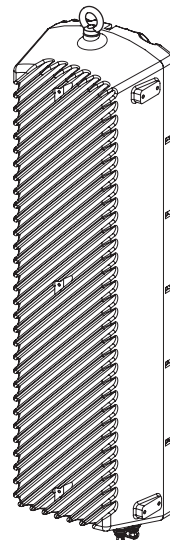
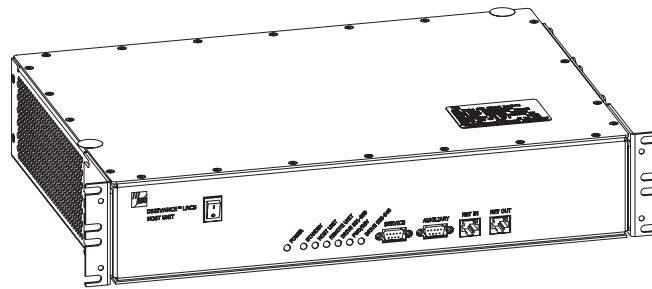




Digivance[®] Street-Level Coverage Solution 800 MHz, 1900 MHz, and 800/900 MHz SMR System Operation and Maintenance Manual



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Digivance® Street-Level Coverage Solution 800 MHz, 1900 MHz, 800/900 MHz SMR System Operation and Maintenance Manual

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REVISION HISTORY

ISSUE	DATE	REASON FOR CHANGE
1	09/2005	Original issue.
2	06/2006	Release of single-band and dual-band remote units that support 800 and 1900 MHz operation and inclusion of the RLM feature in the 800 and 1900 MHz remote units.
3	09/2006	Non-technical changes for agency approvals.

LIST OF CHANGES

The technical changes incorporated into this issue are listed below.

PAGE	IDENTIFIER	DESCRIPTION OF CHANGE
ix	Standards	Added FCC Part 15.5 statement.
2-25	Table 2-7	Deleted references to 1900 MHz Band G

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ABOUT THIS MANUAL

This operation and maintenance manual provides the following information:

- An overview of the Digivance Street-Level Coverage Solution (SCS) system.
- A basic description of the system components including the Host Unit (HU), Remote Unit (RU), and Digivance Element Management System (EMS).
- Procedures for turning-up the system and verifying that the system is functioning properly.
- Procedures for maintaining the system including scheduled maintenance tasks and fault isolation and troubleshooting procedures.
- Product warranty, repair, return, and replacement information.

The procedures for installing the host unit, 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 related manuals, their content, and their publication numbers. Copies of these publications can be ordered by contacting the Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (outside U.S.A. and Canada).

Title/Description	ADCP Number
Digivance LRCS and SCS Systems 800/900 MHz SMR Rear Access Host Unit Installation and Maintenance Manual Provides instructions for mounting the rear access host unit in an equipment rack, installing and connecting the various cables, and replacing the cooling fans.	75-180
Digivance SCS System Interim Single-Band Remote Unit Installation Manual Provides instructions for mounting the interim single-band remote unit and for installing and connecting the various cables.	75-190
Digivance SCS System Single-Band Remote Unit Installation Manual Provides instructions for mounting the single-band remote unit and for installing and connecting the various cables.	75-188
Digivance SCS System Dual-Band Remote Unit Installation and Maintenance Manual Provides instructions for mounting the dual-band remote unit and for installing and connecting the various cables.	75-189
Digivance Element Management System Version 7.0 User Manual Provides instructions for installing the Digivance Element Management System (EMS) software and for using both the Graphical User Interface (GUI) and the Network Operations Center (NOC) versions of the software.	75-201
Digivance SNMP Agent Software Version 7.1 User Manual Describes how to install, configure, and use the LRCS SNMP Proxy Agent.	75-202

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 pigtailed without severe bends. Fiber optic patch cords or pigtailed may be permanently damaged if bent or curved to a radius of less than 2 inches (50 mm).*

STANDARDS CERTIFICATION

Each respective SMR, Cellular, and PCS system in the SCS platform is FCC and IC approved. Information in this manual explains applicable portions of these systems.

FCC: The Digivance SCS system complies with the applicable sections of Title 47 CFR Parts 22, 24, and 90. Installation requirements the licensee needs to follow are listed in Title 47 CFR 90.635. This document may be found at the following website: http://www.access.gpo.gov/nara/cfr/waisidx_03/47cfr90_03.html.

Caution: Modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Part 15.5 General conditions of operation:

- a. Persons operating intentional or unintentional radiators shall not be deemed to have any vested or recognizable right to continue use of any given frequency by virtue of prior registration or certificate of equipment.
- b. Operation of an intentional, unintentional, or incidental radiator is subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental operator.
- c. The operator of a radio frequency device shall be required to cease operating the device upon notification by a Commission representative that the device is causing harmful interference. Operation shall not resume until the condition causing the harmful interference has been corrected.

UL/CUL: The Host Unit complies with UL and CUL 60950 Standard for Safety for Information Technology Equipment including Electrical Business Equipment.

The Remote Unit complies with NEMA Type 6, UL and CUL 50, Standard for Enclosures for Electrical Equipment.

The Remote Unit provides the degree of protection specified by IP67 as defined in IEC (International Electrotechnical Commission) Publication 60529.

The Remote Unit complies with UL and CUL 60950 and UL 50 as Communication Service Equipment under the DUZO category.

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. The term "IC:" before the radio certification number only signifies that Industry Canada Technical Specifications were met.

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
Att	Attenuation
AWG	American Wire Gauge
BER	Bit Error Rate
C	Centigrade
CAN	Controller Area Network
CDRH	Center for Devices and Radiological Health
CD-ROM	Compact Disk Read Only Memory
COM	Common
COMM	Communication
Config	Configuration
CUL	Canadian Underwriters Laboratories
DC	Direct Current
DCE	Data Communications Equipment
DTE	Data Terminal Equipment
EBTS	Enhanced Base Transceiver Station
EIA	Electronic Industries Association
EMS	Element Management System
ESD	Electrostatic Discharge
F	Fahrenheit
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FWD	Forward
GUI	Graphical User Interface
HU	Host Unit
IC	Industry Canada
IEC	International Electrotechnical Commission
IP	Internet Protocol
LED	Light Emitting Diode
LPA	Linear Power Amplifier
LRCS	Long-Range Coverage Solution
MHz	Mega Hertz
MIB	Management Information Base
MPE	Maximum Permissible Exposure
MTBF	Mean Time Between Failure
NC	Normally Closed
NEM	Network Element Manager
NO	Normally Open
NOC	Network Operations Center

OSP	Outside Plant
PA	Power Amplifier
PC	Personal Computer
PCS	Personal Communications System
Rev	Reverse
RF	Radio Frequency
RMA	Return Material Authorization
RU	Remote Unit
RX	Receive or Receiver
SCS	Street-Level Coverage Solution
SNMP	Simple Network Management Protocol
SMR	Specialized Mobile Radio
STM	Spectrum Transport Module
TX	Transmit or Transmitter
UL	Underwriters Laboratories
VAC	Volts Alternating Current
VDC	Volts Direct Current
VSWR	Voltage Standing Wave Ratio
WDM	Wavelength Division Multiplexer
WECO	Western Electric Company

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1 INTRODUCTION

This section provides basic description, application, and configuration information about the Digivance SCS system. Throughout this publication, all items referenced as “accessory items” are not furnished with the basic product and must be purchased separately.

2 SCS SYSTEM OVERVIEW

The Digivance Long Range Coverage Solution (LRCS) system is an RF signal transport system that provides long-range RF coverage to areas where it is impractical to place an Enhanced Base Transceiver Station (EBTS) at the antenna site. High real estate costs and community restrictions on tower and equipment locations often make it difficult to install the EBTS at the same location as the antenna. The LRCS system overcomes equipment placement problems by hubbing base stations at a central location and placing antennas at remote locations with minimal real estate requirements. The LRCS system transports RF signals to 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.

The SCS system provides the same functionality as the LRCS system but incorporates a low profile, low power, low cost remote unit. The SCS system remote unit complements the high power remote unit used with LRCS systems. The primary application includes urban areas where multiple, strategically placed, low power remote units provide better coverage than high power remote units.

2.1 Basic SCS System Components

The basic components of a typical Digivance SCS system and their function are shown in [Figure 1-1](#). A basic SCS system consists of a Host Unit (HU) and a Remote Unit (RU). The HU consists of a rack-mountable chassis that is designed for use in an indoor environment. The RU consists of a sealed enclosure that is designed for use in an outdoor environment. Control and monitoring functions are provided by the Digivance Element Management System (EMS).

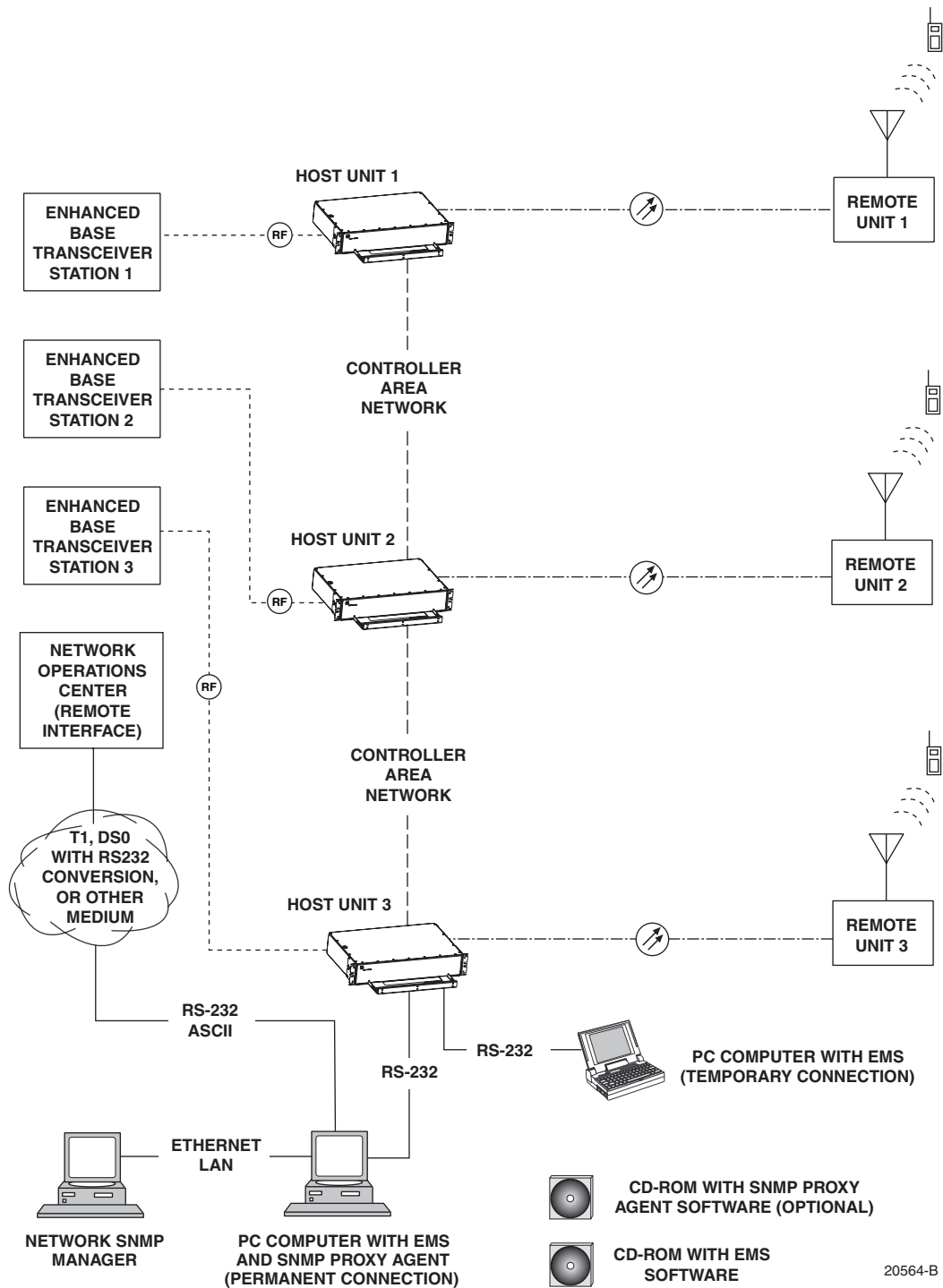


Figure 1-1. SCS System Overview Diagram

2.2 Enhanced Base Transceiver Station Interface

The HU is interfaced with an EBTS over coaxial cables as shown in [Figure 1-2](#). The EBTS provides the RF channel inputs and outputs for a designated sector. In the forward path, the HU receives two RF inputs from the EBTS. The HU digitizes the RF spectrum and then converts it 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 two RF outputs which are supplied to the EBTS over the coaxial cable interface.

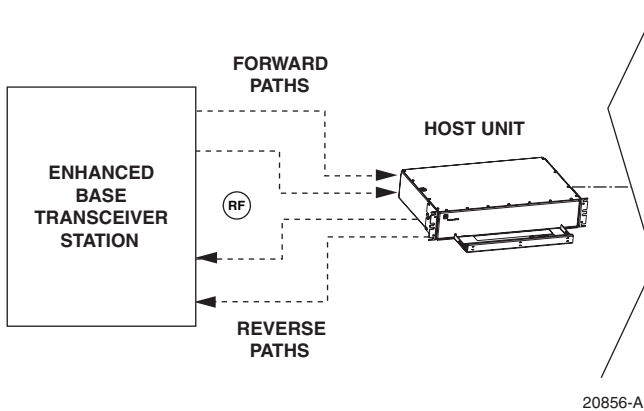


Figure 1-2. EBTS/HU Interface

2.3 Subscriber Unit Interface

The RU interfaces with the subscriber units (cell phones) through an antenna. In the reverse path, the RU receives RF spectrum from each subscriber unit (see [Figure 1-1](#)). The RU digitizes the RF spectrum and then converts it to digital optical signals for transport to the HU over the optical fiber link. In the forward path, the RU receives digital optical signals from the HU. The RU converts the optical signals to RF spectrum for transmission to the subscriber units. The RU is connected to an antenna (not provided) which transmits and receives the subscriber unit RF spectrum.

2.4 Local Management Interface

Communications with an individual Digivance system is supported through a local management interface capability as shown in [Figure 1-3](#). A local management interface requires a PC-type computer loaded with the Digivance Element Management System (EMS) software. EMS provides the various control and monitoring functions required to locally manage a Digivance system. The EMS computer connects directly to the HU through the computer's RS-232 port. Operation is implemented through the EMS Graphical User Interface (GUI). The GUI consists of a series of screens from which the user selects the desired option or function. An RS-232 service port is provided on the HU for connecting the EMS computer.

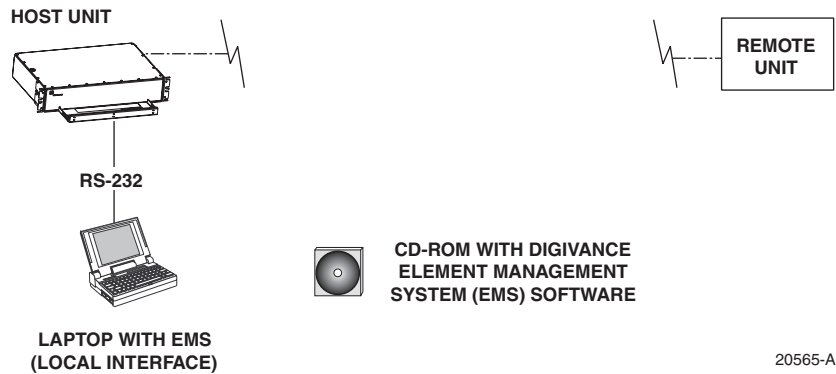


Figure 1-3. Local Management of a Single Digivance System

An EMS computer may be used to locally manage a networked group of multiple Digivance systems as shown in Figure 1-4. A Controller Area Network (CAN) port is provided on each HU. Up to twenty-four HU's may be linked together through the CAN interface and controlled by the same EMS computer. All the networked HU's and the associated RU's may be managed by connecting the EMS computer to one HU. The EMS computer provides an RS-232 port (#1) to support the interface with the networked HU's.

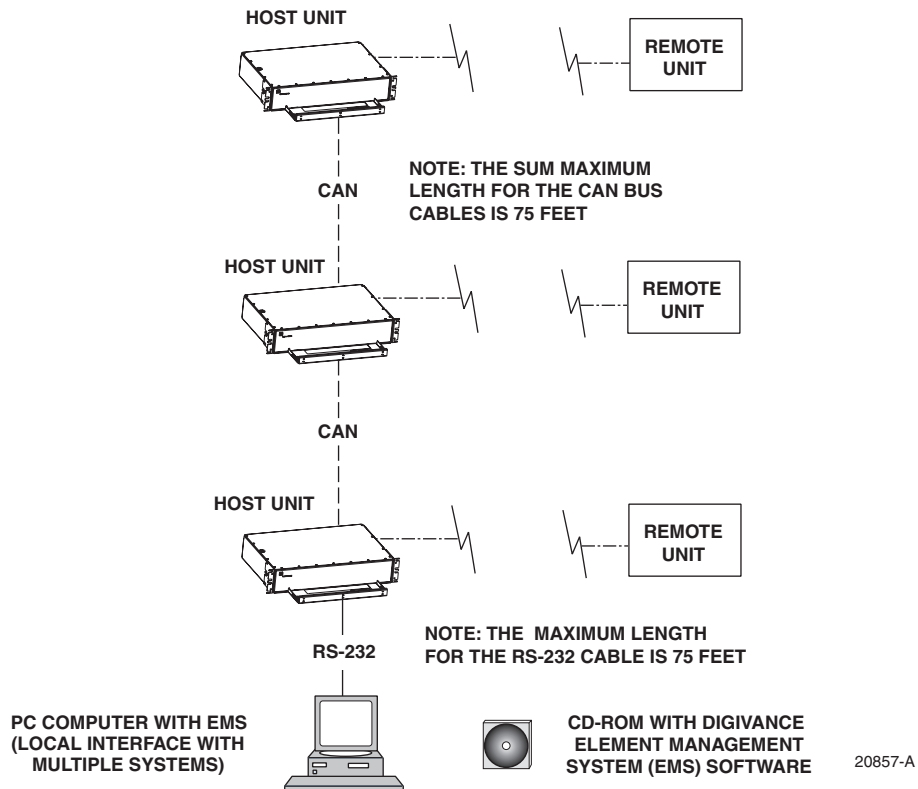


Figure 1-4. Local Management of Networked Digivance Systems

2.5 Network Operations Center Interface

Communications between a Network Operations Center (NOC) and a networked group of multiple Digivance systems is supported by a NOC interface capability as shown in [Figure 1-5](#). To support the NOC interface, a PC-type computer loaded with the Digivance Element Management System (EMS) software is required. EMS provides the various control and monitoring functions required to remotely manage multiple Digivance systems through the NOC interface.

A Controller Area Network (CAN) port is provided on each HU. Up to twenty-four HU's may be linked together through the CAN interface and controlled by the same EMS computer. All the networked HU's and the associated RU's may be managed by connecting the EMS computer to one HU. The EMS computer provides an RS-232 port (#1) to support the interface with the networked HU's.

The NOC can be linked to the EMS computer through a T1 system, DS0 with RS232 conversion, or some other medium. The EMS computer provides an RS-232 ASCII interface port (#2) to support the interface with the NOC.

At the NOC, control and monitoring of the networked Digivance systems is implemented 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.

