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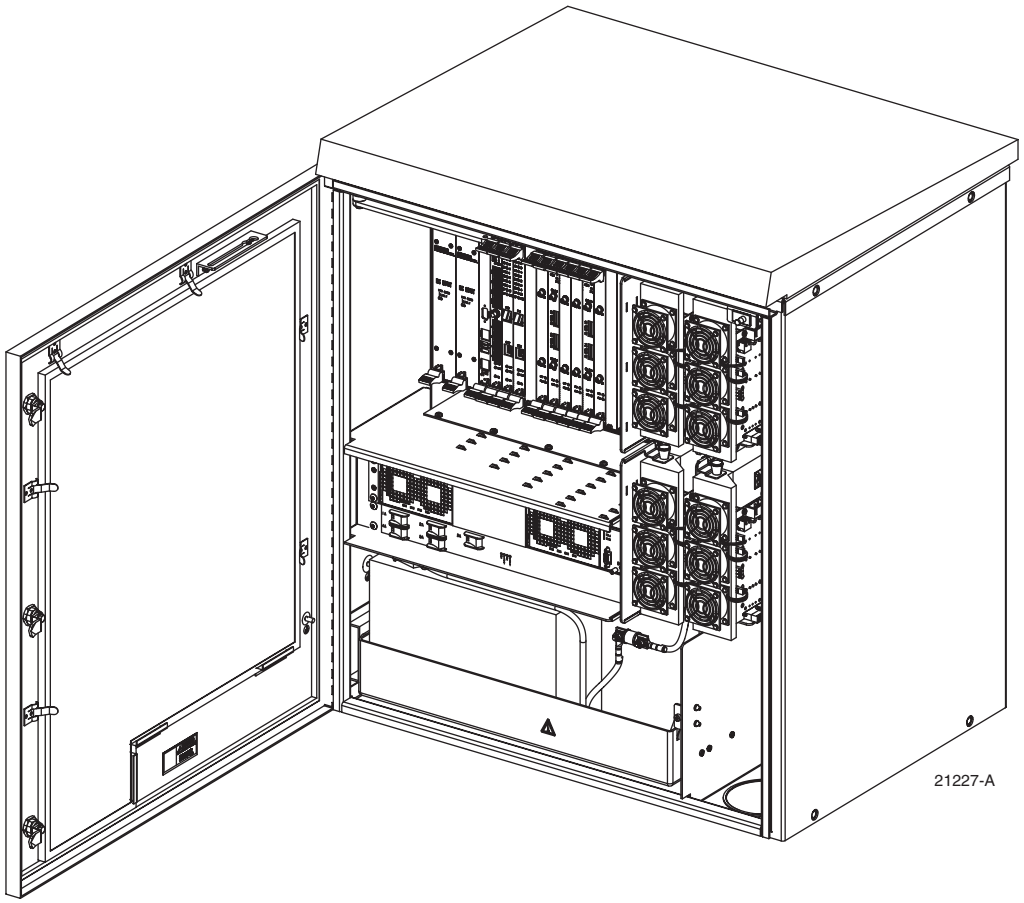
March 2007

# Digivance® NXD
# Radio Access Node (RAN)
# Installation and Maintenance Manual

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## REVISION HISTORY

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## ABOUT THIS MANUAL

This manual provides the following information:

- An overview of the Digivance NXD system;
- A description of the NXD system Radio Access Node (RAN);
- Installation procedures for the RAN;
- Maintenance procedures for the RAN;
- Product support information.

Procedures for installing and operating other NXD system components including the system "Hub" and the EMS software that provides a user interface for the system, are available in other ADC publications, listed under "Related Publications" below, 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). All ADC technical publications are available for downloading from the ADC web site at **www.adc.com**.

| Title/Description | ADCP Number |
|---|---|
| **Digivance CXD/NXD Hub Installation and Maintenance Manual**<br>Provides instructions for installing and operating the NXD system Hub. | **75-193** |
| **Digivance CXD/NXD SNMP Agent and Fault Isolation User Guide**<br>Describes how to troubleshoot the system using the parameters accessed through the NXD system SNMP agents. | **75-195** |
| **Digivance CXD/NXD Element Management System User Manual**<br>Provides instructions for installing and using the Element Management System (EMS) software for the NXD system. | **75-199** |
| **Digivance NXD Multi-Band Distributed Antenna System Operation Manual**<br>Provides instructions for turning up and operating NXD equipment. | **75-209** |
| **2 in. O.D. Quad Cellular/PCS Omni-Directional Antenna Installation Manual**<br>Provides instructions for installing an RF antenna for the NXD system | **75-215** |
| **9 in. O.D. Quad Cellular/PCS Omni-Directional Antenna Installation Manual**<br>Provides instructions for installing an RF antenna for the NXD system | **75-221** |

## 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

⚠ **Warning:** *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.*

⚠ **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.*

⚠ **Caution:** *This system is a RF Transmitter and continuously emits RF energy. Maintain 3 foot (91.4 cm) minimum clearance from the antenna while the system is operating. Wherever possible, shut down the RAN before servicing the antenna.*

⚠ **Caution:** *Always allow sufficient fiber length to permit routing of patch cords and pigtails without severe bends. Fiber optic patch cords or pigtails may be permanently damaged if bent or curved to a radius of less than 2 inches (5.1 cm).*

⚠ **Caution:** *Exterior surfaces of the RAN may be hot. Use caution during servicing.*

## SAFE WORKING DISTANCES

The Digivance NXD antenna, which is mounted on top of a pole, radiates radio frequency energy.

For the occupational worker, safe working distance from the antenna depends on the workers location with respect to the antenna and the number of wireless service providers being serviced by that antenna.

Emission limits are from OET Bulletin 65 Edition 97-01, Table 1 A.

## STANDARDS CERTIFICATION

**FCC**: The Digivance NXD complies with the applicable sections of Title 47 CFR Part 15, 22, 24 and 90.

The Digivance NXD Hub has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Changes and modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commissions rules.

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio & television reception.

**ETL**: This equipment complies with ANSI/UL 60950-1 Information Technology Equipment. This equipment provides the degree of protection specified by IP24 as defined in IEC Publication 529. Ethernet signals are not for outside plant use.

**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.

**Wind Loading**: The NXD RAN is able to withstand wind loads up to 150 mph.

## LIST OF ACRONYMS AND ABBREVIATIONS

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

| | |
|---|---|
| **AC** | Alternating Current |
| **ANT** | Multiband Antenna |
| **BIM** | Base Station Interface Module |
| **BTS** | Base Transceiver Station |
| **C** | Centigrade |
| **CDRH** | Center for Devices and Radiological Health |
| **C/MCPLR** | Cellular SMR Multicoupler |
| **CM** | Centimeter |
| **cPCI** | CompactPCI |
| **CPU** | Central Processing Unit |
| **CXD** | Compact RAN |
| **DAS** | Distributed Antenna System |
| **dB(FS)** | decibals (Full Scale – digital reading) |
| **DC** | Direct Current |
| **Div** | Diversity |
| **EMS** | Element Management System |
| **ESD** | Electrostatic Discharge |
| **F** | Fahrenheit |
| **FDA** | U.S. Food and Drug Administration |
| **FCC** | **U.S.** Federal Communications Commission |
| **GPS** | Global Positioning System |
| **IC** | Industry Canada |
| **IN** | Inch |
| **IP** | Internet Protocol |
| **KG** | Kilogram |
| **LED** | Light Emitting Diode |
| **LSE** | Location Services Equipment |
| **LVD** | Low Voltage Disconnect |
| **MHz** | Mega Hertz |
| **MTBF** | Mean Time Between Failure |
| **MUX** | Multiplexer |
| **Node** | Any CPU in the Digivance NXD system |
| **NXD** | Digivance Neutral Host Product Line |
| **OSP** | Outside Plant |
| **PA** | Power Amplifier |
| **PAA** | Power Amplifier Assembly |
| **PC** | Personal Computer |
| **PCI** | Peripheral Component Interconnect bus |
| **PIC** | PA Interface Controller |

| | |
|---|---|
| **P/MCPLR** | PCS Multicoupler |
| **RAN** | Radio Access Node |
| **RDC** | RAN Down Converter |
| **RDC2** | RAN Down Converter Version 2 |
| **RF** | Radio Frequency |
| **RUC** | RAN Up Converter |
| **RUC2.X** | RAN Up Converter Version 2.X |
| **RUC3** | RAN Up Converter Version 3 |
| **SFP** | Small Form-Factor Pluggable Optical Transceiver |
| **SIF** | Sonet Interface Module |
| **SNMP** | Simple Network Management Protocol |
| **SONET** | Synchronous Optical Network |
| **STF2** | System Interface Module |
| **UL** | Underwriters Laboratories |
| **VAC** | Volts Alternating Current |
| **VDC** | Volts Direct Current |
| **VSWR** | Voltage Standing Wave Ratio |
| **WDM** | Wave Division Multiplex |
| **WSP** | Wireless Service Provider |

# 1 PRODUCT DESCRIPTION

This section describes the Digivance Neutral Host (NXD) Radio Access Node (RAN).

## 1.1 General Description

The RAN, shown in Figure 1, is the remote component in the Digivance NXD Multi-Band Distributed Antenna System. The RAN is a pole-mounted or pad-mounted, weather-resistent cabinet, housing electronic modules that operate on an internal cPCI backplane. Included are a central processing unit, a system interface, an optical interface, optical to RF data converters, RF multicouplers, and DC power supplies. The RAN also houses rectifiers, backup batteries, power amplifiers, and optical wave division multiplexers. Optical and RF functions are both required because the RAN exchanges data with the system Hub using an optical link and exchanges data with wireless users using RF signals. Each RAN provides the system with an RF antenna and can accommodate up to four bands (PCS A-F, SMR A, Cell A"/A, or Cell B/B'). Dual RANs installed at the same location can accommodate up to eight bands using a common antenna.

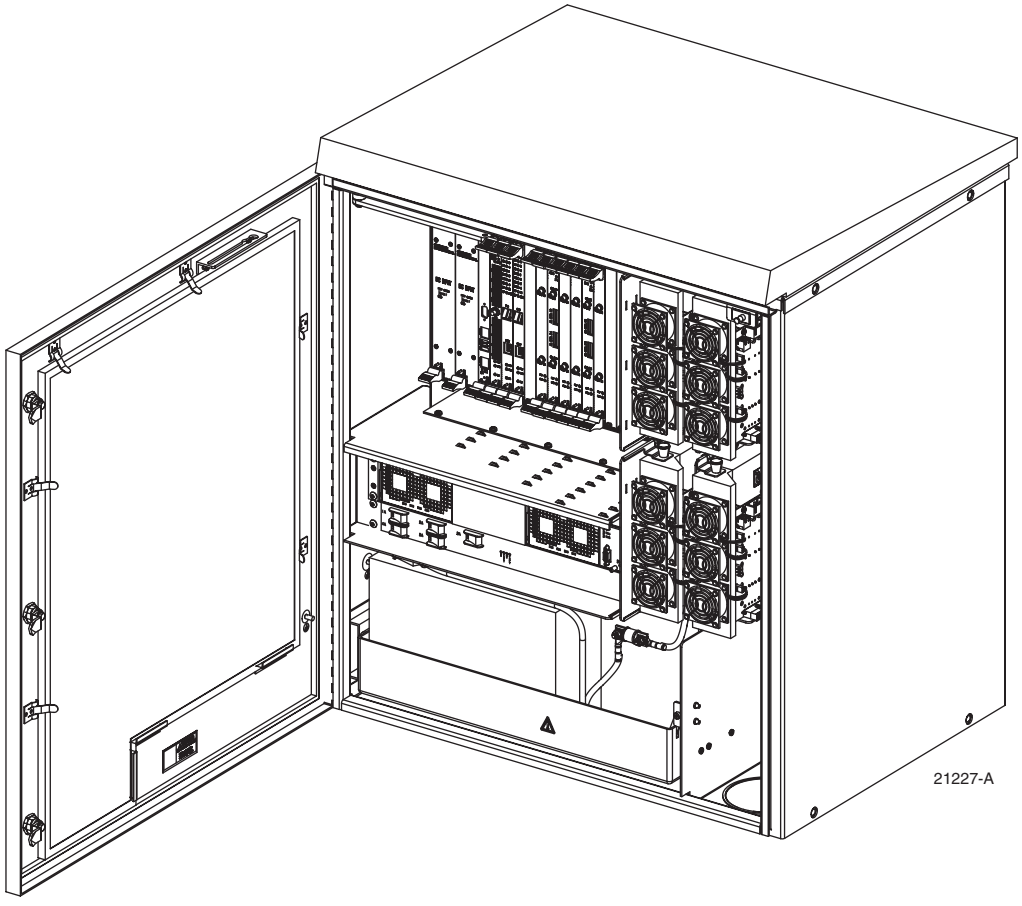



**Figure 1. NXD RAN**

## 1.2 System Function

The NXD Distributed Antenna System (DAS), in which the RAN is the remote component, is a multi-frequency, multi-protocol RF access network providing microcellular Cellular and PCS coverage via a distributed RF access system. In a typical configuration, such as shown in Figure 2, multiple RANs are connected to a central Hub where multiple Base Transceiver Station (BTS) interfaces are located. Signals received at the Hub are distributed to the RANs in digital form by way of a fiber optical link. Within the RANs, the signals are converted from digital to RF format to be transmitted from the RAN antennas. Signals also travel in a reverse direction, from the RANs to the Hub, with a reverse data conversion.

Physically, the DAS consists primarily of electronic modules located in the Hub and RANs. At the Hub, these modules are mounted in an equipment rack typically housed in a common telecommunications structure with the base station electronics for Wireless Service Providers (WSPs), either in the same room or nearby. These modules include high power attenuators, base station modules, a power distribution unit, an Ethernet hub, a Hub reference module, an RF chassis, and one or more digital chassis. The RAN electronic modules, mounted in the RAN cabinet, perform the remote system functions of optical to RF data conversion and RF access. These modules are described in subsequent topics within this product description. Digivance Element Management System (EMS) software, running on a computer located at the Hub, provides a graphical user interface to monitor system performance.

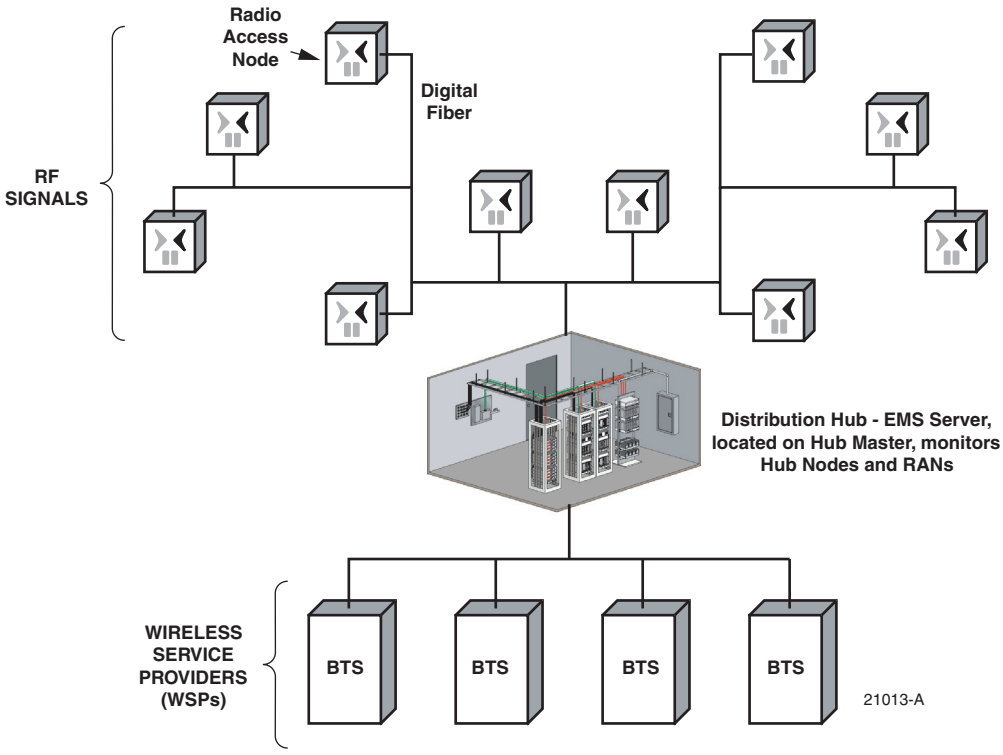



**Figure 2. System Function**

## 1.3 High-Level View

The RAN consists of the main components shown in a high-level view in Figure 3. These components include:

- **RAN Cabinet:** exterior shell of the RAN containing cable connection points, ground studs, and slots or shelves supporting other RAN components.
- **RAN Chassis:** standard Compact PCI (cPCI) shelf capable of housing 21 industry standard cPCI circuit card modules. The modules are plugged into a common backplane providing data bussing between them.
- **Related Electronics:** including rectifiers, Power Amplifier Assemblies (PAAs), batteries, multiplexers, and a circuit breaker panel.

All components called out in the figure except for the multiplexers are separately installable in the field. In most cases, however, the RAN is shipped with a basic set of components having been ordered in advance by the customer and installed in the factory.

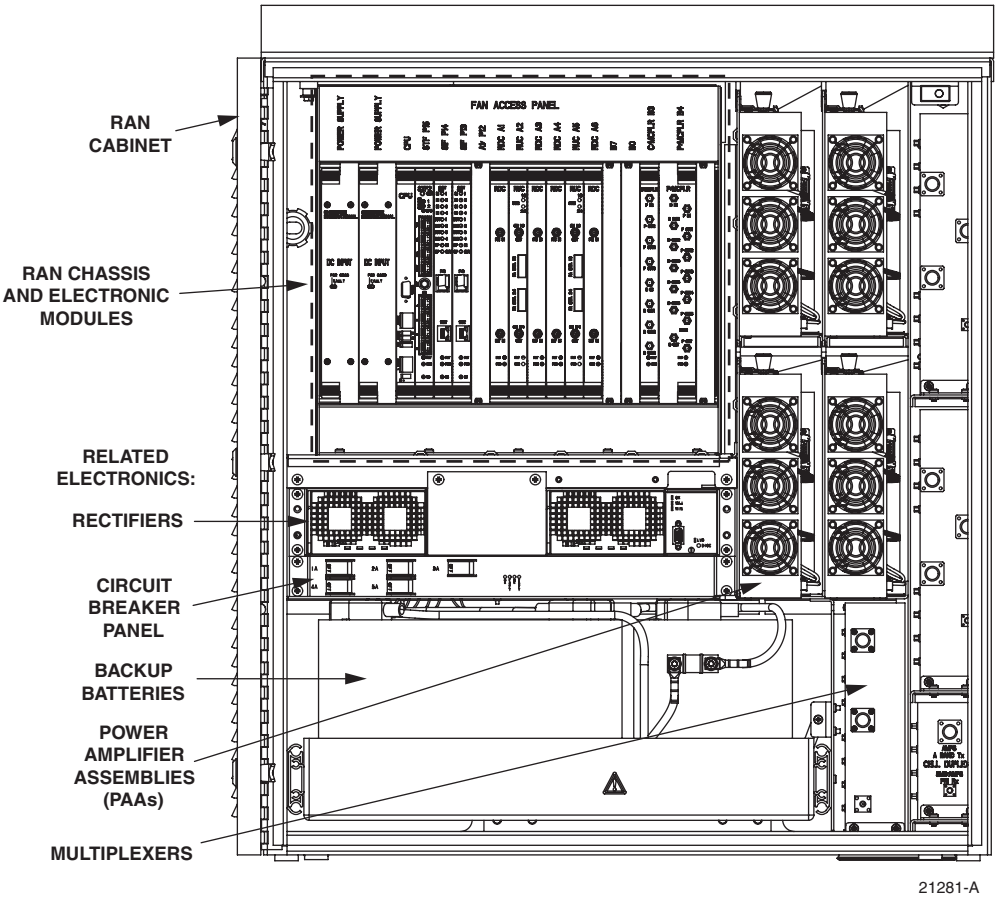



**Figure 3. High Level View**

## 1.4 User Interface

The RAN user interface consists of the various connectors, fittings, mounting slots, power cords, switches, and indicators that are of relevance to the user in installation and operation procedures. The user interface is shown in Figure 4 and described in Table 1.

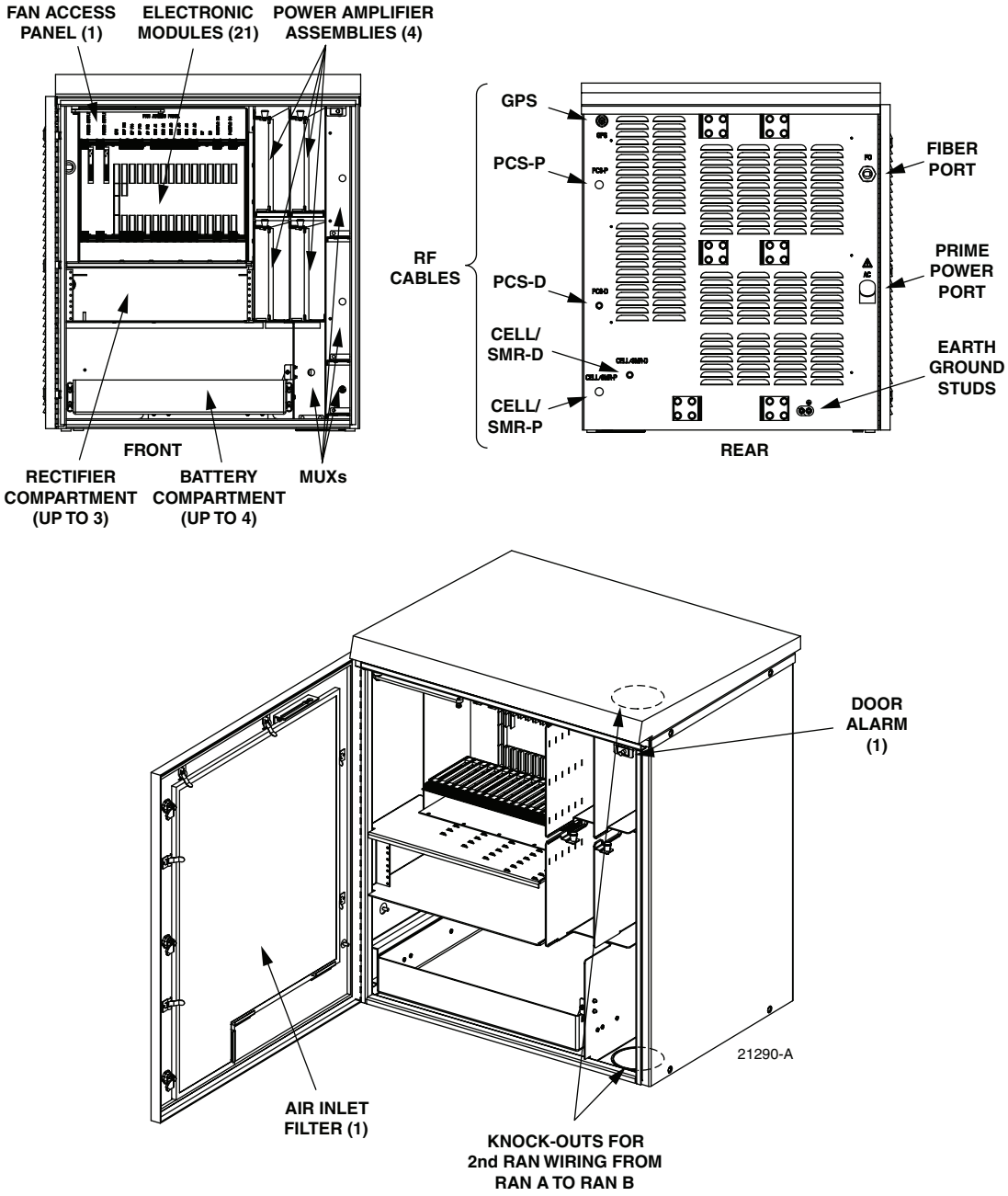



**Figure 4. User Interface**

**Table 1. RAN Cabinet User Interface**

| COMPONENT | WHY RELEVANT | FOR MORE INFORMATION |
|---|---|---|
| **Front View** | | |
| Fan Access Panel | Panel swings down providing access to internal fan compartment; fans can be replaced as required | Section 1.7.8 on Page 20 |
| Electronic Modules | Electronic modules have indicators monitored by the user | Section 1.7 on Page 10 |
| | Electronic modules can be installed and replaced as required | Section 4.1 on Page 57 |
| | Interconnection diagram summarizes connections between modules | Figure 40 on Page 58; Figure 41 on Page 59 |
| Power Amplifier Assemblies | PAAs have indicators monitored by user | Section 1.9 on Page 25 |
| | PAAs can be installed or replaced as required | Section 4.5 on Page 68 |
| Rectifier Compartment | Rectifiers have four unmarked LEDs | Section 1.8 on Page 23 |
| | Rectifiers can be individually installed and replaced as required | Section 4.3 on Page 66 |
| Battery Compartment | Batteries are packaged separately and installed in a standard installation; they can be replaced as required | Section 2.7.6 on Page 50 |
| **Rear Access** | | |
| GPS, PCS-P, PCS-D, CELL/SMR-D, CELL/SMR-P | Connection points for RF cables connecting RAN with GPS antenna and RF antenna. | Section 2.7.3 on Page 45; Table 21 on page 47 |
| Fiber Optic Cables Connection Point | Connection point for fiber optic cable from Hub | Section 2.7.4 on Page 47 |
| Prime Power Contact | Contact point for power ingress. RAN requires 240 VAC, single phase, 20 Amps service, typically routed from a pole- or pad-mounted junction box | Section 2.7.5 on Page 49 |
| Earth Ground Studs | Connection point for ground wires | Section 2.7.2 on Page 44 |
| **Oblique View** | | |
| Air Inlet Filter | Filters are replaced per maintenance schedule | Section 5.2 on Page 70 |
| Door Alarm | Replaceable switch | |
| Knock-Outs for 2nd RAN Wiring from RAN A to RAN B | When two RANs are installed at the same location, an omnibus cable is routed from RAN A to RAN B through these knockout holes | Section 3 on Page 54 |

