4-3

Figure 4-3. Signal Levels, Test Points, and Adjustments

8. Select an attenuator that is as close to the value calculated in step 7 as possible. Try to select a value that will place the baseline signal level of the composite input signal within the preferred range of -25 to -35 dBm.
9. Install the external attenuator in the coaxial cable that is connected to the FORWARD RF IN port at the HU.
10. Subtract the value of the external attenuator used in step 9 from the total composite signal power (P_{tot}) and record the result. This value will be required when setting the attenuation of the HU's internal forward attenuator.

2.3 Enter Site Number and Site Name

All HU's and RU's are programmed with the same site number and site name. It is therefore necessary to assign a unique site name and site number to the HU and RU before they can be connected to the same CAN. Use the following procedure to assign a unique site number and name to each HU and RU system:

1. Click on the **HOST Config** tab and on the **REMOTE Config** tab. The **HOST Config** display and the **REMOTE Config** display will open within the EMS main window as shown in [Figure 4-4](#).

Right-Click on the point shown to open pop-up screen

HOST Site Number

HOST Site Name

REMOTE Site Number
(Entered automatically when the HOST site number is selected)

REMOTE Site Name

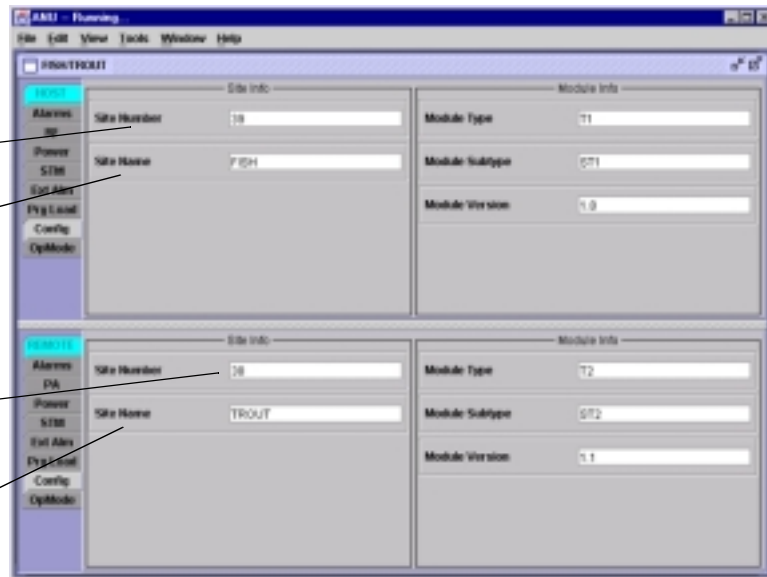


Figure 4-4. HOST and REMOTE Config Displays

2. Right-click on the **HOST Site Number** (see [Figure 4-4](#)). The **Site Number** pop-up screen will open as shown in [Figure 4-4](#). Enter any odd number between 33 and 61 and then click on OK to close the screen and make the changes take effect.

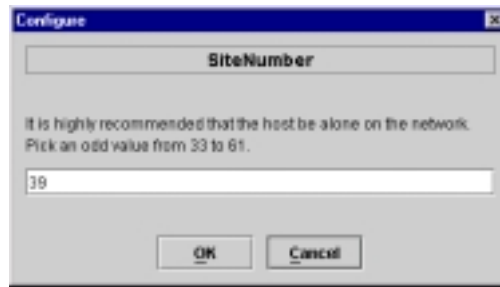


Figure 4-5. HOST Site Number Pop-Up Screen

3. Right-click on the **HOST Site Name** field (see [Figure 4-4](#)). The **Site Name** pop-up screen will open. Enter a unique name for the HOST. The name may be up to 32 characters long and must not contain any spaces. The name may include numbers, punctuation, and upper or lower case letters and must always begin with a letter. Click on OK to close the screen and make the changes take effect.
4. Check the **REMOTE Site Number** field (see [Figure 4-4](#)). The REMOTE Site Number does not have to be entered. When the HOST Site Number is entered, the system will subtract 1 from the HOST Site Number and automatically enter the result for the REMOTE Site Number.
5. Right-click on the **REMOTE Site Name** field (see [Figure 4-4](#)). The **Site Name** pop-up screen will open. Enter a unique name for the REMOTE. The name may be up to 32 characters long and must not contain any spaces. The name may include numbers, punctuation, and upper or lower case letters and must always begin with a letter. Click on OK to close the screen and make the changes take effect.