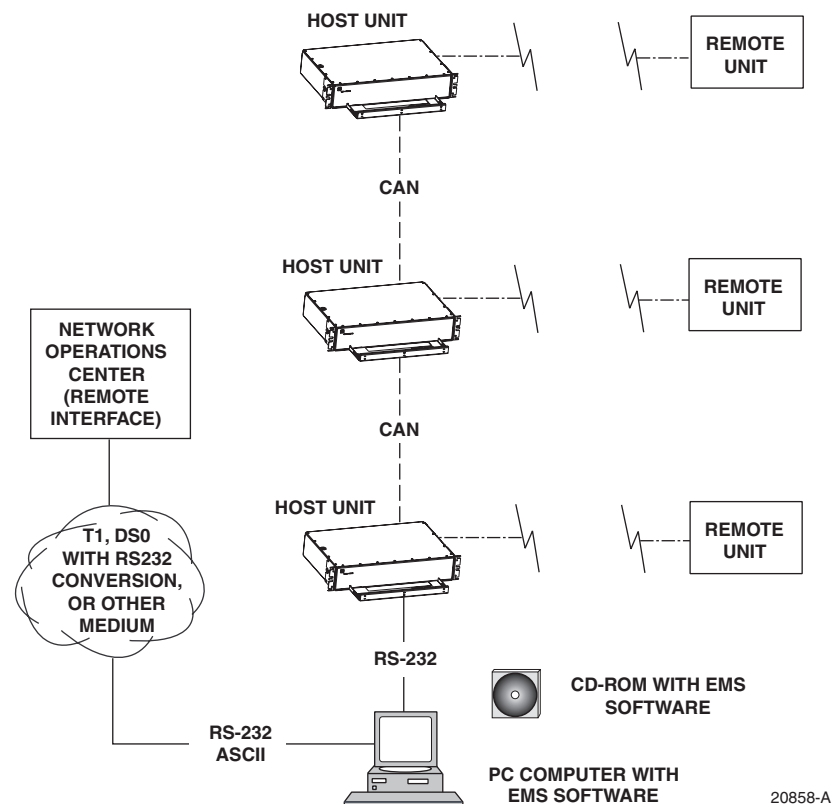


Figure 1-5. Remote Management of Networked Digivance Systems Through NOC Interface

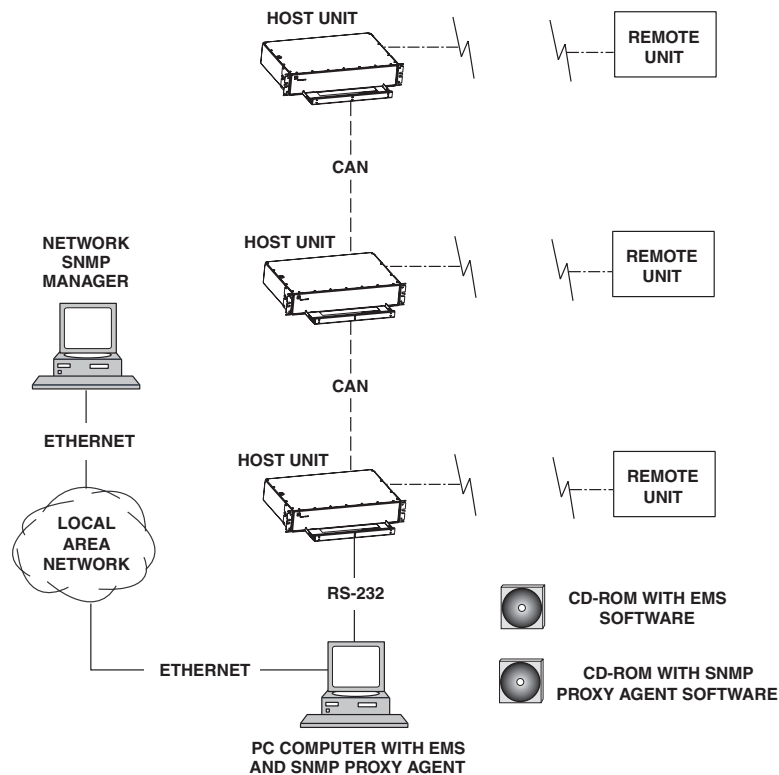
2.6 SNMP Interface

Communications between an external Simple Network Management Protocol (SNMP) Manager and a networked group of multiple Digivance systems is supported by an SNMP interface capability as shown in Figure 1-6. To support the SNMP interface, a PC-type computer loaded with both the Digivance Element Management System (EMS) software and the SNMP Proxy Agent software is required. The EMS and SNMP Proxy Agent software plus the associated Management Information Base (MIB) provide the various control (Set) monitoring (Get) and trap functions required to remotely manage multiple Digivance systems using an SNMP Manager.

A Controller Area Network (CAN) port is provided on each HU. Up to twenty-four HU's may be linked together through the CAN interface and controlled by the same EMS computer. All the networked HU's and the associated RU's may be managed by connecting the EMS computer to one HU. The EMS computer provides an RS-232 port (#1) to support the interface with the networked HU's.

The SNMP Manager may be linked with the EMS computer through a Local Area Network (LAN). The EMS computer provides an Ethernet port to support the interface with the LAN.

The SNMP Proxy Agent supports two versions of the SNMP protocol: SNMPv1 and SNMPv2c. A facility to Register/Unregister an SNMP Manager for receiving traps is also supported by the SNMP Proxy Agent. The SNMP Manager is an option and must be **ordered separately** from the EMS software.



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Figure 1-6. Remote Management of Networked Digivance Systems Through SNMP Manager

3 SYSTEM FUNCTIONS AND FEATURES

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

3.1 Fiber Optic Transport

In a typical Digivance LRCS system, the HU is connected to the RU over two single-mode optical fibers. One fiber is used to transport the **forward path** optical signal. The other fiber 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 fiber. A diagram of the fiber optic transport system for a typical Digivance LRCS system is shown in [Figure 1-7](#).

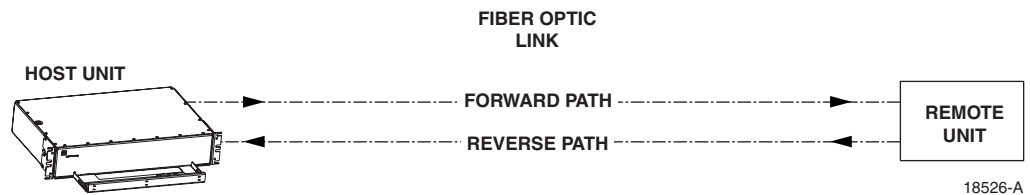


Figure 1-7. LRCS System Fiber Optic Transport - Typical

The maximum length of the optical links is dependent on the loss specifications of the optical fiber, the losses imposed by the various connectors and splices, and the RF modulation protocol response timing limitations. The basic system provides an optical budget of **25 dB** (typical) when used with 9/125 single-mode fiber.

In SCS applications, the forward path and reverse path optical signals from an HU/RU pair are combined onto a single optical fiber. This is accomplished by using a passive bi-directional Wavelength Division Multiplexer (WDM) system. The optical wavelengths used in the Digivance 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, both signals can be combined on a single optical fiber. A WDM module (accessory) is installed with the HU at the host site. The SCS RU, which is equipped with an internally mounted WDM, is installed at the remote site as shown in [Figure 1-8](#).

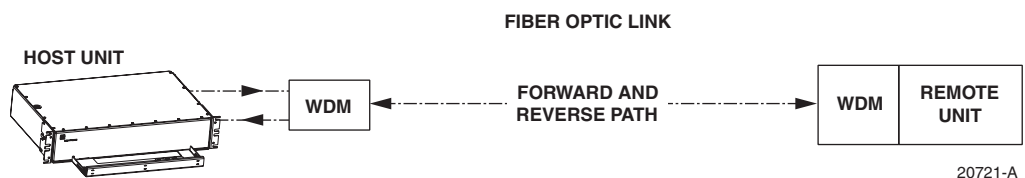


Figure 1-8. SCS System Fiber Optic Transport with Wavelength Division Multiplexer

3.2 Control and Monitoring Software

The EMS software and the SNMP Proxy Agent software provide control and monitoring functions for the Digivance system through the local, NOC, and SNMP interfaces. The EMS software package supports the local and NOC interfaces but does not include the SNMP Proxy Agent software which must be **ordered separately**. Both the EMS and the SNMP Proxy Agent software are required to support the SNMP interface. All software files are provided on CD-ROM's. Software installation consists of copying the software files from the CD-ROM's to a designated directory on the hard-drive of the EMS computer.

The EMS software provides the capability to provision and configure the Digivance system for operation. This includes selecting a site name, setting alarm thresholds, and setting forward and reverse path RF gain adjustments. The EMS software also provides the capability to get alarm messages (individual or summary), obtain data measurements, and to upgrade the HU/RU system software. All control and monitor functions (except software upgrade which is not supported by the NOC/NEM and SNMP interfaces and HU/RU pair site number assignment which is not supported by the SNMP interface) may be implemented using the NOC/NEM interface, the SNMP interface, or the EMS software GUI.

3.3 Fault Detection and Alarm Reporting

LED indicators are provided on the front panel of the HU and on the underside of the RU 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, SNMP manager, or the EMS software GUI.

3.4 Powering

The HU is powered by ± 24 or ± 48 VDC and must be hard-wired to a local DC power source through a fuse panel. A screw-down terminal strip is provided on the rear side of the HU for the power connections.

The RU is powered by 90 to 265 VAC (nominal 120 or 240 VAC), 47 to 63 Hz power. On an optional basis, the RU may be powered by 60 to 89 VAC, 47 to 63 Hz power. A connector is provided on the underside of the RU for the AC power connections. A 3-wire AC power cable rated for outdoor use is included with the RU. The stub end of the cable must be hard-wired to the AC power source.

3.5 Equipment Mounting and Location

The HU consists of a rack-mountable chassis assembly that 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 usually installed within 20 feet of the EBTS and may be mounted in either a 19- or 23-inch, WECO or EIA, equipment rack.

The RU consists of a sealed aluminum enclosure designed for mounting in either an **indoor or outdoor** environment. The RU may be mounted from a pole or the exterior side of a building with the standard mounting bracket or from a strand with an accessory bracket.

4 DUAL-BAND REMOTE UNIT SCS SYSTEMS

Sections 1 through 3 described the functions and features of a typical SCS system equipped with one HU and the single-band RU. Each single-band RU is equipped with the electronics to support one frequency band. If it is necessary to support two frequency bands (such as 800/900 MHz SMR and 1900 MHz) at the same remote location, a dual-band RU can be deployed. A dual-band RU provides the electronic and optical functionality of two single-band RU's except that all the electronic and optical components are housed within a single enclosure.

A dual-band SCS system consists of two standard host units and a dual-band RU that are linked together over two optical fibers. At the hub site, each HU is connected to a separate EBTS facility. The dual-band RU supports the frequency bands (such as 800/900 MHz SMR and 1900 MHz) associated with the two connected HU's. Each HU and the corresponding RU electronics function independently of each other and may be managed separately using the same element management system (EMS). [Figure 1-9](#) shows a typical SCS system equipped with a dual-band RU. One fiber is used to transport the forward/reverse path optical signals for one SCS system. The other fiber is used to transport the forward/reverse path optical signals for the other SCS system.

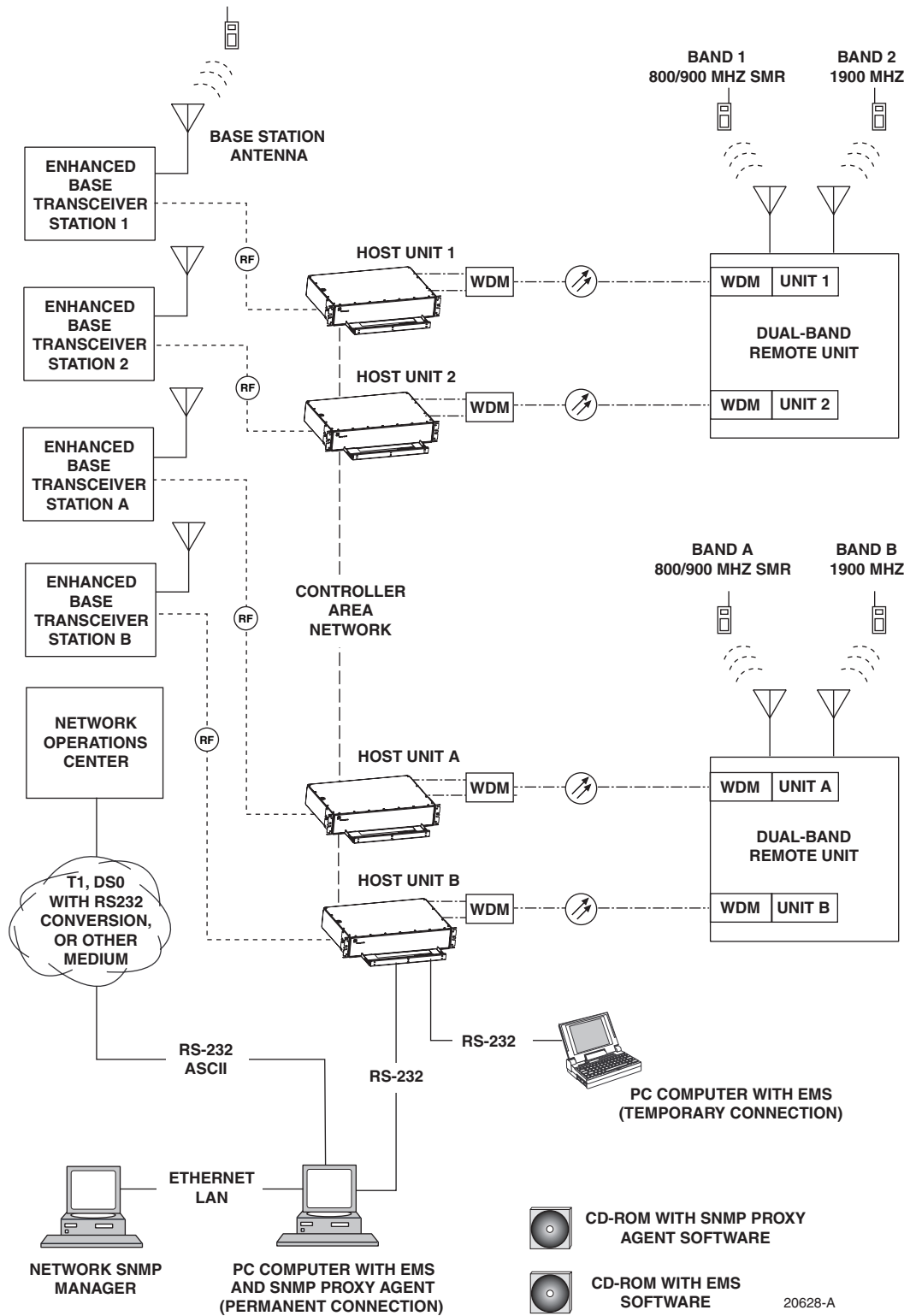


Figure 1-9. SCS System With Dual-Band Remote Units Overview Diagram

SECTION 2: DESCRIPTION

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1 INTRODUCTION

This section describes the basic components of a typical Digivance SCS system including the Host Unit (HU), Remote Unit (RU), element management system, and accessories. The system specifications are provided in a table at the end of this section.

2 HOST UNIT

Two versions of the HU are available. The **rear access** HU, shown in [Figure 2-1](#), is used with 800/900 MHz SMR systems. The **front access** HU, also shown in [Figure 2-1](#), is used with 800 and 1900 MHz systems. Connection points for the RF, optical, and alarm cables are provided on the rear side of the rear access HU and on the front side of the front access HU. Both HU versions provide the following basic functions:

- Provides a limited adjustable RF interface with the BTS.
- Provides a fiber optic interface with the RU.
- Digitizes the two forward path composite RF signals.
- Converts the two digitized forward path RF signals to a digital optical signal.
- Converts the digitized reverse path optical signal to two digitized RF signals.
- Converts the two digitized reverse path RF signals to two composite RF signals.
- Sends alarm information to an external alarm system through relay contact closures
- Provides an RS-232 interface for connecting the EMS computer.
- 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-paint 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. The front access HU is also equipped with a front cable management tray and vertical cable guides.

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 the rear access HU is installed, the front panel of the HU is flush with the front of the rack. When the front access HU is installed, the front panel of the HU is flush with the front of the rack and the cable management tray extends 3.9 inches (99 mm) beyond the front panel. Screws are provided for securing the HU to the equipment rack.

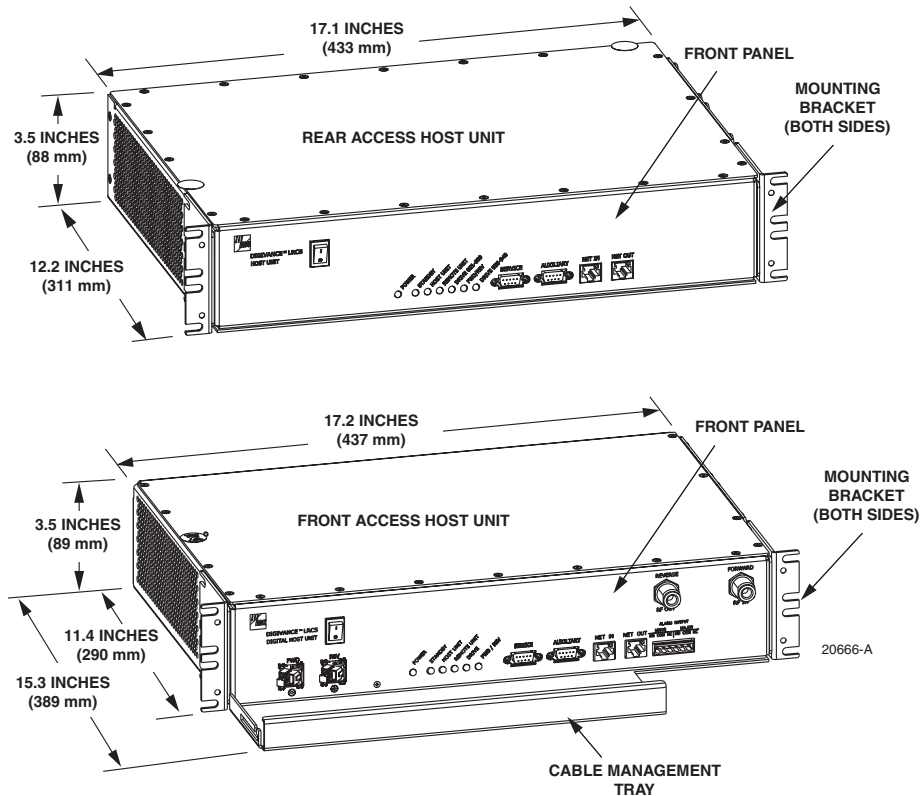


Figure 2-1. Front View of Front and Rear Access Host Units

2.3 Fault Detection and Alarm Reporting

The HU detects and reports various internal and external faults including 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.

Fault and alarm information may also be accessed locally through the EMS software GUI or remotely through the NOC/NEM interface or SNMP interface. An alarm history file is maintained by the EMS software so that a record is kept of all alarms as they occur. This is useful when an alarm is reported and cleared before the reason for the alarm can be determined.

The status of the HU, the alarm state (major or minor), and other alarm information is summarized and reported over the service interface, the CAN interface, and the optical interface to the RU. In addition, the status of the RU is transmitted to the HU over the optical interface and reported over the service interface and the CAN interface.

2.4 RF Signal Connections

The RF signal connections between the **rear access** HU and the EBTS are supported through four N-type female connectors. Two connectors are used for the forward path RF signals and two connectors are used for the reverse path RF signals.

The RF signal connections between the **front access** HU and the EBTS are supported through two N-type female connectors. One connector is used for the forward path RF signal and the other connector is used for the reverse path RF signal.

In most installations, it is usually necessary to install external attenuators to support the RF interface between the HU and the EBTS. The HU should be as close as possible to the EBTS to minimize coaxial cable losses.

2.5 RF Signal Level Adjustments

The HU is equipped with several attenuators for adjusting the signal levels of the forward and reverse path RF signals. The attenuators provide an attenuation adjustment range of 0 to 31 dB and can be set in 1 dB increments. The attenuators are software controlled and are adjusted through the EMS software GUI, NOC/NEM interface, or SNMP interface.

The **host forward path** attenuators adjust the level of the **input** RF signal(s) to the HU. Using the forward path attenuator, an input signal with a nominal composite signal level of -9 dBm to -40 dBm can be adjusted to produce maximum power output. **Additional external attenuation is required if the input signal level is greater than -9 dBm.**

► **Note:** The optimum composite RF input signal level for 800/900 MHz SMR systems is -20 dBm.

The **host reverse path** attenuators adjust the level of the **output** RF signal(s) from the HU and will add from -1 dB of gain (attenuator set to 31 dB) to $+30$ dB of gain (attenuator set to 0 dB) to the RF output signal(s) at the HU.

2.6 Propagation Delay

The HU forward and reverse path propagation delays may be adjusted in 0.1 μ sec increments within a range of 0 to 63 μ s. The propagation delay is software controlled and may be adjusted through the EMS software GUI, NOC/NEM interface, or SNMP interface.

2.7 Optical Connection

Optical connections between the HU and the RU are supported through two optical ports equipped with UPC/SC (flat) connectors. One port is used for the forward path optical signal connection and the other port is used for the reverse path optical signal connection.

2.8 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 24 HUs to be connected together (in daisy-chain fashion) and controlled through a single EMS computer.

2.9 Service Interface Connection

The service interface connection between the HU and the 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 of any one of the networked HUs.

2.10 Powering

The HU is powered by ± 21 to ± 60 VDC power (nominal ± 24 or ± 48 VDC). 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 PowerWorx GMT Series Fuse Panel (available separately). The power circuit for each HU must be protected with a 3 Amp GMT fuse. An On/Off switch is provided on the HU front panel.

2.11 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 generated if a high temperature condition ($>50^{\circ}\text{C}/122^{\circ}\text{F}$) occurs. The fans may be field-replaced if either fan fails.