## 1.5 Dimensions and Specifications

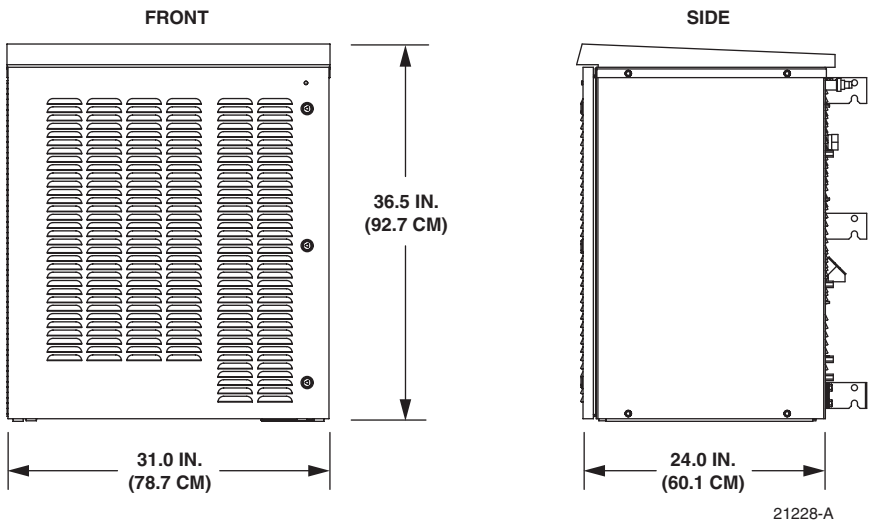



**Figure 5. NXD RAN Dimensions**

**Table 2. RAN Specifications**

| ITEM | SPECIFICATION | COMMENT |
|---|---|---|
| **Physical and Mechanical** | | |
| Dimensions (HxWxD) | 36.5 x 31.0 x 24.0 inches<br>(92.7 x 78.7 x 60.1 cm) | See also Figure 5 |
| Weight<br>with extended batteries (4) | 300 lbs. (136.4 kg)<br>625 lbs. (284.1 kg) | RAN without batteries<br>Total RAN + 4 batteries |
| Color | Putty white | |
| Bands per box | Up to 4 | |
| Boxes per RAN site | Up to 2 RANs | |
| RF connections | RAN cabinet has<br>5 Type N plugs | Cable type: CommScope PN 540ANM or equivalent |
| **Environmental and Thermal** | | |
| Box thermal management | External air | Variable speed fans (PIC/PA Assembly and cPCI) |
| Operating temperature | -40 to +50 degrees C | -40 to 122 degrees F |
| Cold-start temperature | -20 to +50 degrees C | -4 to 122 degrees F |
| Storage temperature | -40 to +85 degrees C | -40 to 185 degrees F |
| Internal air temperature | 0 to 60 degrees C | 32 to 140 degrees F |
| Weather resistance | NEMA-3R | |
| Operational humidity | 95% | |
| Acoustic emissions | 63 dBA | |

**Table 2. RAN Specifications**

| ITEM | SPECIFICATION | COMMENT |
|---|---|---|
| **Power** | | |
| AC power ingress | 240 VAC, 20 Amps, single phase | |
| Battery backup options<br>extended<br>glitch | <br>120 minutes<br>5 minutes | -48 volts<br>@25 degrees C (degrees F)<br>for four bands |
| RAN box power use | 2700 Watts Max.<br>16 Amps Max. | |
| cPCI rack power | -48 VDC | |
| **Optical** | | |
| Fiber cable ingress | Nylon connector accommodates cable diameters in range 0.38-0.50 inches (0.97-1.27 cm). | For larger cable sizes, refer to the note in Section 1.6.2 on Page 9. |
| Fiber type | Corning SMF-28 or equivalent | |
| Optical connectors | LC | Standard on SFP transceivers |
| Insertion loss | 0.2 dB Typical, 0.4 dB Max. | |
| Number of fibers required | 1-4 fiber runs per RAN | |
| Fiber configuration | Star (point to point) or ring | Ran ring limited to 3 SIFs |
| Fiber data link protocol | OC-48 | |
| Wavelengths per fiber<br>with WDM option<br>with CWDM option | 1 (1310 nm)<br>2 (1310/1550)<br>8 (1470-1610) | Without WDM/CWDM option<br><br>20 nm increments (ITU-GRID) |
| Optical transceiver type | SFP | Dual LC connector |
| Optical Tx power | -3 dBm Max, -10 dBm Min. | Finistar FTRJ-1320-1 (or equivalent) |
| Optical Rx sensitivity | -22 dBm Typical, -18 dBm Max. | |
| Optical link margin | 2 dB | Estimated |
| Optical link loss | 6 dB | Estimated |
| Optical Rx saturation level | -3 dBm | Min. Max. operational power |
| Optical Rx damage level | -3 dBm | Min. Max survivable power |
| Optical safety class | 1 | ANSI Z 136.2 |
| **RF** | | |
| Tuning frequency<br>PCS band<br>Cellular band<br>SMR 800 band<br>SMR 900 band | Receive Path<br>1850-1910 MHz<br>824-849 MHz<br>806-824 MHz<br>896-901 MHz | Transmit Path<br>1930-1990 MHz<br>869-894 MHz<br>851-869 MHz<br>935-940 MHz |
| Instantaneous bandwidth | 15 MHz | |
| Receiver noise figure<br>PCS band<br>Cellular band | <br>6 dB<br>5 dB | Measured at Hub output connector (BIM, RxP) without BTS at 10 dB gain and a single RAN |

**Table 2. RAN Specifications**

| ITEM | SPECIFICATION | COMMENT |
|---|---|---|
| Input IP3 | -21 dBm | Two tone tests at -56 dBm |
| Received signals<br>In band<br>Out of band +/- 8.5 MHz<br>Out of band +11/-13 MHz<br>Out of band +13/-16 MHz | <br>-41 dBm<br>-3 dB<br>-43 dB<br>-83 dB | RDC capability (at cabinet input)<br>A/D clip level, single RF channel<br>Selectivity (function of SAW filter)<br>Selectivity<br>Selectivity |
| Automatic gain control<br>Detector integration time<br>Attack time<br>Decay time<br>Gain control range | <br>10 usec<br>0 usec<br>0 usec<br>30 dB | Activated if A/D clips, changes gain of A/D and gain in digits. Design ensures analog gain and digital gain change will be timed correctly. 15 dB noise figure at -14 dB gain |
| Gain in series with BTS | -10 to +10 dB | Lower limit for simulcast with a host tower site, the max reduces effect of cascaded noise figure |
| Gain parallel to BTS | 0 to +30 dB | Allows injection after BTS amplifiers |
| Gain stability | +/- 2dB | Over temperature, frequency, and aging valid for input signals below AGC threshold |
| System Bandwidth<br>Forward Path<br>Reverse Path | <br>15 MHz block increments<br>15 MHz block increments | |
| Impedance | 50 ohm | |
| Output Power<br>Cellular/SMR 10 Watt MCPA<br>PCS 20 Watt MCPA | <br>6.5 Watts (+38 dBm) composite<br>12.5 Watts (+41 dBm) composite | <br>At antenna port<br>At antenna port |
| Gain resolution | 1 dB | |
| Gain measurement | | Configured at startup using factory calibration of modules and user data |

**Note:** The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when 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 cause interference to adjacent band users. The power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

## 1.6 RAN Cabinet

The RAN cabinet is a NEMA-3R enclosure designed to protect its electronic components from weather and human tampering. The cabinet is weather-tight but contact with salt-air mist should be avoided as it may decrease the mean time between failure of some components. The cabinet has ventilation openings to allow entry of cool air and escape of hot air. The cabinet provides

termination points for the coaxial antenna cable, fiber optic cable, ground cable, and AC cable. The cabinet has inbuilt AC power surge protection and limited storage for fiber optic cables.

### 1.6.1 Mounting

The RAN cabinet may be mounted on a wood pole or on a concrete pad. Mounting bracket kits (available from ADC) are required for each type of installation.

### 1.6.2 Fiber Optic Cable Entry

A nylon connector is provided on the rear of the RAN cabinet for routing a fiber optic cable into the cabinet. The cord connector provides cable strain relief and a watertight seal at the fiber optic cable entry point. As the connector nut is tightened, a soft neoprene bushing compresses to tightly grip the cable without applying excessive force to the fibers. The connector accommodates cables of a diameter in the range .38 to .50 inches (.97 to 1.27 cm).

**Note:** If the installer has a larger cable, the manufacturer (Hubbell Inc.) makes bushings that fit this connector in the following size ranges: .500-.625, .625-.750, .750-.875, .875-1.00, 1.00-1.125 inches.

In a typical installation, the connectorized end of a multi-fiber OSP cable is routed into the cabinet through the cord connector and the individual fibers are connected to the optical transceiver on the Synchronous Interface Card (SIF). Excess slack is stored inside the cabinet. The stub end of the cable is routed to an external splice enclosure (not provided) for splicing to the outside plant fiber optic cable.

### 1.6.3 Antenna Cable Connections

Five N-type plugs are provided on the rear of the RAN cabinet for connecting the antenna coaxial cables. On the inside of the cabinet, coaxial jumper cables (included with the cabinet) are used for connecting to the antenna port on the appropriate multiplexer.

### 1.6.4 AC Power Wiring Entry and Grounding

The NXD RAN uses 240 VAC power. A one inch (2.54 cm), 90 degree rigid elbow conduit fitting is provided on the rear of the cabinet. The conduit should be routed to an external junction box (not provided). It is suggested that an external AC outlet (not provided) be installed near the cabinet to power test equipment and power tools. The AC source should supply 50/60 Hz, single-phase power through a circuit breaker rated at 20 Amps.

### 1.6.5 Ventilation

Ventilation openings are provided in the front door of the RAN cabinet to permit entry of air for cooling. A filter removes dirt particles so that only clean air enters the cabinet. The heated air exits the cabinet through the rear side. The four PAAs are each equipped with three cooling fans that pull air through the module and exhaust it to the rear of the cabinet. A fan assembly at the top of the RAN chassis forces the air out the rear side of the cabinet.

## 1.7 RAN Chassis and Electronic Modules

The RAN chassis, shown in Figure 6, is a standard Compact PCI (cPCI) shelf capable of housing 21 industry standard cPCI circuit cards (called "electronic modules" in this manual). The backplane supports the basic cPCI functions and it has been extended to allow the routing of DIF™, reference clocks and I2C signals between I2C modules. The RAN chassis also houses cooling fans within the Fan Access Panel on the top of the chassis. Table 3 identifies the electronic modules using the callout reference numbers from Figure 6.

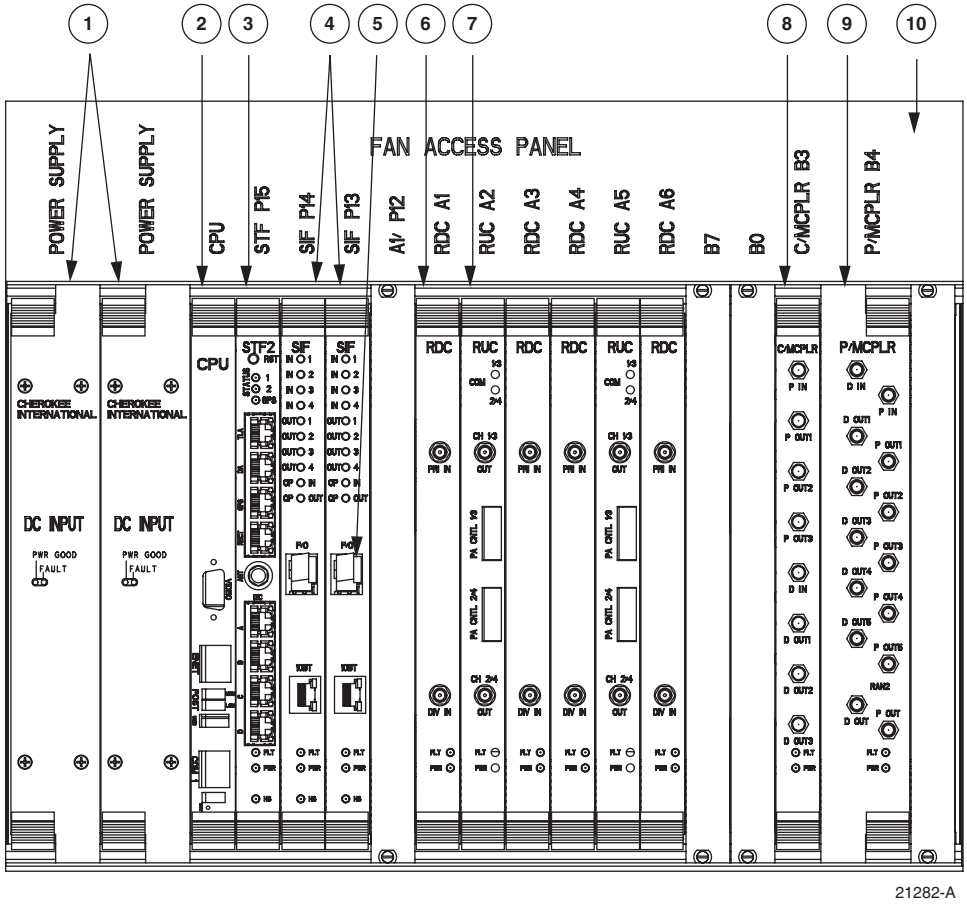



**Figure 6. RAN Chassis**

**Table 3. RAN Chassis Electronic Modules**

| REF # | MODULE NAME | FOR DETAILS REFER TO |
|---|---|---|
| 1 | cPCI Power Supplies | Section 1.7.1 on Page 12 |
| 2 | Central Processing Unit (CPU) | Section 1.7.2 on Page 13 |
| 3 | System Interface (STF2) | Section 1.7.3 on Page 14 |
| 4 | Synchronous Interface (SIF) | Section 1.7.4 on Page 15 |
| 5 | Small Form-Factor Pluggable Optical Transceiver (SFP) | Section 1.7.5 on Page 17 |

**Table 3. RAN Chassis Electronic Modules**

| REF # | MODULE NAME | FOR DETAILS REFER TO |
|---|---|---|
| 6 | RAN Down Converter (RDC or RDC2) | Section 1.7.6 on Page 17 |
| 7 | RAN Up Converter (RUC2.X or RUC3) | Section 1.7.7 on Page 19 |
| 8 | 800 MHz Multi-Coupler | Section 1.7.9 on Page 20 |
| 9 | 1900 MHz Multi-Coupler | Section 1.7.10 on Page 22 |
| 10 | Fan Access Panel | Section 1.7.8 on Page 20 |

Figure 7 is a schematic showing the data flow in the RAN chassis, as represented by the PCS-A band. As shown, data flows in two directions, from the Hub through the RAN to the antenna, and from the antenna through the RAN back to the Hub. In each direction, data conversion occurs, with optical data "upconverted" to RF data in the up direction in the schematic, and RF data "downconverted" to optical data in the down direction. In an up direction, the RUC module converts Digitized Intermediate Frequency (DIF) data into PCS, Cellular, and SMR frequency RF bands. The RF signals are amplified and then transmitted from the RF antenna. In the down direction, the RDC module converts PCS, Cellular, and SMR frequency bands into DIF data. The overall series of events is managed by the CPU using an Ethernet connection to the chassis backplane.

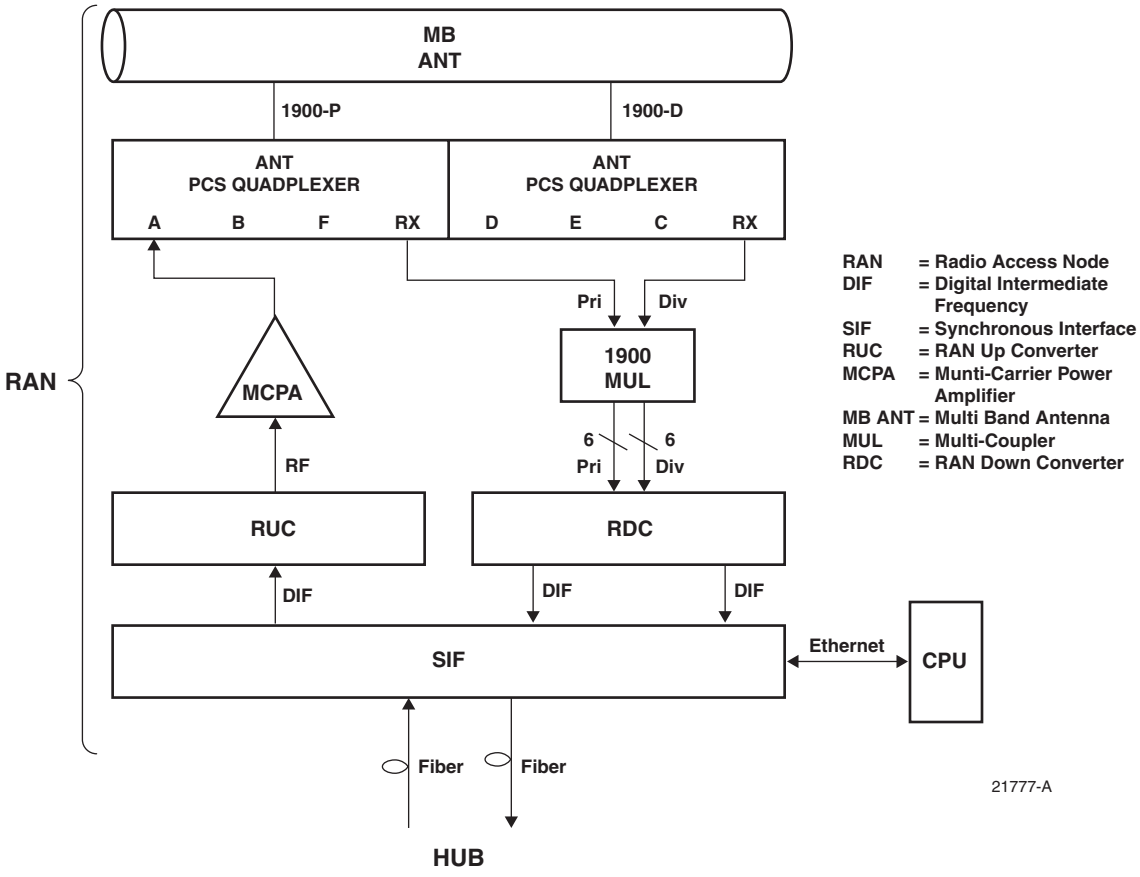



**Figure 7. RAN Chassis Schematic**

### 1.7.1 cPCI Power Supply Modules

The Compact PCI (cPCI) Power Supply Modules provide +/-12V, 5V, and 3.3V DC power to the cPCI backplane for use by the cPCI electronic modules. Each RAN requires one power supply module. Two modules can be used to provide redundancy if desired. These modules are hot swappable. Figure 8 shows the cPCI Power Supply Module faceplate. Table 4 describes the faceplate components called out in the figure.

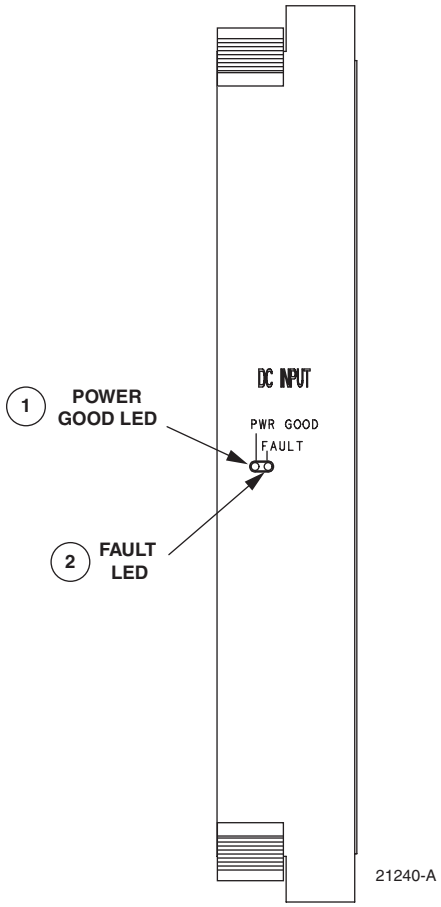



**Figure 8. cPCI Power Supply Module Faceplate**

**Table 4. cPCI Power Supply Module Faceplate**

| Ref # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | PWR GOOD | Single-color LED (green) | Power Good. Turns green when module has power |
| 2 | FAULT | Single-color LED (red) | Fault. Turns red when module has insufficient power to perform its function |

### 1.7.2 Central Processing Unit (CPU) Module

The Central Processing Unit (CPU) Module is a cPCI-based, single-board x86 computer with disk running on a Linux operating system. Each RAN chassis has one CPU module. The CPU runs a process management program that manages all RAN hardware including RF and digital equipment. The program also manages RF signal gain and monitors signal presence and quality. Figure 9 shows the CPU module faceplate. Table 5 describes the faceplate components called out in the figure.

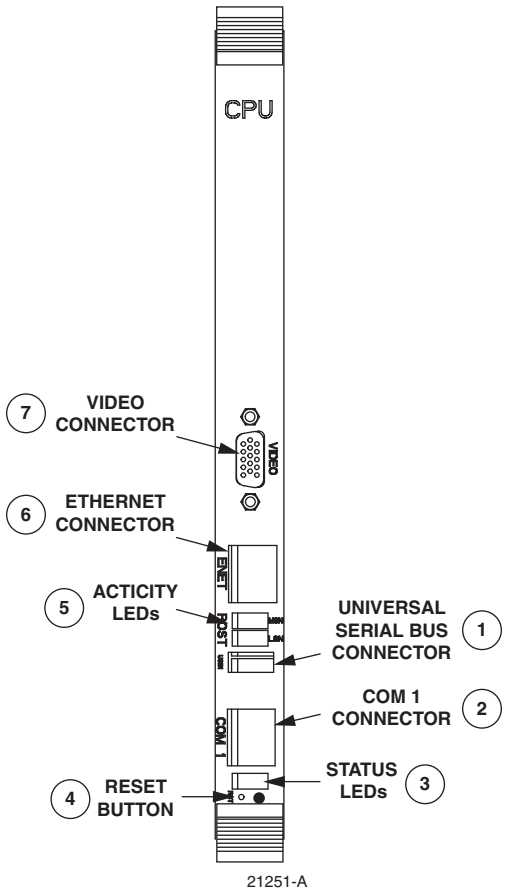



**Figure 9. CPU Module Faceplate**

**Table 5. CPU Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | USB1 | USB connector | Front panel input/output for USB connectivity |
| 2 | COM 1 | RJ-11C connector | Front panel interface for COM1 |
| 3 | (Unmarked) | Status LEDs | LED 1 is POST (red on start-up, turns green on successful completion of start-up self test); LED 2 & 3 are undefined; LED 4 (blinking green) indicates disk or flash memory activitity |

**Table 5. CPU Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 4 | RST | Recessed switch | Reset. Used to manually reset the CPU |
| 5 | POST | Single-color LEDs (yellow) | Post. Top four LEDs give status of CPU during initial boot process; bottom four give board operation status |
| 6 | ENET | RJ-45 connector with single-color LEDs (green and yellow) | Ethernet. 10 BaseT. Connects to RJ-45 connector on SIF module (10BT port) using cable 1001478P001. Connection status (green) and 100 BT (yellow) |
| 7 | VIDEO | 15-PIN VGA connector | Video. Not used by Digivance system |

### 1.7.3 System Interface (STF2) Module

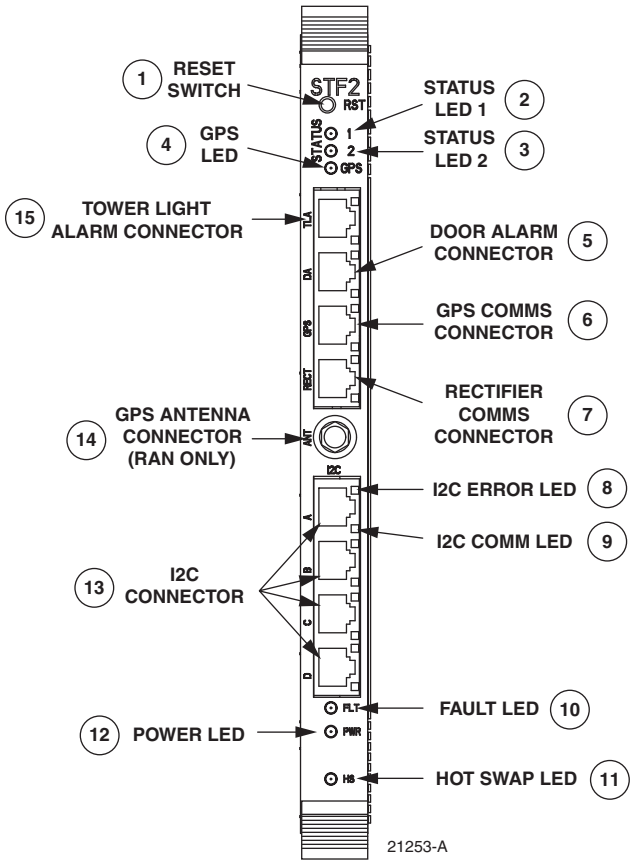
The System Interface (STF2) Module is a cPCI electronic module that provides the CPU and other electronic modules with the ability to communicate with one another using the four I2C buses on the cPCI backplane. One STF2 is used per RAN. The STF2 also has the GPS antenna input port located in the center of the module faceplate. STF2 modules are specified according to the number of qualifying communications devices being utilized. Table 6 describes the module faceplate components. Figure 10 shows the location of the faceplate components.