2.4 Enter Host Forward Attenuation

The HU internal forward path attenuator setting determines the maximum composite output signal level at the STM antenna port. The appropriate attenuation value for any particular system is based on the number of channels the system is transporting and the baseline signal level of the composite forward path input signal input at the HU's FORWARD RF IN port. The maximum output power that can be provided by the system is 45 dBm (30 watts). The maximum power permitted per channel is 5 watts. The total forward path gain that is provided by the system (with host and remote forward attenuators set to 0 dB) is 85 dBm. Use the following procedure to set the forward path attenuation to provide the maximum composite output signal level:

1. Click on the **HOST RF** tab. The **HOST RF** display will open within the EMS main window as shown in [Figure 4-6](#).

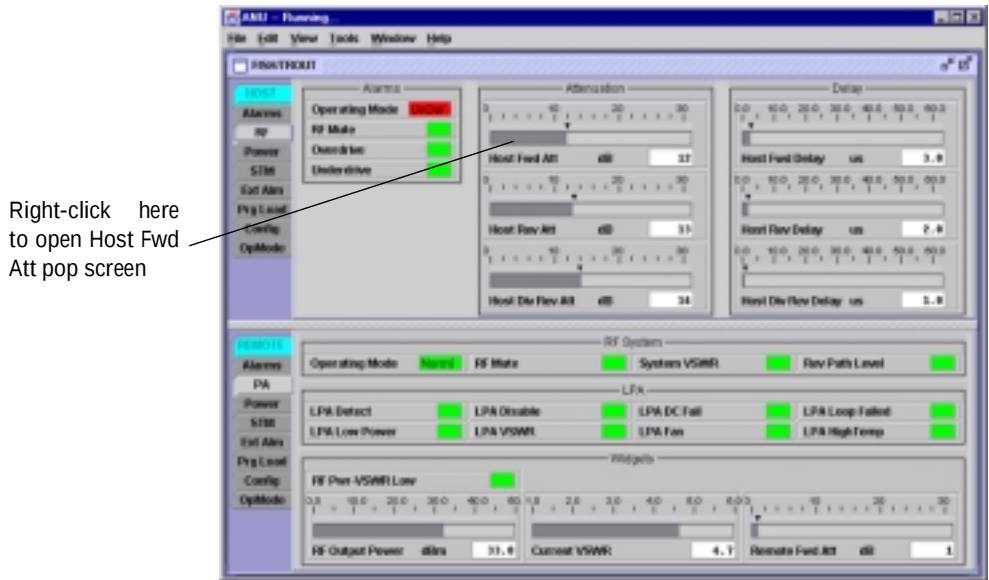


Figure 4-6. HOST RF Display

2. Right-click on the **Host Fwd Att** section of the display (see Figure 4-6). The **Host Fwd Att** pop-up screen will open as shown in [Figure 4-7](#).

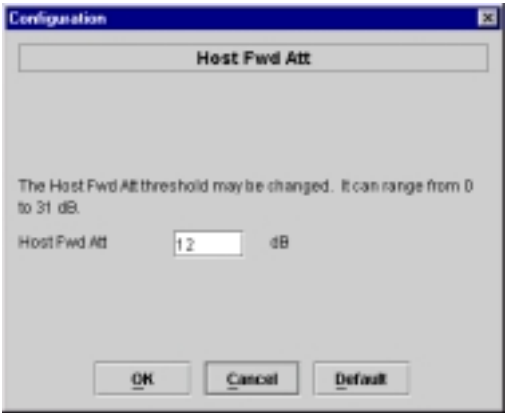


Figure 4-7. Host Fwd Att Pop-Up Screen

3. Obtain the value of the baseline total composite input signal level as determined in step 10 of [Section 2.2](#).
4. Refer to [Table 4-1](#) to determine the appropriate value to enter for the Host forward path attenuator. Note that the correct entry is determined by both the number of channels the system will transport and the baseline total composite input signal level.
5. Enter the attenuation value and click OK to close the pop-up screen and to make the changes take effect.