2.12 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 **rear access** HU user interface points are indicated in [Figure 2-2](#) and described in [Table 2-1](#). The **front access** HU user interface points are indicated in [Figure 2-3](#) and described in [Table 2-2](#).

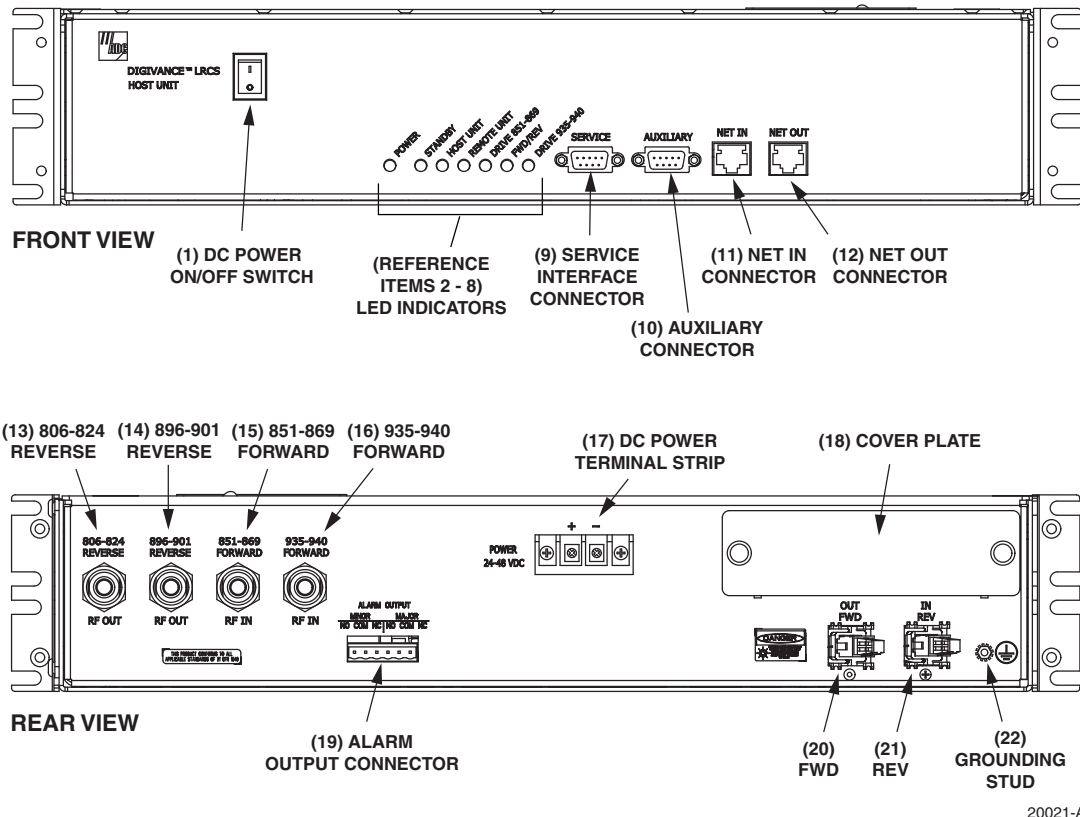



Figure 2-2. Rear Access Host Unit User Interface

Table 2-1. Host Unit User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	I/O	On/Off rocker switch	Provides DC power on/off control.
2	POWER	Multi-colored LED (green/yellow)	Indicates if the HU is powered (green) or unpowered (off). See Note.
3	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.
4	HOST UNIT	Multi-colored LED (green/yellow/red)	Indicates if the HU is normal (green), overheated (yellow), or faulty (red). See Note.
5	REMOTE UNIT	Multi-colored LED (green/yellow/red)	Indicates if no alarms (green), a minor alarm (yellow), or a major alarm (red) is reported by the RU. See Note.
6	DRIVE 851-869	Multi-colored LED (green/yellow/red)	Indicates if the level of the 851-869 MHz RF input signal to the HU is normal (green), low (yellow), or high (red). See Note.

Table 2-1. Host Unit User Interface, continued

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
7	FWD/REV (PORT 1/PORT 2)	Multi-colored LED (green/red)	Indicates if the reverse/forward path optical signals from the RU/HU are normal (green), if no signals are detected (red), or if excessive errors are detected (red). See Note.
8	DRIVE 935–940	Multi-colored LED (green/yellow/red)	Indicates if the level of the 935–940 MHz RF input signal to the HU is normal (green), low (yellow), or high (red). See Note.
9	SERVICE	DB-9 connector (female)	Connection point for the RS-232 service interface cable.
10	AUXILIARY	DB-9 connector (female)	Connection point for the RS-232 auxiliary interface cable. Not supported by SCS Remote Unit.
11	NET IN	RJ-45 jack (female)	Connection point for the CAN interface input cable.
12	NET OUT	RJ-45 jack (female)	Connection point for the CAN interface output cable.
13	806–824 REVERSE	N-type female RF coaxial connector	Output connection point for the 806–824 MHz reverse path RF coaxial cable.
14	896–901 REVERSE	N-type female RF coaxial connector	Output connection point for the 896–901 MHz reverse path RF coaxial cable.
15	851–869 FORWARD	N-type female RF coaxial connector	Input connection point for the 851–869 MHz forward path RF coaxial cable.
16	935–940 FORWARD	N-type female RF coaxial connector	Input connection point for the 935–940 MHz forward path RF coaxial cable.
17	POWER 24–48 VDC	Screw-type terminal strip	Connection point for the DC power wiring.
18	No designation	Cover plate	Covers the mounting slot for the wavelength division multiplexer module.
19	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.
20	FWD (PORT 1)	UPC/SC connector (flat single-mode)	Output connection point for the forward path optical fiber.
21	REV (PORT 2)	UPC/SC connector (flat single-mode)	Input connection point for the reverse path optical fiber.
22		Chassis ground stud	Connection point for a chassis grounding wire.

Note: A more detailed description of LED operation is provided in Section 4.

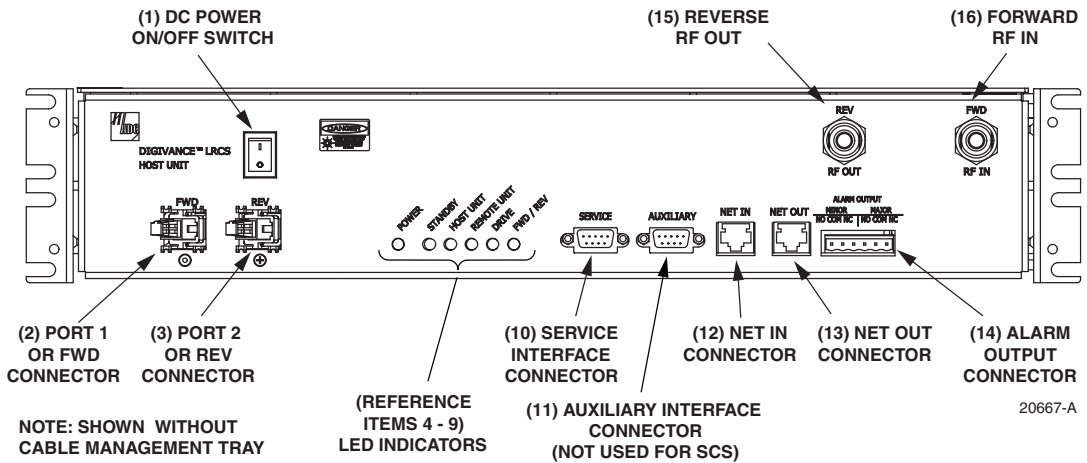



Figure 2-3. Front Access Host Unit User Interface

Table 2-2. Host Unit User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	I/O	On/Off rocker switch	Provides DC power on/off control.
2	FWD	SC connector (single-mode)	Output connection point for the forward path optical fiber.
3	REV	SC connector (single-mode)	Input connection point for the reverse path primary optical fiber.
4	POWER	Multi-colored LED (green/yellow)	Indicates if the HU is powered (green) or unpowered (off). See Note.
5	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.
6	HOST UNIT	Multi-colored LED (green/yellow/red)	Indicates if the HU is normal (green), overheated (yellow), or faulty (red). See Note.
7	REMOTE UNIT	Multi-colored LED (green/yellow/red)	Indicates if no alarms (green), a minor alarm (yellow), or a major alarm (red) is reported by the RU. See Note.
8	DRIVE	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.
9	FWD/REV	Multi-colored LED (green/red)	Indicates if the reverse path optical signals from the STM are normal (green), if no signals are detected (red), or if excessive errors are detected (red). See Note.
10	SERVICE	DB-9 connector (female)	Connection point for the RS-232 service interface cable.
11	AUXILIARY	DB-9 connector (female)	Not used with SCS systems.

Table 2-2. Host Unit User Interface, continued

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
12	NET IN	RJ-45 jack (female)	Connection point for the CAN interface input cable.
13	NET OUT	RJ-45 jack (female)	Connection point for the CAN interface output cable.
14	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.
15	REV RF OUT	N-type female RF coaxial connector	Output connection point for the primary reverse path RF coaxial cable.
16	FWD RF IN	N-type female RF coaxial connector	Input 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.
	 (Rear side - not shown)	Chassis ground stud	Connection point for a chassis grounding wire.
Note: A more detailed description of LED operation is provided in Section 4.			

3 REMOTE UNIT

The RU is available in either a single-band or a dual-band version. Both versions of the RU provide the following basic functions:

- Convert the digitized forward path optical signals to digitized RF signals.
- Convert the digitized forward path RF signals to composite RF signals.
- Digitize the reverse path composite RF signals.
- Convert the digitized reverse path RF signals to digitized optical signals.
- Provide an RF interface (antenna port) for the remote antenna(s).
- Provide an optical interface for the HU.
- Transport alarm, control, and monitoring information to the HU via the optical interface.
- Accept AC power input.
- Provide a visual indication of unit status

3.1 Primary Components

Depending on the version, the RU consists of either two or four electronic assemblies mounted within an environmentally-sealed cast-aluminum enclosure. The Spectrum Transport Module (STM) provides optical-to-RF and RF-to-optical conversion and digitizing functions; alarm, control, and monitoring functions; power conversion functions; RF filtering and interface functions. The Linear Power Amplifier (LPA) works in conjunction with the STM to amplify

the forward path RF signal. The aluminum enclosure provides a mounting point for the electronic assemblies, controls RF emissions, seals out dirt and moisture, and provides passive cooling. The electronic assemblies are not user replaceable or accessible. All connectors and indicators are mounted on the bottom of the RU enclosure for easy access.

The **single-band** version of the RU consists of one STM and one LPA mounted within the same enclosure. The **dual-band** version, shown in [Figure 2-4](#), consists of two STM's and two LPA's mounted within the same enclosure. The dual-band version makes it possible to support two separate frequency bands with a single RU.

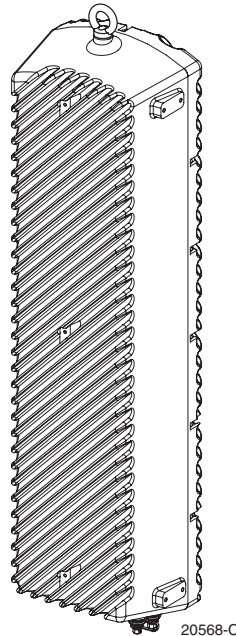


Figure 2-4. Dual-Band Remote Unit

3.2 Mounting

The RU may be mounted on a flat vertical surface (such as the side of a building), on a utility pole, or from a horizontal cable or overhead support. A combination wall/pole mounting bracket is provided with each unit. A separate strand-mount kit (accessory item) is available if it is necessary to mount the RU from a cable. Inside-pole mounting and underground vault installations are also possible. Contact the Wireless TAC (see Section 5) for additional information.

3.3 Fault Detection and Alarm Reporting

The RU detects and reports various faults including remote unit fault, optical fault, output power fault, temperature fault, and power amplifier fault. A single bottom-mounted Light Emitting Diode (LED) indicator turns from off to red if a major fault is detected. The status of the STM and LPA, the alarm state, and other fault information is summarized and reported over the optical interface to the HU. Fault and alarm information may be accessed at the HU through the EMS software GUI or remotely through the NOC/NEM interface or SNMP interface.

3.4 Antenna Cable Connection

The antenna cable connection between the RU and the antenna is supported through either one (single-band RU) or two (dual-band RU) 50-ohm N-type female connectors. The antenna cable/cables carry the forward and reverse path RF signals between each antenna and RU. An externally-mounted lightning protector is available as an accessory. The antenna connector on the lightning protector may be either an N-type female connector or a 7/16 mm DIN connector. The RU enclosure must be properly grounded for the lightning protector to function properly. On an optional basis, the dual-band RU may be equipped with one N-type connector (and internal diplexor) to support operation with a single antenna.

3.5 RF Signal Level Adjustment

The RU is equipped with digital attenuators for adjusting the signal level of the forward path RF **output** signals. The **remote forward path** attenuators adjust the level of the two output RF signals at the RU antenna port and will add from 0 to 31 dB of attenuation to the output signal level. The attenuator can be set in 1 dB increments. The attenuator is software controlled and is adjusted through the EMS software GUI, the NOC/NEM interface, or SNMP interface.

3.6 Optical Connection

Fiber optic connections between the **single-band** RU and the associated HU are supported through a single hardened optical port. All single-band RU's are equipped with an internally mounted Wavelength Division Multiplexer (WDM). This allows a single optical port to provide the optical fiber connection for the combined forward and reverse path signals.

Fiber optic connections between the **dual-band** RU and the two associated HU's (two HU's are required with a dual-band RU) are supported through two hardened optical ports. All dual-band RU's are equipped with two internally-mounted WDM's. One port provides the optical fiber connection for the combined forward and reverse path signals for HU #1. The other port provides the optical fiber connection for the combined forward and reverse path signals for HU #2.

Each hardened optical port houses an SC adapter. A standard APC/SC type connector is connected to the internal side of the adapter. The optical port accepts drop cables that are terminated with APC/SC hardened connectors. The optical port is also compatible with OptiTap connectors manufactured by Corning Incorporated.

3.7 Powering

The RU is powered by 90 to 265 VAC (nominal 120 or 240 VAC), 47 to 63 Hz power. On an optional basis, the RU may be powered by 60 to 89 VAC, 47 to 63 Hz power. The power is supplied through a 20-foot three-wire AC power cable that is provided with the RU. The power cable connects to a mini 3-pin power connector mounted on the bottom of the RU enclosure. The stub end of the cable must be hard-wired to the AC power source. The power cable is rated for indoor or outdoor use and must not be routed through conduit. Accessory power cables are also available separately in lengths of 40, 60, or 100 feet.

3.8 Grounding

A grounding terminal (hex socket capscrew and washer) is provided on the bottom of the enclosure for connecting a grounding cable to the enclosure. A 1.5 meter #6 stranded copper wire terminated with a ring terminal is provided with the RU for linking the enclosure to an earth ground source.

3.9 Cooling

Passive cooling of the electronic assemblies is provided by conducting excess heat from the electronic components to the aluminum enclosure. The heat is dissipated to the outside air by radiation and convection air flow over the enclosure’s external cooling fins. An alarm is generated if a high temperature condition occurs within the enclosure. If necessary, the RU may be equipped with solar shields (accessory) that reduce the effect of solar loading on the aluminum enclosure.

3.10 User Interface

The RU user interface consists of the connectors, grounding lug, and LED that are provided on the bottom of the RU enclosure. The user interface points for the single-band RU are indicated in [Figure 2-5](#) and described in [Table 2-3](#). The user interface points for the interim single-band and the dual-band RU are indicated in [Figure 2-6](#) and described in [Table 2-4](#).

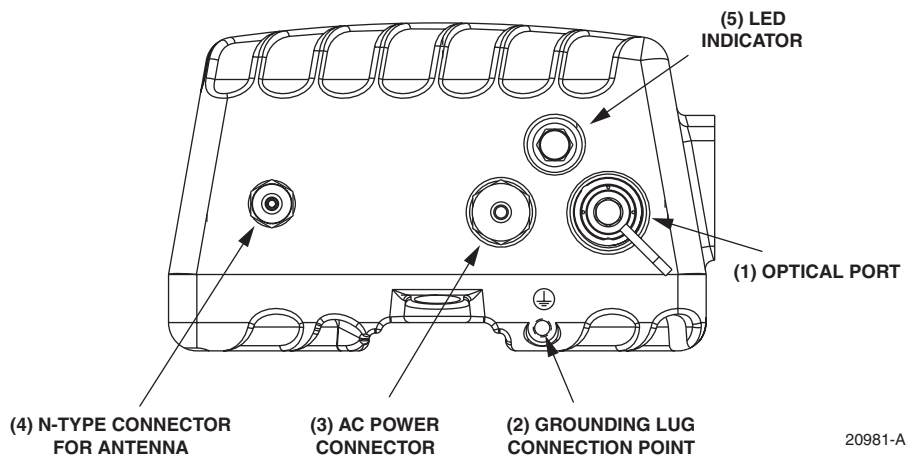

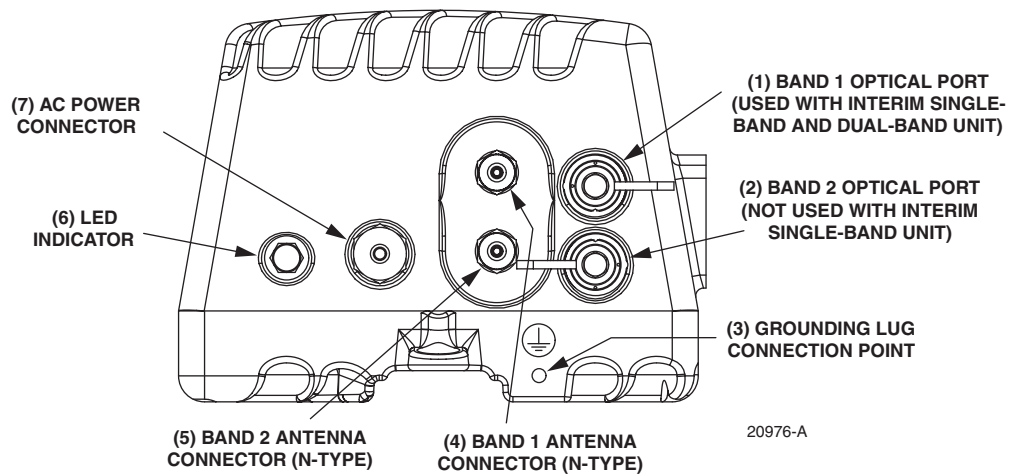


Figure 2-5. Single-Band Remote Unit User Interface

Table 2-3. Single-Band Remote Unit User Interface


REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	BAND 1	APC/SC hardened adapter	Input/output connection point for the combined forward and reverse path optical fiber. The host unit must be equipped with a WDM.
2		Threaded hole with hex socket screw	Connection point for the grounding wire.
3	POWER	Mini 3-wire AC power connector	Connection point for the AC power cord.
4	ANT	N-type female RF coaxial connector	Connection point for the antenna cable.
5	No designation	Red LED (off/red)	Indicates if the RU is powered and normal (off) or if a major fault is detected (red). See Note.
Note: A more detailed description of the LED operation is provided in Section 4.			



NOTE: THE STANDARD REMOTE UNIT IS EQUIPPED WITH TWO ANTENNA CONNECTORS. AS AN OPTION, THE REMOTE UNIT CAN BE EQUIPPED WITH ONE ANTENNA CONNECTOR TO SUPPORT OPERATION WITH A SINGLE ANTENNA.

Figure 2-6. Interim Single-Band and Dual-Band Remote Unit User Interface

Table 2-4. Interim Single-Band and Dual-Band Remote Unit User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	BAND 1	APC/SC hardened adapter	Input/output connection point for the BAND 1 (lower frequency system) combined forward and reverse path optical fiber. The host unit must be equipped with a WDM.
2	BAND 2 (Interim single band unit)	Unused hardened adapter	The Band 2 optical port is not used with the interim single-band version of the RU.
	BAND 2 (Dual-band unit)	APC/SC hardened adapter	Input/output connection point for the BAND 2 (higher frequency system) combined forward and reverse path optical fiber. The host unit must be equipped with a WDM.
3		Threaded hole with hex socket screw	Connection point for the grounding wire.
4	BAND 1	N-type female RF coaxial connector	Connection point for the multi-frequency antenna cable or Band 1 (lower frequency) cable if two antennas are installed.
5	BAND 2 (not present with single antenna remote units)	N-type female RF coaxial connector	Connection point for the Band 2 (higher frequency) antenna cable.
6	No designation	Red LED (off/red)	Indicates if the RU is powered and normal (off) or if a major fault is detected (red). See Note.
7	POWER	Mini 3-wire AC power connector	Connection point for the AC power cord.
Note: A more detailed description of the LED operation is provided in Section 4.			

4 ACCESSORY ITEMS

This section provides a brief description of the accessory items that are available separately for the SCS system. The accessory items may or may not be required depending on the application.