**Table 6. System Interface Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | RST | Recessed switch | Reset. Used to halt operation of the CPU operating system. A power ON reset is required to restart the CPU |
| 2 | STATUS 1 | Single-color LED (yellow) | Reserved for future use. Indicator turns yellow when the CPU is not installed or has malfunctioned |
| 3 | STATUS 2 | Single-color LED (yellow) | Reserved for future use. Indicator turns yellow when the CPU is not installed or has malfunctioned |
| 4 | STATUS GPS | Single-color LED (green) | Indicator showing that 1PPS signal is available. Led toggles once per second (RAN only) |
| 5 | DA | RJ-45 connector | Door Alarm. Input using cable 1001474P001; small LED on this connector lights (red) when door is open |
| 6 | GPS | RJ-45 connector | Not used |
| 7 | RECT | RJ-45 connector | Rectifier. Communications to rectifier using cable 1001476P001 |
| 8 | (Unmarked) | Single-color LED (red) | I2C Error LEDs. One on each I2C RJ-45 connector. Indicator turns red when there is no response on port |
| 9 | (Unmarked) | Single-color LED (green) | I2C Comm LEDs. One on each I2C RJ-45 connector. Indicator turns green when an I2C message sent on the port |
| 10 | FLT | Single-color LED (red) | Fault. Indicator turns red when module has failed or upon startup until the module has completed initialization |

**Table 6. System Interface Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 11 | HS | Single-color LED (blue) | Not used |
| 12 | PWR | Single-color LED (green) | Power. Indicator turns green when module has power |
| 13 | I2C A-D | RJ-45 connectors | I2C (Bus). Connectors to I2C buses |
| 14 | ANT | SMA connector | Antenna. Input for GPS antenna signal |
| 15 | TLA | RJ-45 connector | Tower Light Alarm (unused) |




n

**Figure 10. System Interface Module Faceplate**

### 1.7.4 Synchronous Interface (SIF) Module

The Synchronous Interface (SIF) Module provides the optical interface between the Hub and the RAN. This interface provides for exchange of digitized RF signal information and 10BaseT Ethernet command and control information. Each RAN can have up to two SIFs, each handling two bands with diversity receive paths.

The SIF module is equipped with a small form-factor pluggable optical transceiver (SFP) module. (For more information on the SFP, see Section 1.7.5.) Figure 11 shows the SIF module faceplate. Table 7 describes the faceplate components.

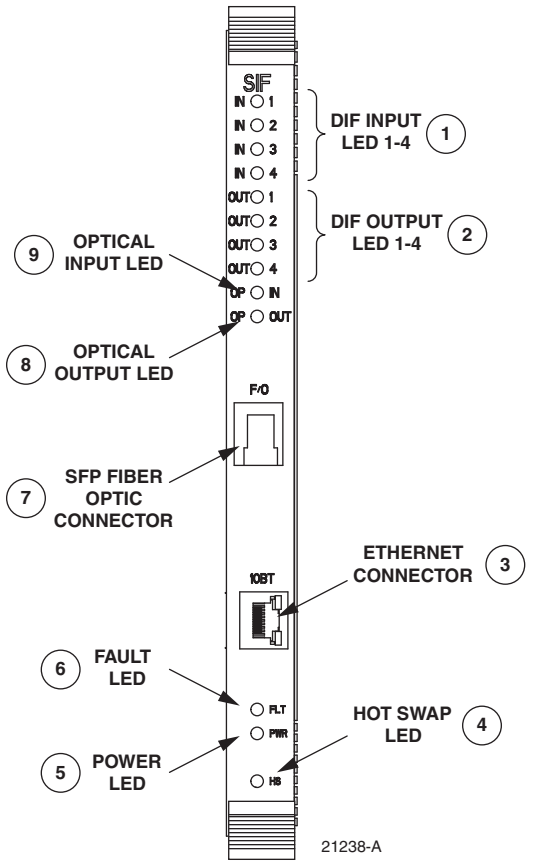



**Figure 11. Synchronous Interface Module Faceplate**

**Table 7. Synchronous Interface Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | IN 1-4 | Tri-color LED (green/yellow/red) | In. Indicates if DIF input is not enabled (off), good (green), degraded (yellow), clock issue (blinking), or no DIF tone lock or unused channel (red) |
| 2 | OUT 1-4 | Tri-color LED (green/yellow/red) | Out. Indicates if DIF output is not enabled (off), good (green), degraded (yellow), clock issue (blinking), or bad data on output of unused channel (red) |
| 3 | 10BT | RJ-45 connector | 10BaseT (Ethernet). Communications between SIF and CPU using cable 1001478P001 |
| 4 | HS | Blue LED | Not used |
| 5 | PWR | Green LED | Power. Lights when module has power |
| 6 | FLT | Red LED | Fault. Lights when module has failed and during start-up until module is initialized |

**Table 7. Synchronous Interface Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 7 | F/O | Dual-LC connectors | Fiber/Optics. Optics connector on SFP optical transceiver |
| 8 | OP IN | Tri-color LED (green/yellow/red) | Optical In. Indicates input status of the SFP interface: not enabled (off), good (green), degraded (yellow), or bad output signals (red) |
| 9 | OP OUT | Tri-color LED (green/yellow/red) | Optical Out. Indicates output status of SFP interface: not enabled (off), good (green), degraded (yellow), or bad framing, bad parity, no signal, or no signal lock (red) |

### 1.7.5 Small Form-Factor Pluggable (SFP) Optical Transceiver

The Small Form-Factor Pluggable (SFP) Optical Transceiver, located on the SIF module and shown in Figure 12, provides the optical interface between the Hub equipment and the RAN hardware. The SFP has a laser transmitter and an optical receive detector.

The Digivance NXD system uses industry standard SFP optics which offer a number of configuration options depending on the requirements of the project. The SFP modules are available separately and may or may not be installed in the SIF depending on the configuration ordered. The SFP module is specified as up to two per RAN and is able to support two bands with receive diversity.

The standard SFP module has an optical budget of 9 dB. The SFP module is factory and field replaceable with optical transceivers having extended optical budgets up to 26 dB or Coarse Wave-Division Multiplexing (CWDM) optical wavelengths.

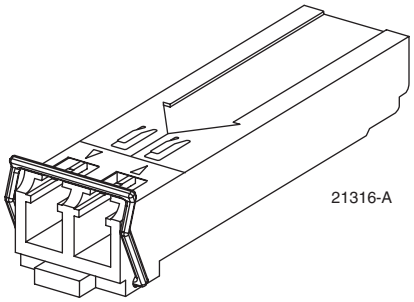



**Figure 12. Small Form-Factor Optical Transceiver**

### 1.7.6 RAN Down Converter (RDC or RDC2) Module

The RAN Down Converter (RDC or RDC2) Module is a cPCI electronic module housing a dual-diversity wideband RF receiver. This module takes PCS, Cellular, SMR A, and SMR B signals from a primary and secondary antenna (via the appropriate multicoupler) and converts the signals to Digitized Intermediate Frequency (DIF).

This module also provides a CW test tone for use in reverse continuity testing. The RF signals are input into the module by way of coax cables terminated with SMA connectors on the faceplate (at the ports labeled PRI IN and DIV IN). Figure 13 shows the module faceplate. Table 8 describes the module faceplate components called out in the figure.

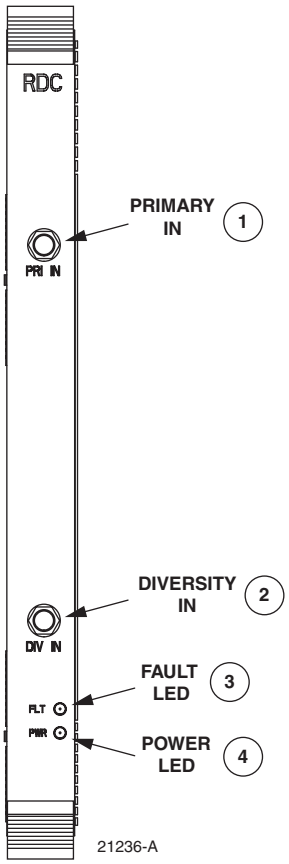



**Figure 13. RAN Down Converter Module Faceplate**

**Table 8. RAN Down Converter Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | PRI IN | SMA connector | Primary In. Receives RF primary output from either C/PMC-PLR or P/MCPLR module. Connection is made using cable 1955000P081 |
| 2 | DIV IN | SMA connector | Diversity In. Receives RF diversity output from either C/PMCPLR or P/MCPLR module. Connection is made using cable 1955000P081 |
| 3 | FLT | Red LED | Fault. Lights when module has failed and during start-up until module has initialized; blinks after module receives a system clock and is awaiting initialization |
| 4 | PWR | Green LED | Power. Lights when module has power |

### 1.7.7 RAN Up Converter (RUC2.X or RUC3) Module

The RAN Up Converter (RUC2.X or RUC3) Module is a cPCI electronic module that takes Digitized Intermediate Frequency (DIF) signals from a DIF signal generated by the SIF and converts the signals to RF (PCS, Cellular, SMR A, and SMR B frequency bands). Each module supports two simultaneous bands via wideband outputs. The RUC also provides clocking for its neighboring RDC. For module faceplate and callouts, see Figure 14 and Table 9.

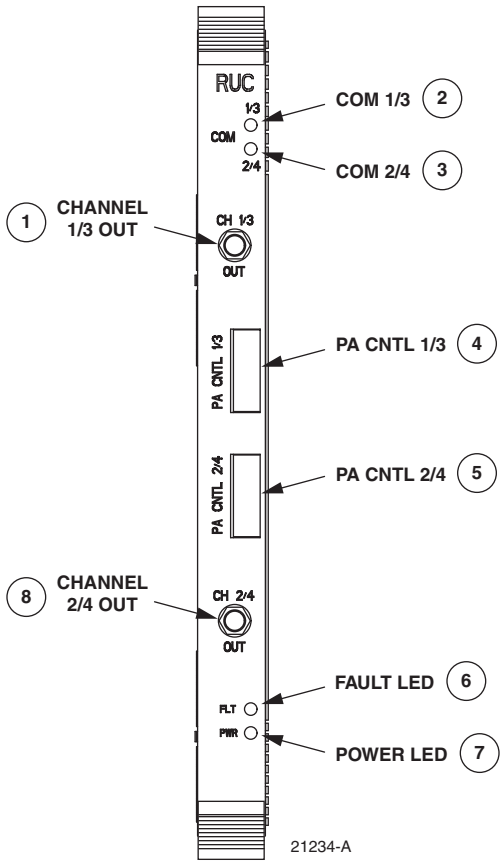



**Figure 14. RAN Up Converter Module Faceplate**

**Table 9. RAN Up Converter Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | CH 1/3 OUT | SMA connector | Channel 1/3 Out* |
| 2 | COM 1/3 | Yellow LED | COM Port 1/3. Turns yellow when DIF is locked to SIF channel 1 or 3* |
| 3 | COM 2/4 | Yellow LED | COM Port 2/4. Turns yellow when DIF is locked to SIF channel 2 or 4* |
| 4 | PA CNTL 1/3 | I2C flatpack connector | PA Control Channel 1 or 3. Outputs control data to the PIC card on the PAA for the channel being provided (using cable 1955000P079)* |

**Table 9. RAN Up Converter Module Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 5 | PA CNTL 2/4 | I2C flatpack connector | PA Control Channel 2 or 4. Outputs control data to the PIC card on the PAA for the channel being provided (using cable 1955000P079)* |
| 6 | FLT | Red LED | Fault. Turns red when the module has failed. Indicator is lit during start-up until module has initialized. Indicator will blink after module receives system clock and is awaiting initialization |
| 7 | PWR | Green LED | Power. Turns green when module has power |
| 8 | CH 2/4 OUT | SMA connector | Channel 2 or 4 OUT* |

* An RUC in slot A2 will connect to PAAs 1 and 2. An RUC in slot A5 will connect to PAAs 3 and 4. Therefore, the RUC front panel indicators of 1/3 and 2/4 will map to PAAs 1 and 2 connections in slot A2 and PAA 3 and 4 connections in slot A5.

### 1.7.8 Fan Access Panel

The Fan Access Panel, shown in Figure 15, has a hinged front panel that swings down providing access to the two fans cooling the RAN chassis. These fans are user-replaceable. This panel has labels identifying the electronic modules located in the cPCI shelf below the panel.

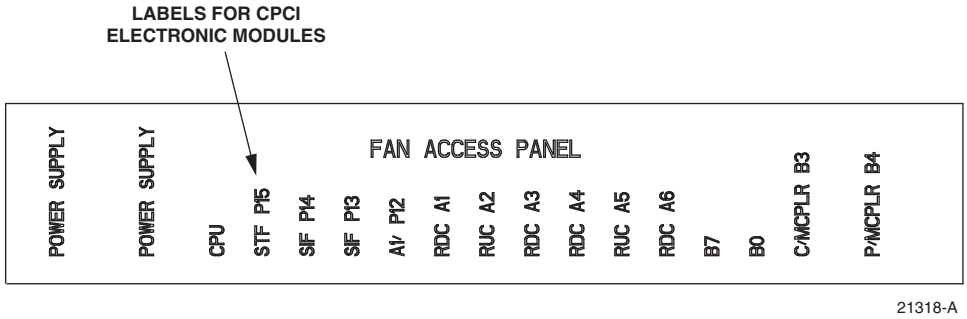



**Figure 15. Fan Access Panel**

### 1.7.9 800 MHz Multicoupler (C/MCPLR)

The 800 MHz (C/MCPLR) Module is a cPCI electronic module that houses the dual-diversity, receive unit for the 800 MHz bands. This module interfaces to the multiplexer system and contains the front end low noise amplifiers for the reverse path. The module has six outputs (Cell bands A, B, and 800 MHz, with diversity).

Figure 16 shows the location of the faceplate components. Table 10 describes the faceplate components.

**Table 10. C/MCPLR Modules Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | P IN | SMA connector | Primary In. Receives RF primary reverse path input from primary antenna |
| 2 | D IN | SMA connector | Diversity In. Receives RF diversity reverse path input from secondary antenna |
| 3 | P OUT | SMA connectors | Primary Out. 3 primary outputs (Cell bands A, B, and SMR-A). Each output being used connects to one RDC electronic module, either in the same RAN or in the extension RAN if present. Connection is made using cable 1955000P081 |
| 4 | D OUT | SMA connectors | Diversity Out. 3 diversity outputs (Cell bands A, B, and SMR-A). Each output being used connects to one RDC electronic module, either in the same RAN or in the extension RAN if present. Connection is made using cable 1955000P081 |
| 5 | FLT | Red LED | Fault. Lights when module has failed and during start-up until module has initialized |
| 6 | PWR | Green LED | Power. Lights when module has power |

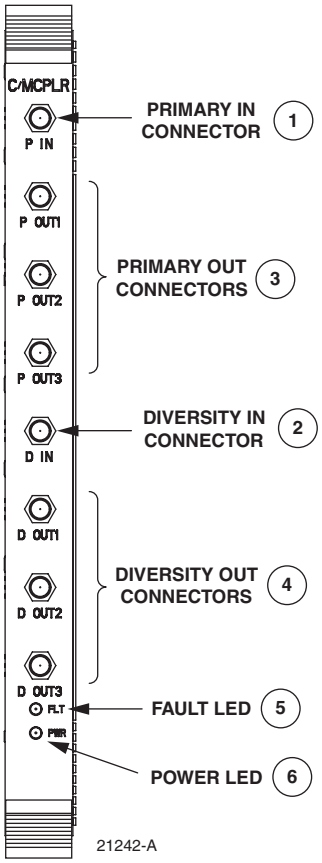



**Figure 16. C/MCPLR Module Faceplate**

### 1.7.10 1900 MHz Multicoupler (P/MCPLR)

The 1900 MHz (P/MCPLR) Module is a cPCI electronic module that houses the dual-diversity, receive unit for the PCS band. This module interfaces to the multiplexer system and contains the front end low noise amplifiers for the reverse path. The PCS band has 12 outputs (bands A-F, with diversity). Figure 17 shows the location of the faceplate components. Table 11 describes the module faceplate components.

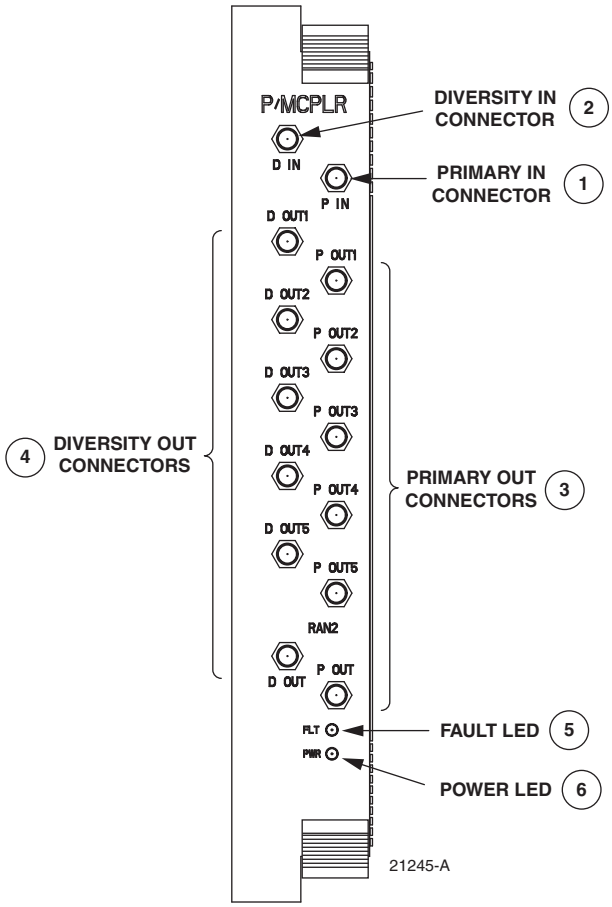



**Figure 17. P/MCPLR Modules Faceplates**

**Table 11. P/MCPLR Modules Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | P IN | SMA connector | Primary In. Receives RF primary reverse path input from primary antenna |
| 2 | D IN | SMA connector | Diversity In. Receives RF diversity reverse path input from secondary antenna |
| 3 | P OUT | SMA connectors | Primary Out. 6 primary outputs (bands A-F); each output being used connects to one RDC module, in either same RAN or extension RAN if present. Connection is made using cable 1955000P081 |

**Table 11. P/MCPLR Modules Faceplate Components**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 4 | D OUT | SMA connectors | Diversity Out. 6 diversity outputs (bands A-F); each output being used connects on one RDC module, in either same RAN or extension RAN if present. Connection is made using cable 1955000P081 |
| 5 | FLT | Red LED | Fault. Lights when module has failed and during start-up until module has initialized |
| 6 | PWR | Green LED | Power. Lights when module has power |

## 1.8 Rectifier Shelf

The Rectifier Shelf, shown in Figure 18, is a chassis/backplane device that contains rectifier modules and a Low Voltage Disconnect (LVD) unit. The shelf interconnects the rectifier modules and LVD unit, and provides an interface to external connectors.

Typically, the rectifier shelf contains two rectifier modules. The center panel on the shelf can be removed to add a third rectifier, providing N+ redundancy as more equipment is added to the RAN chassis.

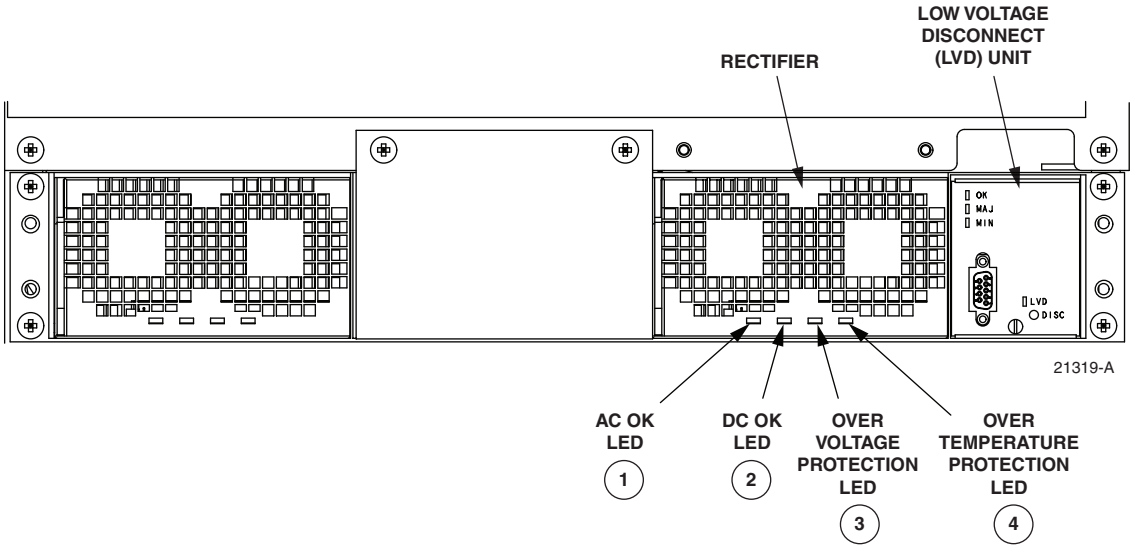



**Figure 18. Rectifier Shelf**

### 1.8.1 Rectifier Module

The rectifier module converts 240 VAC prime power into -48 VDC for use within the RAN. Each rectifier has four LEDs, shown in Figure 18 and described in Table 12. The rectifiers are controlled by the LVD unit under command of the STF2 module.

**Table 12. Rectifier Indicators**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | (Unmarked) | Green LED | AC OK. Lights when AC power is present |
| 2 | (Unmarked) | Green LED | DC OK. Lights when rectifier is limiting current |
| 3 | (Unmarked) | Red LED | Over Voltage Protection. Lights when rectifier has failed |
| 4 | (Unmarked) | Red LED | Over Temperature Protection. Lights when over temperature compensation circuit is active |

### 1.8.2 Low Voltage Disconnect (LVD) Unit

The Low Voltage Disconnect (LVD) Unit (Figure 19) disconnects power automatically when the RAN voltage falls below a specified minimum. The LVD unit also manages the backup batteries (extended or glitch).

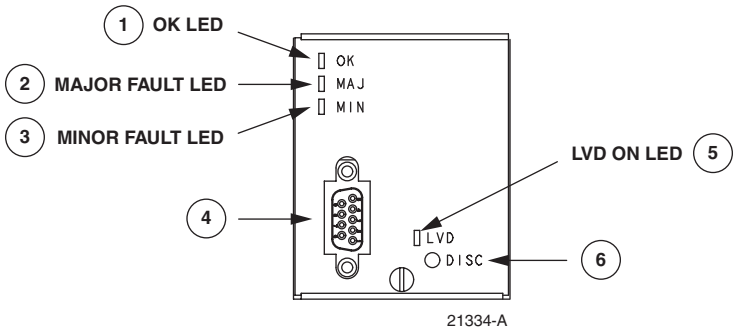



**Figure 19. Low Voltage Disconnect Unit**

**Table 13. LVD Indicators**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | OK | Green LED | Okay. Lights when power system is functioning correctly |
| 2 | MAJ | Red LED | Major Fault. Lights when a major fault exists |
| 3 | MIN | Yellow LED | Minor Fault. Lights when a minor fault exists |
| 4 | (Unmarked) | 9-pin connector | Connector for cable 1001476P001 to the RECT (RJ45 connector) port on the STF module |
| 5 | LVD | Red LED | Low Voltage Disconnect. Lights when switch has closed due to low voltage |
| 6 | DISC | Switch | Disconnect. Pressing this switch disconnects the backup batteries |

## 1.9 Power Amplifier Assembly

The Power Amplifier Assembly (PAA) is an electronic device that amplifies RF signals in the forward path just before they are transmitted to the RAN antenna. Up to four PAAs may be mounted in the RAN, each providing one band. Each PAA consists of a Power Amplifier (PA), a control board called the PA Interface Controller (PIC), and a cooling system. The PA is multi-channel. Different units are used for PCS, Cellular, and SMR 800 bands.

The PIC interfaces to the discrete signals of the PA. The PIC also provides DC power to the PA by converting from -48 VDC to +12 VDC or +28 VDC depending upon which PA is being used. Each PA has its own PIC. The PIC is managed is managed by the CPU over an I2C connection through its corresponding RUC. The cooling system consists of a heat sink and three fans that provide cooling for the PA by blowing external air across the heat sink. The fans are software-controlled. The PIC module monitors the tachometer outputs of the fan.

Figure 20 shows the PA assembly connection points and indicators. Table 14 describes the items called out in the figure.