Table 4-1. Host Forward Attenuator Settings

NUMBER OF CHANNELS	BASILINE COMP INPUT SIGNAL	HOST FWD ATT SETTING	NUMBER OF CHANNELS	BASILINE COMP INPUT SIGNAL	HOST FWD ATT SETTING
1 The specified attenuation setting for the host forward path attenuator produces a maximum output signal level at the STM ANTENNA port of 37 dBm (5 watts per channel)	-25 dBm	23 dB	4 The specified attenuation setting for the host forward path attenuator produces a maximum output signal level at the STM ANTENNA port of 43 dBm (5 watts per channel)	-25 dBm	17 dB
	-26 dBm	22 dB		-26 dBm	16 dB
	-27 dBm	21 dB		-27 dBm	15 dB
	-28 dBm	20 dB		-28 dBm	14 dB
	-29 dBm	19 dB		-29 dBm	13 dB
	-30 dBm	18 dB		-30 dBm	12 dB
	-31 dBm	17 dB		-31 dBm	11 dB
	-32 dBm	16 dB		-32 dBm	10 dB
	-33 dBm	15 dB		-33 dBm	9 dB
	-34 dBm	14 dB		-34 dBm	8 dB
	-35 dBm	13 dB		-35 dBm	7 dB
2 The specified attenuation setting for the host forward path attenuator produces a maximum output signal level at the STM ANTENNA port of 40 dBm (5 watts per channel)	-25 dBm	20 dB	5 The specified attenuation setting for the host forward path attenuator produces a maximum output signal level at the STM ANTENNA port of 44 dBm (5 watts per channel)	-25 dBm	16 dB
	-26 dBm	19 dB		-26 dBm	15 dB
	-27 dBm	18 dB		-27 dBm	14 dB
	-28 dBm	17 dB		-28 dBm	13 dB
	-29 dBm	16 dB		-29 dBm	12 dB
	-30 dBm	15 dB		-30 dBm	11 dB
	-31 dBm	14 dB		-31 dBm	10 dB
	-32 dBm	13 dB		-32 dBm	9 dB
	-33 dBm	12 dB		-33 dBm	8 dB
	-34 dBm	11 dB		-34 dBm	7 dB
	-35 dBm	10 dB		-35 dBm	6 dB
3 The specified attenuation setting for the host forward path attenuator produces a maximum output signal level at the STM ANTENNA port of 41 dBm (5 watts per channel)	-25 dBm	19 dB	6 or more The specified attenuation setting for the host forward path attenuator produces a maximum output signal level at the STM ANTENNA port of 45 dBm (5 watts or less per channel)	-25 dBm	15 dB
	-26 dBm	18 dB		-26 dBm	14 dB
	-27 dBm	17 dB		-27 dBm	13 dB
	-28 dBm	16 dB		-28 dBm	12 dB
	-29 dBm	15 dB		-29 dBm	11 dB
	-30 dBm	14 dB		-30 dBm	10 dB
	-31 dBm	13 dB		-31 dBm	9 dB
	-32 dBm	12 dB		-32 dBm	8 dB
	-33 dBm	11 dB		-33 dBm	7 dB
	-34 dBm	10 dB		-34 dBm	6 dB
	-35 dBm	9 dB		-35 dBm	5 dB

2.5 Enter Host Forward and Reverse Delay

The forward and reverse delay function allows entry of from 0 to 63 μ sec of delay in the forward and reverse paths. This feature is used when multiple systems are used to transport the same channel and there is a significant difference in the path delay between systems. Additional delay may be entered to balance the overall system delay. The amount of delay required must be calculated by the RF engineer and should be included in the system design plan. The default setting is 0 μ sec. Use the following procedure to change the forward and reverse path delay:

1. Click on the **HOST RF** tab. The **HOST RF** display will open within the EMS main window as shown in [Figure 4-8](#).