4.1 Strand Mount Kit for RU

A strand-mount kit is available if the application requires that the RU be mounted from an overhead cable system. Mounting pads are provided on the side of the RU enclosure for securing a pair of cable-attachment clips. Screws are used to secure the cable-attachment clips to the RU enclosure.

4.2 Lightning Protector for RU

An external lightning protector is available separately for the RU. It is recommended that an external lightning protector be installed at the RU antenna port to reduce the chance of damage to electronic components should a lightning strike occur. The antenna terminal on the lighting protector may be equipped with either an N-type female connector or a 7/16 mm DIN female connector depending on the application requirements.

4.3 Solar Shields

A solar shield kit is available if the RU must be mounted in full sunlight for extended periods of time with extremely high ambient temperatures. The solar shields attach to the exterior of the RU enclosure and shade the enclosure from direct exposure to the sun. The solar shields are constructed of sheet metal and are painted to match the color of the RU enclosure. All fasteners and brackets required for installation are provided with the kit.

5 DIGIVANCE ELEMENT MANAGEMENT SYSTEM

The Digivance Element Management System (EMS) is a software-based network management tool that provides control and monitoring functions for the Digivance system. The Digivance 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 **local** control by an on-site service technician and also **remote** control through either a Network Operations Center (NOC) interface or an SNMP interface.

5.1 Digivance EMS Primary Components

The primary components of the Digivance EMS, shown in [Figure 2-7](#), are packaged separately from the various Digivance hardware items and consist of the following items: User Manuals, mouse pad, license agreement, and either one or two CD-ROM's which contain the various elements of the software. The software installs on a PC-type computer which is not provided. A cable (DGVL-000000CBPC) for connecting the EMS computer to the HU is available separately as an accessory item.

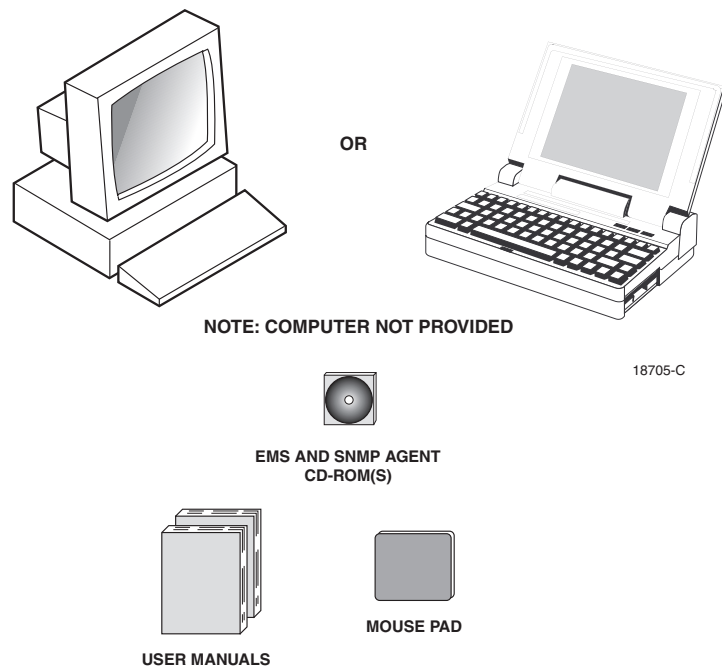


Figure 2-7. Digivance Element Management System

EMS Software: The EMS software and the Java 2 Runtime Environment software are loaded on a CD-ROM. The EMS software provides **local** monitor and control functions through a Graphical User Interface (GUI) and **remote** monitor and control functions through the NOC/NEM interface.

SNMP Proxy Agent Software: The SNMP Proxy Agent software (when included) is loaded on a CD-ROM. The SNMP Proxy Agent together with the EMS provides for remote monitor and control functions through a network SNMP manager. When the SNMP interface is required for system operation, both the EMS software and SNMP Proxy Agent software must be installed on the same computer. The SNMP Proxy Agent software will not function without the EMS software.

Control Programs: The host and remote control programs are installed by the factory in each respective host unit or RU. Updated versions of the host and remote control program software will be provided by Customer Service on a “as needed” basis.

5.2 Software Installation

Software installation consists of inserting each specified CD-ROM into the computer’s CD-ROM drive and then running the software install programs. This places the EMS, Java 2 Runtime Environment, and SNMP Proxy Agent (if included) software files in assigned folders on the computer’s hard drive. Software installation instructions are provided in the Digivance Element Management System User Manual (See Related Publications section).

5.3 Computer Operation

Permanent control and monitoring functions may be provided by a PC-type desk-top computer that is permanently connected to a HU. The EMS program must be running in order for the NOC interface to function. Both the EMS program and SNMP Proxy Agent program must be running in order for the SNMP interface to function. A PC-type lap-top computer running just the EMS program can be used as a portable network management tool for service and maintenance purposes. The laptop computer may be connected temporarily to the HU to trouble-shoot problems on-site and then removed when the maintenance task is completed. The specifications for the EMS computer are provided in the Digivance Element Management System User Manual (See Related Publications section).

5.4 Digivance EMS Computer Interface Connections

The service interface connection between the EMS computer and the HU 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 (accessory item) equipped with a male DB-9 connector on one end and a PC-compatible connector on the other end is required to link the EMS computer to the HU.

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

T1 system, DS0 with RS232 conversion, or other medium. Cables and equipment (not provided) to support the RS-232 interface connection between the EMS computer and the NOC interface are required.

The SNMP interface connection between the EMS computer and the SNMP manager requires that the EMS computer be equipped with an Ethernet port. The link between the EMS computer and a network SNMP manager would generally be supported by a Local Area Network (LAN). Cables and equipment (not provided) to support the connection between the EMS computer and the LAN are required.

5.5 Digivance Software User Interfaces

The Digivance EMS provides three software user interfaces: the EMS Graphical User Interface (GUI), the Network Operation Center–Network Element Manager (NOC/NEM) interface, and the SNMP interface. The EMS GUI, the NOC interface, and the SNMP interface provide the same basic functions. However, the NOC interface and the SNMP interface cannot be used to download new system software to the Digivance system. In addition, the SNMP interface cannot be used to assign a system site number to a HU/RU pair during installation.

The EMS GUI is used for **local** control and monitoring operations. The EMS GUI consists of a series of displays and screens, such as the one shown in Figure 2-8, that provide the user with alarm and status information and that allow the user to set various operating parameters. Directives are implemented by pointing and clicking on the desired action and also by entering text in various dialog boxes. Refer to the Digivance Element Management System User Manual (see Related Publications section) for additional information.



Figure 2-8. Typical EMS Graphical User Interface – Host/Remote Alarms Display

The NOC/NEM interface is a text-based command line interface that is used for **remote** control and monitoring operations (**except software download**). The NOC/NEM interface consists of defined ASCII text strings that are input as SET or GET commands followed by the action or information required. A text string response is received from the specified Digivance system or systems to confirm the requested action or to report the requested information. Examples of several typical NOC-NEM interface commands and the responses received are shown in [Figure 2-9](#). 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 locally from the EMS computer. Refer to the Digivance Element Management System User Manual (see Related Publications section) for additional information.

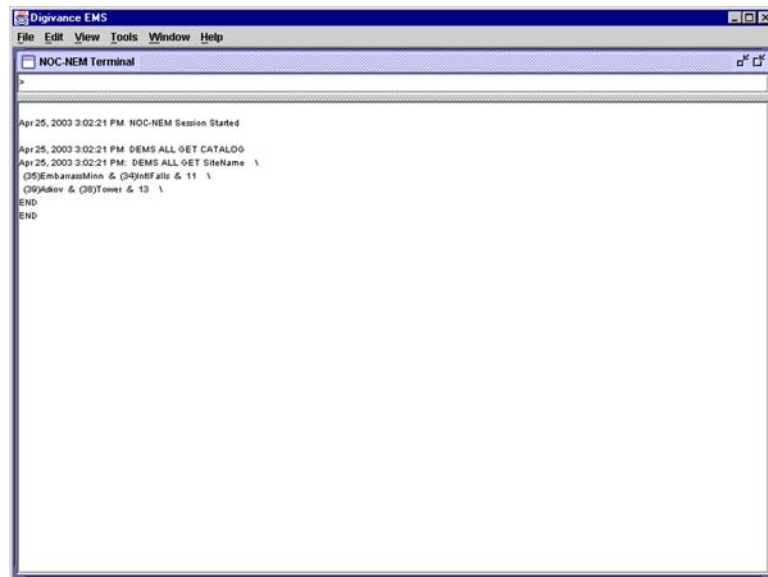


Figure 2-9. NOC/NEM Interface Typical Commands

The SNMP interface is used for **remote** control and monitoring operations (**except software download and site number assignment**). The SNMP interface uses a Management Information Base (MIB) to define a list of identifiers that are supported by the SNMP agent. The SNMP manager communicates with the SNMP agent over a LAN. Directives, based on the MIB identifier, are issued by the SNMP manager to the SNMP agent along with instructions to either get the specified identifier or set the specified identifier. The directive is then executed on the Digivance system by the SNMP agent. The SNMP agent also has the ability to send autonomous messages (called traps) to the SNMP manager to report changes in the status of the managed system. The SNMP manager Stargazer Version 8.0 is available from ADC for use with the SNMP agent. Other SNMP managers are available from various network management software vendors. Refer to the SNMP Agent Software User Manual (see Related Publications section) for additional information.

6 SPECIFICATIONS

Refer to the following tables for the system, host unit, and remote unit specifications. All specifications apply after a five minute warm-up period.

[Table 2-5](#) – SCS 800/900 MHz SMR system nominal specifications

[Table 2-6](#) – SCS 800 MHz system nominal specifications

[Table 2-7](#) – SCS 1900 MHz system nominal specifications

[Table 2-8](#) – Host Unit nominal specifications

[Table 2-9](#) – WDM nominal specifications

[Table 2-10](#) – Remote Unit nominal specifications

Table 2-5. SCS 800/900 MHz SMR System Nominal Specifications

PARAMETER	SPECIFICATION	REMARKS
Optical - Host and Remote Unit Fiber type	9/125, single-mode	
Number of fibers required	1 for single-band remote unit 2 for dual-band RU	All SCS remote units include a WDM.
Forward path wavelength	1550 nm	
Reverse path wavelength	1310 nm	
Optical transmit power output Host Unit Remote Unit	0 dBm +1.3 dBm (includes WDM insertion loss)	
Optical budget	25 dB	For optical BER of 10 ⁻⁶
Optical Receiver Input Maximum	-15 dBm	
Optical connectors	UPC/SC Host unit OptiTap APC/SC Remote unit	
RF Forward Path - 800/900 MHz System bandwidth	18 MHz 5 MHz	800 MHz transmit 900 MHz transmit
Frequency range	851-869 MHz 935-940 MHz	
Gain of forward path (Host input to Remote primary antenna port)	78.1 dB (typical)	At band center, room temperature, and 0 dB attenuation setting. Includes power amplifier.
Gain flatness Band flatness Channel flatness	± 2.0 dB across freq. range ± 1.5 dB variation across any 1.25 MHz channel	
Gain variation	± 3 dB over temp and unit-to-unit	
Propagation delay	< 6 μs (typical)	Excludes fiber delay
Configurable propagation delay Range Step size	0 to 63 μs 0.1μs ± 100 ns	Plus standard propagation delay
Spurious In-band self generated Dynamic range (noise floor)	<-13 dBm at remote output <-60 dBc at 30 KHz bandwidth	
Transmit peak-to-average	≥10 dB	
Two-tone Intermodulation	≤-52 dBc	two tones @ 5 Watts each
Nominal composite RF input signal level	-40 dBm at 0 dB attenuation -9 dBm at max. attenuation	-20 dBm is the optimal RF input signal level.
Configurable input level Range Step size	31 dB 1 ± 0.5 dB ±10% of attenuation monotonic	

Table 2-5. SCS 800/900 MHz SMR System Nominal Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Composite RF Output power of both bands (see Note 1 at end of table)	38.1 dBm (6.5 Watts) at remote antenna port with -40 dBm input	10 Watts at LPA output
Configurable RF Output Range Step size	31 dB at remote unit $1 \pm 0.5 \text{ dB} \pm 10\%$ of attenuation monotonic	
Transmit path insertion loss	1.9 dB typical	
RF Reverse Path - 800/900 MHz System bandwidth	18 MHz 5 MHz	800 MHz receive 900 MHz receive
Frequency range	806–824 MHz 896–901 MHz	
Propagation delay	< 8 μs (typical)	Excludes fiber delay
Configurable propagation delay Range Step size	Up to 63 μs $0.1 \mu\text{s} \pm 100 \text{ ns}$	Plus standard propagation delay
Gain of reverse path Overall gain Gain variation	$30 \pm 2 \text{ dB}$ at band center at room temperature 3 dB over temperature	
Gain flatness Band flatness Channel flatness	$\pm 2.0 \text{ dB}$ across frequency range $\pm 1.5 \text{ dB}$ variation across any 1.25 MHz channel	
Out-of-band rejection	-40 dB at $\geq 12.5 \text{ MHz}$ from center of subband	
Spurious (in-band self generated)	-110 dBm referred to input	
Intermodulation	-62 dBc	two tones @ -50 dBm
System noise figure	9 dB at mid-band	
Configurable RF output Range Step size	31 dB $1 \pm 0.5 \text{ dB} \pm 10\%$ of attenuation monotonic	
Blocking dynamic range	70 dB	
Level limiting ALC threshold	-40 dBm $\pm 3 \text{ dB}$ instantaneous	
Level limiting ALC range	27 dB	

Note: Per Industry Canada Section 5.3 - The rated output power of this equipment is for single carrier operation. For situations where multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

Table 2-6. SCS 800 MHz System Nominal Specifications

PARAMETER	SPECIFICATION	REMARKS
Optical - Host and Remote Unit		
Fiber type	9/125, single-mode	
Number of fibers required	1 for single-band remote unit 2 for dual-band RU	All SCS remote units include a WDM.
Forward path wavelength	1550 nm	
Reverse path wavelength	1310 nm	
Optical transmit power output Host Unit Remote Unit	0 dBm +1.3 dBm (includes WDM insertion loss)	
Optical budget	25 dB	For optical BER of 10 ⁻⁶
Optical Receive Input Maximum	-15 dBm	
Optical connectors	UPC/SC Host unit OptiTap APC/SC Remote unit	
RF Forward Path - 800 MHz		
System bandwidth A band B band	11 and 1.5 MHz 10 and 2.5 MHz	
Frequency range A band B band	869–880 and 890–891.5 MHz 880–890 and 891.5–894 MHz	
Out-of-band emissions Primary	-13 dBm per 1 MHz bandwidth from 10 kHz to 20 GHz	
Gain of forward path (Host input to Remote primary antenna port)	78.5 dB (typical)	At band center, room temperature, and 0 dB attenuation setting. Includes power amplifier.
Gain flatness Band flatness Channel flatness	± 2.0 dB across freq. range ± 1 dB variation across any 1.25 MHz channel	
Gain variation	± 3 dB over temp and unit-to-unit	
Out-of-band rejection	-40 dB at ≥ ±17.5 MHz from center of subband	
Propagation delay	< 6 μs (typical)	Excludes fiber delay
Configurable propagation delay Range Step size	Up to 63 μs 0.1 μs ± 100 ns	Plus standard propagation delay
Spurious In-band self generated Free dynamic range	<-13 dBm at remote output <-60 dBc at 30 kHz bandwidth	
Transmit peak-to-average	≥10 dB	

Table 2-6. SCS 800 MHz System Nominal Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Two-tone Intermodulation	≤ -55 dBc at remote output	Two tones @ 5 Watts each
CDMA Intermodulation 885 kHz to 1.25 MHz 1.25 to 1.98 MHz 1.98 to 2.25 MHz	-45 dBc per 30 kHz -8 dBm per 30 kHz -55 dBc per 30 kHz	Absolute level
Nominal composite RF input signal level	-40 dBm at 0 dB attenuation -9 dBm at max. attenuation	An input signal level of -40 dBm provides maximum output power
Configurable input level Range Step size	31 dB 1 ± 0.5 dB $\pm 10\%$ of attenuation monotonic	
Composite RF Output power (see Note 1 at end of table)	38.5 dBm (7.0 Watts) at remote antenna port with -40 dBm input	10 Watts at LPA output
Configurable RF Output Range Step size	31 dB at remote unit 1 ± 0.5 dB $\pm 10\%$ of attenuation monotonic	
Transmit path insertion loss	2.5 dB maximum	
RF Reverse Path - 800 MHz		
System bandwidth A band B band	11 and 1.5 MHz 10 and 2.5 MHz	
Frequency range A band B band	824-835 and 845-846.5 MHz 835-845 and 846.5-849 MHz	
Propagation delay	6 μ s	Excludes fiber delay
Configurable propagation delay Range Step size	Up to 63 μ s 0.1 μ s ± 1 100 ns	Plus standard propagation delay
Gain flatness Band flatness Channel flatness	1.5 dB across frequency range ± 1 dB variation across any 1.25 MHz channel	
Gain of reverse path Overall gain Gain variation	30 ± 2 dB at band center at room temperature 3 dB over temperature	ALC not invoked ALC not invoked
Out-of-band rejection	-40 dB at $\geq \pm 17.5$ MHz from center of subband	ALC not invoked
Spurious (in-band self generated)	-110 dBm referred to input	ALC not invoked
Intermodulation	-62 dBc two tones at -50 dBm	
System noise figure	8 dB at mid-band	ALC not invoked

Table 2-6. SCS 800 MHz System Nominal Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Configurable RF output Range Step size	31 dB $1 \pm 0.5 \text{ dB} \pm 10\%$ of attenuation monotonic	
Blocking dynamic range	70 dB	
Level limiting ALC threshold	-40 dBm ± 3 dB instantaneous	
Level limiting ALC range	30 dB	
RF Forward and Reverse Path Modulation Accuracy		
Service/Mod Type/Parameter		
TDMA/n/4-DQSK/rms EVM	7%	
GSM/GMSK/rms phase error	4°	
EDGE/8PSK/rms EVM	7%	
EIA-97D/CDMA/rho factor	.97%	

Note: Per Industry Canada Section 5.3 - The rated output power of this equipment is for single carrier operation. For situations where multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

Table 2-7. SCS 1900 MHz System Nominal Specifications

PARAMETER	SPECIFICATION	REMARKS
Optical - Host and Remote Unit		
Fiber type	9/125, single-mode	
Number of fibers required	1 for single-band remote unit 2 for dual-band RU	All SCS remote units include a WDM.
Forward path wavelength	1550 nm	
Reverse path wavelength	1310 nm	
Optical transmit power output Host Unit Remote Unit	0 dBm +1.3 dBm (includes WDM insertion loss)	
Optical budget	25 dB	For optical BER of 10 ⁻⁶
Optical Receive Input	-15 dBm	
Optical connectors Host Unit Remote Unit	UPC/SC Host unit OptiTap APC/SC Remote unit	
RF Forward Path - 1900 MHz		
System Bandwidth	20 MHz AD band, 25 MHz DBE, BEF, and EFC bands.	
Frequency range AD DBE BEF EFC	1930 to 1950 MHz 1945 to 1970 MHz 1950 to 1975 MHz 1965 to 1990 MHz	
Out-of-band emissions (Primary)	-13 dBm per 1 MHz bandwidth from 10 kHz to 20 GHz	
Gain of forward path (Host input to Remote primary antenna port)	77.7 dB (typical)	At band center, room temperature, and 0 dB attenuation setting. Includes power amplifier.
Gain flatness Band flatness Channel flatness	± 1.5 dB across freq. range ± 1 dB variation across any 1.25 MHz channel	
Gain variation	± 3 dB over temp and unit-to-unit	
Out-of-band rejection	-40 dB at ≥ ±17.5 MHz from center of subband	
Propagation delay	< 2.5 μs	Excludes fiber delay
Configurable propagation delay Range Step size	Up to 63 μs 0.1 μs ± 100 ns	Plus standard propagation delay