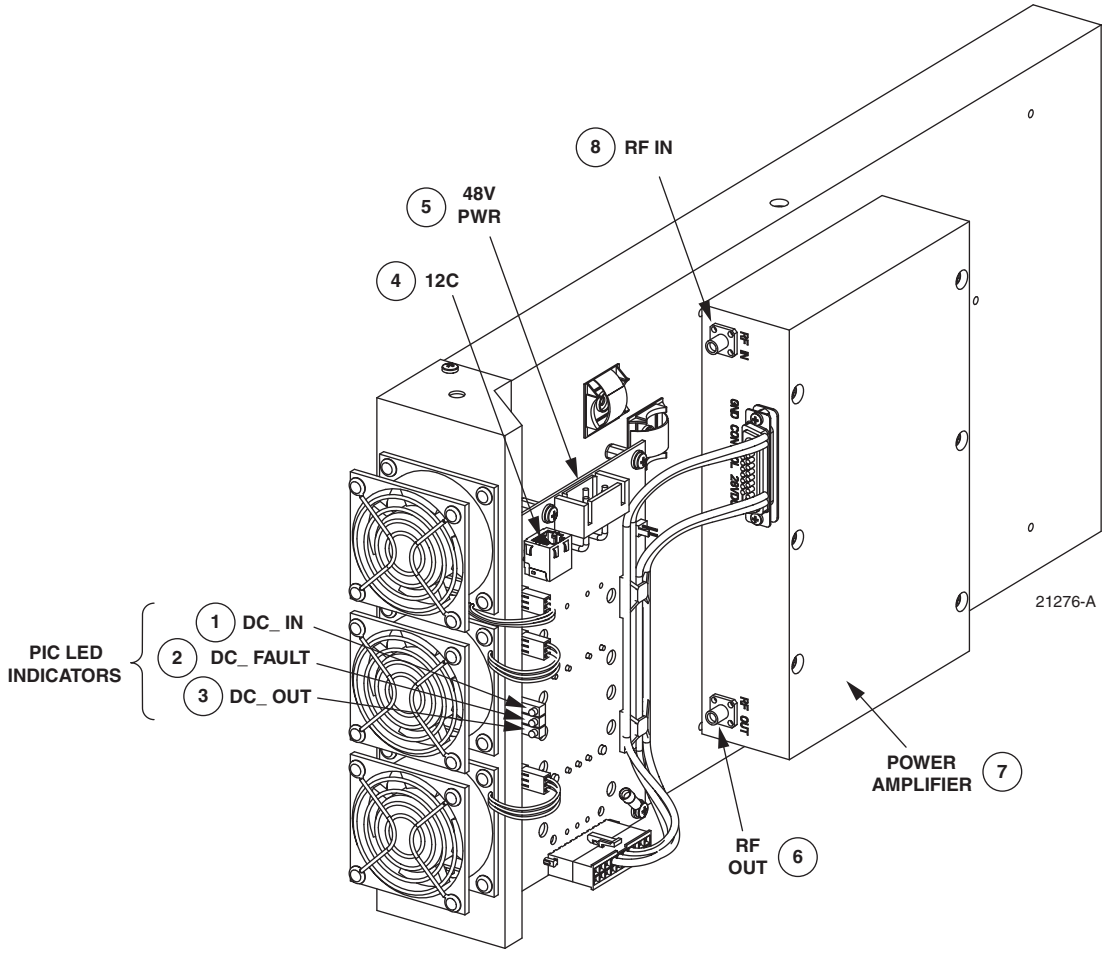



**Figure 20. Power Amplifier Assembly**

**Table 14. PAA Connection Points and Indicators**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | DC_IN | Green LED | DC In. Lighted when PIC has -48 VDC input |
| 2 | PA_FAULT | Red LED | PA Fault. Lighted when PA has failed |
| 3 | DC_OUT | Green LED | DC Out. Lighted when PIC has +28 VDC output |
| 4 | I2C | RJ-45 connector (J1) | I2C (Bus). Connection to RUC module P/A CNTRL using cable 1001475P001 |
| 5 | 48V PWR | Positronic 3-pin connector (J2) | 48 Volt DC Power. Input to PIC for -48 VDC using PIC power harness 1001471P001 |
| 6 | RF OUT | SMA connector | RF Out. Output of PA for cable 1955000P080 to one of the four plexers (depending on band), connector port TX |
| 7 | (Unmarked) | Power Amplifier | Power amplifier (see description on preceding page) |
| 8 | RF IN | SMA connector | RF In. Input from RUC for cable 19559999P079 |

## 1.10 Multiplexer System

The NXD RAN multiplexer system consists of four units that interface to the antenna, PAs, and multicouplers:

- Quadplexer Primary (PCS Bands A, B, F), interfaces to PCS primary antenna;
- Quadplexer Diversity (PCS Bands D, E, C), interfaces to PCS diversity antenna;
- Triplexer Primary, either of two types:
  - Type one (Cellular Band B, SMR800 Band), interfaces to 800 MHz primary antenna;
  - Type two (SMR800 Band, SMR900 Band), interfaces to 800 MHz primary antenna;
- Diplexer Diversity (Cellular Band A), interfaces to 800 MHz diversity antenna.

For a schematic of the PCS multiplexers, see Figure 21. For a schematic of the Cellular/SMR multiplexers, see Figure 22 (showing Cellular B, SMR800 triplexer) or Figure 23 (showing SMR800, SMR900 triplexer).

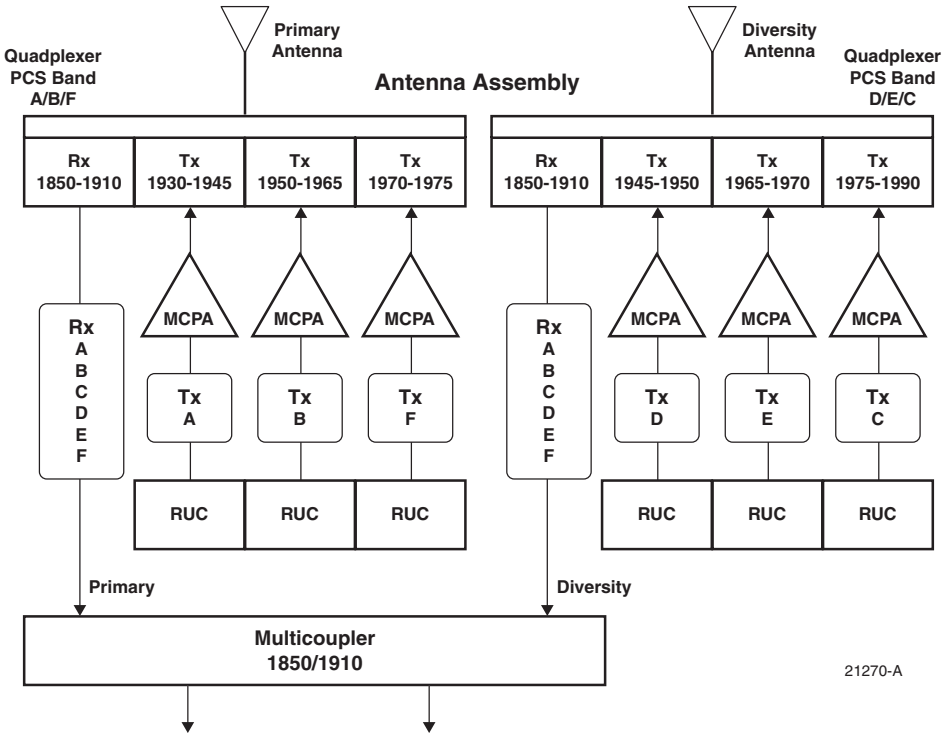



**Figure 21. PCS Multiplexers**

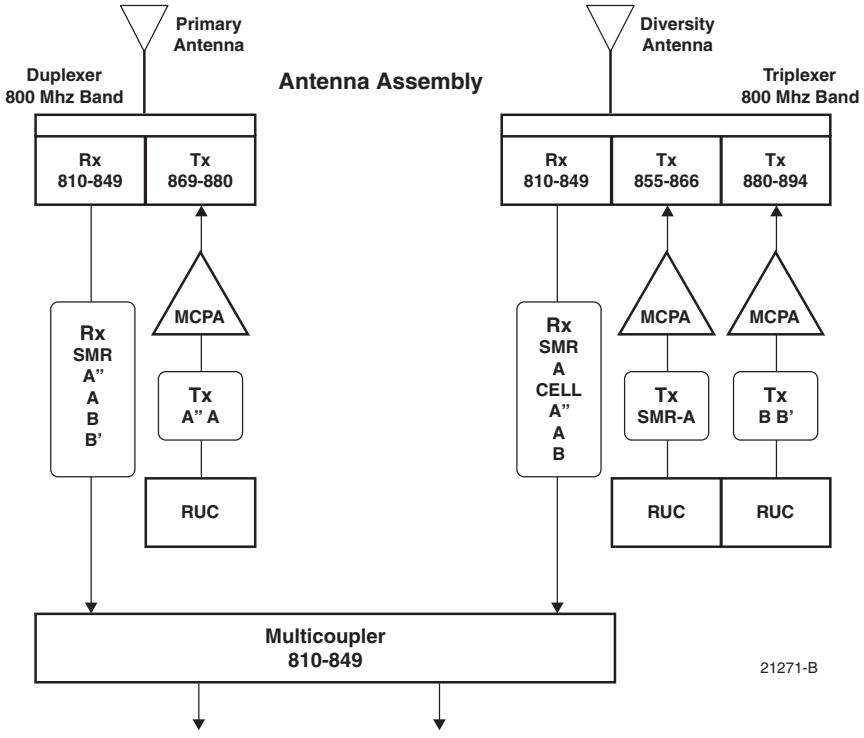



**Figure 22. Cell/SMR Multiplexers (With Cell/SMR 800 Triplexer)**

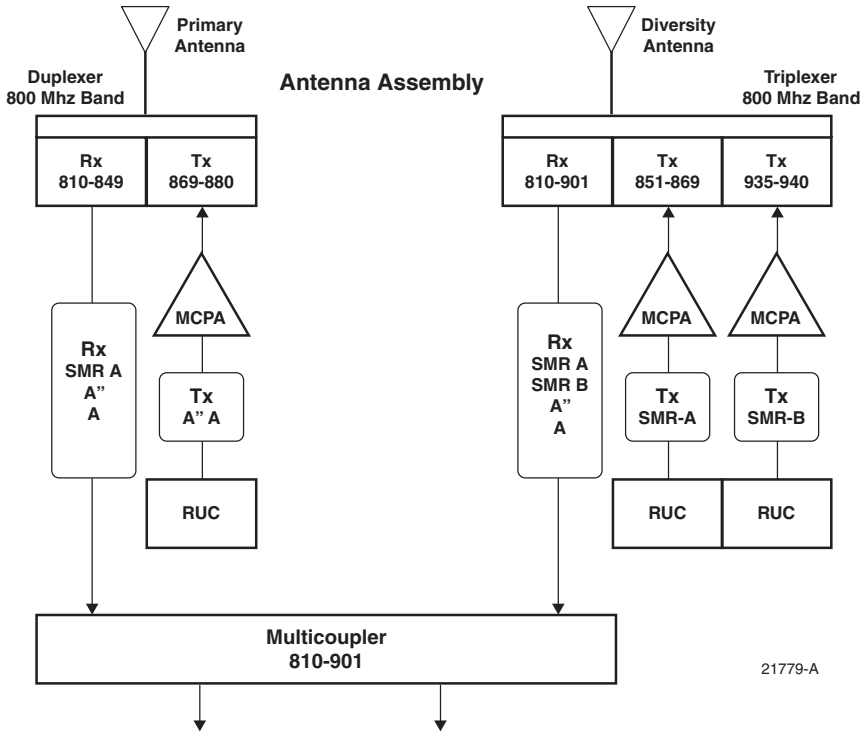



**Figure 23. SMR Multiplexers (With SMR 800/900 Triplexer)**

## 1.11 Circuit Breaker Panel

The Circuit Breaker Panel, shown in Figure 24, contains five circuit breakers. It distributes the RAN's -48 VDC power and protects the RAN's electronics. Table 15 gives the circuit breaker functions. Table 16 describes the panel LEDs.

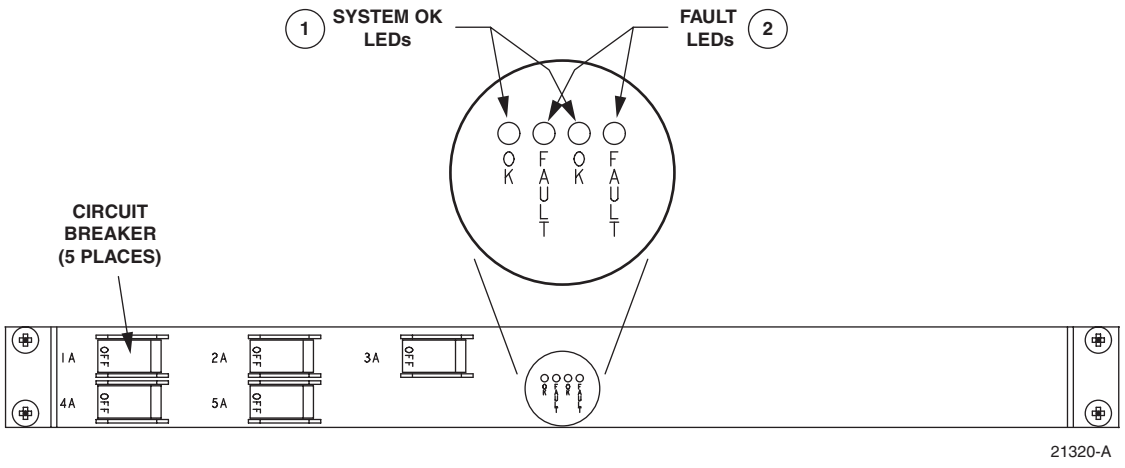



**Figure 24. Circuit Breaker Panel**

**Table 15. Circuit Breaker Functions**

| BREAKER | FUNCTION |
|---|---|
| 1A | PA1 |
| 2A | PA2 |
| 3A | PA3 |
| 4A | PA4 |
| 5A | cPCI chassis |

**Table 16. Circuit Breaker Panel LEDs**

| REF # | DESIGNATION | DEVICE | FUNCTIONAL DESCRIPTION |
|---|---|---|---|
| 1 | OK | Green LED | Okay. Lights when AC power is present |
| 2 | FAULT | Red LED | Fault. Lights when rectifier is limiting current |

## 1.12 Backup Batteries

The NXD RAN has two backup battery options:

- **Extended Batteries:** provide backup protection for up to two hours. These are four 12V, 85-100 AH internal batteries connected in series for a -48V system. The four batteries together with associated wiring and hardware weigh 325 pounds (147.7 kg).
- **Glitch Batteries:** provide backup protection for up to five minutes. These are small, motorcycle type batteries connected in a series configuration.

## 1.13 Antenna

ADC provides a pole-mount antenna kit for use when the RAN is mounted on a wooden utility pole. The kit must be separately ordered from the RAN. Pole mounting is the most common type of RAN installation.

The antenna offered interfaces with the PCS and Cellular/SMR bands and supports two branch diversity receive paths. Also included in the kit is the GPS antenna used by the RAN.

The RAN may also be mounted outdoors on a concrete pad. This type of installation may use a conventional directional antenna in either a sector or quasi-omni antenna configuration, depending on the coverage objective and design. Proper antenna selection and the mounting installation are the responsibility of the design engineer.

Antenna installation is covered in separate publications, available for downloading from the ADC web site, www.adc.com. Refer to RELATED PUBLICATIONS on Page vii.

# 2 STANDARD INSTALLATION PROCEDURES

This section provides the standard procedures for a typical installation. The RAN may be installed either on a wooden pole or on a concrete pad.

This section is organized as follows:

- Sections 2-1 through 2-4 provide information that is relevant before installing the cabinet. These subsections contain an installation overview, unpacking instructions, a list of required material and tools, and site preparation guidelines.
- Section 2-5 tells how to install a cabinet on a wooden utility pole. Included are instructions for installing the pole mount bracket and then installing the cabinet on the bracket. Also included are instructions for installing the rain shields.
- Section 2-6 tells how to install the RAN on a concrete pad. Included are instructions for pouring the concrete pad, mounting the RAN on the pad, and installing the pedestal enclosure.
- Section 2-7 contains other standard procedures typically done at every installation. These procedures describe how to install the solar shield, grounding wire, RF cables, fiber optic cable, AC power, and backup batteries.

**Note:** Section 3 contains instructions for installing a second RAN at the same location. Section 4 provides information on non-standard installation procedures such as installing an electronic module.

Installation of the RAN cabinet may proceed separately from the installation of the corresponding Hub equipment. When the installation of the RAN is completed, refer to the Digivance NXD Multi-Band Distributed Antenna System Operation Manual (ADCP-75-209) for system turn-up and test procedures.

The procedures in this section assume that the required Outside Plant (OSP) fiber optic cable has already been routed between the Hub and the RAN, that the required antenna has been installed, and that a coaxial cable terminated with an N-type connector has been routed to the RAN from the antenna.

**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.*

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

## 2.1 Installation Overview

A standard (typical) installation of the RAN consists of the following steps:

**Warning:** *Electronic components can be damaged by static electrical discharge. To prevent ESD damage, always wear an ESD wrist strap when handling electronic components.*

**Note:** To insure that all optical connectors and optical ports remain dust-free during installation, leave all dust caps and dust protectors in place until directed to remove them for installation.

1. Checking out and preparing the installation site.
2. Unpacking and inspecting the shipped items.
3. Installing a pole mount frame or pedestal mount.
4. Installing the RAN cabinet on the pole or pad.
5. Installing the rain shields (pole mount) or pedestal enclosure (pad mount).
6. Installing the solar shield.
7. Installing a ground wire.
8. Connecting RF cables between the antenna and RAN.
9. Installing the fiber optical cable that connects the RAN to the Hub.
10. Installing AC power.
11. Installing backup batteries in the cabinet.

## 2.2 Unpacking and Inspection

The RAN is shipped to the field pre-configured with all modules and components that the customer has ordered. Electronic modules except for the batteries are shipped already installed in the cabinet.

The following optional accessories may also be shipped with the RAN:

- Back-up batteries
- Non-standard SFP optical transceiver

Use the following procedure to unpack and inspect the RAN components:

1. Open the shipping cartons and carefully unpack each component from the protective packing material.
2. Check each component for broken or missing parts. If there are damages, contact ADC for an RMA (Return Material Authorization) and to reorder if replacement is required. For contact information, refer to Section 6 on Page 72.

## 2.3 Required Materials and Tools

The following materials must be supplied by the installer:

- (Pole mount only) Three galvanized steel square headed bolts with minimum tensile strength of 20,050 lbs., 3/4 in. diameter, and of a length appropriate to pole diameter; Three nuts for bolts, three flat washers, three split ring washers, and three 3-in. square curved washers (see Figure 27 on Page 39)

- (Pad mount only) Four 1/2 in. diameter galvanized steel bolts with four lock washers, four flat washers, and four concrete anchors (see Figure 29 on Page 41)
- 3M 8426-9M cold shrink
- 3M Skothkote Electrical Coating 14853
- Ten Type N plugs (CommScope PN: 540ANM or equivalent)
- Coaxial cable (CommScope PN: FXL540OPE or equivalent)
- Electrician's tape
- Water seal
- Electrical conduit
- Conduit fittings
- Connector sealant material
- Panduit LLCF6-14B-L or equivalent (X2)
- Two-hole compression lug terminal for #6 AWG wire
- Ground rod
- Connector for attaching #6 AWG grounding wire to approved ground source

The following tools are required to perform this procedure:

- Torque wrench
- Drill
- Drill bit (appropriate for pole width and 3/4 in. bolts)
- 7/16 in. open-end wrench
- Compression pliers for #6 AWG grounding lug
- Wire cutters
- Wire strippers
- Conduit cutter
- Conduit bender

## 2.4 Site Preparation

This section describes site preparation for installation and is presented only as a guideline for a typical RAN installation.

### 2.4.1 Space Requirements

When an installation site for the RAN is selected, either on a utility pole or concrete pad, care must be exercised to ensure that the site provides adequate space and clearance to accommodate the current installation and any future upgrades. Table 17 gives RAN dimensions.

**Table 17. RAN Dimensions**

| CONFIGURATION | WIDTH | HEIGHT | DEPTH |
|---|---|---|---|
| RAN | 31.35 in. (76.7 cm) | 36.5 in. (92.7 cm) | 27.5 in. (69.9 cm) |
| Dual RAN | 31.25 in. (76.7 cm) | 73 in. (185.4 cm) | 27.5 in. (69.9 cm) |

### 2.4.2 Power Requirements

Power must be available at the RAN site. The RAN requires 240 VAC, single phase, 20 Amps service. Included with the power meter must be surge protection and circuit breakers.

The RAN can have up to three 1500 watt rectifiers. For the minimum specified voltage (176 VAC), each can draw up to 10 amps. The RAN will draw up to 1800 watts normally, but when batteries are re-charging that amount will increase the current draw into a RAN to up to 16 Amps. Therefore, one 20 Amps service is required per four band RAN.

In a pole mount installation, the power meter is typically installed on the pole below the unit in separate boxes. In a concrete pad installation, an external junction box is typically placed near the RAN providing AC power, surge protection, and circuit breakers.

### 2.4.3 Antenna Requirement

ADC offers a pole-mount antenna kit (accessory) for use when the RAN is mounted on a wooden utility pole. Either a 2 in. (5.08 cm) O.D. model or a 9 in. (22.86 cm) O.D. model can be ordered. Pole mounting is the most common installation. The antenna interfaces with the PCS and Cellular/SMR bands and supports two branch diversity receive paths. Also included in the kit is the GPS antenna used by the RAN. Installation instructions for the pole mount antenna are included with the kit.

When the RAN is mounted on a concrete pad, a conventional directional antenna may be used (customer supplied). The antenna may be set to operate in either a sector or quasi-omni configuration, depending on the coverage objective and design. Proper antenna selection and the mounting installation are the responsibility of the design engineer.

### 2.4.4 RF Cable Requirements

RF cables are required at the installation site to provide the physical link between the RAN and the antenna. In a pole-mount installation, U-duct of an appropriate size is also required to cover the RF cables on the pole. The U-duct provides only physical protection. It should not be considered to provide electrical isolation from conductors on the pole. Adequate clearance must be obtained for the routing of these cables past the existing services as defined in the previous topic. In a concrete pad installation, RF cables from the antenna are routed and protected per the installation plan provided by the design engineer.

### 2.4.5 Fiber Requirements

Optical fibers are required at the site to provide the physical link between the RAN and the Hub. In a typical installation, the identified fibers are broken out of a multi-fiber sheath and routed to a splice box where they are spliced to pigtails connecting the main sheath to the RAN. The actual fiber bundle location on the utility pole may vary per the agreed to attachment point. Refer to Figure 25. The nylon cable connector on the rear of the RAN accommodates cables of a diameter in the range .38 to .50 inches (.97 to 1.27 cm). For larger size cables, refer to Section 1.6.2 on Page 9.

## 2.5 Installing a RAN Cabinet on a Wooden Utility Pole

Figure 25 shows the main components and their spatial placement in a typical NXD RAN pole mount installation.

### 2.5.1 Site Requirements Unique to Pole Mounting Locations

If power lines are present at the top of the pole, spacing requirements applicable to the RF cabling and any other hardware installed in the electric space must be considered. Per the National Electrical Safety Code, vertical clearance at supports for primary-supply conductors above other facilities is required to be 16 in. (40.64 cm) above neutrals and 40 in. (101.6 cm) above communications (60 in. [152.4 cm] if above 8700V).

For supply conductors at voltages up to 8700 between conductors, the minimum horizontal clearance provided by the NESC ANSI C2 is 12 in. (30.5 cm). For higher voltages, it is required that .4 in. (10.2 mm) be added for every 1000V above 8700. Table 18 lists the required clearances for some common high voltages.

**Table 18. Antenna Clearance vs. Voltage**

| VOLTAGE | HORIZONTAL CLEARANCE |
|---|---|
| 8700V | 12.0 in. (30.5 cm) |
| 15 kV | 14.52 in. (36.9 cm) |
| 28 kV | 19.72 in. (50.1 cm) |
| 38 kV | 23.72 in. (60.2 cm) |

This information is from the Standard Handbook for Electrical Engineers, 13th Edition, McGraw Hill, Chapter 18, Section 151, Pages 18-65.