Right-click here to
open the Host Fwd
Delay pop-up screen

Right-click here to
open the Host Rev
Delay pop-up screen

Right-click here to
open the Host Div Rev
Delay pop-up screen

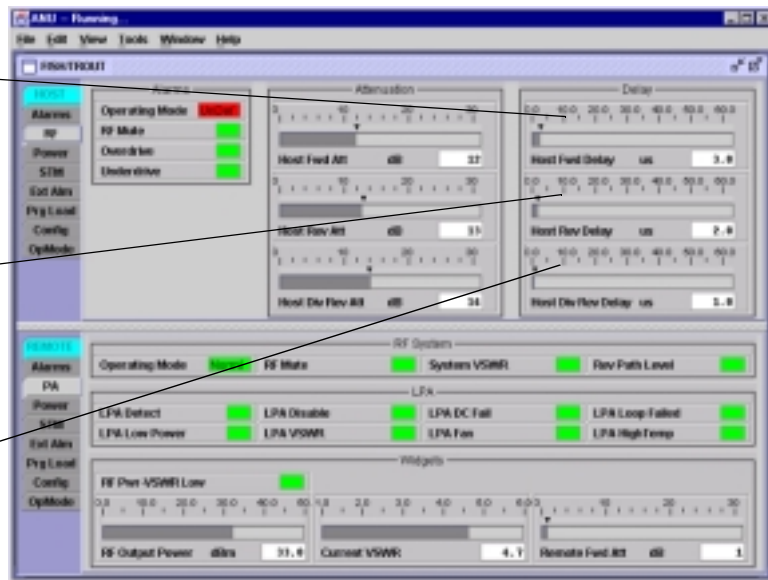


Figure 4-8. HOST RF Display

2. Right-click on the **Host Fwd Delay** section of the display (see [Figure 4-8](#)). The **Host Fwd Delay** pop-up screen will open as shown in [Figure 4-9](#).
3. Obtain the value of the forward delay as specified in the system design plan.
4. Enter the forward path delay value and click OK to close the pop-up screen and to make the changes take effect.
5. Repeat the process for reverse delay and diversity reverse delay by right-clicking on the appropriate delay section (see [Figure 4-8](#)) and then entering the required delay value in the pop-up screen.
6. Click OK to close each pop-up screen and to make the changes take effect.

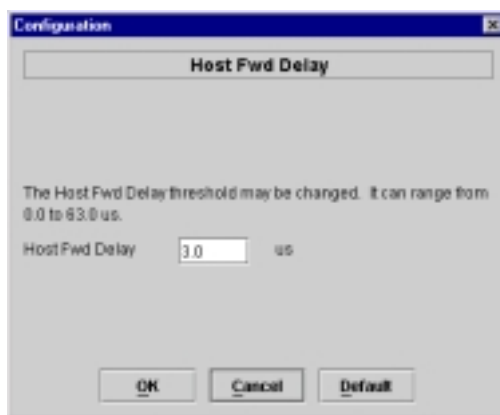


Figure 4-9. Host Fwd Delay Pop-Up Screen

2.6 Determine Output Signal Level at STM Antenna Port

The RF output signal level should be measured at the STM ANTENNA port to verify that maximum composite signal level does not exceed 5 watts per channel. Use the following procedure to verify if the power level is at the required level:

1. Verify that RF ON/OFF switch on the LPA in the **OFF** position.
2. Disconnect the antenna cable from the STM ANTENNA port.
3. Connect a spectrum analyzer or RF power meter to the STM ANTENNA port. (Check the input rating of the test equipment and insert a PAD if necessary.)
4. Place the RF ON/OFF switch on the LPA in the **ON** position.
5. Measure the RF level of a single carrier, such as the control channel, in dBm. Make sure the resolution bandwidth of the spectrum analyzer or power meter is narrow enough to measure the power of the single 30 kHz channel only.
6. Calculate the total composite signal power using the following formula:

$$P_{\text{tot}} = P_c + 10\log N$$

Where,

P_{tot} is the total composite power in dBm

P_c is the power per carrier in dBm as measured in step 2, and

N is the total number of channels.

7. Record the result calculated in step 6.
8. Place the RF ON/OFF switch on the LPA in the **OFF** position.
9. Disconnect the spectrum analyzer or RF power meter from the STM ANTENNA port.
10. Re-connect the antenna cable to the STM ANTENNA port.

- **Note:** To comply with Maximum Permissible Exposure (MPE) requirements, the maximum composite output from the antenna cannot exceed 1000 Watts EIRP and the antenna must be permanently installed in a fixed location that provides at least **6 meters** (20 feet) of separation from all persons.

2.7 Enter Remote Forward Attenuation

The STM internal forward path attenuator setting is used to fine tune or reduce the power level of the composite output signal level at the STM antenna port. The maximum composite output signal level at the STM antenna port is set using the Host internal forward attenuator (see Section 2.4). However, component variations may result in the output power at the STM antenna port being slightly above or below the specified maximum of 5 watts per channel. If this is the case, the STM forward attenuator may be used in conjunction with the Host forward attenuator to add or remove attenuation to produce the required output signal level. If less power than the maximum of 5 watts per channel is required, the STM forward attenuator may be used to reduce the power level to the specified level. The default setting is 0 dB. Use the following procedure to change the STM forward attenuation:

1. Click on the **REMOTE PA** tab. The **REMOTE PA** display will open within the EMS main window as shown in [Figure 4-10](#).

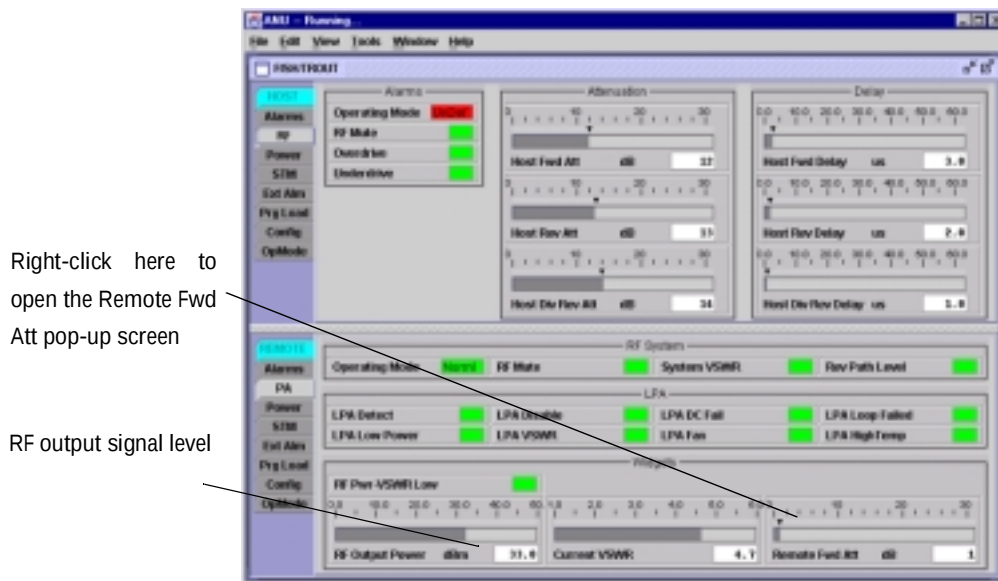
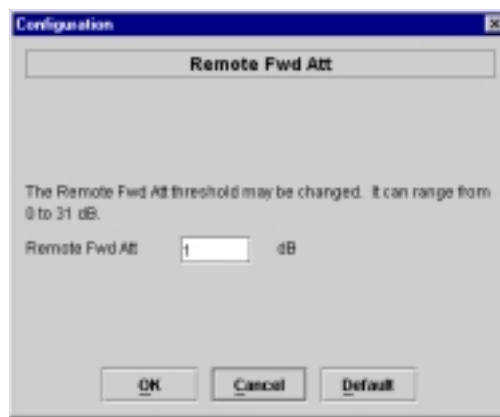