Table 2-7. SCS 1900 MHz System Nominal Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Spurious In-band self generated Free dynamic range	-13 dBm at remote output 60 dB at 30 kHz bandwidth	
Transmit peak-to-average	10 dB	
Two-tone Intermodulation	-55 dBc at remote output	two tones at 5 Watts each
CDMA Intermodulation 885 kHz to 1.25 MHz 1.25 to 1.98 MHz 1.98 to 2.25 MHz	-45 dBc per 30 kHz -8 dBm per 30 kHz -55 dBc per 30 kHz	Absolute level
Nominal composite RF input signal level	-40 dBm at 0 dB attenuation -9 dBm at max. attenuation	An input signal level of -40 dBm provides maximum output power
Configurable input level Range Step size	31 dB 1 ± 0.5 dB ±10% of attenuation monotonic	
Composite RF Output power (see Note 1 at end of table)	37.7 dBm (5.9 Watts) at remote antenna port with -40 dBm input	
Configurable RF Output Range Step size	31 dB at remote unit 1 ±0.5 dB ±10% of attenuation monotonic	
Transmit path insertion loss	2.4 dB maximum	
RF Reverse Path - 1900 MHz System Bandwidth	20 MHz AD band, 25 MHz DBE, BEF, and EFC bands.	
Frequency range AD DBE BEF EFC	1850 to 1870 MHz 1865 to 1890 MHz 1870 to 1895 MHz 1885 to 1910 MHz	
Propagation delay	2.5 µs Maximum	Excludes fiber delay
Configurable propagation delay Range Step size	0 to 63 µs 0.1µs ±1 100 ns	Plus standard propagation delay
Gain flatness Band flatness Channel flatness	1.5 dB across frequency range ±1 dB variation across any 1.25 MHz channel	
Gain of reverse path Overall gain Gain variation	30 ± 2 dB at band center at room temperature 3 dB over temperature	ALC not invoked ALC not invoked
Out-of-band rejection	-40 dB at ≥ ±17.5 MHz from center of subband	ALC not invoked

Table 2-7. SCS 1900 MHz System Nominal Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Spurious (in-band self generated)	-110 dBm referred to input	ALC not invoked
Intermodulation	-62 dBc	two tones at -50 dBm
System noise figure	8 dB at mid-band	ALC not invoked
Configurable RF output Range Step size	31 dB $1 \pm 0.5 \text{ dB} \pm 10\%$ of attenuation monotonic	
Blocking dynamic range	70 dB	
Level limiting ALC threshold	-40 dBm \pm 3 dB instantaneous	
Level limiting ALC range	30 dB	
RF Forward and Reverse Path Modulation Accuracy		
Service-Mod Type-Parameter		
TDMA- $\pi/4$ -DQSK-rms EVM	7%	
GSM-GMSK-rms phase error	4°	
EDGE-8PSK-rms EVM	7%	
EIA-97D-CDMA-rho factor	0.97%	

Note: Per Industry Canada Section 5.3 - The rated output power of this equipment is for single carrier operation. For situations where multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

Table 2-8. Host Unit Nominal Specifications

PARAMETER	SPECIFICATION	REMARKS
Physical/Environmental/ Electrical - Host Unit		
Dimensions (H×W×D)		
Rear Access	3.5 × 17.1 × 12.2 inches (88 × 433 × 311 mm)	Dimension for width does not include the mounting brackets which can be installed for either 19- or 23-inch racks.
Front Access	3.5 × 17.2 × 15.3 inches (88 × 437 × 389 mm)	
Mounting	19- or 23-inch rack	EIA or WECO
Weight	18 lbs. (8.2 kg)	
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
Optical ports	UPC/SC	
External alarm connector	Screw-type terminals	NO and NC relay contacts
DC power connector	Screw-type terminal strip	
RF coaxial cable connectors	50 ohm N-type (female)	50 ohms input/output impedance
Service connector	DB-9 (female)	RS-232 DTE interface
Auxiliary connector	DB-9 (female)	Not used with SCS systems
CAN connectors	RJ-45 jack	
Voltage input	Nominal ± 24 or ± 48 VDC	± 21 to ± 60 VDC
Power consumption	55 watts	
Current rating	1 Amp at -48 VDC	
Reliability at 25°C	MTBF 80,000 hours	Excluding fans

Table 2-9. Host Unit and Remote Unit WDM Nominal Specifications

PARAMETER	SPECIFICATION	REMARKS
Optical - WDM		
Passband	1310 nm ± 20 nm 1550 nm ± 20 nm	
Forward path insertion loss		
Host WDM	0.7 dB	Does not include connector loss
Remote WDM	0.3 dB	
Reverse path insertion loss		
Host WDM	0.3 dB	Does not include connector loss
Remote WDM	0.7 dB	
Isolation	> 30 dB minimum	
Return loss (Reflectance)	< -50 dB	All input ports

Table 2-10. Remote Unit Nominal Specifications

PARAMETER	SPECIFICATION	REMARKS
Physical/Environmental/ Electrical - Remote Unit Dimensions (L×W×D) Single-Band Dual-Band and Interim Single Band	29.4 × 9.7 × 5.7 inches (747 × 246 × 145 mm) 37.3 × 10.2 × 7.5 inches (947 × 259 × 191 mm)	
Mounting	Pole, wall, or strand mounted	Requires accessory kit for strand mounting
Weight Single-Band Dual-Band and Interim Single Band	51.2 lbs. (23.2 kg) 90.5 lbs. (41.0 kg)	Without solar shields installed
Weather resistance (see Note)	NEMA-6, IEC IP67	Indoor or outdoor installation
Lightning protection	20 kA IEC 1000-4-5 8/20 μ s waveform	Provided by external lightning protector (accessory)
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
AC power connector	Mini 3-pin	3-wire power cable included
Antenna connector(s)	50 ohm N-type (female)	50 ohms input/output impedance
Optical port(s)	APC/SC hardened adapter	
Voltage input	90 to 265 VAC, 47 to 63 Hz 60 to 89 VAC, 47 to 63 Hz	Standard Option
Power consumption Single-Band (all types) Dual-Band	300 VA at 120 VAC 600 VA at 120 VAC	
Current rating Single-Band (all types) Dual-Band	2.5 Amps at 120 VAC 5.0 Amps at 120 VAC	Requires 15 Amp circuit
Reliability at 25°C	MTBF - 50,000 hours	

Note: The SCS remote unit has been tested to assure it meets the dust and water resistance requirements of IP67 as specified by IEC Publication 60529. These tests were conducted using closure caps attached to the remote unit cable ports. To assure the dust and water resistance level is maintained, it is the responsibility of the user to select AC power, antenna, and fiber optic cable assemblies that have a dust and water resistance level of IP67 or higher. If user is uncertain of cable manufacturers that meet this requirement, please contact ADC Technical Assistance.

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SECTION 3: OPERATION

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1 BEFORE STARTING OPERATION

This section provides guidelines for turning-up the Digivance system, 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
- DC voltmeter
- External RF and optical attenuators (if specified in system design plan)
- PC-type computer with Digivance Element Management System (EMS) Version 3.01 software installed
- Straight-through RS-232 DB-9 interface cable (accessory)
- Handset
- Pencil or pen
- Writing pad

1.2 Readiness Check

Before starting the turn-up process, inspect the complete Digivance 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**).
- ▶ **Note:** When connecting the equipment to the supply circuit, be sure to check equipment nameplate ratings to avoid overloading circuits which may cause damage to over-current protection devices and supply wiring.
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 ± 21 to ± 60 VDC (nominal ± 24 or ± 48 VDC). The DC power provided to the HU can be either polarity.
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 all electrical and optical connections have been completed and that all optical fibers, coaxial cables, and wires are properly routed and secured.
2. At the AC breaker box, make sure the circuit breaker for the circuit that supplies AC power to the RU is in the **open** (off) position.

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.

- ▶ **Note:** SCS systems that include a dual-band RU are comprised of two systems that operate and function independently of each other. Each system can be independently turned-up, tested, and placed into service. The EMS will recognize each system regardless of the frequency/band and will display the appropriate screens. The frequency/band can be verified by clicking on the **HOST Host** tab and on the **REMOTE STM** tab. The frequency/ band for the selected system will be displayed on the right side of the screen.

Each Digivance system must be turned-up separately before being networked together with multiple systems through the CAN interface. Use the following procedure to turn-up each Digivance system:

1. Temporarily disconnect the external alarm system or notify the alarm system provider that testing is in progress.
 2. If the HU is networked together with multiple HU's, temporarily disconnect the CAN cables from the NET IN and NET OUT ports of the 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 EMS if multiple HU's with the same site number and site name are networked together through the CAN interface. It is therefore necessary to temporarily disconnect the CAN interface cables from the HU when it is being configured for operation until a unique site number and name can be assigned.
3. Determine if the forward path composite input signal level at the host unit RF IN port(s) is appropriate to produce the required RF output signal level. Note that 800/900 MHz SMR host units have two forward path RF ports. Adjust by installing an **external attenuator** if necessary. For 800/900 MHz SMR systems., the optimum input signal level is **-20 dBm**. Refer to [Section 2.1](#) for the calculation and adjustment procedure.
 4. At the HU: Place the ON/OFF switch on the HU in the **ON** position (press **I**).
 5. At the RU: Place the AC circuit breaker switch in the closed (ON) position.
 6. Wait 6 to 10 seconds for the HU and the RU to initialize and then observe the LED indicators on the HU and RU. Refer to Section 4: Maintenance for the troubleshooting procedures if the indicators do not respond as specified in [Table 3-1](#).

Table 3-1. LED Indicator Operation at Initial Turn-Up

REAR ACCESS HOST UNIT	FRONT ACCESS HOST UNIT	REMOTE UNIT
POWER – Green	POWER – Green	STATUS – Off
STANDBY – Off	STANDBY – Off	Note: This LED will turn red for 6 to 10 seconds while the RU initializes and then turn off.
HOST UNIT – Green	HOST UNIT – Green	
REMOTE UNIT – Green	REMOTE UNIT – Green	
DRIVE 851–869 – Green, Yellow, or Red DRIVE 935–940 – Green, Yellow, or Red	DRIVE – Green, Yellow, or Red	
FWD/REV (PORT 1/PORT 2) – Green	FWD/REV (PORT 1/PORT 2) – Green	

7. Measure the input optical power level at the HU and RU and verify that the optical power level received at the HU and RU is within **-15 to -25 dBm**. Refer to Section 4: Maintenance for the optical power test procedure.
8. Connect the EMS computer (if not already connected) to the SERVICE connector on the HU front panel. If necessary, a separate laptop computer loaded with the EMS software can be temporarily connected and used to initially configure the system.

- Start up the EMS software program. The EMS main window will open as shown in [Figure 3-1](#). The EMS software should be installed on a PC-type computer and the PC's COMM port should be configured to interface with the HU. For information about installing the EMS software and configuring the PC's COMM port, refer to the Digivance Element Management System User Manual (see Related Publications section).

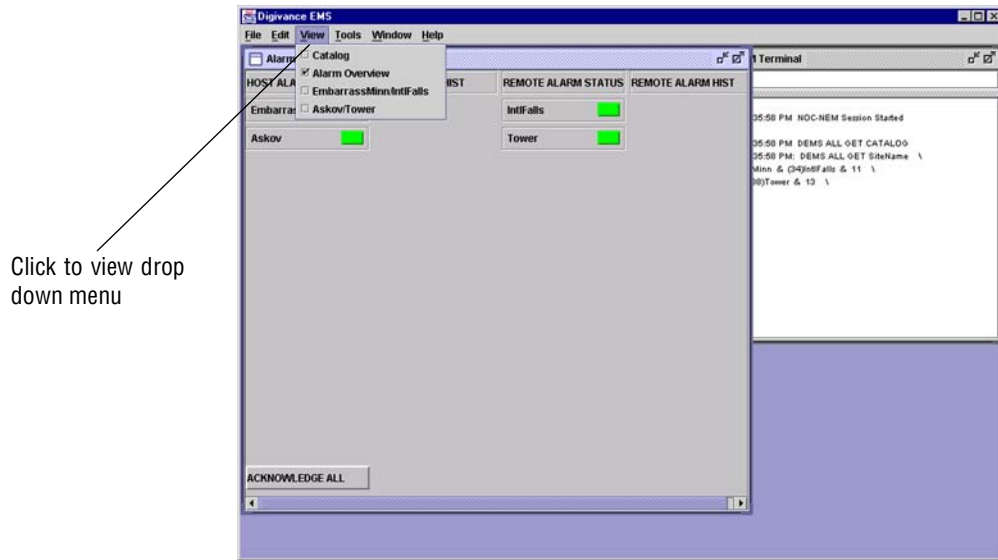


Figure 3-1. Digivance Element Management System Main Window

- Open the **View** drop down menu and connect to the Host and Remote pair by selecting the "NotNamed/NotNamed" Host/Remote pair. The **HOST Alarms** display and the **REMOTE Alarms** display will open within the main window as shown in [Figure 3-2](#).

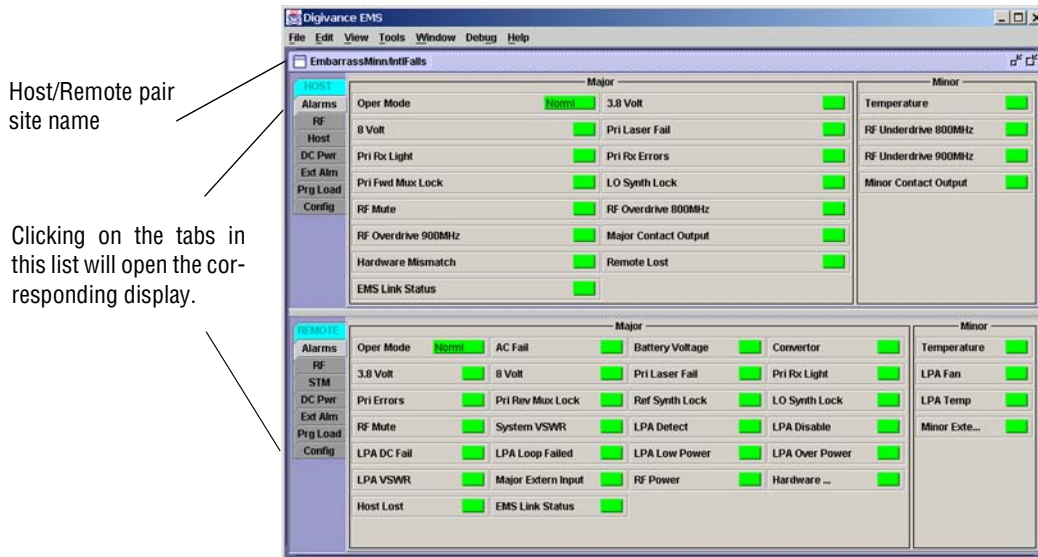


Figure 3-2. Typical Host and Remote Alarms Display

11. New Control program software and FPGA program software will be provided separately on a “as needed” basis. If new Control and FPGA software is not provided with the system, proceed to step 12. If a Control and FPGA software upgrade is required, contact the ADC Technical Assistance Center (see Section 5) for help with the download procedure.
12. Click on the **HOST Config** tab and on the **REMOTE Config** tab (see [Figure 3-2](#)). The **HOST Config** display and the **REMOTE Config** display will open within the main window.
13. Enter the **Site Name** and **Site Number** for both the HOST and the REMOTE unit. Refer to [Section 2.2](#) for details.
 - ▶ **Note:** The Site Name and Site Number must be unique for each Digivance system.
14. If the Digivance system will be networked together with other Digivance systems, reconnect the CAN cables to the HU’s NET IN and NET OUT ports.
15. Verify that no Major or Minor alarms are being reported in either the HOST or REMOTE **Alarm** displays (except as indicated in the note below) and that all alarm fields are green.
 - ▶ **Note:** The Host RF Underdrive may indicate a minor alarm until the Host Fwd Att and Remote Fwd Att values are set.
16. Click on the **HOST RF** tab (see [Figure 3-2](#)). The **HOST RF** display will open within the main window.
17. Enter the **Host Fwd Att** (Forward Attenuation) value. This sets the forward input RF signal level at the HU. Refer to [Section 2.3](#) for details. By default, this value is set to 31 dB. If the DRIVE LED on the HU front panel was red, it should turn green when this step is completed. Note that 800/900 MHz SMR HU’s have two DRIVE LED’s.
18. Determine if the RF output power at the RU ANTENNA is at the correct level up to a composite maximum of +38.1 dBm (6.5 Watts) for 800/900 MHz SMR systems, +38.5 dBm (7.0 Watts) for 800 MHz systems, and +37.7 dBm (5.9 Watts) for 1900 MHz systems. Refer to [Section 2.4](#) for details.
19. Click on the **REMOTE RF** tab (see [Figure 3-2](#)). The **REMOTE RF** display will open within the main window.
20. Enter the **Remote Fwd Att** value. This adjusts the RF output signal level at the HU ANTENNA port. By default this value is set to 31 dB. Refer to [Section 2.5](#) for details.
21. Click on the **HOST RF** tab (see [Figure 3-2](#)). The **HOST RF** display will open within the main window.
22. Enter the **Host Rev Att** (Reverse Attenuation) values. This sets the reverse output RF signal levels at the host unit RF OUT port(s). By default each value is set to 31 dB. Refer to [Section 2.6](#) for details. Note that 800/900 MHz SMR host units have two REVERSE RF OUT ports.
23. If a delay adjustment is required, enter the **Host Fwd Delay** and **Host Rev Delay** values. By default, the delay values are set to 0. Refer to [Section 2.7](#) for details.

24. 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.
 - ▶ **Note:** When two or more HU's are connected together through the CAN interface, only one EMS computer is required to manage the networked Digivance systems. The EMS computer may be connected to the SERVICE port 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.

2.1 Reference Procedure: Determine Forward Path Input Signal Level

The level of the composite RF input signals received at the host unit FORWARD RF IN port(s) will vary depending on the EBTS, the cable loss, the number of channels present, and the required forward path composite power. If maximum composite RF output is required at the RU, the level of the composite RF input signal received at the HU must fall within a range of **-9 to -40 dBm**. If the signal level is not within this range, it must be adjusted using an external attenuator. Note that the 800/900 MHz SMR host unit has two FORWARD RF IN ports. Use the 851-869 FORWARD RF IN port to complete this procedure. Then repeat this procedure for the 935-940 FORWARD RF IN port.

- ▶ **Note:** The optimum level for an 800/900 MHz SMR composite input signal is **-20 dBm**

If using the Conditioning Panel or Duplexing Panel, refer to the user manual shipped with the panel (ADCP-75-147) for the procedures for measuring and adjusting the RF input signal level at the HU. If connecting a single HU to a single EBTS, 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 EBTS. The required signal levels and test points for **800/900 MHz SMR** systems are shown in [Figure 3-3](#). The required signal levels and test points for **800 MHz** and **1900 MHz** systems are shown in [Figure 3-4](#). Note that 800/900 MHz SMR Host Units have two forward path ports.

- ▶ **Note:** Check the input rating of the test equipment and the output rating of the EBTS. To avoid burning out the spectrum analyzer or power meter, it may be necessary to insert a 30 dB 100W (or similar) attenuator between the EBTS and test equipment.

2. If using a spectrum analyzer, proceed to step 3. If using a power meter, measure the composite signal power from the EBTS and then proceed to step 5.
3. Measure the RF level of a single carrier, such as the control channel, in dBm. Make sure the resolution bandwidth of the spectrum analyzer is 30 kHz. Maximum power in any channel should not exceed 5W (+37 dB).
4. Calculate the total composite signal power from the EBTS using the following formula:

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

P_{tot} is the total composite power in dBm

P_c is the power per carrier in dBm as measured in step 3, and

N is the total number of channels.