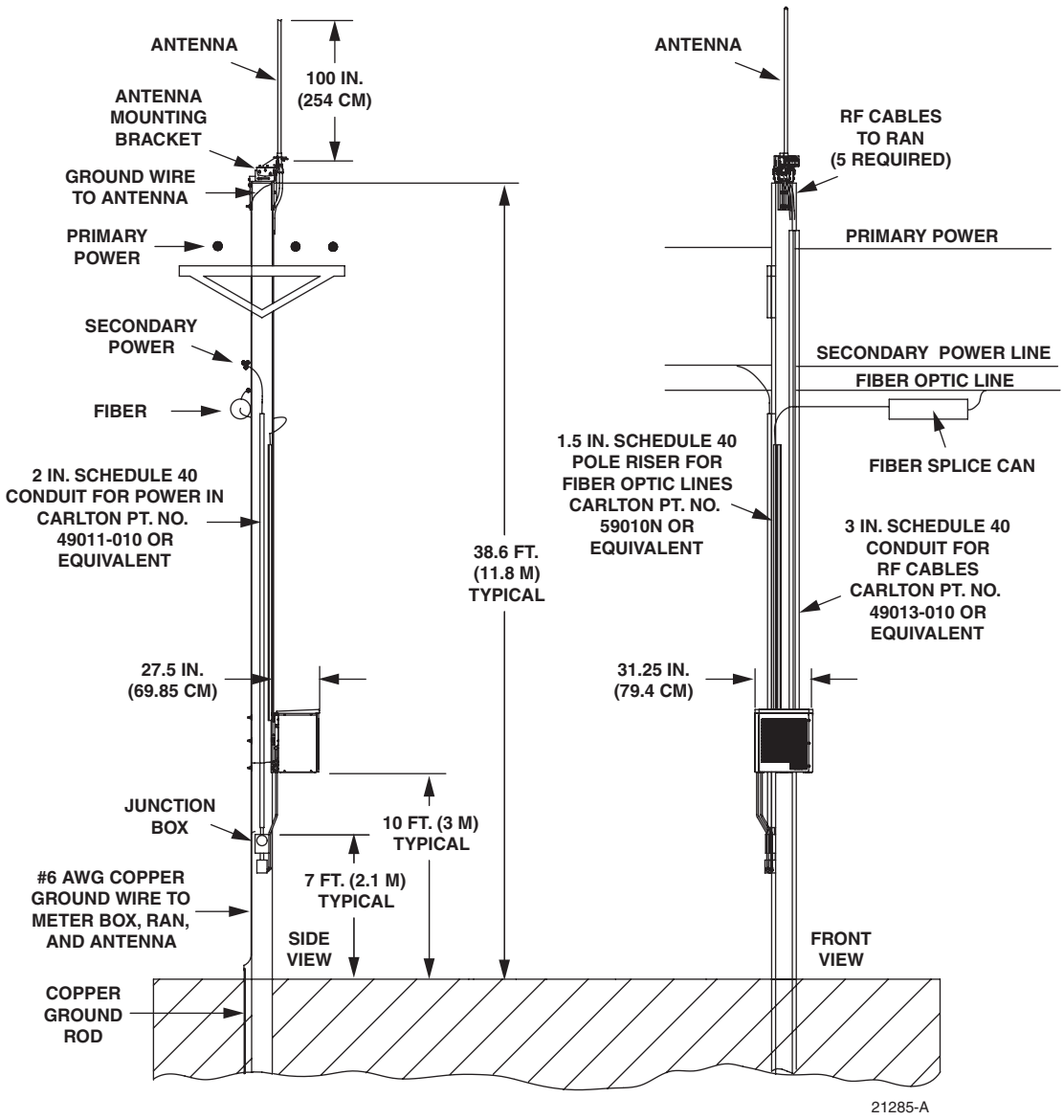



**Figure 25. Typical Pole-Mount Installation**

### 2.5.2 Pole Loading Analysis

A pole loading analysis should be performed before the RAN is mounted on the pole to verify that the pole can support the weight of the RAN in various conditions. The analysis should take into account the pole top antenna, the RAN and batteries, and the possibility of an expansion RAN with batteries. Table 19 lists the weights of various NXD components and configurations.

**Table 19. RAN Component Weights**

| CONFIGURATION OR COMPONENT | WEIGHT |
|---|---|
| Base RAN without batteries | 379 lbs. (172.3 kg) |
| Base RAN with four batteries | 679 lbs. (308.6 kg) |
| Expansion RAN with four batteries | 619 lbs. (281.4 kg) |
| Antenna pole-mount bracket (9 inch) | 56 lbs. (25.5 kg) |
| Antenna pole-mount bracket (2 inch) | 57 lbs. (25.9 kg) |
| Pole-top antenna (9 inch) | 47 lbs. (21.4 kg) |
| Pole-top antenna (2 inch) | 12 lbs. (5.5 kg) |

Three load types should be considered: static weight loading, ice loading, and wind loading. These types should be considered on the pole, wires, and any equipment installed on the pole. A qualified engineer should perform the pole loading analysis, taking into account both vertical and horizontal forces. The specified horizontal load is applied 2 ft. (60.1 cm) from the top and the assumption is that the pole acts as a cantilever with maximum stresses applied at the ground level. Table 20 provides acceptable loads by pole class.

**Table 20. Loading by Pole Class**

| POLE CLASS | HORIZONTAL LOAD |
|---|---|
| 1 | 5400 lbs. (2454.5 kg) |
| 2 | 3700 lbs. (1681.8 kg) |
| 3 | 3000 lbs. (1363.6 kg) |

The strength of the wood pole is defined in Standard Handbook for Electrical Engineers, 13th Edition, McGraw Hill, Chapter 18, Section 135, “Strength of Wood Poles,” Pages 18-57. The wood pole strength calculation is defined in Standard Handbook for Electrical Engineers, 13th Edition, McGraw Hill, Chapter 18, Section 136, Reference NEC.

### 2.5.3 Installing the Cabinet Mounting Bracket

The Digivance NXD Wood Pole Mounting Bracket, shown in Figure 26, is an accessory item that is used to attach the Digivance NXD cabinet to a power distribution pole or related object. The bracket is attached to the pole using galvanized steel square head bolts that are attached through holes drilled through the wooden pole. An example of an installed NXD wood pole mounting bracket is shown in Figure 26.

Use the following procedure to install the RAN wood pole mounting bracket:

1. Determine the mounting height of the RAN and mark the pole at the desired location of the base of the RAN.

**Note:** Install the RAN pole mount bracket on the side of the utility pole assigned by the utility company or required by local zoning.

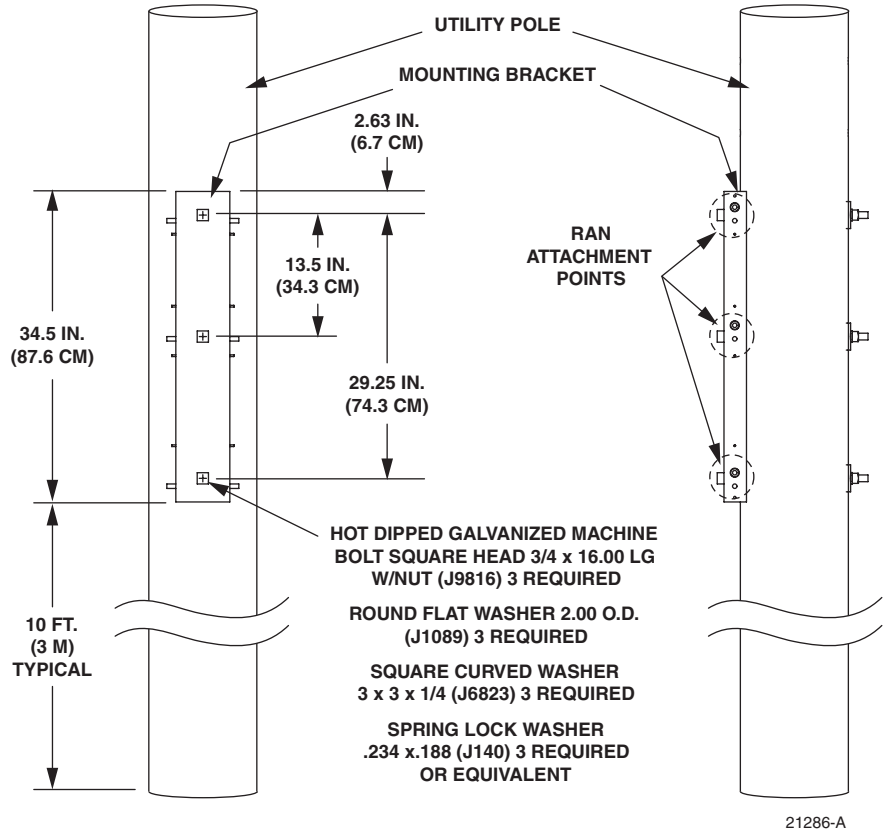



**Figure 26. Cabinet Mounting Bracket**

2. Place the pole mount bracket against the pole.
3. Strap or otherwise hold the bracket in place.
4. Using a level, adjust the bracket to make it vertically level.
5. Mark the three holes to be drilled through the wood pole.
6. Remove the pole mount bracket.
7. Drill three holes through the pole using a 7/8 in. wood bit.
8. Using a 3/4 in. machine bolt, put a 2 in. flat washer on the bolt.
9. Place the pole mounting bracket against the pole.
10. Align the holes in the bracket with the holes drilled in the pole.
11. Install one bolt through the bracket and pole (using any of the three holes).
12. Place a 3 in. square curved washer, lock washer, and 3/4 in. nut on the other end of the machine bolt; do not tighten.
13. Repeat steps 8-12 for the other two holes.
14. Using a 1-1/8 in. wrench, tighten the mounting hardware to 103 ft.-lbs.

### 2.5.4 Mounting the RAN Cabinet on the Bracket

The cabinet is shipped with the mounting hardware required for mounting the RAN cabinet on the RAN wood pole mounting bracket. The hardware consists of six 1/2 in. bolts, six nuts, 12 lock washers, and 12 flat washers. Use the following procedure to mount the cabinet. Refer to Figure 27.

**Caution:** *Do not install batteries in the RAN prior to mounting the RAN securely on the utility pole.*

1. Remove the RAN from the mounting pallet.
2. Securely attach the boom truck cable to the four hoist eyes of the RAN.
3. Carefully raise the RAN toward the cabinet mounting bracket.
4. With a person in the bucket truck and positioned at the RAN pole mounting bracket, guide the RAN onto the RAN pole mounting bracket so that the RAN holds onto the studs on the mounting bracket.

**Note:** Once the RAN is hung on the studs, the through bolts will self-align.

5. Place a lock washer and a flat washer on a 1/2 in. by 1-3/4 in. bolt.
6. Screw the bolt in hand tight.
7. Repeat the previous two steps for the remaining five mounting holes.
8. Install a flat washer, lock washer, and nut on each of the six studs.
9. Using a 3/4 in. wrench, tighten the bolts to 75 ft.-lbs.
10. Carefully detach the boom truck cable from the hoist eye of the RAN.
11. Remove the hoist eyes by unscrewing from the RAN top.

### 2.5.5 Installing the Rain Shields

There are two rain shields to be installed on the rear of the RAN. They are identified as “rain shield right” and “rain shield left.” Use the following procedure to install the rain shields. Refer to Figure 27.

1. Using the supplied hardware, place the left rain shield over the three studs in the pole mount bracket and three studs on the RAN.
2. Place a lock washer then a nut on each stud.
3. Using a nut driver or wrench, tighten to 6 ft.-lbs.

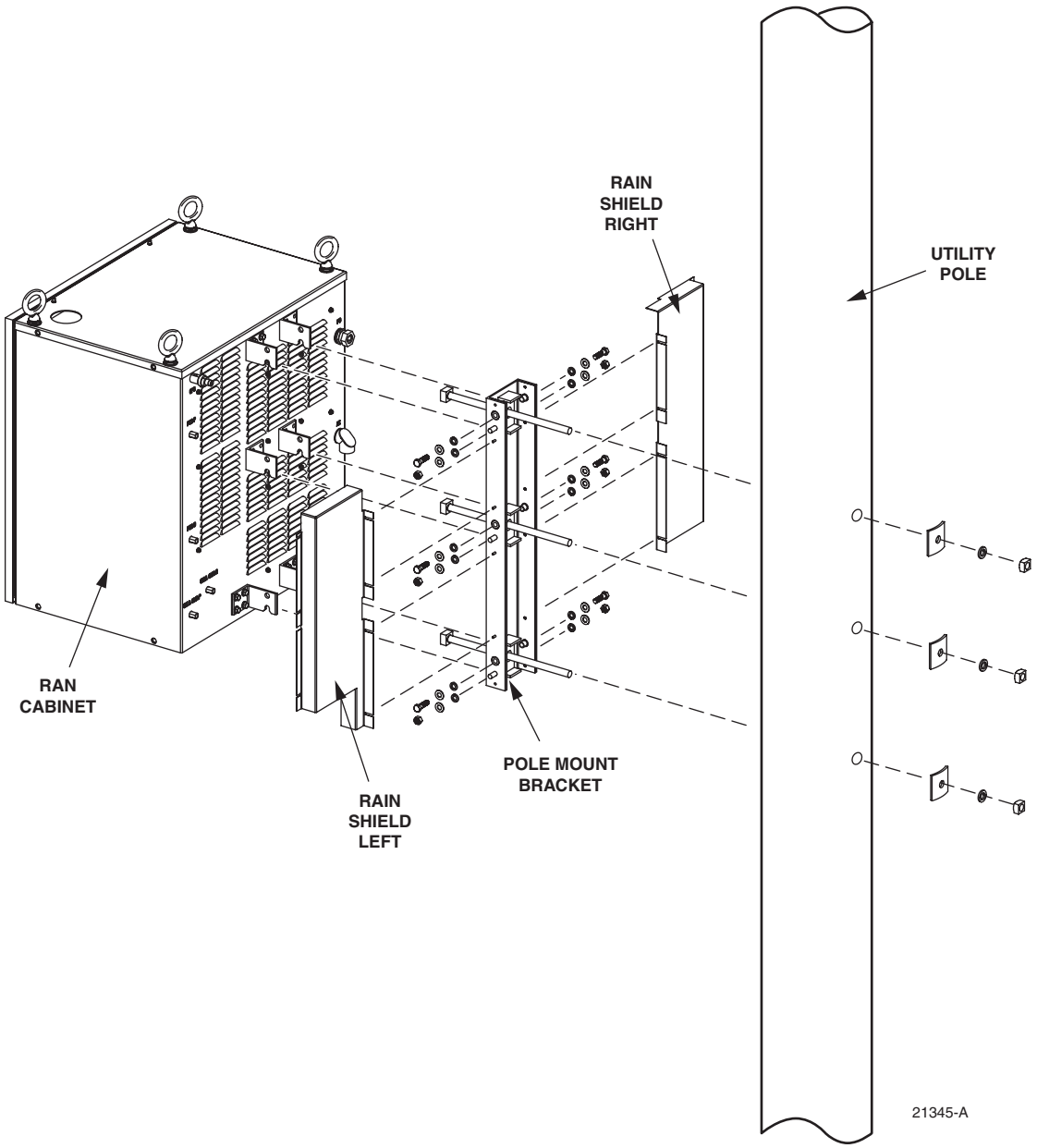



**Figure 27. Pole Mount Components**

## 2.6 Installing a RAN Cabinet on a Concrete Pad

This section contains the procedures for installing the RAN on a concrete pad.

Choose an installation site that conforms to all local codes. Obtain all required permits prior to starting installation. Situate the concrete pad along the trench that was used for routing the OSP fiber cables for the system.

### 2.6.1 Pouring a Concrete Pad

Prepare a base for the concrete pad that meets all local code requirements. The base must have a footing of 4 to 6 inches (10.2 to 15.2 cm) of sand or gravel on firmly compacted soil. Concrete pad height is site and climate dependent. Height should be based on keeping the front door air intake louvers and rear bottom exhaust vent free of obstruction. For dimensions of pad, refer to Figure 28.

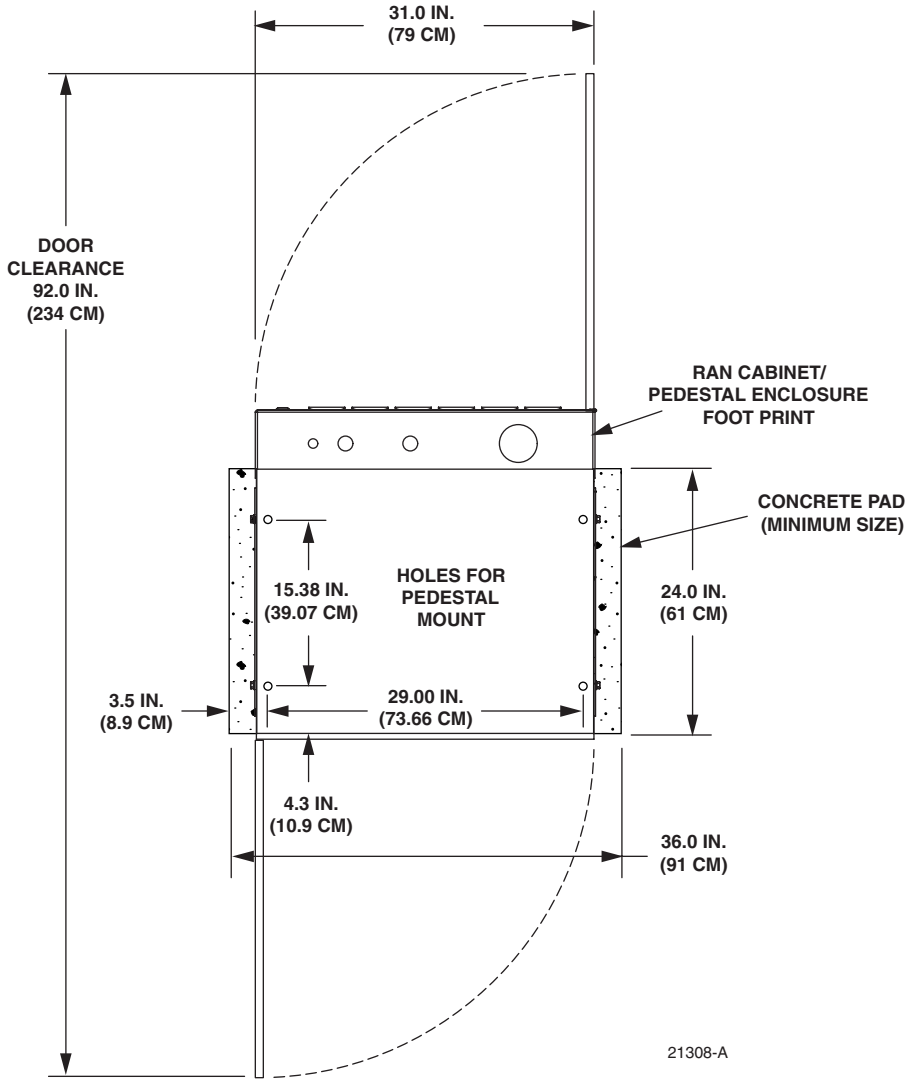



**Figure 28. Concrete Pad Dimensions**

### 2.6.2 Mounting the Cabinet on a Concrete Pad

Use the following procedure to mount the cabinet on the concrete pad.

1. Fasten the pedestal mounts to the concrete pad using the customer-supplied hardware identified in Figure 29.

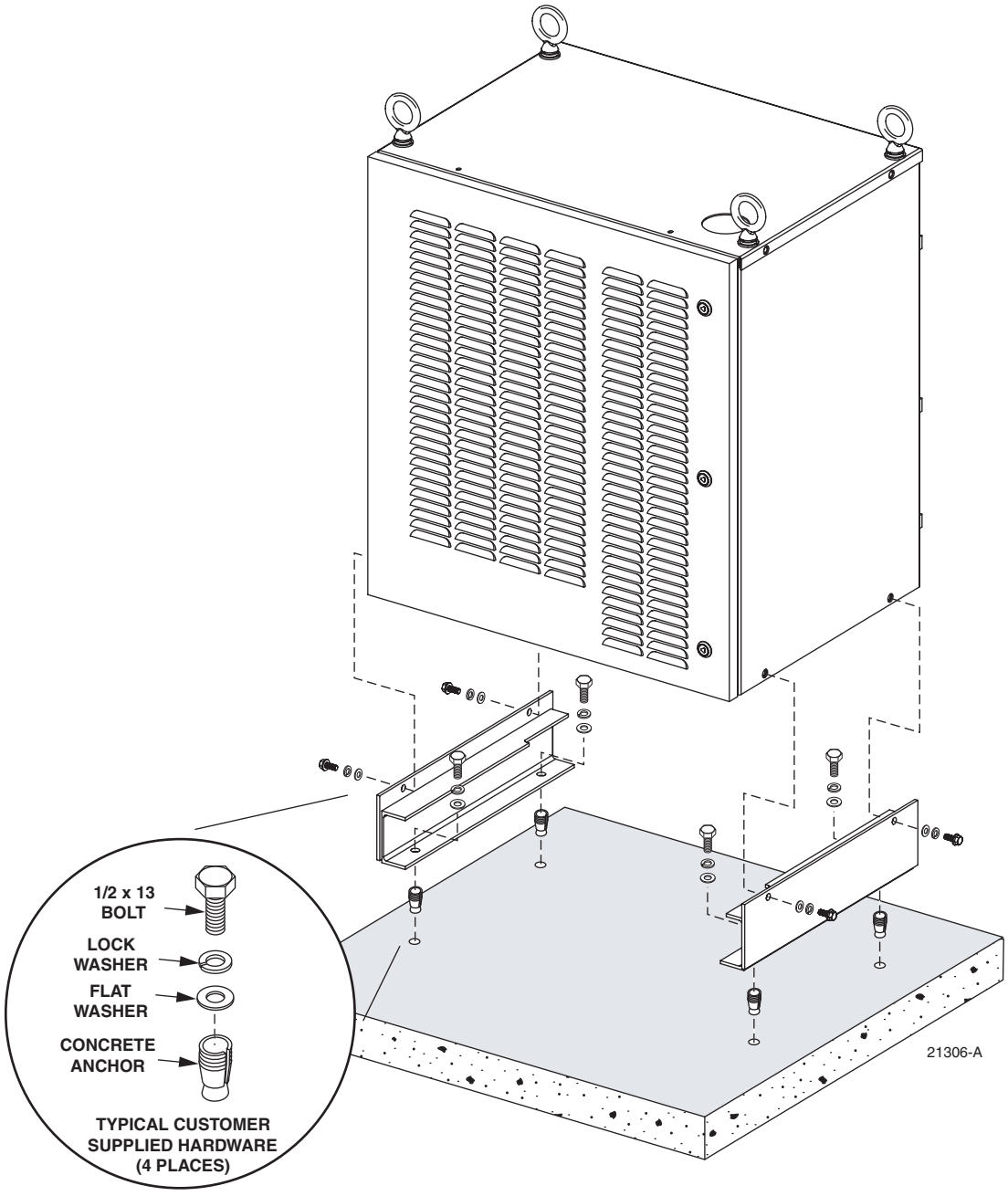



**Figure 29. Installing Pedestal Mount and Cabinet**

**Warning:** *Use appropriate lifting equipment when moving or installing the cabinet. Do not stand under the cabinet as it is being hoisted into position for installation. A failure of the lifting equipment could result in serious personal injury.*

2. Using appropriate lifting equipment, lower the cabinet into position on the cabinet mounts.
3. Secure the cabinet from the side, as shown, using the four bolts, four flat washers, and four lock washers from the shipping pallet mounting brackets.

### 2.6.3 Installing the Pedestal Enclosure

The pedestal enclosure, shown in Figure 30, mounts on the back of the cabinet.

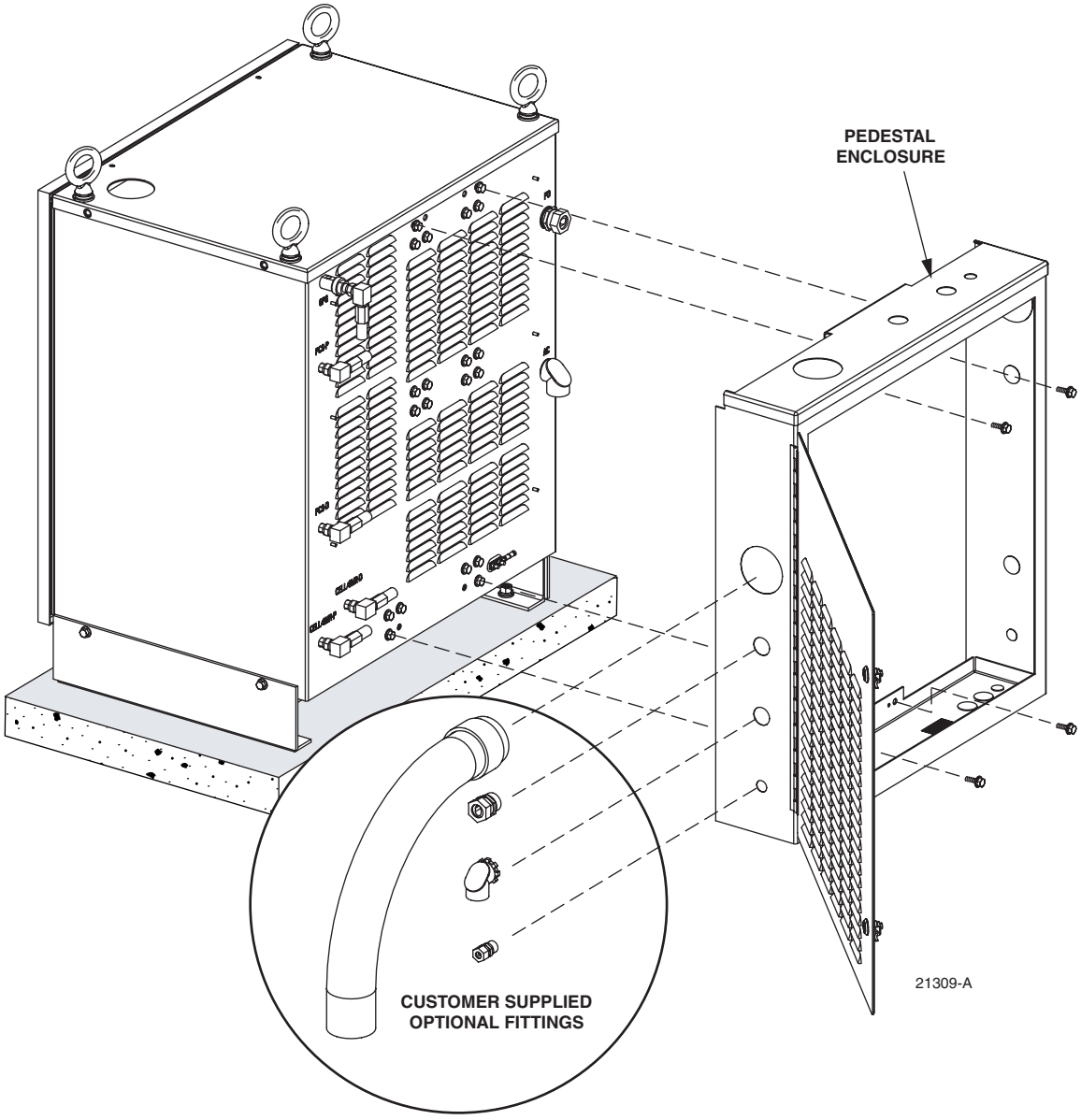



**Figure 30. Installing Pedestal Enclosure**

Use the following procedure to install the pedestal enclosure:

1. Orient the pedestal enclosure as shown and attach it to the back of the cabinet using the four bolts provided.
2. Close the pedestal enclosure door and secure the door with the key provided.