Figure 4-10. REMOTE PA Display

2. Check the level of the RF output signal (as determined in [Section 2.6](#)) against the values shown in [Table 4-2](#).
3. Determine if more or less attenuation is required to produce the required output signal level.
4. Right-click on the **Remote Fwd Att** section of the display (see [Figure 4-10](#)). The **Remote Fwd Att** pop-up screen will open as shown in [Figure 4-11](#).

Table 4-2. Maximum Composite Output Signal Levels

NUMBER OF CHANNELS	MAXIMUM OUTPUT SIGNAL LEVEL
1	37 dBm
2	40 dBm
3	41 dBm
4	43 dBm
5	44 dBm
6 or more	45 dBm

**Figure 4-11. Remote Fwd Att Pop-Up Screen**

5. Enter the required attenuation value and click OK to close the pop-up screen and to make the changes take effect.
6. Verify that the appropriate RF output signal level appears in the **RF Pwf-VSWR Low** section (see [Figure 4-10](#)).

► **Note:** To comply with Maximum Permissible Exposure (MPE) requirements, the maximum composite output from the antenna cannot exceed 1000 Watts EIRP and the antenna must be permanently installed in a fixed location that provides at least **6 meters** (20 feet) of separation from all persons.

2.8 Enter Host Reverse Attenuation

The level of the RF signal that should be input to the BTS will vary depending on the type of BTS and the number of channels present. To interface with the BTS, the reverse path signal level must be adjusted to provide the signal level required by the BTS. The HU provides from 0 to 30 dB of gain in the reverse path. Use the following procedure to set the reverse path gain:

1. Check the BTS manufacturer's specifications to determine the composite signal level required at the BTS reverse path input port.

2. Determine the overall gain and loss imposed on the signal by the antenna, antenna cable, and by the cables that connect the HU to the BTS.
3. Determine the amount of gain required to raise the reverse path signal to the level required at the BTS.
4. Click on the HOST **RF** tab. The HOST **RF** display will open within the EMS main window as shown in [Figure 4-12](#).