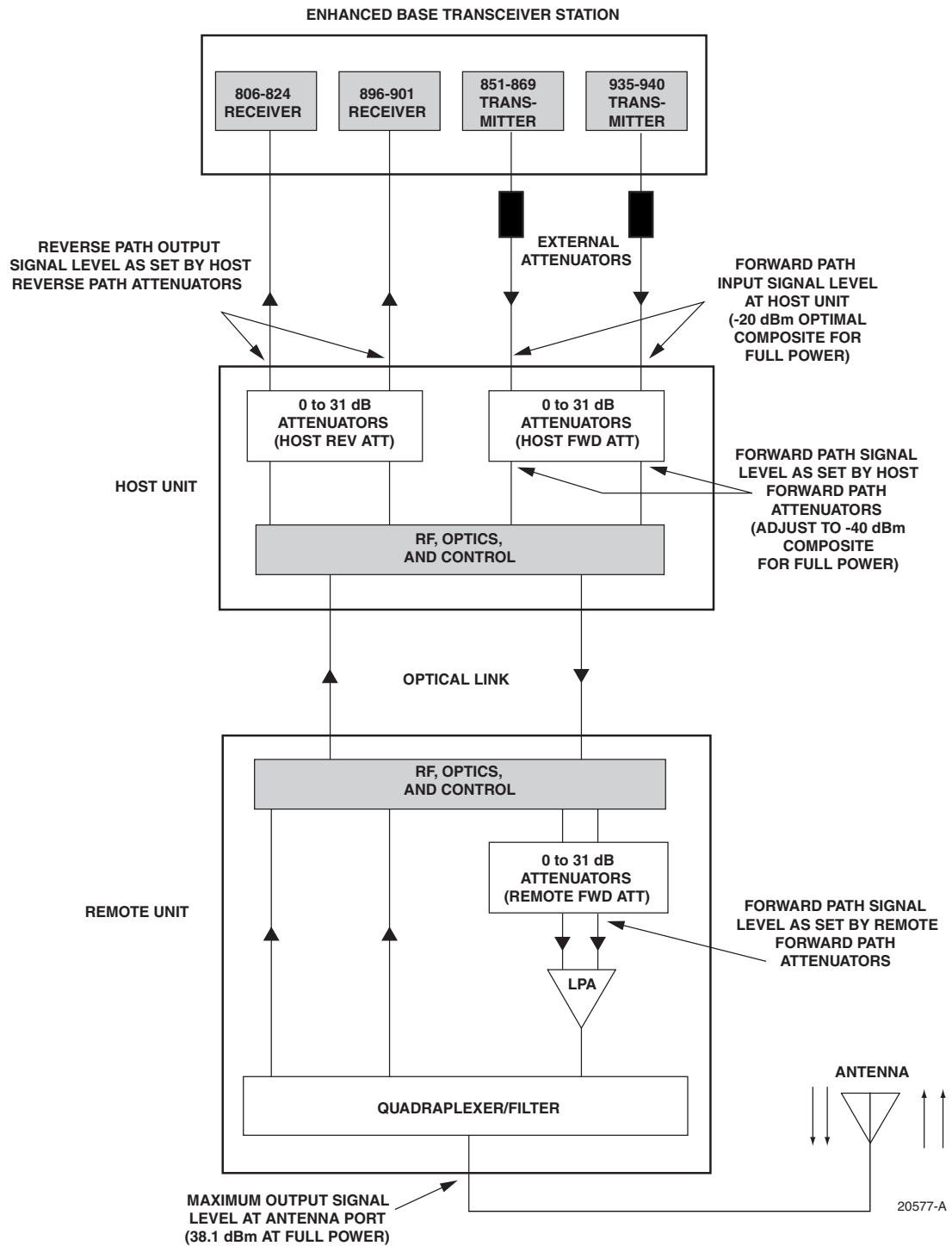


Figure 3-3. Signal Levels, Test Points, and Adjustments for 800/900 MHz SMR Systems

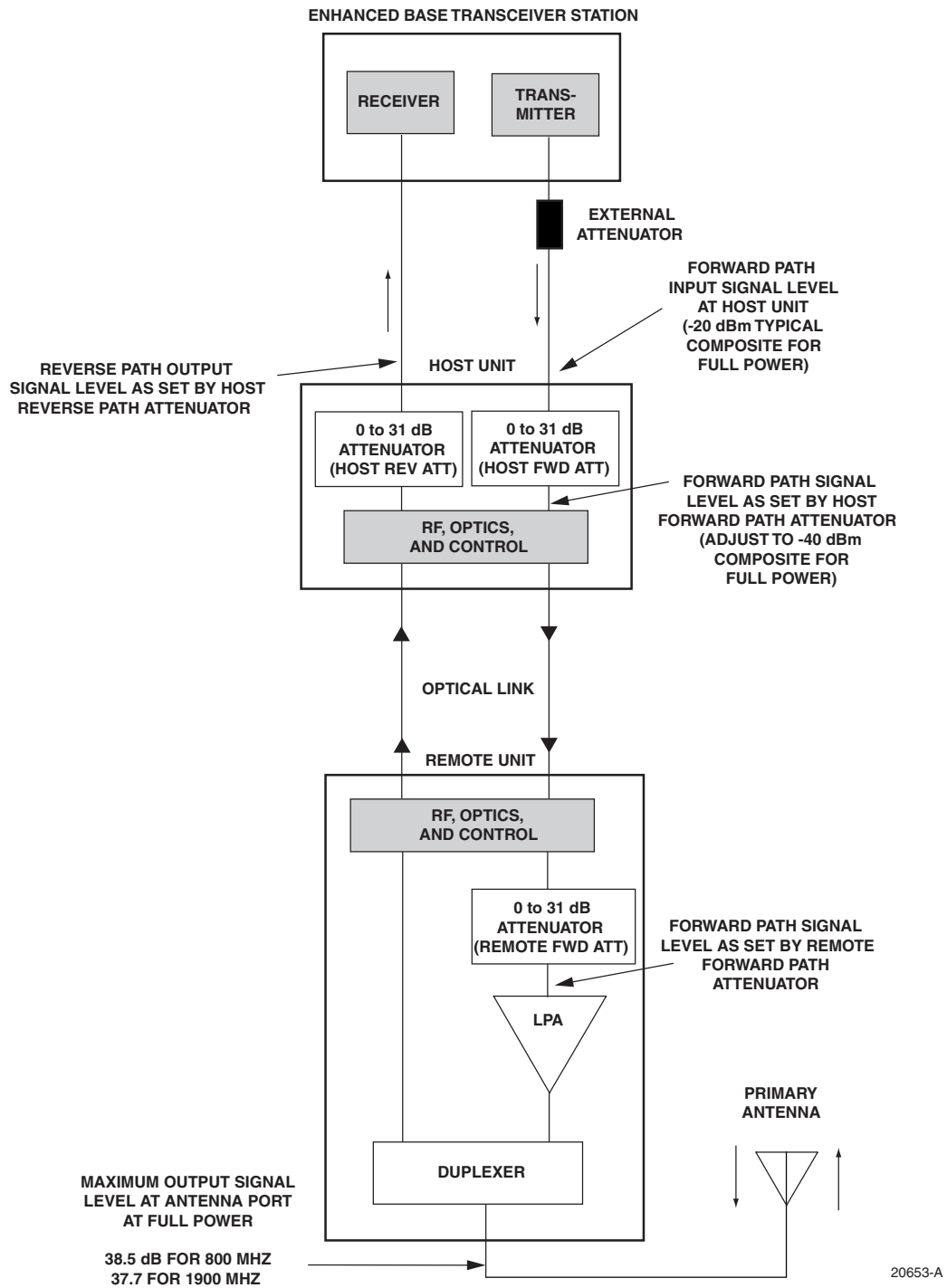


Figure 3-4. Signal Levels, Test Points, and Adjustments for 800 MHz and 1900 MHz Systems

5. Determine the total cable loss that is imposed by the forward path coaxial cable that links the EBTS 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 -20 (optimum 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 optimum level for input to the HU. The following formula outlines the required calculations for steps 6 and 7:

$$P_{\text{tot}} - (\text{Cable and insertion loss}) - (-20) = \text{Value of external attenuator required}$$

► **Note:** If the input signal level is already -20 dBm, no external attenuator is required.

8. Select an attenuator that is as close to the value calculated in step 7 as possible.
9. Install the external attenuator in the coaxial cable that is connected to the corresponding FORWARD RF IN port at the HU.



Caution: *The Host Unit can be damaged if it is overdriven by the EBTS. Always install an external protective attenuator at the Host Unit FWD RF IN port if the forward path composite input signal level is greater than -9 dBm.*

10. If turning up an 800/900 MHz SMR system, repeat steps 1–9 for the 935–940 FORWARD RF IN port at the HU. Install the external attenuator in the coaxial cable that is connected to the 935–940 FORWARD RF IN port at the HU.
11. Subtract the value of the external attenuator 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 path attenuators.

2.2 Reference Procedure: Enter Site Name and Site Number

All HU's and RU's are programmed with the same site name and site number. 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 network. Use the following procedure to assign a unique site name and number 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 3-5](#).
2. Click on the **HOST Site Name Edit** button (see [Figure 3-5](#)). The **Site Name** pop-up screen will open as shown in [Figure 3-6](#). 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.

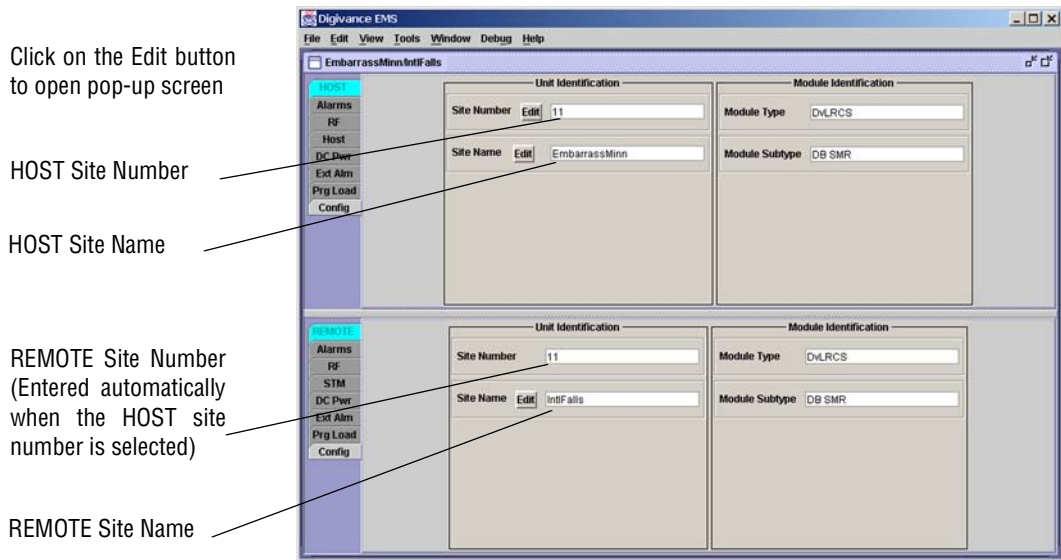


Figure 3-5. HOST and REMOTE Config Displays

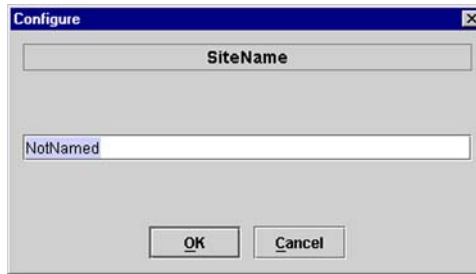


Figure 3-6. HOST Site Name Pop-Up Screen

3. Click on the HOST **Site Number Edit** button (see [Figure 3-5](#)). The **Site Number** pop-up screen will open. Enter any number (must be unique) between 1 and 24 and then click on **OK** to close the screen and make the changes take effect.
4. Check the REMOTE **Site Number** field (see [Figure 3-5](#)). The REMOTE Site Number does not have to be entered. When the HOST Site Number is entered, the system will automatically enter the same number for the REMOTE Site Number.
5. Click on the REMOTE **Site Name Edit** button (see [Figure 3-5](#)). 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.
6. Open the Tools menu at the top of the main window and then select Refresh Catalog to make the new Host and Remote site names appear in the View menu.

2.3 Reference Procedure: Enter Host Forward Attenuation

The HU internal forward path attenuator setting determines the maximum composite output signal level at the RU antenna port. The appropriate attenuation value for any particular system is based on the number of channels the system is transporting and the signal level of the composite forward path signals input at the host units RF IN ports. By default, the forward path attenuator is set to 31 dB.

The maximum output power is 38.1 dBm (6.5 Watts) for 800/900 MHz SMR systems, 38.5 dBm (7.0 Watts) for 800 MHz systems, and 37.7 dBm (5.9 Watts) for 1900 MHz systems. The total forward path gain that is provided by the system (with host and remote forward attenuators set to 0 dB) is 78.1 dBm for 800/900 MHz SMR systems, 78.5 dBm for 800 MHz systems, and 77.7 for 1900 MHz systems. For 800/900 MHz SMR systems, this procedure sets the attenuation for both FORWARD RF IN ports.

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 3-7](#).

Click on Edit button to open Host Fwd Att pop-up screen

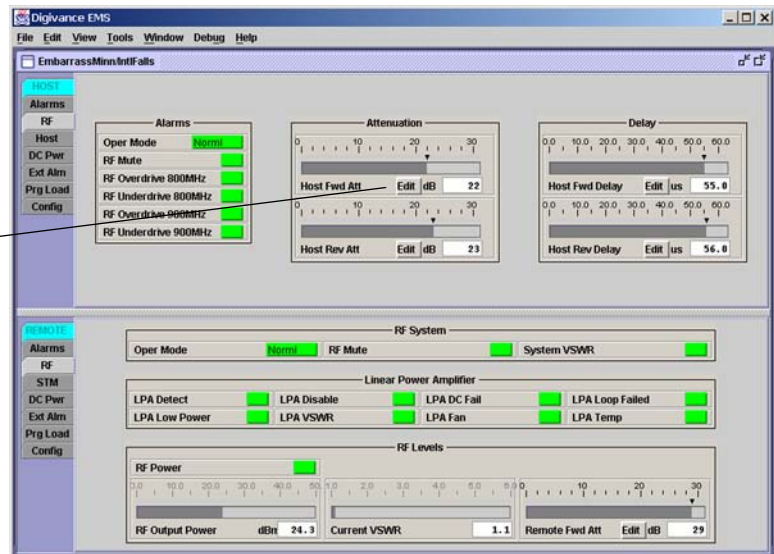


Figure 3-7. Typical HOST RF Display

2. Click on the **Host Fwd Att Edit** button (see [Figure 3-7](#)). The **Host Fwd Att** pop-up screen will open as shown in [Figure 3-8](#).
3. Obtain the value of the total composite input signal level as determined in step 11 of [Section 2.1](#).

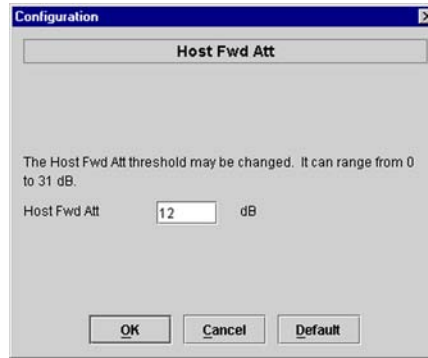


Figure 3-8. Host Fwd Att Pop-Up Screen

4. Determine the appropriate value to enter for the Host forward path attenuator by subtracting the required system output level (per system design plan) from the system gain (78.1 dB for 800/900 MHz SMR, 78.5 for 800 MHz, and 77.7 dB for 1900 MHz) and then adding the composite input signal level. The result (see sample calculation) is the amount of attenuation required.

$$\text{Atten} = (\text{System Gain}) - (\text{Required System Output Power}) + (\text{Composite Input Power})$$

5. Enter the attenuation value and click OK to close the pop-up screen and to make the changes take effect.

2.4 Reference Procedure: Determine Output Signal Level at RU Antenna Port

The RF output signal level should be measured at the RU ANTENNA port to verify that the composite signal level is at the expected level. Use the following procedure to determine the power level:

- **Note:** The RF output signal level measured in this procedure should be approximately 31 dBm less than the output level specified for operation. This is because the factory default setting for the **remote** forward attenuator is 31 dB. The final adjustment of the system RF output signal level will be completed in [Section 2.5](#)

1. Place the AC circuit breaker switch (at the RU power panel) in the open (OFF) position.
2. Disconnect the antenna cable from the RU ANTENNA port.
3. Connect a spectrum analyzer or RF power meter to the HU ANTENNA port. (Check the input rating of the test equipment. Insert a 30 dB 100 W attenuator if necessary.)
4. Place the AC circuit breaker switch (at the RU power panel) in the closed (ON) position.
5. If using a spectrum analyzer, proceed to step 6. If using a power meter, measure the composite signal power from the RU and then proceed to step 8.
6. Measure the RF level of a single carrier, such as the control channel, in dBm. Make sure the resolution bandwidth of the spectrum analyzer is 30 kHz.

7. Calculate the total composite signal power 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 6, and

N is the total number of channels.

8. Record the result measured in step 5 or calculated in step 7.
9. Place the AC circuit breaker switch (at the RU power panel) in the open (OFF) position.
10. Disconnect the spectrum analyzer or RF power meter from the HU ANTENNA port.
11. Re-connect the antenna cable to the HU 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.
12. Place the AC circuit breaker switch (at the RU power panel) in the closed (ON) position.

2.5 Reference Procedure: Enter Remote Forward Attenuation

The RU internal forward path attenuator setting is used to reduce the power level of the composite output signals at the RU. The maximum composite output signal level at the RU antenna port is set using both the HU forward attenuator (see [Section 2.3](#)) and the RU forward attenuator. Component variations may result in the output power at the HU antenna port being slightly above or below the calculated value. The RU forward attenuator is used in conjunction with the HU forward attenuator to add or remove attenuation to produce the required output signal level at the antenna port. The default setting for the RU forward attenuator is 31 dB. Use the following procedure to change the RU forward attenuation:



Caution: *The RU may be destroyed if the maximum recommended output signal level at the RU antenna port is exceeded. Make sure that sufficient attenuation is inserted in the forward path to prevent the RU from being overdriven.*

1. Click on the REMOTE **RF** tab. The REMOTE **RF** display will open within the EMS main window as shown in [Figure 3-9](#).
2. Check the level of the RF output signal (as determined in [Section 2.4](#)) against the system design plan specifications. The maximum output signal level permitted is 38.1 dBm (6.5 Watts) for 800/900 MHz SMR systems, 38.5 dBm (7.0 Watts) for 800 MHz systems, and 37.7 dBm (5.9 Watts) for 1900 MHz systems.
3. Determine if more or less attenuation is required to produce the required output signal level.
4. Click on the **Remote Fwd Att** field **Edit** button (see [Figure 3-9](#)). The **Remote Fwd Att** pop-up screen will open as shown in [Figure 3-10](#).

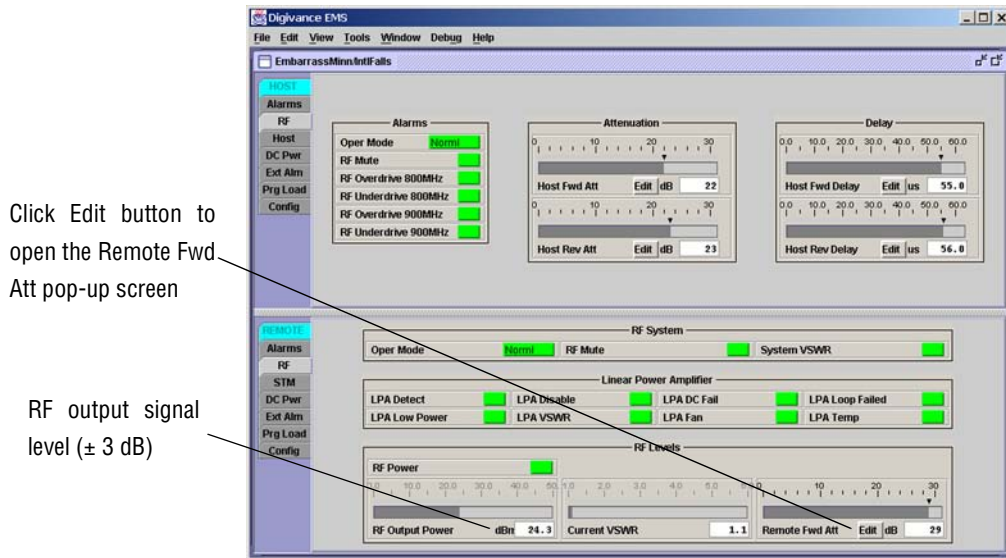


Figure 3-9. Typical REMOTE LPA Display

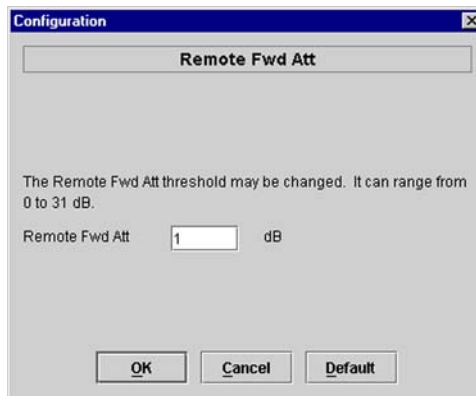


Figure 3-10. Remote Fwd Att Pop-Up Screen

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 Output Power** field (see Figure 3-9). This is primarily a reference value and should not take the place of external test equipment when determining the power level of the composite RF output signal. Depending on the modulation type and number of channels, the EMS software may report a power level that is higher or lower (± 3 dB) than the actual RF output signal.

► **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.

2.6 Reference Procedure: Enter Host Reverse Attenuation

The level of the RF signal that should be input to the EBTS will vary depending on the type of EBTS, the receive distribution, and the number of channels present. To interface with the EBTS, the reverse path signal level must be adjusted to provide the signal level required at the EBTS input port(s). The HU provides from -1 to $+30$ dB of gain in the reverse path. By default, the host reverse attenuator is set to -31 dB of attenuation which provides -1 dB of gain. Use the following procedure to set the reverse path gain:

1. Check the EBTS manufacturer's specifications to determine the composite signal level required at the reverse path input port(s). Note that 800/900 MHz SMR host units have two reverse path input ports.
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 EBTS.
3. Determine the amount of gain required to raise the reverse path signal to the level required at the EBTS.
4. Click on the HOST **RF** tab. The HOST **RF** display will open within the EMS main window as shown in [Figure 3-11](#).

Click Edit button to open the Host Rev Att pop-up screen



Figure 3-11. Typical HOST RF Display

5. Click on the **Host Rev Att** field **Edit** button (see [Figure 3-11](#)). The **Host Rev Att** pop-up screen will open as shown in [Figure 3-12](#).