## 2.7 Other Standard Installation Procedures

This section contains other procedures done at every installation after the RAN is mounted on a wooden pole or concrete pad.

### 2.7.1 Installing a Solar Shield

Each RAN has a solar shield that mounts on top of the cabinet. Hardware for the solar shield can be found in a bag fastened to the inside of the battery compartment. The hardware consists of two 1/4 in. bolts, each with flat washer and sealing washer. Use the following procedure to install the solar shield. Refer to Figure 31.

1. Remove the solar shield from its packaging.
2. Place a lock washer and flat washer and then the sealing washer on each 1/4 in. machine bolt.
3. Using the key provided, open the RAN door.

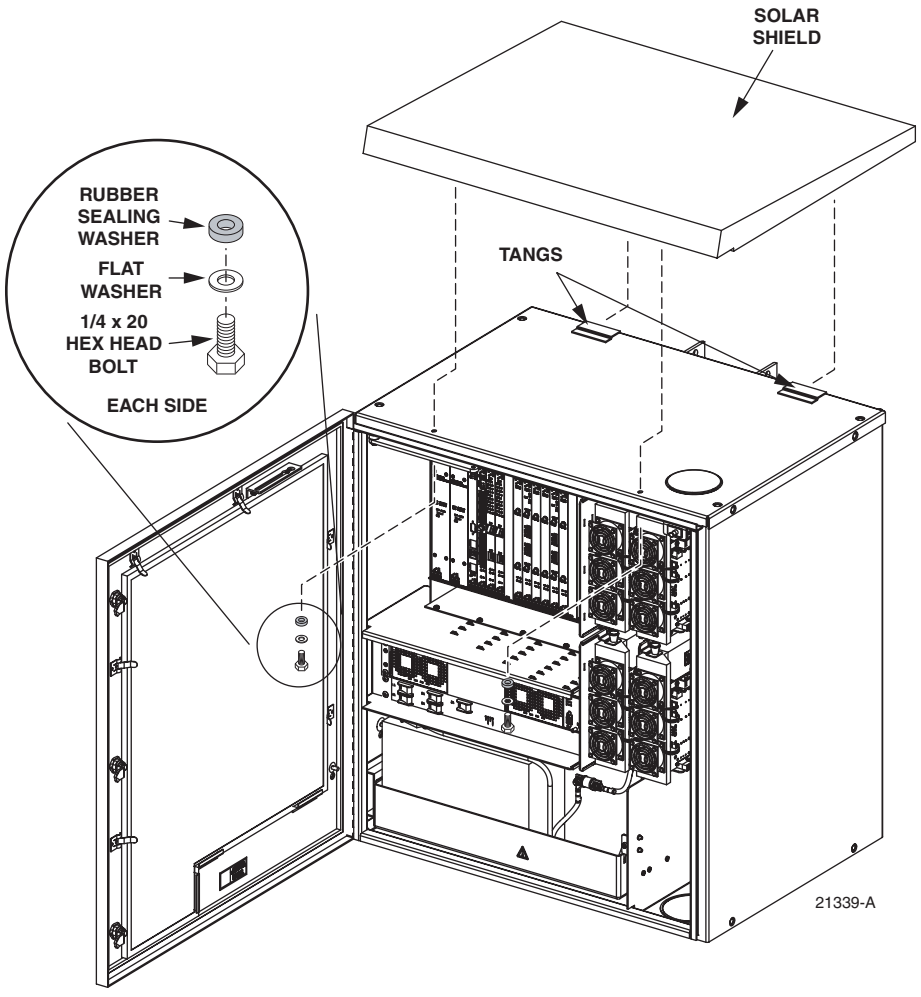



**Figure 31. Installing the Solar Shield**

4. Locate the two 1/4 in. machine bolts, each with flat washer and sealing washer, in a bag fastened to the inside of the battery compartment.
5. Place the solar shield on the top of the RAN.
6. Push the solar shield backward until it extends slightly beyond the back of the cabinet then pull it forward catching the two tangs of the solar shield on the top of the RAN.
7. Locate the two clearance holes on the left and right sides just inside the door frame.
8. Align the solar shield threaded holes with the clearance holes and insert the two 1/4 in. machine bolts in the hole.
9. Using a 7/16 in. nut driver or socket screw, tighten the two 1/4 in. machine bolts to secure the solar shield. Tighten to 6 ft.-lbs.

### 2.7.2 Installing a Ground Wire

Each RAN is designed with provisions for connecting to earth ground. Earth grounding is to be done in accordance with the National Electric Code and local building code. Two ground studs for connecting the ground wire are located on the back of the RAN (Figure 32). A 2-hole compression type lug terminal should be installed on the ground studs for connecting a #6 AWG copper grounding wire.

The following material must be supplied by the installer:

- Panduit LLCF6-14B-L or equivalent (X2)
- Two-hole compression lug terminal for #6 AWG wire
- #6 AWG wire
- Connector for attaching the wire to an approved ground source

The following tools are required to perform this procedure:

- Compression pliers for #6 AWG grounding lug
- Wire cutters
- Wire stripper

Use the following procedure to install the ground wire:

⚠ **Caution:** *For proper equipment operation, an approved earth ground connection must be provided. The recommended minimum wire size is #6 AWG copper wire.*

1. Obtain a length of #6 AWG (4 mm) copper wire for use as a cabinet grounding wire.
2. Crimp the #6 AWG copper grounding wire to the compression lug.
3. Secure the compression lug to the back of the cabinet.
4. Route the free end of the grounding wire to an approved earth ground source.
5. Cut the grounding wire to length and connect it to the earth ground source as specified by local code.

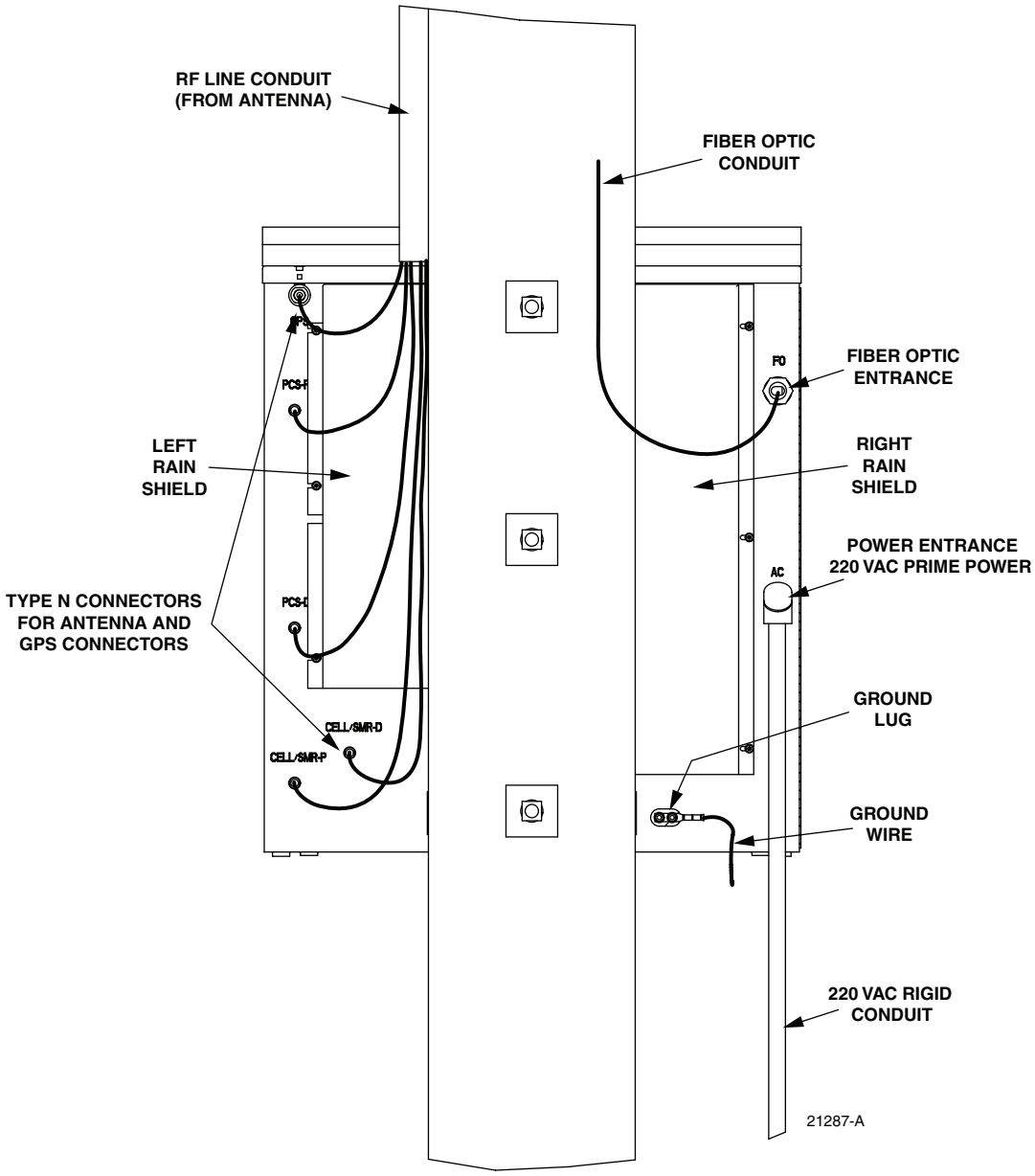



**Figure 32. Cable Connection Points**

### 2.7.3 Installing RF Cabling

RF cabling on the RAN connects the RF antenna to the RF input on the back of the RAN. There are five Type N receptacles on the antenna and five Type N receptacles on the back of the RAN, identified in Table 21 on page 47.

There are two main steps in installing RF cables: weatherproofing the cables, and routing and securing the cables.

#### 2.7.3.1 Weatherproofing RF Cables

RF cables should be weatherproofed before being installed. The following materials are required (customer supplied):

**Note:** Read and understand the manufacturer's instructions prior to using these products.

- 3M 8426-9M cold shrink
- 3M Skothkote Electrical Coating 14853

Use the following procedure to weatherproof the RF cables:

1. Prior to connecting the RF cables to either the RAN or antenna, place one 3M 8426-9M cold shrink kit over the cable end, then connect the cable end to its intended termination point. Follow the manufacturer's directions, which are included with each kit.
2. After the cold shrink has been applied, coat the entire length of the cold shrink material with the 3M Scotchkote Electrical Coating, number 14853.

#### 2.7.3.2 Routing and Securing RF Cables

For cable installation, the following materials are required (customer supplied):

- 10 Type N male plugs (CommScope PN: 540ANM or equivalent)
- Coax cable (CommScope PN: FXL540OPE or equivalent)
- Electrician's tape
- Water seal

Use the following procedure to route and secure the RF cabling:

1. Measure from the antenna base connectors to the RAN connectors to determine the coax cable length including service loops and drip loops. Refer to Figure 25 on Page 35.
2. Install the Type N plugs on each end of each of the RF cables.

**Note:** Right angle connectors may not be needed if there is enough space or if the coax cable is flexible enough to create a proper bend radius in the cable. Reference the coax cable manufacturer specifications for allowable bend radii.

**Note:** A cable sweep test is highly recommended. When testing the RF and GPS coaxial cables, use a matched load. The VSWR should be 1:1:1. The return loss should be 26.444 dB or better.

3. Attach each end of the cables to the appropriate connectors on the antenna base and the RAN. Refer to Figure 33 and Table 21.
4. Tighten each connector to 20 ft.-lbs.
5. After each connector is tightened, cover the entire connection with electrician's tape, then wrap the connection in water seal and finally cover the water seal with wraps of electrician's tape.

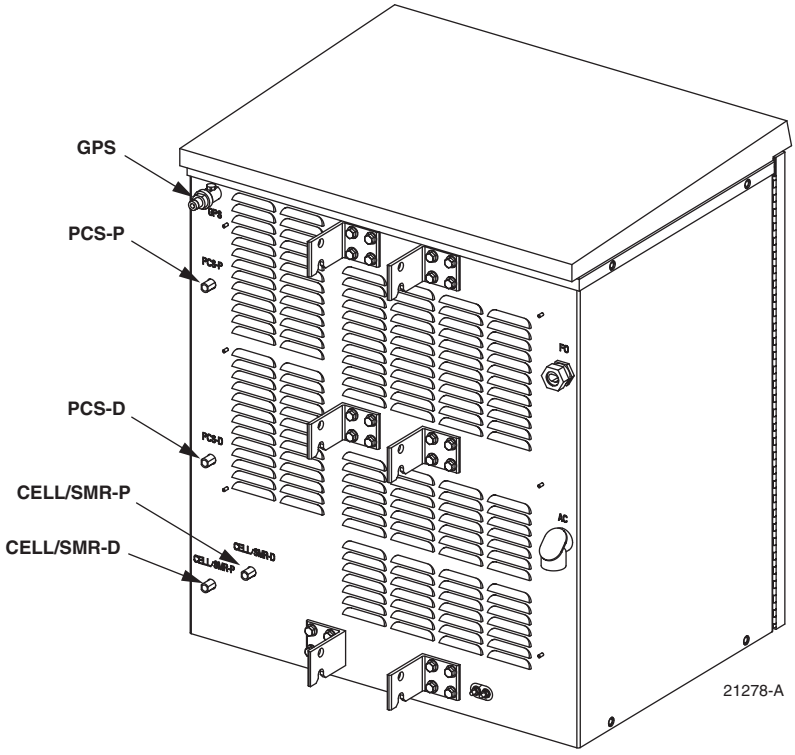



**Figure 33. Installing the RF Cables**

**Table 21. RAN Antenna Ports and Antenna Base Ports**

| LABEL ON RAN | LABEL ON ANTENNA | BAND |
|---|---|---|
| GPS | GPS | Global Positioning System (GPS) |
| PCS-P | PCS-T | PCS primary receive path and transmits from PCS A, B or F |
| PCS-D | PCS-B | PCS diversity receive path and transmits from PCS D, E or C |
| CELL/SMR-D | CELL/SMR-D | Cell/SMR primary receive path and transmits from Cell A"/A |
| CELL/SMR-P | CELL/SMR-P | Cell/SMR diversity receive path and transmits from SMR A or Cell B/B' |

**Note:** When building out RANs, connect the quadplexers that will contain the first PCS bands to the top of the PCS antenna element. On the Phasar antenna, this is marked on the base PCS-T.

### 2.7.4 Installing Pre-Connectorized Indoor/Outdoor Fiber Optic Cable

Fiber optic cable installation consists of routing a pre-connectorized outdoor-rated fiber optic cable from an external splice enclosure to the NXD RAN cabinet, routing the cable into the cabinet, and then breaking out the individual fibers for connection. The NXD RAN has a fiber interface on the front of the Synchronous Interface (SIF) Module in the RAN chassis. The fiber enters the cabinet on the rear side.

All fiber optic cable connections require single-mode Dual-LC type connectors.

Figure 34 shows the basic configuration of the optical path between the Hub SIF and the RAN SIF. For optical specifications, refer to Table 2 on page 6.

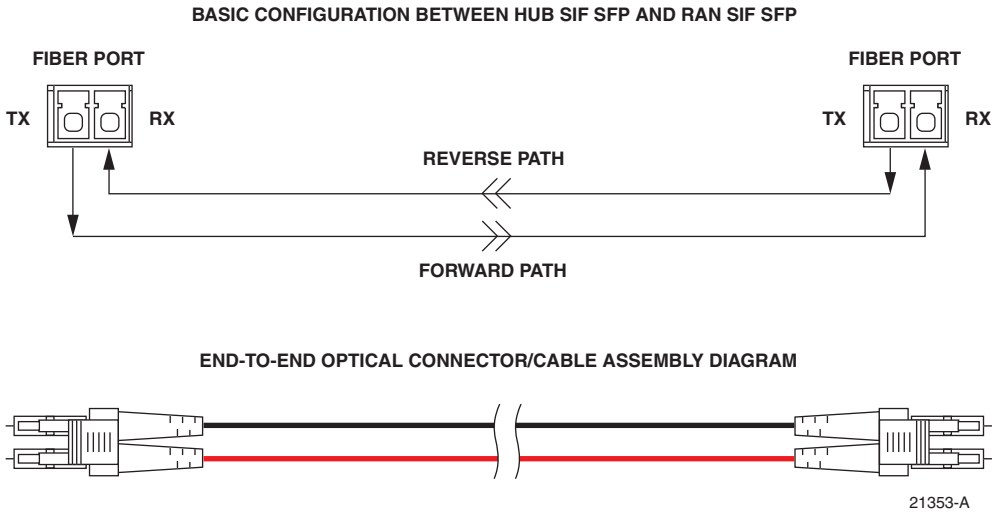



**Figure 34. Optical Path Between Hub SIF and RAN SIF**

For fiber cable ingress, the RAN is equipped with a nylon fiber optic connector located on the rear side of the cabinet. The connector accommodates cables of a diameter in the range .38 to .50 inches (.97 to 1.27 cm).

**Note:** If the installer has a larger cable, the manufacturer (Hubbell Inc.) makes bushings that fit this connector in the following size ranges: .500-.625, .625-.750, .750-.875, .875-1.00, 1.00-1.125 inches.

Use the following procedure to install the fiber optic cable:

**Note:** The routing of an Outside Plant (OSP) fiber optic cable from the Hub to a splice enclosure in the vicinity of the RAN cabinet and the splicing of selected OSP cable fibers to the fibers in the outdoor-rated cable is the responsibility of the installer.

**Warning:** *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. Route the connectorized end of the fiber optic cable from the splice enclosure (not provided) to the rear side of the cabinet. Estimated length of cable is 30 feet (9 meters) although this is dependent upon distance from the splice enclosure.

**Note:** The fiber should not have armored jacketing which may be a source for Electro-Magnetic Interference (EMI).

2. Install the compression nut and an appropriate sized split ring and bushing over the cable end. Note that the beveled side of the split ring should face toward the compression nut.
3. Insert the end of the cable into the fiber entry opening on the bottom of the cabinet and pull the cable into the cabinet.
4. Connect fiber to the LC receptor located on the SIF electronic module. For location, refer to Figure 11 on Page 16.
5. Pull back any excess fiber from within the NXD cabinet.
6. Tighten the compression nut on the fiber entry connector body to secure the cable.
7. Seal all connections.

### 2.7.5 Installing AC Power

**Note:** Power interfacing for the RAN must be performed by a licensed electrician.

Prime power for the RAN is 240 VAC, 20 Amps, single phase. A separate service disconnect and lightning arrestor for each RAN must be installed with proper grounding. An electric meter is optional depending on local agreements.

A non-connectorized #14 AWG 3-wire power cable is provided with the RAN cabinet for the AC power connections. The power cable is connected to a wiring harness within the cabinet and is approximately 20 feet (6 meters) long. The stub end of the cable must be routed out of the cabinet through conduit to an external junction box (not provided). At the junction box, the power cable must be connected to the AC power system wiring. The RAN electrical input fitting is located on the right rear of the cabinet, labeled “AC.”

The AC power cable provides three wire leads for Line, Neutral, and Ground connections. All AC wires must be run within conduit. The interface at the RAN is a 1 in. (2.54 cm) 90 degree receptor elbow.

For installation of AC power, the following materials are required (customer provided):

- Electrical conduit
- Conduit fittings
- Connector sealant material

The following tools are required to perform this procedure:

- Wire cutters
- Wire strippers
- Conduit cutter
- Conduit bender

**Note:** All electrical work must comply with local codes and requirements. A locally licensed electrical contractor is best qualified to perform this work. For operation at less than 20 Amps, consult with ADC Technical Service.

**Danger:** *Use extreme caution when working with high voltage AC power. Ensure all power is disconnected before working on power circuits.*

Use the following procedure to install the AC power wiring:

1. Install outdoor conduit between the the AC power junction box and the AC power fitting (rigid 90 degree receptor elbow) on the back of the cabinet.
2. Use a UL approved outdoor conduit connector (not provided) to connect the conduit to the AC power junction box.

**Note:** A reducer fitting must be provided to accommodate any size change to the conduit.

3. Route the AC power cable through the conduit to the AC junction box.
4. Install the required AC power supply wires between the AC junction box and the AC circuit breaker box (by the junction box not within the RAN).
5. Strip off the insulation from the AC power cable wire leads and from the AC supply wires and connect the AC power cable wires to the AC supplier cable.
6. Connect the AC power to the AC wiring harness.
7. At the AC circuit breaker box, connect the AC power supply load wire(s) to a 20 Amp circuit breaker.
8. Place the circuit breaker in the ON position and then test the connectorized AC power cable within the cabinet for proper voltage levels and correct polarity.
9. Place the circuit breaker in the OFF position when testing is complete.

### 2.7.6 Installing Backup Batteries (Extended or Glitch)

Backup batteries for the RAN may be either two-hours-extended or five minutes glitch. The batteries will need to be installed and under charge before they will be able to provide full service. Battery storage life is one year in an environmentally controlled area. Batteries should be checked prior to installation. Each battery should measure 12.6 V or greater across terminals. Any battery that measures less should not be used. Refer to the battery manufacturer's manual for specific information including charging recommendations, tests, and maintenance.

#### 2.7.6.1 Battery Safety Rules

For safety purposes, observe the following DO's and DON'T's when installing the batteries or performing battery tests and maintenance:

- DO use qualified personnel only for battery maintenance
- DO follow all battery and charger manufacturer maintenance instructions

- DO wear protective equipment (face shield, goggles, gloves) when working with or around battery systems.
- DO use proper lifting techniques when working with batteries.
- DO use insulated tools when working on batteries.
- DO remove all rings and metal watchbands before working on batteries.
- DON'T service batteries individually. Replace pack as a unit.
- DON'T replace a defective pack with an alternate type. Use only the replacement packs provided by ADC.
- DON'T lift batteries by their terminals.
- DON'T place tools, unconnected cables, or metal objects to rest on top of the batteries.
- DON'T use any chemical cleaners (ammonia, bleach, etc.) to clean batteries.
- DON'T remove vent caps or add anything to sealed, maintenance-free batteries.
- DON'T smoke, cause sparks, or carry an open flame near any battery system.
- DON'T approach any energized battery system that shows signs of over-charging or over discharging (severe swelling, cover deformation, vent caps popping off). Disconnect and isolate the battery system from all charging and discharging circuitry before approaching the system.
- DON'T circumvent any device installed by the battery or charger manufacturer for the purpose of protecting the battery system. These devices include fuses, circuit breakers, disconnects, switches, etc.

#### 2.7.6.2 Battery Installation

Use the following procedure to install the batteries:

**Warning:** *Do not short battery connections together or to ground. The battery pack has high current capacity and can cause burns or serious personal injury when shorted.*

**Warning:** *To avoid personal injury or fire damage, do not incinerate or mutilate the battery. Do not short the battery terminals and do not store or operate the battery in an airtight container.*

**Warning:** *The batteries contain hazardous materials. Deliver defective batteries to an authorized disposal center for disposal or recycling.*

**Caution:** *Before connecting batteries, be sure to turn off the low voltage connect switch located on the rectifier. The LED will be OFF.*

1. Open the RAN door.
2. Turn off the battery disconnect switch (labeled DISC) on the low voltage disconnect unit in the RAN chassis. For location, refer to Figure 19 on Page 24. The LVD LED will light up (red) when the batteries are disconnected.
3. Move the gravity latch in the battery drawer to the up position. Refer to Figure 35.

4. Pull out the battery drawer.
5. Move the gravity latch to the down position. Lock the telescopic slide into the locked out position.
6. Install the batteries in the drawer as follows, referring to Figure 36 for extended batteries and Figure 37 for extended batteries:
   a. Place the batteries in the drawer in the configuration shown.
   b. Wire the batteries in series as shown.
   c. Find the wiring harness coiled up on the floor of the battery back up drawer and plug the Anderson connectors together as shown.
7. Move the gravity latch up, push the battery drawer in, and move the gravity latch down.
8. Reconnect the battery disconnect switch (DISC) on the LVD unit. For location, refer to Figure 19 on Page 24. The LVD LED on the low voltage disconnect unit should will turn off when the batteries are reconnected.