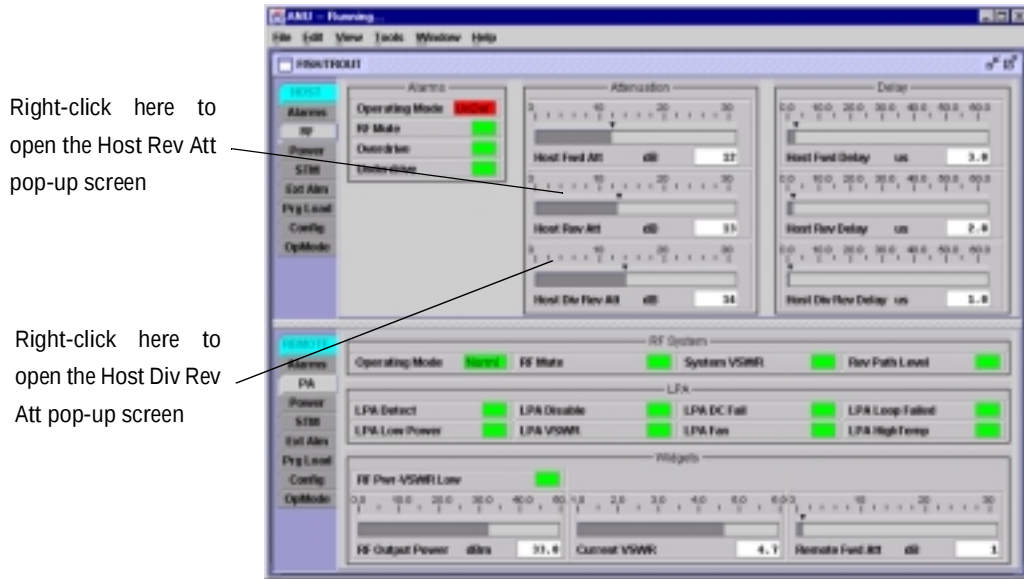


Figure 4-12. HOST RF Display

5. Right-click on the **Host Rev Att** section of the display (see [Figure 4-12](#)). The **Host Rev Att** pop-up screen will open as shown in [Figure 4-13](#).

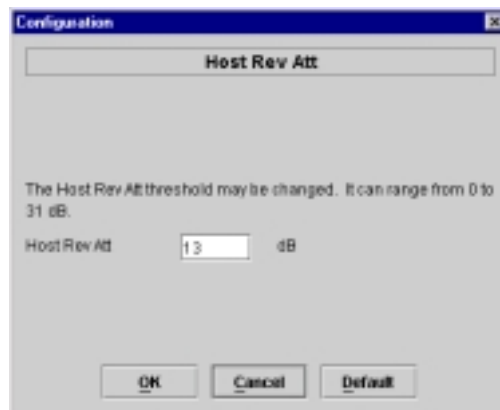


Figure 4-13. Host Rev Att Pop-Up Screen

6. Enter the attenuation value that will provide the required gain. Refer to [Table 4-3](#) for the attenuation values and the corresponding gain values.
7. Click OK to close the pop-up screen and to make the changes take effect.
8. Repeat the process for the diversity reverse path by right-clicking on the **Host Div Rev Att** section (see [Figure 4-12](#)) and then entering the required attenuation value in the **Host Dive Rev Att** pop-up screen.
9. Click OK to close the pop-up screen and to make the changes take effect.

Table 4-3. Reverse Path Setting

ATTENUATION SETTING	GAIN PROVIDED	ATTENUATION SETTING	GAIN PROVIDED	ATTENUATION SETTING	GAIN PROVIDED
0 dB →	30 dB	11 dB →	19 dB	22 dB →	8 dB
1 dB	29 dB	12 dB	18 dB	23 dB	7 dB
2 dB	28 dB	13 dB	17 dB	24 dB	6 dB
3 dB	27 dB	14 dB	16 dB	25 dB	5 dB
4 dB	26 dB	15 dB	15 dB	26 dB	4 dB
5 dB	25 dB	16 dB	14 dB	27 dB	3 dB
6 dB	24 dB	17 dB	13 dB	28 dB	2 dB
7 dB	23 dB	18 dB	12 dB	29 dB	1 dB
8 dB	22 dB	19 dB	11 dB	30 dB	0 dB
9 dB	21 dB	20 dB	10 dB	-	-
10 dB	20 dB	21 dB	9 dB	-	-

SECTION 5: MAINTENANCE

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1 WARRANTY/SOFTWARE

The Product and Software warranty policy and warranty period for all ADC Products is published in ADC's Warranty/Software Handbook. Contact the Broadband Connectivity Group (BCG) Technical Assistance Center at 1-800-366-3891, extension 63475 (in U.S.A. or Canada) or 952-946-3475 (outside U.S.A. and Canada) for warranty or software information or for a copy of the Warranty/Software Handbook.

2 SOFTWARE SERVICE AGREEMENT

ADC software service agreements for some ADC Products are available at a nominal fee. Contact the BCG Technical Assistance Center at 1-800-366-3891, extension 63475 (in U.S.A. or Canada) or 952-946-3475 (outside U.S.A. and Canada) for software service agreement information.