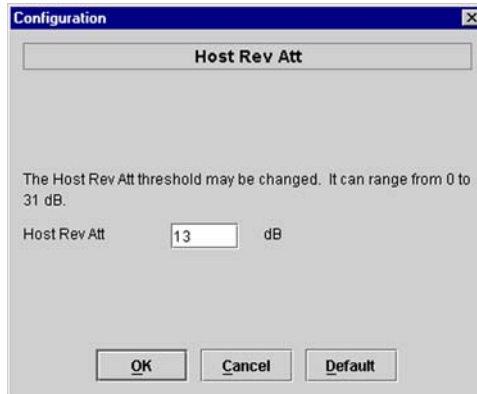


Figure 3-12. Host Rev Att Pop-Up Screen

6. Enter the attenuation value that will provide the required gain. Refer to [Table 3-2](#) for the attenuation values and the corresponding gain (nominal) values.
7. Click **OK** to close the pop-up screen and to make the changes take effect.

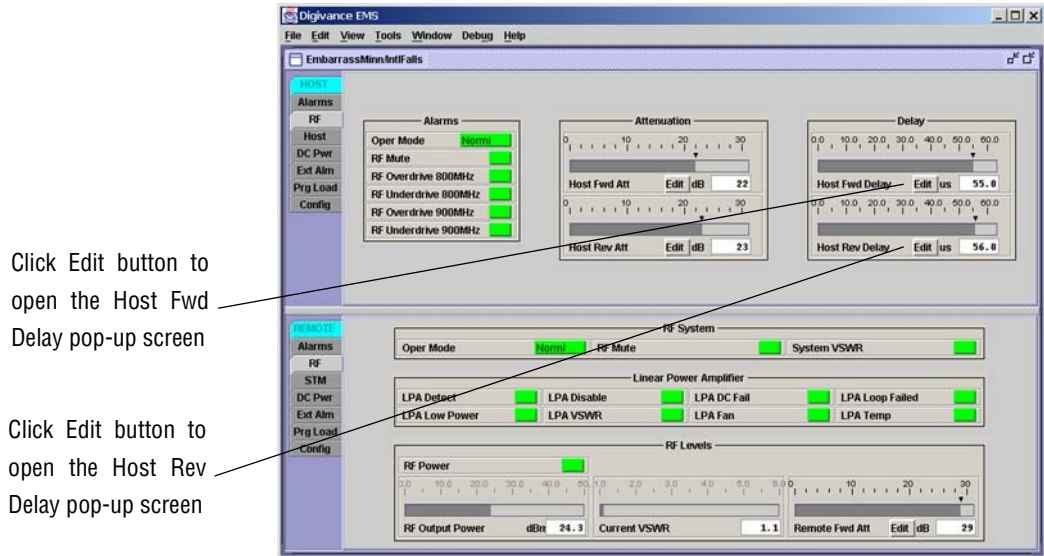
Table 3-2. Reverse Path Attenuation Setting and Nominal Gain Provided

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	31 dB	-1 dB
10 dB	20 dB	21	9 dB		

2.7 Reference Procedure: 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 3-13](#).



Click Edit button to open the Host Fwd Delay pop-up screen

Click Edit button to open the Host Rev Delay pop-up screen

Figure 3-13. Typical HOST RF Display

2. Click on the **Host Fwd Delay** field **Edit** button (see [Figure 3-13](#)). The **Host Fwd Delay** pop-up screen will open as shown in [Figure 3-14](#).



Figure 3-14. Host Fwd Delay Pop-Up Screen

3. Obtain the value of the forward delay as specified in the system design plan. The delay is adjustable in 0.1 μ sec steps.
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 by right-clicking on the appropriate delay section (see [Figure 3-13](#)) 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.

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SECTION 4: MAINTENANCE

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1 SYSTEM MAINTENANCE OVERVIEW

This section explains the Digivance system fault detection and alarm reporting system, provides a method for isolating and troubleshooting faults, and provides test procedures. The Digivance system requires minimal regular maintenance to insure continuous and satisfactory operation. The only components that require regular replacement are the HU cooling fans.

Maintenance also includes diagnosing and correcting service problems as they occur. When an alarm is reported, it will be necessary to follow a systematic troubleshooting procedure to locate the problem. Once the source of the problem is isolated, the appropriate corrective action can be taken to restore service. The only internal components that can be replaced are the cooling fans that mount in the HU. The failure of any other internal component will require replacement of the entire unit.

1.1 Tools and Materials

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

- IR filtering safety glasses
- Patch cords with SC connectors
- 15 dB in-line SC optical attenuators
- Optical power meter (1550 and 1310 nm)

2 FAULT DETECTION AND ALARM REPORTING

The Digivance LRCS on-board embedded software detects various unit and system faults which generate either a Major or Minor alarm. A Major alarm indicates that the system has failed in a way that directly affects RF transport performance. When a major alarm occurs, all RF functions are disabled and the system is out of service. A Minor alarm means that system performance is not affected or in some cases, that the performance may no longer be optimal. When a minor alarm occurs, RF functions continue and the system remains in service.

The following means are used to report Major and Minor alarms:

- HU alarm contacts
- HU and RU LED's
- EMS software Graphical User Interface (GUI)
- Network Operations Center - Network Element Manager (NOC/NEM) interface
- SNMP interface

The HU is equipped with a set of both normally open (NO) and normally closed (NC) alarm contacts which may be used to report both Major and Minor alarms to an external alarm system. The alarm contacts summarize the inputs so that any Major or Minor alarm will trigger an alarm report to the external alarm system.

The HU is equipped with multiple front panel LED indicators that show status and alarm information by displaying various colors: Green, Red, Yellow, and Off. The RU is equipped with a single LED indicator that shows status and alarm information by displaying either Red or Off. A detailed description of the Host Unit and Remote Unit LED indicators is provided respectively in [Table 4-1](#) and [Table 4-2](#).

The EMS software GUI provides both a summary and a detailed list of alarm information that includes unit and module level faults, circuit faults, and measured value faults such as voltages, RF power, and temperature. A summary showing a list of all systems and their current alarm status is presented through the Alarm OverView display. A more detailed list of alarm information is presented through the HOST alarm display and the REMOTE alarm display. The various fault conditions that trigger a major or minor alarm report are shown in the HOST and REMOTE alarm displays.

The NOC/NEM interface provides the same summary and detailed listing of alarm information as the EMS software GUI but in an ASCII text string format. Sending the command GET ALARMSUMMARY produces a list of all systems and their current alarm status. Sending the command GET ALARM ALL for a specific system will produce a detailed list of alarm information for the specified system.

The SNMP interface provides alarm information to up to ten SNMP managers which must be registered with the SNMP agent. The SNMP interface allows the SNMP managers to receive the alarm and status information generated by the host and remote units. The presentation of the alarm information is dependent on the features of the SNMP manager.

Table 4-1. Host Unit LED Indicators

INDICATOR	COLOR	DESCRIPTION
POWER	Green Off	Indicates if the HU is powered or un-powered. The DC power source is on. The DC power source is off.
STANDBY	Green (blinking) Yellow (blinking) Red (blinking) Off	Indicates if the system is in the standby, normal, test, or program load mode. The HU is in the standby mode. The HU is in the program load mode. The HU is in the test mode. The HU is in the normal mode.
HOST UNIT	Green Yellow Red	Indicates if the HU is normal, over temperature, if an internal fault is detected, or if there is an equipment mismatch. The HU is normal. The HU is over temperature or detects an internal fault. The HU detects an internal fault or HU/RU band mismatch.
REMOTE UNIT	Green Yellow Red	Indicates if an alarm is detected at the RU. No alarms detected at the RU. A minor alarm is detected at the RU. A major alarm is detected at the RU.
DRIVE 851–869 DRIVE 935–940 (Rear Access HU) DRIVE (Front Access HU)	Green Yellow Red	Indicates if the specified forward path RF signal level is normal, above overdrive threshold, or below underdrive threshold. The RF signal level is normal The RF signal level is below the underdrive threshold. The RF signal level is above the overdrive threshold.
FWD/REV (PORT 1/PORT 2)	Green Red	Indicates if the reverse path optical signals from the RU are normal, if optical signal errors are detected, or if the optical signal is not detected. The reverse path optical signals are normal. Excessive errors (see Note) are detected in the reverse path optical signals or the HU is not receiving a reverse path optical signal.

Note: Excessive errors means the Bit Error Rate (BER) has exceeded 10^{-6} (1 bit error per million bits).

Table 4-2. Remote Unit LED Indicator

INDICATOR	COLOR	DESCRIPTION
STATUS	Off Red	Indicates if the RU is unpowered, normal, if optical signal errors are detected, if the optical signal is not detected, or if an internal fault is detected. The RU is unpowered or the RU is normal and no faults are detected. The RU detects an internal fault, excessive errors (see Note) are detected in the forward path optical signals, or the RU is not receiving a forward path optical signal.

Note: Excessive errors means the Bit Error Rate (BER) has exceeded 10^{-6} (1 bit error per million bits).

3 FAULT ISOLATION AND TROUBLESHOOTING

Alarm information may be accessed using the HU and RU LED indicators, the EMS software GUI, the NOC-NEM interface, or the SNMP manager. When an alarm occurs, use the unit LED indicator(s) and any one of the specified software tools to determine which Digivance system is affected, which unit (HU or RU) reported the alarm, and the fault that generated the alarm. Then refer to either [Section 3.1](#) Host Unit Troubleshooting or [Section 3.2](#) RU Troubleshooting to isolate the problem and to determine the corrective action required.

When attempting to isolate a problem, always determine the initial fault that generated the alarm report. Some faults may cause additional faults to be reported which tends to obscure the initial reason for the alarm. To help isolate faults, the EMS GUI provides an AlarmOverview screen, shown in [Figure 4-1](#), that indicates which Digivance system/unit is reporting the alarm.

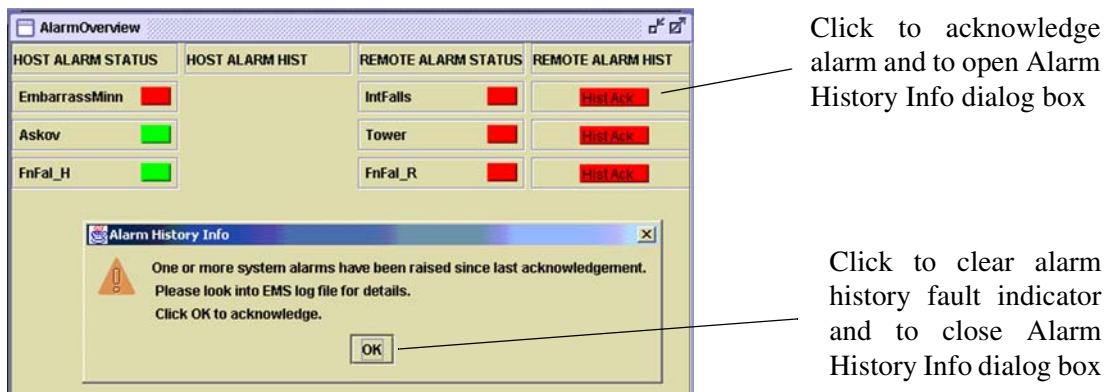


Figure 4-1. AlarmOverView Screen

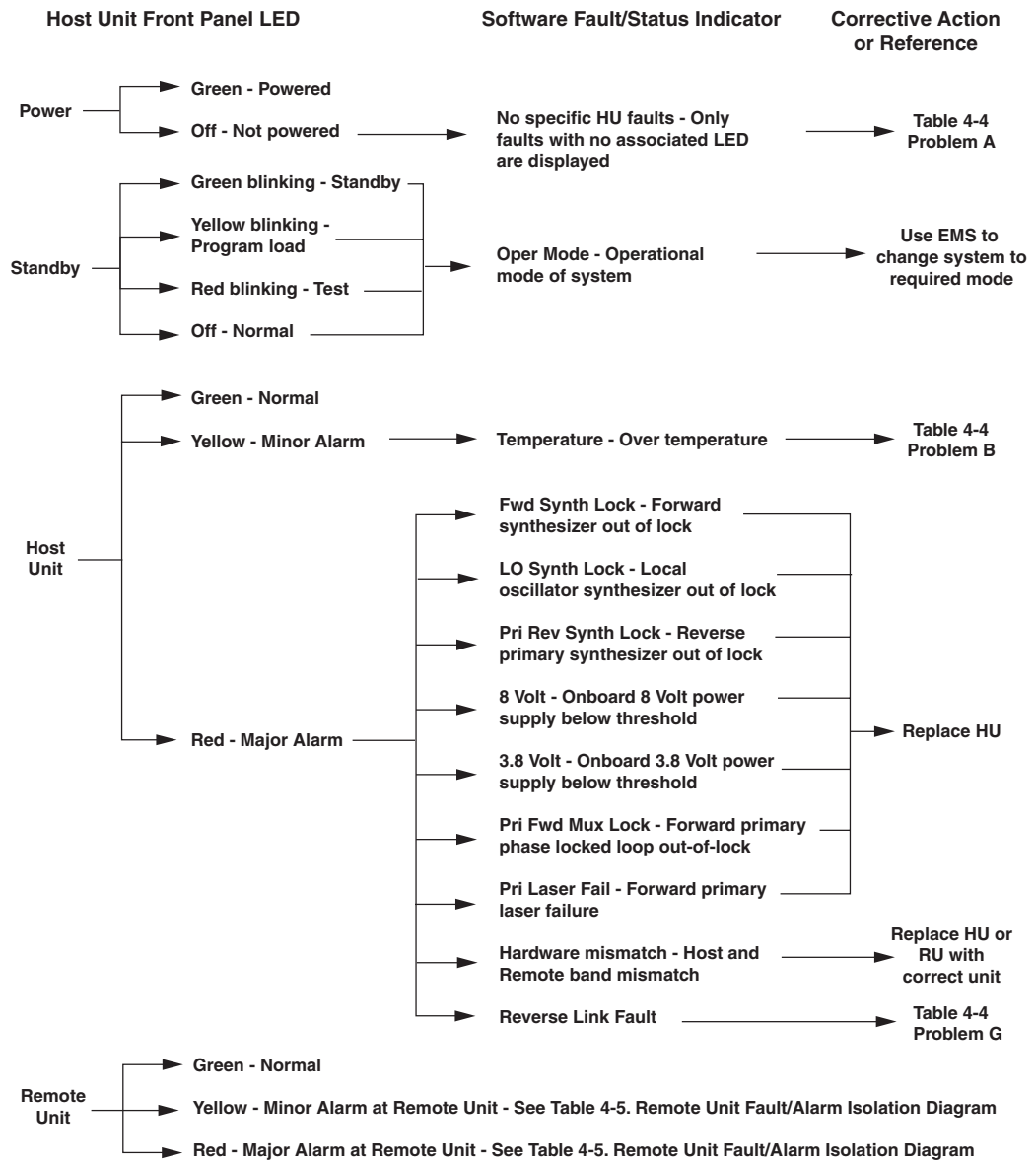
The AlarmOverview screen includes an ALARM HIST indicator which the user should click to acknowledge that an alarm exists. Acknowledging the alarm opens the Alarm History Info dialog box (also shown in [Figure 4-1](#)) which directs the user to view the EMS Log file for details. The EMS Log file lists the various faults in the order in which they occurred. Clear each fault starting with the initial fault. In most instances, clearing the initial fault will also clear any remaining faults. For additional information on using the AlarmOverview screen, refer to the Digivance Element Management System User Manual (see Related Publications section).

- ▶ **Note:** It is recommended that if there are alarms at both the HU and RU, the optical faults should be checked and cleared first. Because the HU and RU function as a system, a fault in the fiber optic link will cause alarms to be reported by both the HU and RU.

3.1 Host Unit Troubleshooting

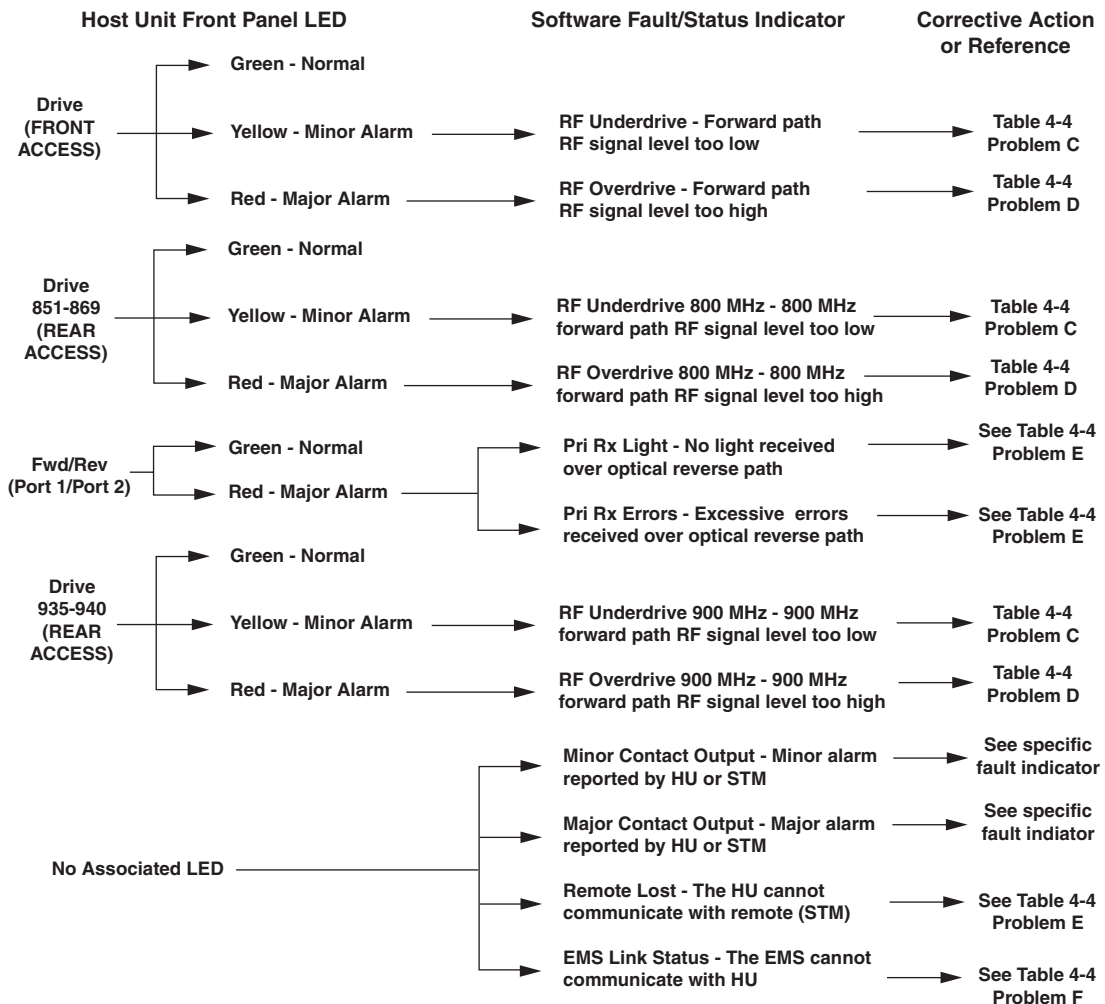
Use this section to troubleshoot alarms that originate with the Host Unit. When a **Minor** alarm occurs, one (or more) of the Host Unit LED's will turn **yellow** and the EMS software will indicate a minor fault/alarm. When a **Major** alarm occurs, one (or more) of the Host Unit LED's will turn red and the EMS software will report a major fault/alarm. Locate the LED and the corresponding software fault/status indicator in [Table 4-3](#) and then take the corrective action indicated.

Table 4-3. Host Unit Fault/Alarm Isolation Diagram



Continued
20013-B

Table 4-3. Host Unit Fault/Alarm Isolation Diagram, continued



20583-A

Table 4-4. Host Unit Fault/Alarm Corrective Action

PROBLEM A: The HU is not powered.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. The HU is turned off. 2. The fuse is open/removed from the fuse panel or the DC power has failed.	1. Place On/Off switch in the On position. 2. Check DC power source, repair as needed, and replace or reinstall fuse at fuse panel.
PROBLEM B: The HU is overheating.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Air intake or exhaust opening to HU chassis is blocked 2. Ambient temperature > 50° C/122° F. 3. Faulty fan. 4. The HU has failed.	1. Remove cause of air-flow blockage. 2. Reduce ambient temperature. 3. Replace HU fan (See applicable manual). 4. Replace HU.