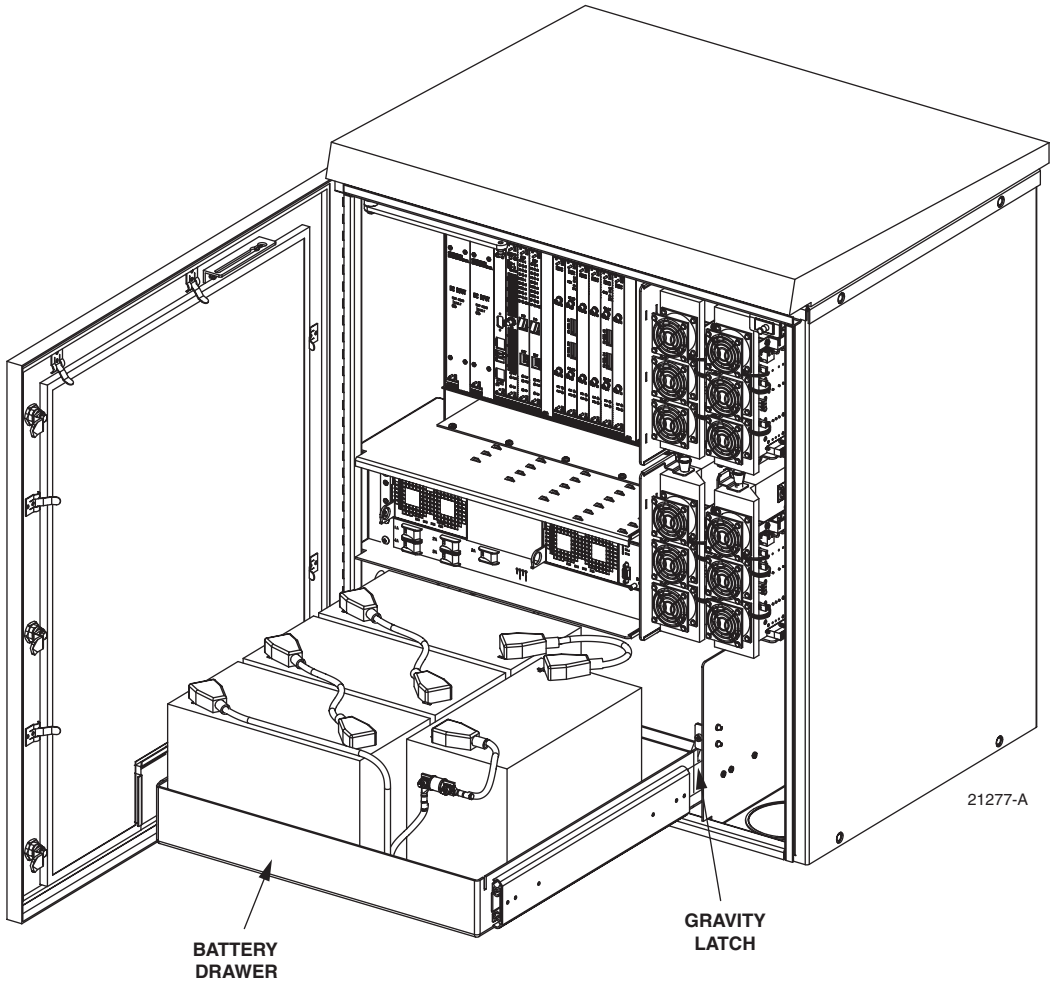



**Figure 35. Open Battery Drawer**

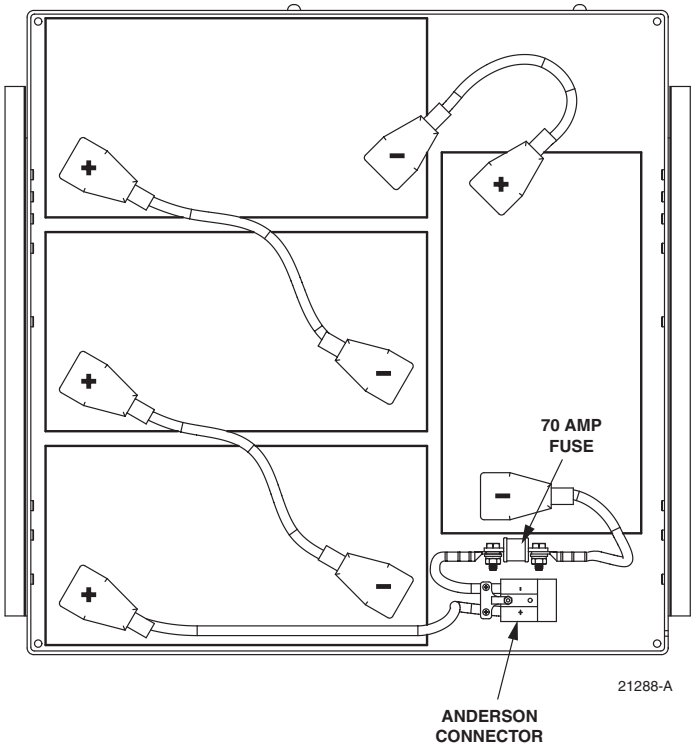



**Figure 36. Extended Batteries in Drawer**

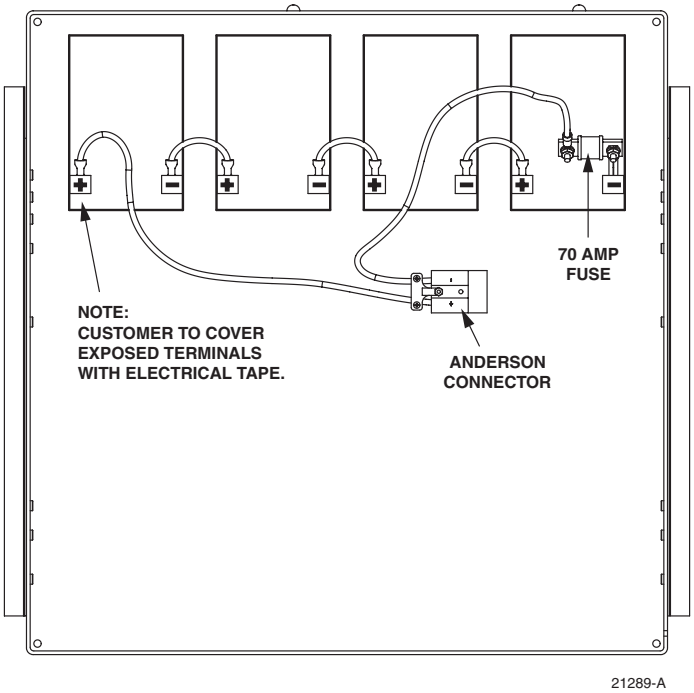



**Figure 37. Glitch Batteries in Drawer**

# 3 INSTALLING AN EXTENSION RAN (POLE MOUNT)

Two RANs can be installed at the same location to provide up to eight bands at that location using a common antenna. Each RAN requires its own separate power and RF cables and fiber optical cable. Figure 38 shows a typical dual RAN pole mount installation.

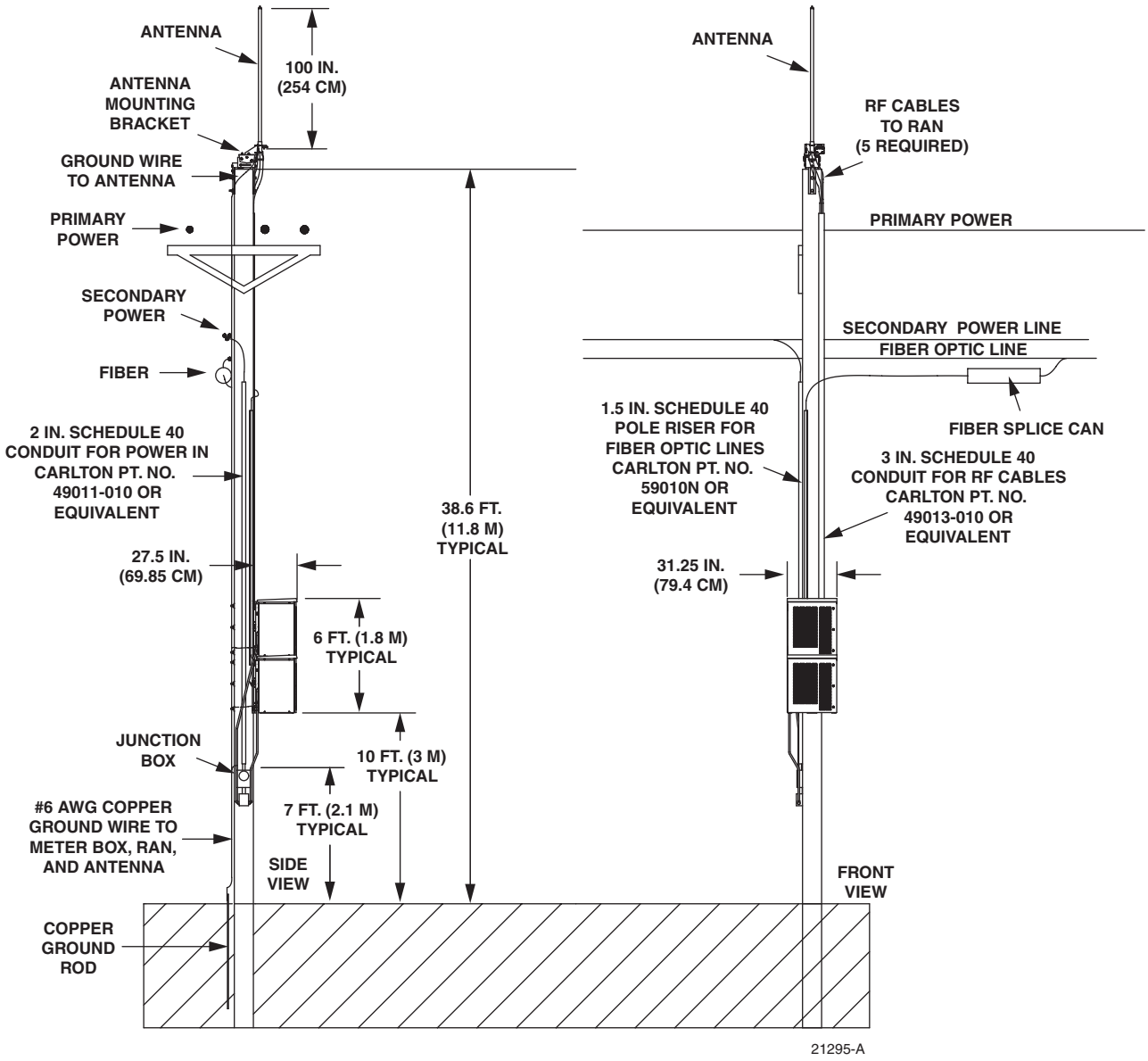



**Figure 38. Typical Dual RAN Pole-Mount Installation**

### Materials Required (Customer Supplied):

- Three galvanized steel bolts with tensile strength of 20,500 lbs. or greater, 3/4 inch diameter, of a length appropriate to pole diameter

- Three nuts, three flat washers, three 3 in. square curved washers, and three split ring washers for bolts

**Materials Required, ADC Supplied:**

- RAN fixturing angle P/N 1001509P001 (X2)
- 1/4-20 X 3/4 hex bolts (X4)
- 2 in. through hull bulkhead fitting
- Flexible grommet

Use the following procedure to install an expansion RAN. Refer to Figure 39.

**Note:** This procedure assumes that the expansion RAN is installed on a utility pole directly above the existing RAN.

1. Open the existing RAN door.
2. Remove the solar shield from the existing RAN. Refer to the solar shield installation procedure in Section 2.7.1 on Page 43 and do the steps in a reverse order.

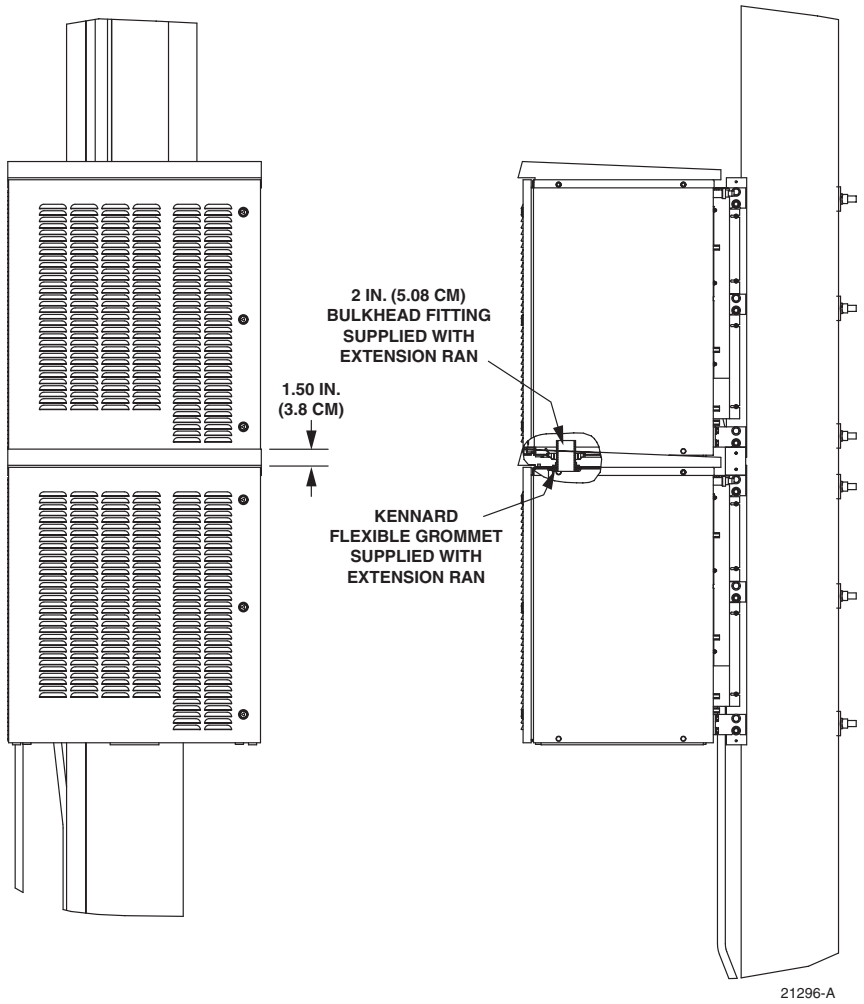



**Figure 39. Dual RAN Pole Mount**

3. If RF cables will be routed from the existing RAN M/MCPLR or P/MCPLR module to the extension RAN, remove the hole seal plugs located on the top right of the existing RAN and on the bottom right of the extension RAN.

**Note:** In this case, the multicoupler modules, the PAAs, and the GPS in the existing RAN will be providing input into the extension RAN RDC module, the PAAs, and the STF module (ANT input) for some or all of bands 5-8. The associated RF cables from the multicouplers will be routed out of the top of the existing RAN and into the bottom of the extension RAN.

4. Bolt the fixturing angle to each side the expansion RAN pole mount bracket bottom holes using the two 1/4-20 X 3/4 hex bolts.
5. Raise the assembly above the existing RAN and align the bottom of the fixturing angle with the top of the existing pole mount bracket.
6. Bolt the fixturing angle to each side of the existing RAN pole mount bracket top holes using the two 1/4-20 X 3/4 hex bolts.
7. Install the extension RAN pole mount bracket, RAN cabinet, and rain shields following the instructions in Section 2.5.3 on Page 36, Section 2.5.4 on Page 38, and Section 2.5.5 on Page 38, respectively.
8. Install a solar shield on the extension RAN following the instructions in Section 2.7.1 on Page 43.
9. Install a grounding wire on the extension RAN following the instructions in Section 2.7.2 on Page 44.
10. Install the RF cables from the antenna to the extension RAN following the instructions in Section 2.7.3 on Page 45.
11. Install the fiber optic cable from the Hub to the extension RAN following the instructions in Section 2.7.4 on Page 47.
12. Install AC power in the extension RAN following the instructions in Section 2.7.5 on Page 49.
13. Install backup batteries in the extension RAN following the instructions in Section 2.7.6 on Page 50.
14. Close and secure both RANs.

# 4 NON-STANDARD INSTALLATION PROCEDURES

This section contains other installation procedures that are not typically done at a RAN installation. These procedures cover field installation of electronic modules and other components like the RAN chassis fans.

## 4.1 Installing an Electronic Module

If installing an electronic module in the field, refer to the appropriate procedure in this section. There is a procedure for each type of electronic module. For a comprehensive description of the electronic modules including function, controls, and indicators, refer to the appropriate topic in Section 1.7 on Page 10.

Typically, the RAN chassis is shipped populated with the appropriate modules based on the pre-ordered system configuration. Installation of electronic modules is only required when installing a new electronic module or when changing the the system configuration.

**Note:** Not all options and features are supported in combination.

The electronic modules install into predetermined slots in the chassis identified by the labels on the fan access panel above the chassis. For an illustration of the fan access panel labels and a listing of the slots, refer to Section 1.7 on Page 10.

**Warning:** *Electronic components can be damaged by static electrical discharge. To prevent ESD damage, always wear an ESD wrist strap when handling electronic components.*

The interconnection diagram shown in Figure 40 and Figure 41 on the next two pages summarizes the interconnections between the RAN chassis electronic modules and other electronic components of the RAN such as rectifiers and PAAs.

**Note:** The interconnection diagram shows a typical configuration. Other configurations are possible that would be interconnected slightly differently.

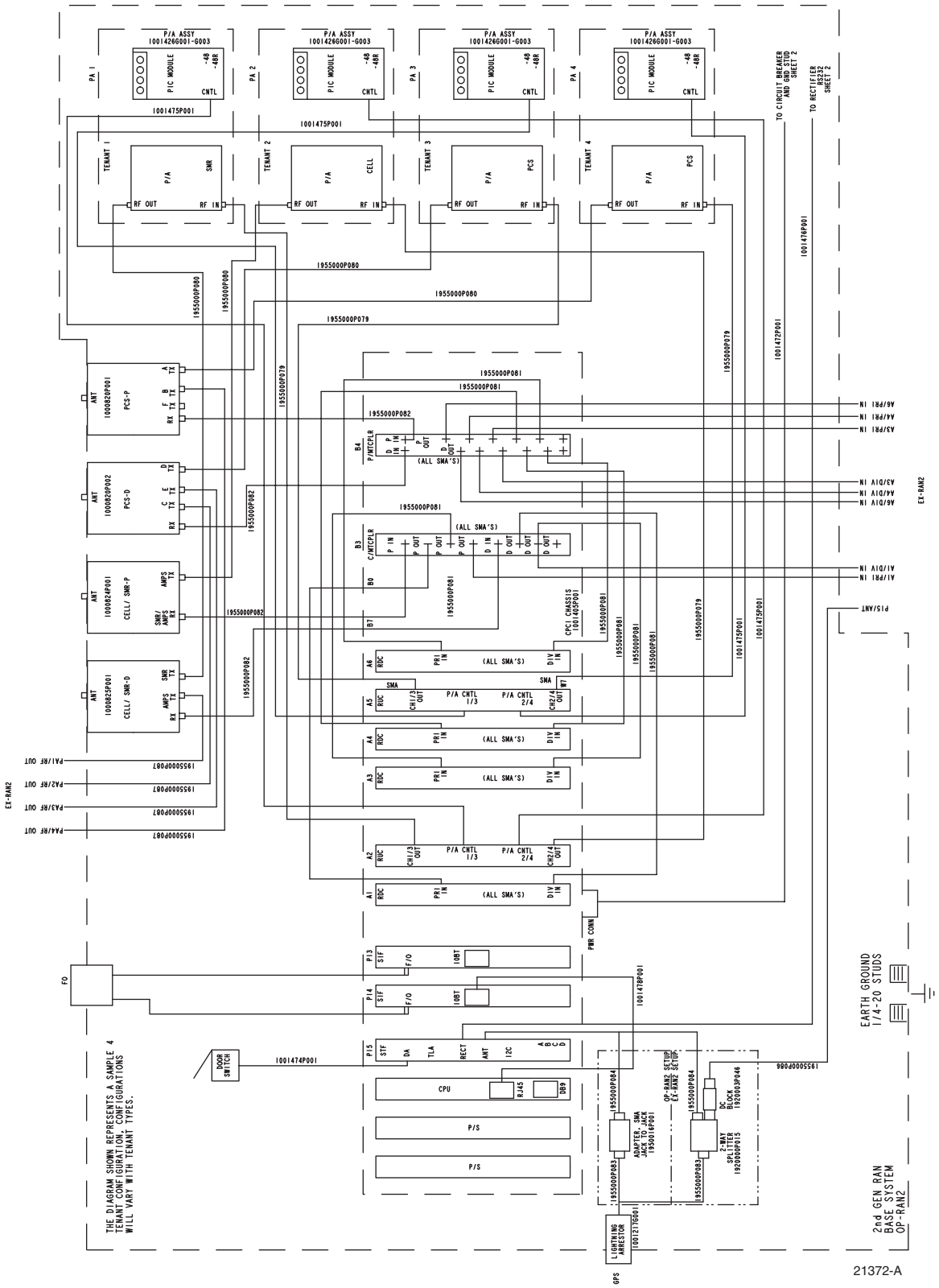



**Figure 40. RAN Interconnection Diagram Part 1**

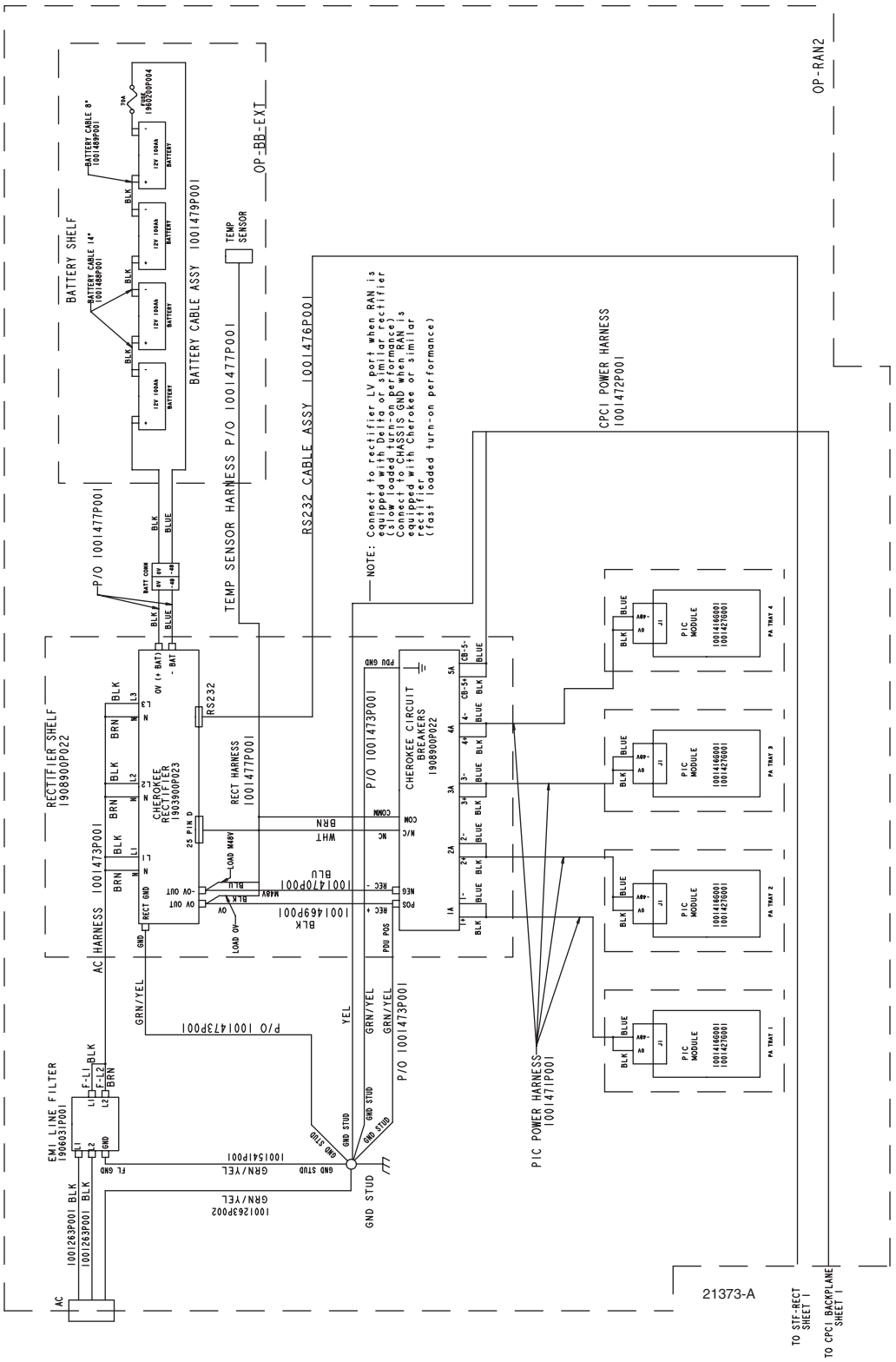



**Figure 41. RAN Interconnection Diagram Part 2**

### 4.1.1 Installing a Central Processing Unit (CPU) Module

The Central Processing Unit (CPU) module installs into Slot 5 of the RAN chassis. Only one CPU may be installed in the RAN chassis.

**Note:** For a description of the CPU module including function, controls, and indicators, refer to Section 1.7.2 on Page 13. For a RAN chassis interconnection diagram, refer to Figure 40 on Page 58.

Use the following procedure to install the CPU module (Figure 42):

1. Open the RAN door.
2. Locate the designated slot for the CPU module. The CPU module installs into Slot 5, which is identified with a red colored card guide.
3. Remove the CPU module from the anti-static packaging and orient the module for installation as shown in the figure.
4. Slide the CPU module into the designated slot within the RAN chassis.
5. Lock the IEL handles on the top and bottom of the CPU module into the cPCI chassis.
6. Tighten the two Phillips head screws inside the handles.
7. Connect the short CAT5e jumper (cable 1001478P001) between the “ENET” port on the CPU module the “10BT” port on the SIF module.

**Note:** If there are two SIF modules present, connect the cable to the first SIF module (leftmost SIF module when viewed from the front of the chassis).