3 REPAIR/EXCHANGE POLICY

All repairs of ADC Products must be done by ADC or an authorized representative. Any attempt to repair or modify ADC Products without written authorization from ADC voids the warranty.

If a malfunction cannot be resolved by the normal troubleshooting procedures, call the BCG Technical Assistance Center at 1-800-366-3891, extension 63475 (in U.S.A. or Canada) or 952-946-3475 (outside U.S.A. and Canada). A telephone consultation can sometimes resolve a problem without the need to repair or replace the ADC Product.

If, during a telephone consultation, ADC determines the ADC Product needs repair, ADC will authorize the return of the affected Product for repair and provide a Return Material Authorization number and complete return shipping instructions. If time is critical, ADC can arrange to ship the replacement Product immediately. In all cases, the defective Product must be carefully packaged and returned to ADC.

4 REPAIR CHARGES

If the defect and the necessary repairs are covered by the warranty, and the applicable warranty period has not expired, the Buyer's only payment obligation is to pay the shipping cost to return the defective Product. ADC will repair or replace the Product at no charge and pay the return shipping charges.

Otherwise, ADC will charge a percentage of the current Customer Product price for the repair or NTF (No Trouble Found). If an advance replacement is requested, the full price of a new unit will be charged initially. Upon receipt of the defective Product, ADC will credit Buyer with 20 percent of full price charged for any Product to be Out-of-Warranty. Products must be returned within thirty (30) days to be eligible for any advance replacement credit. If repairs necessitate a visit by an ADC representative, ADC will charge the current price of a field visit plus round trip transportation charges from Minneapolis to the Buyer's site.

5 REPLACEMENT/SPARE PRODUCTS

Replacement parts, including, but not limited to, button caps and lenses, lamps, fuses, and patch cords, are available from ADC on a special order basis. Contact the BCG Technical Assistance Center at 1-800-366-3891, extension 63475 (in U.S.A. or Canada) or 952-946-3475 (outside U.S.A. and Canada) for additional information.

Spare Products and accessories can be purchased from ADC. Contact Sales Administration at 1-800-366-3891, extension 63000 (in U.S.A. or Canada) or 952-946-3000 (outside U.S.A. and Canada) for a price quote and to place your order.

6 RETURNED MATERIAL

Contact the ADC Product Return Department at 1-800-366-3891, extension 63748 (in U.S.A. or Canada) or 952-946-3748 (outside U.S.A. and Canada) to obtain a Return Material Authorization number prior to returning an ADC Product.

All returned Products must have a Return Material Authorization (RMA) number clearly marked on the outside of the package. The Return Material Authorization number is valid for 90 days from authorization.

7 CUSTOMER INFORMATION AND ASSISTANCE

For customers wanting information on ADC products or help in using them, ADC offers the services listed below. To obtain any of these services by telephone, first dial the central ADC telephone number, then dial the extension provided below.

The central number for calls originating in the U.S.A. or Canada is **1-800-366-3891**. For calls originating outside the U.S.A. or Canada, dial country code “1” then dial **952-946-3000**.

Sales Assistance Extension 63000	• Quotation Proposals • Ordering and Delivery • General Product Information
Systems Integration Extension 63000	• Complete Solutions (from Concept to Installation) • Network Design and Integration Testing • System Turn-Up and Testing • Network Monitoring (Upstream or Downstream) • Power Monitoring and Remote Surveillance • Service/Maintenance Agreements • Systems Operation
BCG Technical Assistance Center Extension 63475 E-Mail: bcg_tac@adc.com	• Technical Information • System/Network Configuration • Product Specification and Application • Training (Product-Specific) • Installation and Operation Assistance • Troubleshooting and Repair
Product Return Department Extension 63748 E-Mail: repair&return@adc.com	• ADC Return Authorization number and instructions must be obtained before returning products.

Product information may also be obtained using the ADC web site at **www.adc.com** or by writing ADC Telecommunications, Inc., P.O. Box 1101, Minneapolis, MN 55440-1101, U.S.A.

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