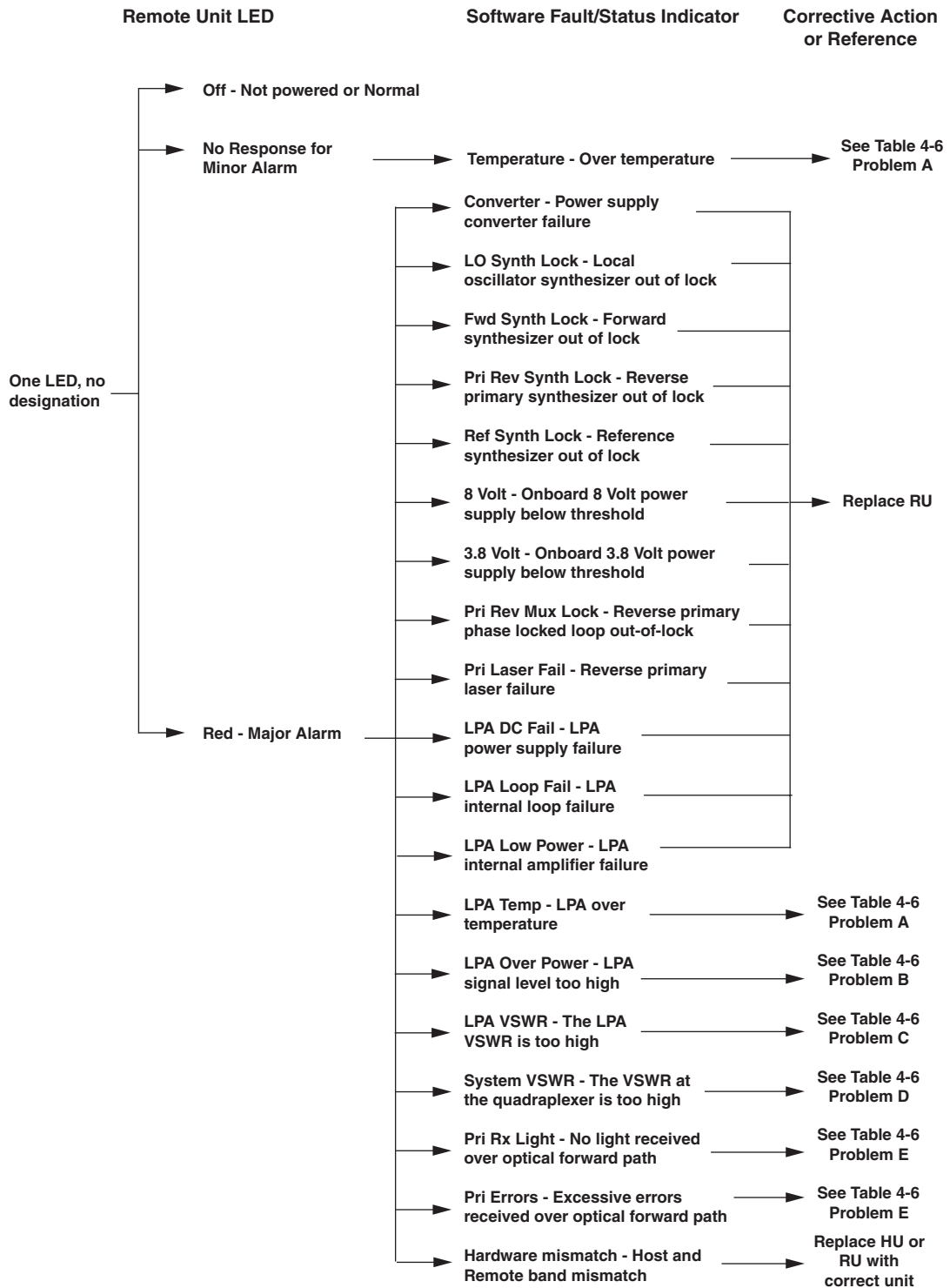
Table 4-4. Host Unit Fault/Alarm Corrective Action, continued

PROBLEM C: The RF input signal level is below the underdrive threshold.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Composite output signal from EBTS is too low.	1. Check EBTS composite output signal level and adjust if too low.
2. Faulty coaxial connection between the HU and the EBTS.	2. Correct EBTS cables if faulty.
3. Incorrect attenuation in forward path RF coaxial link.	3. Check Host Forward Attenuator setting and adjust if attenuation is too high.
PROBLEM D: The RF input signal is above the overdrive threshold.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Composite output signal level from EBTS is too high.	1. Check EBTS composite output signal level and adjust if too high.
2. Incorrect attenuation in forward path RF coaxial link.	2. Check Forward Attenuator setting and adjust if attenuation is too low.
PROBLEM E: No light received over the reverse path or excessive errors received over the reverse path	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Faulty reverse path optical fiber.	1. Test optical fiber. Clean connector if dirty. Repair or replace optical fiber if faulty. (See Section 4.1).
2. Faulty optical transmit port at the RU; or faulty optical receive port at the HU	2. Test optical ports. Replace HU or RU if port is faulty (See Section 4.2).
PROBLEM F: The HU does not respond to control or monitoring commands sent by the EMS.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. The HU is not powered.	1. See Problem A this table.
2. The cable connection between the HU and the EMS computer is faulty.	2. Inspect EMS cable and repair or replace if faulty.
3. The CAN cable connections between the HUs in a multiple HU installation are faulty.	3. Inspect each CAN cable and repair or replace if faulty.
PROBLEM G: There is a loss of gain in either the primary or diversity reverse path of 10 dBm or greater.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. The HU has failed.	1. Replace the HU.
2. The RU has failed	2. Replace the RU.

3.2 RU Troubleshooting

Use this section to troubleshoot alarms that originate with the RU. When a **Minor or Major** alarm occurs, the RU STATUS LED will turn **red** and the EMS software will indicate a minor or major fault/alarm. Use the EMS software to identify the fault and then refer to [Table 4-5](#) to determine the corrective action required.

Table 4-5. Remote Unit Fault/Alarm Isolation Diagram



Continued

20584-B

Table 4-5. Remote Unit Fault/Alarm Isolation Diagram, continued

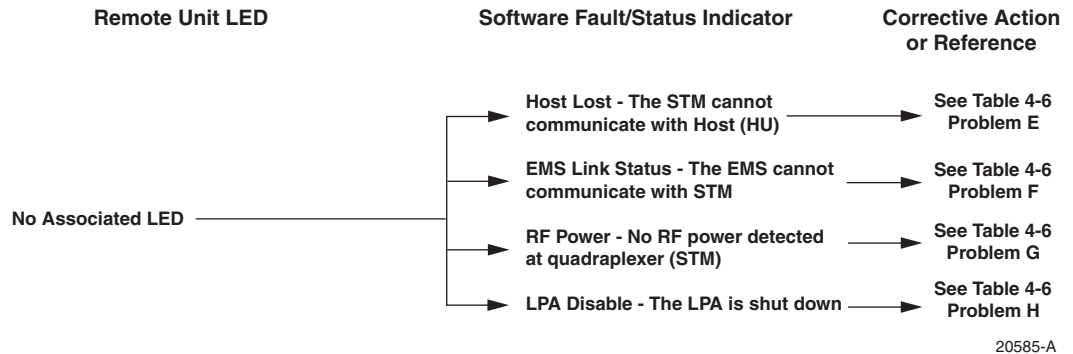


Table 4-6. Remote Unit Fault/Alarm Corrective Action

PROBLEM A: The RU (STM or LPA) is overheating.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Debris preventing air from freely circulating around the RU aluminum enclosure.	1. Remove cause of air-flow blockage.
2. Ambient temperature > 50° C/122° F.	2. Reduce ambient temperature.
3. The RU has failed.	3. Replace RU.
PROBLEM B: The output power from the LPA exceeds the maximum rating.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. The power level of the RF forward path composite input signal at the HU is too high.	1. Check the power level of the RF composite input signal at the HU and adjust to correct level. To reset, use EMS to place Digivance system in standby mode and then place system back in normal mode.
2. The RU (LPA) has failed.	2. Replace RU.
PROBLEM C: The VSWR at the LPA exceeds the threshold setting of 3:1.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. The antenna cable or antenna cable connectors are faulty.	1. Inspect antenna cable and connectors and repair or replace as needed. To reset, use EMS to place Digivance system in standby mode and then place system back in normal mode.
2. The antenna or antenna system is faulty.	2. Check the antenna circuit for shorts or opens (including lightning protector). To reset, use EMS to place Digivance system in standby mode and then place system back in normal mode.
3. The RU quadraplexer or LPA has failed.	3. Replace RU.

Table 4-6. Remote Unit Fault/Alarm Corrective Action, continued

PROBLEM D: The forward path VSWR is above threshold.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Faulty antenna or antenna system.	1. Check the antenna system for shorts or opens (including lightning protector). To reset, use EMS to place Digivance system in standby mode and then place system back in normal mode.
2. Faulty antenna cable.	2. Check the antenna cable for faulty connections.
3. The RU quadraplexer has failed.	3. Replace the RU.
PROBLEM E: No light received over the forward path or excessive errors received over the forward path	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Faulty forward path optical fiber.	1. Test optical fiber. Clean connector if dirty. Repair or replace optical fiber if faulty. (See Section 4.1).
2. Faulty optical transmit port at the HU; or faulty optical receive port at the RU.	2. Test optical ports. Replace HU or RU if port is faulty (see Section 4.2).
PROBLEM F: The RU does not respond to control or monitoring commands sent by the EMS.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. The cable connection between the HU and the EMS computer is faulty.	1. Inspect EMS cable and repair or replace if faulty.
PROBLEM G: No RF power is detected at the RU quadraplexer.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. No RF power is being input to the HU or the RF input signal level at the HU is too low.	1. Check the RF input power level at the HU and adjust until within specifications.
2. The RU (LPA) is faulty.	2. Replace RU.
PROBLEM H: The RF output from the RU (LPA) is shut down.	
POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. The LPA is in the forced shutdown mode.	1. Check for fault conditions that will cause a major alarm. Correct faults as required. To reset, use EMS to place Digivance system in standby mode and then place system back in normal mode
2. The RU (LPA) is faulty.	2. Replace RU.

4 TEST PROCEDURES

This section provides procedures for common troubleshooting and maintenance tests. Refer to these procedures as needed when specified in the Fault/Alarm Isolation Diagrams in [Section 3](#).

4.1 Optical Power Test

A break in an optical fiber or a fault with the optical connector will interrupt communications between linked components or generate excessive errors. Use the following procedure to isolate a problem with an optical fiber or connector.



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 transmitter of any 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 transmitter or optical fiber connector to avoid the potential of dangerous amounts of radiation exposure. This practice also prevents dirt particles from entering the connector.

1. Put on the IR filtering safety glasses.
2. Notify the NOC or alarm monitoring system operator that the system is going offline.
3. At the HU, place the On/Off switch in the **OFF** position (press **0**). At the RU, place the AC circuit breaker switch in the open (OFF) position.

► **Note:** Turning off the HU and RU disables the respective lasers which is necessary in order to safely inspect and clean the optical connectors.

4. Disconnect the optical fiber connectors for the fiber to be tested at the HU **and** the RU.
5. Inspect the optical connectors. Verify that connectors are clean and that no scratches or imperfections are visible on the fiber end. Clean and polish the optical connectors if necessary.
6. Connect the optical power meter to the **output** (receiver) end of the optical fiber as shown in [Figure 4-2](#). If an attenuator was included in the fiber link, make sure it is installed.

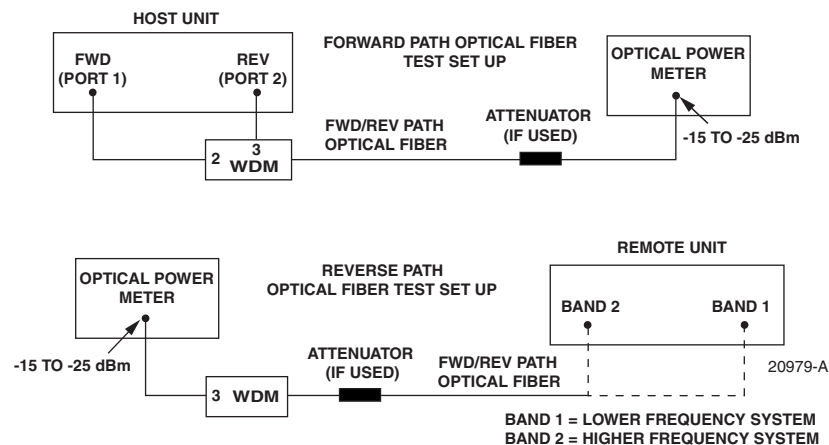


Figure 4-2. Forward and Reverse Path Optical Fiber Test Set Up

7. Connect the **input** (transmitter) end of the optical fiber to the **transmitting** HU or RU.
8. If the **transmitting** unit is the HU, place the On/Off switch in the **ON** position (press **I**). If the **transmitting** unit is the RU, close (turn on) the AC circuit breaker switch.
9. Using the **transmitting** HU or RU as an optical light source, measure the optical power at the **receiver** end of the optical fiber. The power level of the optical signal received at the HU or RU should be **-15 to -25 dBm** (with attenuator installed). If the power level of the received optical signal is within this range, the optical fiber and the far end unit are good. If the power level of the signal is greater than -15 dBm, insert additional attenuation to bring the signal level within the specified range. If the power level is less than -25 dBm, the value of the external attenuator is too high, the optical fiber is faulty, or the far end unit optical transmitter is faulty. Continue with test procedure to isolate the problem



Caution: Erratic operation may occur with an optical input signal level of -13 dBm or higher. If the optical input signal level exceeds -9 dBm, the optical receiver may be damaged.

10. If the **transmitting** unit is the HU, place the On/Off switch in the **OFF** position (press **O**). If the **transmitting** unit is the RU, open (turn off) the AC circuit breaker switch.
11. Disconnect the optical power meter from the **receiver** end of the optical fiber.
12. Use a 1 meter patch cord to connect the optical power meter to the **transmitting** HU or RU as shown in [Figure 4-3](#).

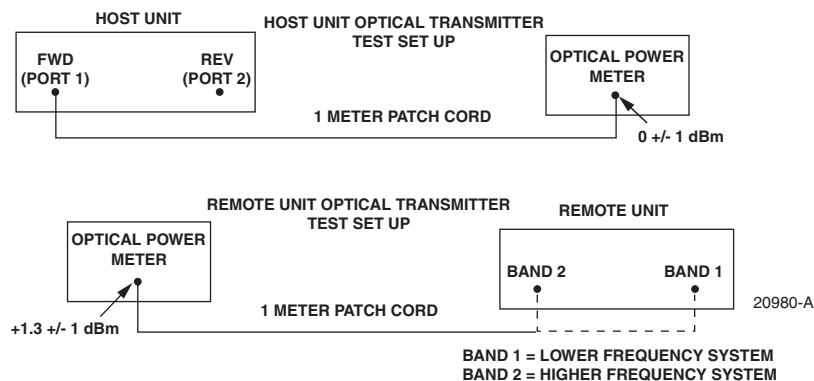


Figure 4-3. Host Unit and Remote Unit Optical Transmitter Test Set Up

13. If the **transmitting** unit is the HU, place the On/Off switch in the **ON** position (press **I**). If the **transmitting** unit is the RU, close (turn on) the AC circuit breaker switch.
14. Measure the optical output power of the **transmitting** HU or RU. The power level of the optical output signal from the HU or RU must meet the following specification:

Forward Path Signal at the HU: 0 ± 1 dBm

Reverse Path Signal at the RU: $+1.3 \pm 1$ dBm

If the power level of the optical output signal is within specifications with a 1 meter patch cord installed, the fiber optic link is faulty. If the power level of the optical signal is not within specifications, the far end HU or RU optical transmitter is faulty.

15. If the **transmitting** unit is the HU, place the On/Off switch in the **OFF** position (press **0**). If the **transmitting** unit is the RU, open (turn off) the AC circuit breaker switch.
16. Disconnect the optical power meter from the **receiver** end of the optical fiber.
17. Reconnect the optical fibers to the **receiving** HU or RU.
18. Repeat steps 3 through 17 for each optical fiber that requires testing.
19. When ready to put the system back into service, place the On/Off switch on the HU in the **ON** position (press **1**) and close (turn on) the AC circuit breaker switch for the RU.
20. Notify the NOC or alarm monitoring service that the system is going back online.

4.2 Optical Loopback Test

The following procedure provides a test to determine if an optical port fault exists with the Host Unit.

- ▶ **Note:** Because the RU is equipped with a WDM, the optical loopback test cannot be performed on the RU.



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 transmitter of any 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 transmitter or optical fiber connector to avoid the potential of dangerous amounts of radiation exposure. This practice also prevents dirt particles from entering the connector.*

1. Put on the IR filtering safety glasses.
2. Notify the NOC or alarm monitoring system operator that the system is going offline.
3. Place the On/Off switch in the **OFF** position (press **0**).
4. Disconnect the optical fiber connectors from the FWD (PORT 1) and REV (PORT 2) optical ports and place a dust cap over each connector.
5. Plug a 15 dB in-line optical attenuator into the FWD (PORT 1) optical port as shown in [Figure 4-4](#).



Caution: *The optical receiver can be damaged if the power level of the optical input signal is too high. To avoid damaging the optical receiver when performing the loopback test, always install a 15 dB in-line attenuator in the optical receiver circuit.*

6. Connect a 1 meter patch cord between the optical attenuator and the REV (PORT 2) optical port.
7. Place the On/Off switch in the **ON** position (press **1**).

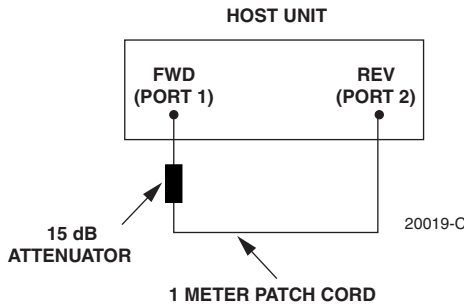


Figure 4-4. Host Unit Loopback Test

8. Observe the FWD/REV (PORT 1/PORT 2) LED indicator which will turn either red or green. If the LED turns red, either the FWD (PORT 1) optical transmitter or the REV (PORT 2) receiver is faulty. If the LED turns green, both the FWD (PORT 1) and the REV (PORT 2) optical ports are good.
9. Place the On/Off switch in the **OFF** position (press **0**).
10. Remove the dust caps from the optical fiber connectors.
11. Clean each connector (follow connector supplier's recommendations) and then insert each connector into the appropriate optical port.
12. When ready to put the HU back into service, place the On/Off switch in the **ON** position (press **1**).
13. Notify the NOC or alarm monitoring service that the system is going back online.

5 SCHEDULED MAINTENANCE REQUIREMENTS

The only scheduled maintenance required for the SCS system is to remove and replace the HU cooling fans. This should be done at 60 month intervals. Refer to the applicable Digivance LRCS Host Unit Installation and Maintenance Manual (See Related Publications section) for the procedure.

SECTION 5: GENERAL INFORMATION

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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 Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (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 Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (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 Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (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 Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (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 73000 (in U.S.A. or Canada) or 1-952-938-8080 (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 73748 (in U.S.A. or Canada) or 952-917-3748 (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

PHONE:

U.S.A. OR CANADA

Sales: 1-800-366-3891 Extension 73000

Technical Assistance: 1-800-366-3891

Connectivity Extension 73475

Wireless Extension 73476

EUROPE

Sales Administration: +32-2-712-65 00

Technical Assistance: +32-2-712-65 42

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UK: 0800 960236

Spain: 900 983291

France: 0800 914032

Italy: 0800 782374

ASIA/PACIFIC

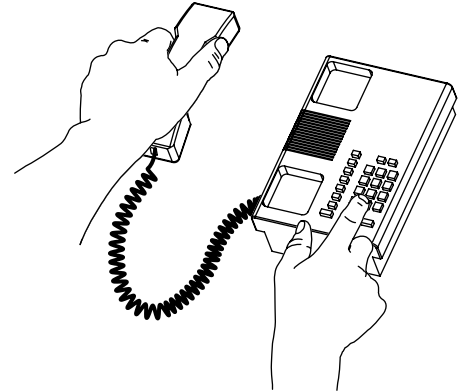
Sales Administration: +65-6294-9948

Technical Assistance: +65-6393-0739

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Sales Administration: +1-952-938-8080

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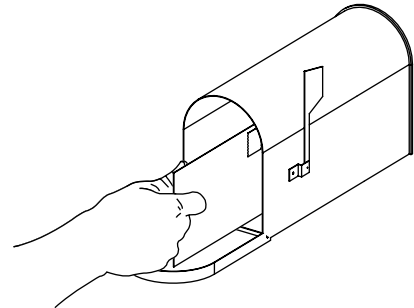


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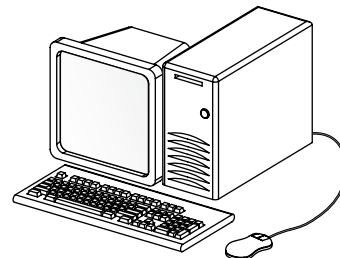
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