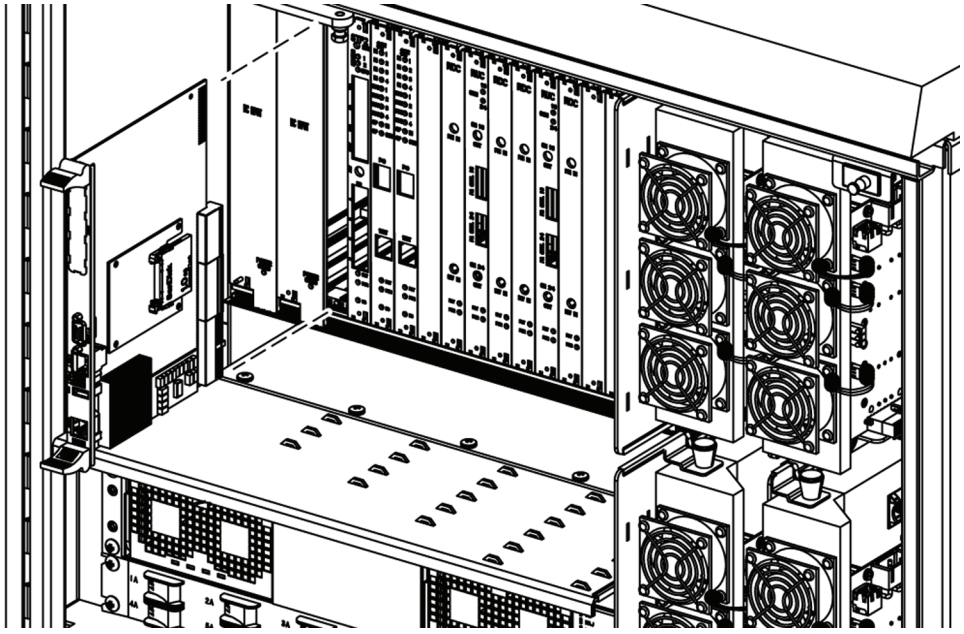


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**Figure 42. Installing a CPU Module**

### 4.1.2 Installing a Systems Interface (STF2) Module

The System Interface module (STF2) is installed into Slot 6 of the RAN Chassis. Only one STF2 module may be installed per RAN chassis.

**Note:** For a description of the STF2 module including function, controls, and indicators, refer to Section 1.7.3 on Page 14. For a RAN chassis interconnection diagram, refer to Figure 40 on Page 58.

Use the following procedure to install the STF2 module (Figure 43):

1. Open the RAN door.
2. Locate the designated slot for the STF2 module. The module installs into Slot 6.
3. Remove the STF2 module from the anti-static packaging and orient for installation.
4. Slide the STF2 module into the designated slot within the RAN chassis.
5. Lock the IEL handles on the top and bottom of the STF2 module into the cPCI chassis and tighten the handle screws.
6. Using cable 1001474P001, connect the RAN door switch to the RJ-45 connector labeled DA (Door Alarm) on the front of the STF2 module.
7. Using cable 1955000P084, connect the GPS antenna to the SMA connector labeled ANT (Antenna) in the center of the module.
8. Using cable 1001476P001, connect the RECT port on the STF2 module to the unlabeled 9-pin port on the Low Voltage Disconnect (LVD) unit. For location of the LVD port, refer to Section 1.8.2 on Page 24.

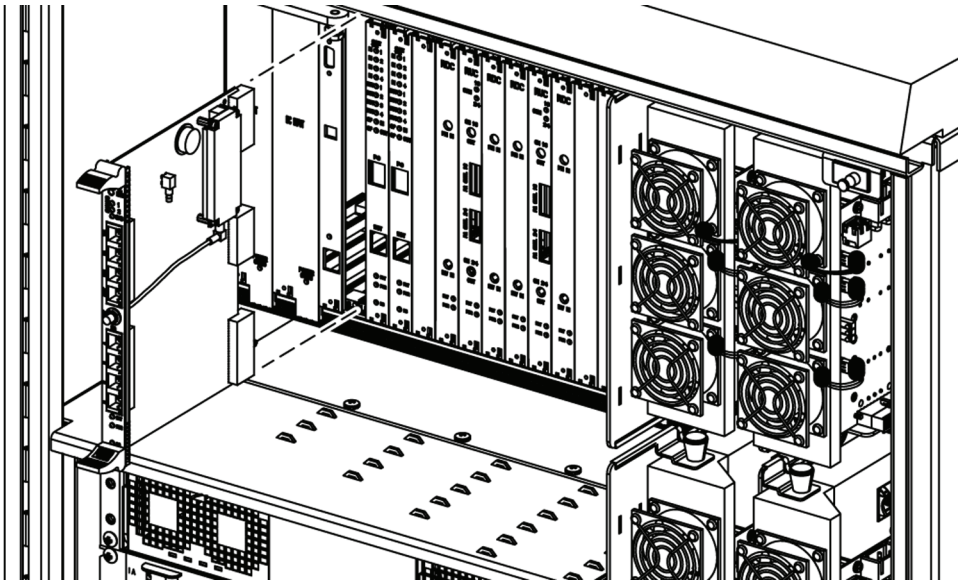

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**Figure 43. Installing an STF2 Module**

### 4.1.3 Installing a Synchronous Interface (SIF) Module

The Synchronous Interface Module (SIF) is installed into Slot 7 or Slot 8 of the RAN chassis. One SIF module is required for each two bands installed in the RAN. For the first two bands use Slot 7. For the second two bands, use Slot 8.

**Note:** For a description of the SIF module, including function, controls, and indicators, refer to Section 1.7.4 on Page 15. For a RAN chassis interconnection diagram, refer to Figure 40 on Page 58.

Use the following procedure to install the SIF module (Figure 44):

1. Open the RAN door.
2. Locate the designated slot for the SIF module. The module installs into Slot 7 or Slot 8. Refer to the introductory text above for more information.
3. Remove the SIF from the anti-static packaging and orient for installation.
4. Slide the SIF into the designated slot within the RAN chassis.
5. Lock the IEL handles on the top and bottom of the SIF module into the cPCI chassis and tighten handle screws.

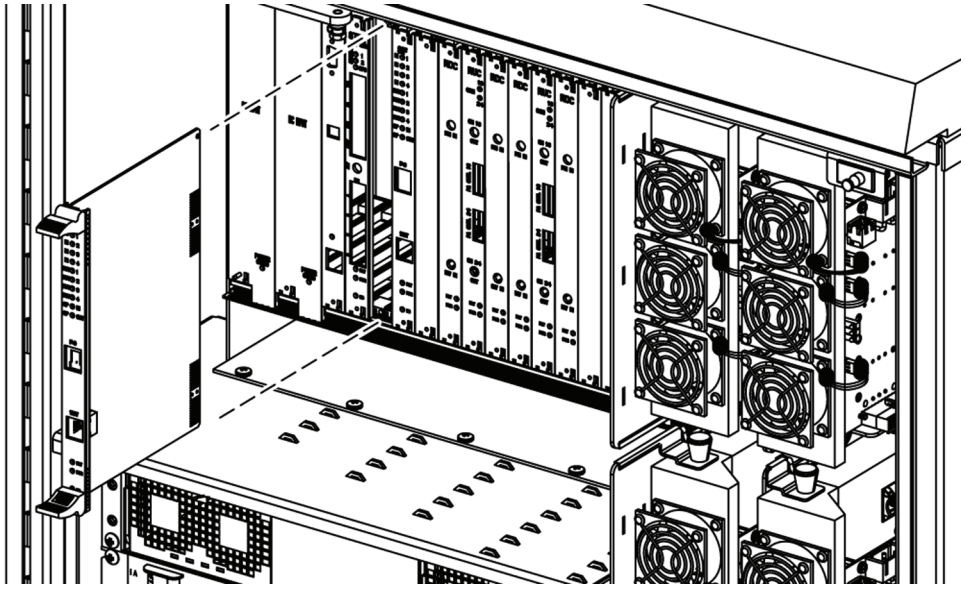

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**Figure 44. Installing an SIF Module**

6. If this SIF module is being installed into Slot 7, connect the short CAT5e jumper (cable 1001478P001) between the “10BT” port on the SIF and the “ENET” port on the CPU module. (For a slot 8 SIF, no cable is required.)
7. Carefully route the internal fibers to the front of the SIF module.

8. If the optical transceiver is mounted into the SIF module, then connect the fiber to the dual LC connector. If optical transceiver is not mounted into the SIF module, follow the SFP installation procedure in Section 4.1.4 on Page 63.

### 4.1.4 Installing a Small Form-Factor Optical Transceiver (SFP)

The SFP installs in the front center of the SIF module.

**Note:** For a description of the SFP, refer to Section 1.7.5 on Page 17. See also the description of the SIF module faceplate in Section 1.7.4 on Page 15.

Use the following procedure to install an SFP:-

1. Locate the transceiver socket on the front of the SIF and remove the port cover from the socket.
2. The color of the transceiver extractor handle corresponds to the optical specifications of the SFP and CWDM designations. Select the optical transceiver that is to be used to communicate with the target RAN.

**Note:** For CWDM systems, it is extremely important that the correct wavelength be installed in each SIF. Consult the site fiber plan for details

3. Remove the transceiver from the anti-static packaging and orient for installation.
4. Insert the optical transceiver into the socket until it locks into place.
5. Connect fiber or replace the optical transceiver dust cap if it was removed for installation.

### 4.1.5 Installing a RAN Down Converter (RDC or RDC2) Module

The RAN Down Converter (RDC) module may be installed into any of four slots in the RAN chassis, depending on the band for which the module will be used. One RDC module is required for each band. The four slots are:

- Slot 10 (labeled RDC A1): used for first band
- Slot 12 (labeled RDC A3): used for second band
- Slot 13 (labeled RDC A4): used for third band
- Slot 15 (labeled RDC A6): used for fourth band

**Note:** For a description of the module including function, controls, and indicators, refer to Section 1.7.6 on Page 17. For a RAN chassis interconnection diagram, refer to Figure 40 on Page 58.

Use the following procedure to install an RDC or RDC2 module (Figure 45):

1. Identify the slot designated RAN chassis slot for the RDC module. This will be Slot 10, 12, 13, or 15. For more information, refer to the introductory text above.
2. Remove the RDC module from the anti-static packaging and orient the module for installation.

3. Slide the RDC module into the designated slot within the RAN chassis.
4. Lock the IEL handles on the top and bottom of the RDC module into the chassis and tighten the handle screws.
5. Using an SMA coaxial cable (1955000P081), connect one end to the PRI IN port on the RDC module and the other end to the appropriate P OUT port on the C/MCPLR or P/MCPLR module. Each P OUT port is associated with a different band.

**Note:** For more information on the C/MCPLR module ports, see Section 1.7.9, 800 MHz Multicoupler (C/MCPLR), on page 20. For more information on the P/MCPLR module ports, see Section 1.7.10, 1900 MHz Multicoupler (P/MCPLR), on page 22.

6. Using an SMA coaxial cable (1955000P081), connect one end to the DIV IN port on the RDC module and the other end to the appropriate D OUT port on the C/MCPLR or P/MCPLR module. Each D OUT port is associated with a different band. For more information on these ports, refer to the sections identified in the note above.

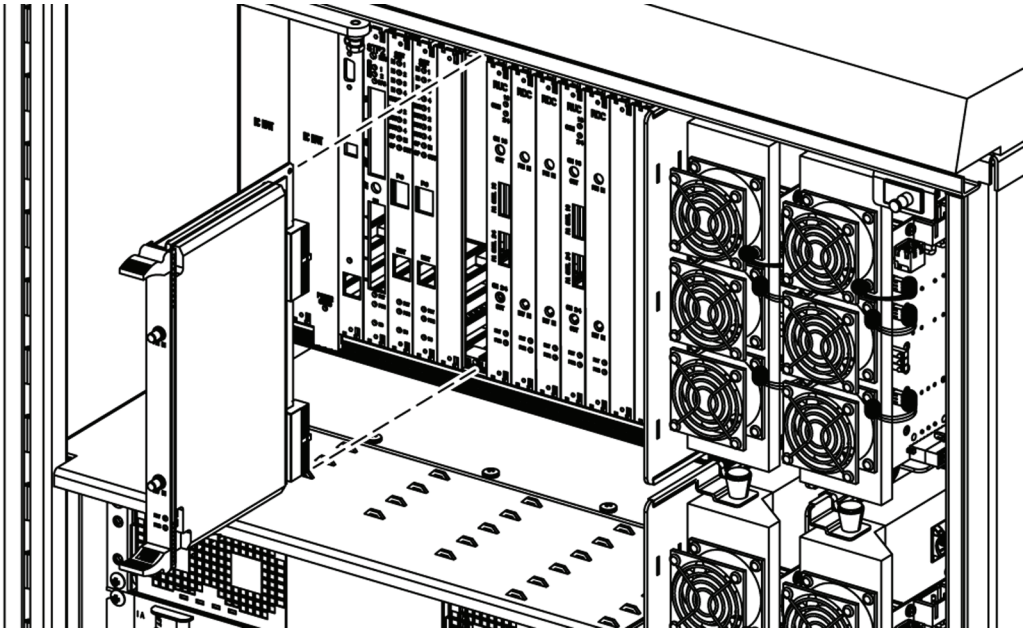

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**Figure 45. Installing an RDC Module**

### 4.1.6 Installing a RAN Up Converter (RUC2.X or RUC3) Module

The RAN Up Converter (RUC2.X or RUC3) module may be installed into either of two slots in the RAN chassis, depending on the band for which the module will be used. One module is required for each two bands. The two slots are:

- Slot 11 (labeled RUC A2): used for first and second bands
- Slot 14 (labeled RUC A5): used for third and fourth bands

**Note:** For a description of the module including function, controls, and indicators, refer to Section 1.7.7 on Page 19. For a RAN chassis interconnection diagram, refer to Figure 40 on Page 58.

Use the following procedure to install an RUC2.X or RUC3 module (Figure 46):

1. Identify the designated chassis slot for the RUC module. This will be Slot 11 or 14. For more information, see introductory text above.
2. Remove the RUC module from the anti-static packaging and orient for installation.
3. Slide the RUC module into the designated slot within the RAN cPCI chassis.
4. Lock the IEL handles on the top and bottom of the RUC module into the cPCI chassis and tighten handle screws.

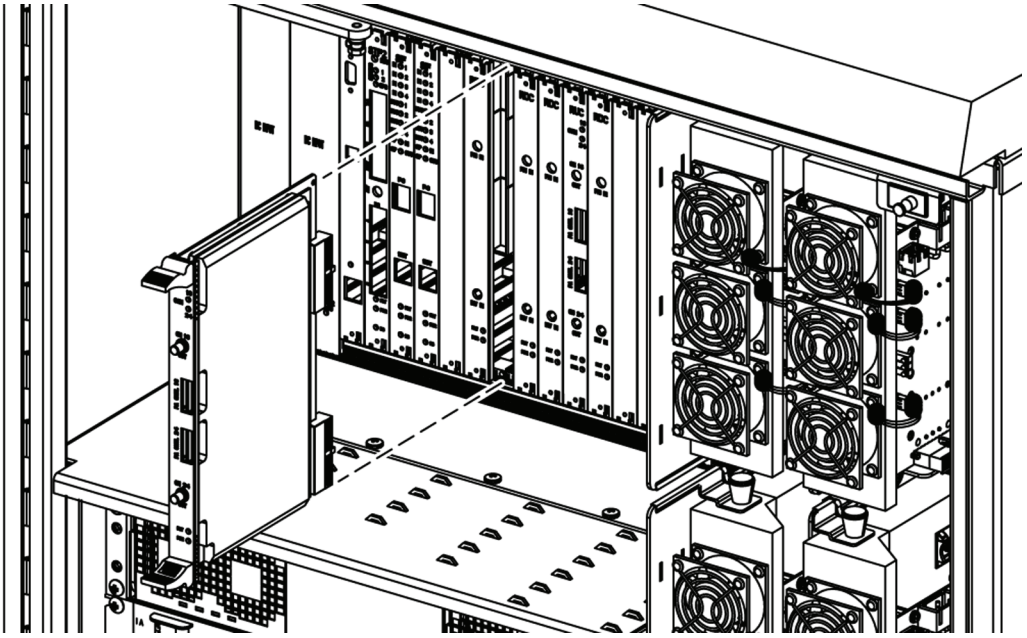

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**Figure 46. Installing an RUC Module**

5. Using cable 1955000P079, connect the CH1/3 connector on the RUC module to either of the following as appropriate:
   - RF IN port on PAA1 if RUC module is in slot A2
   - RF IN port on PAA3 if RUC module is in slot A5
6. Using cable 1955000P079, connect the CH 2/4 connector on the RUC module to either of the following as appropriate:
   - RF IN port on PAA2 if RUC module is in slot A2
   - RF IN port on PAA4 if RUC module is in slot A5

7. Using cable 1001475P001, connect the PA CTL1/3 connector on the RUC module to either of the following as appropriate:
   - CNTL port on PAA1 if RUC module is in slot A2
   - CNTL port on PAA3 if RUC module is in slot A5
8. Using cable 1001475P001, connect the CTL 2/4 connector on the RUC module to either of the following as appropriate:
   - CNTL port on PAA2 if RUC module is in slot A2
   - CNTL port on PAA4 if RUC module is in slot A5

## 4.2 Installing cPCI Chassis Air Baffles

The air baffles for the RAN chassis are used in all empty chassis slots. This is done to maintain airflow around the chassis modules.

Use the following procedure to install air baffles:

1. Identify designated RAN Chassis cPCI slot for the cPCI air baffle.
2. Insert air baffle into designated slot on chassis and tighten screws.

## 4.3 Installing a Rectifier Module

To install a rectifier module, use the following procedure (Figure 47):

**Note:** For a description of the rectifier including function, controls, and indicators, refer to Section 1.8 on Page 23. For a RAN chassis interconnection diagram, refer to Figure 40 on Page 58.

1. Connect cables following Section 22 on Page 66.
2. Slide the rectifier into the rectifier compartment.
3. Turn the gravity latch down to lock the rectifier in place.

**Table 22. Rectifier Ports and Connections**

| RECTIFIER PORT | CONNECTS TO | USING CABLE | COMMENTS |
|---|---|---|---|
| L1, L2, L3 | EMI Line Filter F-L1, F-L2 | 1001473P001 | Connect black wire to F-L1 (on EMI Line Filter); connect brown wire to FL-2 |
| RECT GND | GND Stud | 1001473P001 | Connect to cabinet ground stud |
| +BAT, -BAT | Anderson connector | 1001477P001 | Connect to Anderson connector in battery compartment; connect black wire to 0V (+BAT) and blue wire to -BAT |
| OV OUT, -OV OUT | temp sensor, circuit breakers REC+ and REC- | 1001477P001 1001469P001 1001470P001 | Place temperature sensor in battery compartment; connect 1001477P001 black wire to OV OUT and blue wire to -OV OUT; connect 1001469P001 from rectifier OV OUT to circuit breaker POS; connect 1001470P001 from rectifier -OV OUT to circuit breaker NEG |

**Table 22. Rectifier Ports and Connections**

| RECTIFIER PORT | CONNECTS TO | USING CABLE | COMMENTS |
|---|---|---|---|
| 25 Pin D | Circuit breaker panel N/C port | 1001477P001 | Connect white wire to circuit breaker N/C and brown wire to COM |
| RS232 | STF module RECT port | 1001476P001 | Connect to STF module connector labeled RECT in RAN chassis and RS-232 connector on the rectifier |

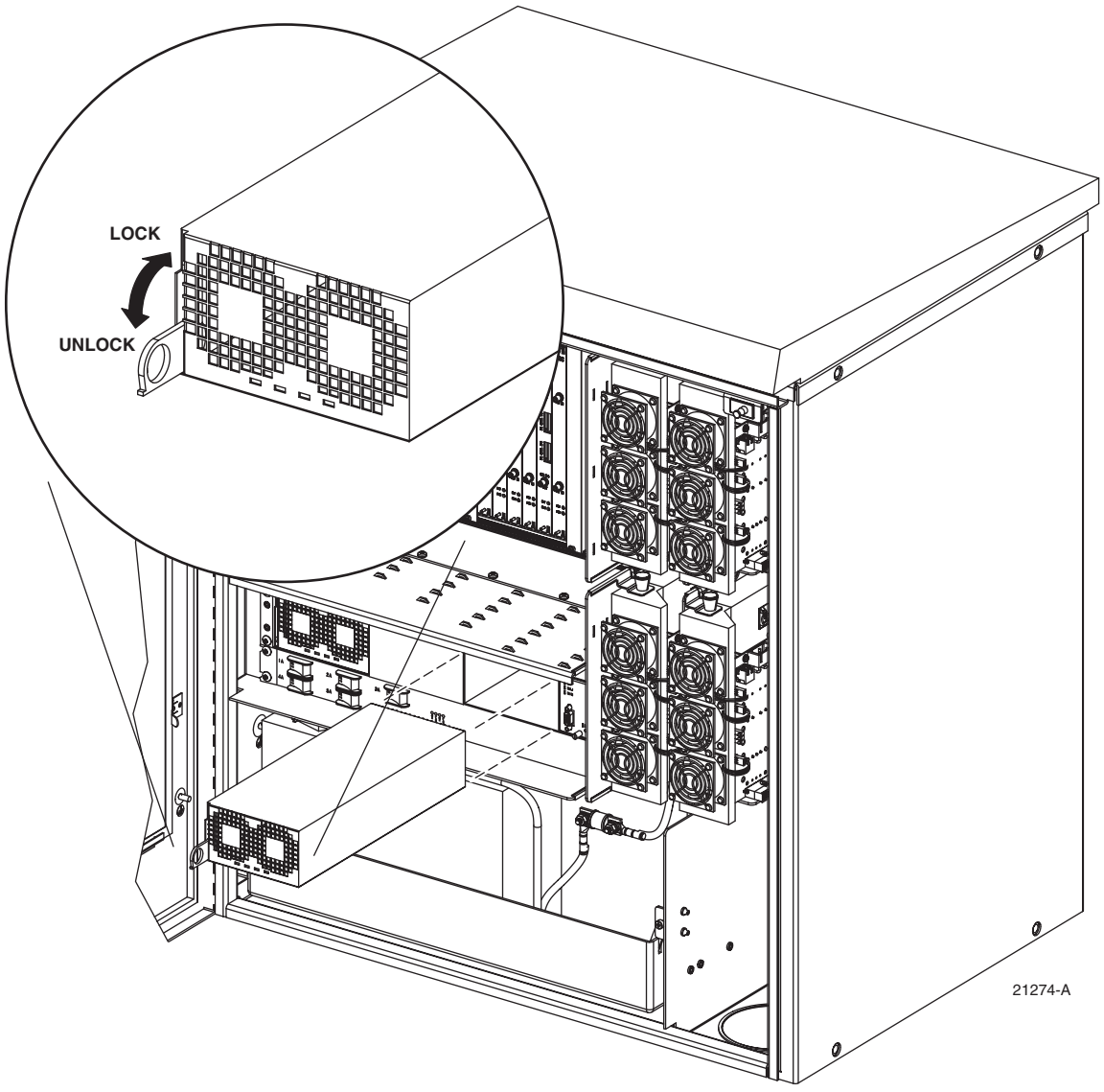


**Figure 47. Installing a Rectifier**

## 4.4 Installing a Compact PCI Power Supply (cPCI P/S) Module

The cPCI Power Supply Module installs into Slots 1 and 2 or Slots 3 and 4 of the RAN chassis. One module is required per RAN chassis. Either set of two slot can be used. A second module can be installed for redundancy.

**Note:** For a description of the cPCI P/S module including function, controls, and indicators, refer to Section 1.7.1 on Page 12. For a RAN chassis interconnection diagram, refer to Figure 40 on Page 58.

Use the following procedure to install a cPCI Power Supply Module:

1. Identify the designated chassis slots for the module. This will be Slots 1 or 2 or Slot 3 and 4.
2. Remove the module from the anti-static packaging and orient for installation.
3. Slide the module into the designated slots within the RAN cPCI chassis.
4. Lock the IEL handles on the top and bottom of the RUC module into the cPCI chassis and tighten handle screws.

## 4.5 Installing a Power Amplifier Assembly

The RAN holds up to four PAAs. One PAA is required for each band being supported. Use the following procedure to install a PAA:

**Note:** For a description of the PAA including function, controls, and indicators, refer to Section 1.9 on Page 25. For a RAN chassis interconnection diagram, refer to Figure 40 on Page 58.

1. Connect cables per Table 23.
2. Slide the PAA into place.

**Table 23. PAA Connections**

| PAA PORT | CONNECTS TO | USING CABLE TYPE | COMMENTS |
|---|---|---|---|
| I2C (J2) | RUC module P/A CNTL 2/4 or 1/3 | 1001475P001 | RJ-45 connector. Connect cable from PIC module port J2 (CNTL) to RUC P/A CNTL 1/3 or P/A CNTL 2/4 |
| 48V PWR (J1) | Circuit breaker 1A, 2A, 3A, or 4A port | 1001471P001 | Positronic 3-pin connector. Connect cable from PIC module J1 port to circuit breaker 1A, 2A, 3A, or 4A port; the circuit breaker has an individual output for each of the four PAAs |
| RF OUT | Plexer module TX port | 1955000P080 | SMA connector. Connect cable from PAA RF OUT to plexer port TX |
| RF IN | RUC module CH 1/3 or CH 2/4 port | 1955000P079 | SMA connector. Connect cable from PAA RF IN port to RUC module CH 1/3 or CH 2/4 port |

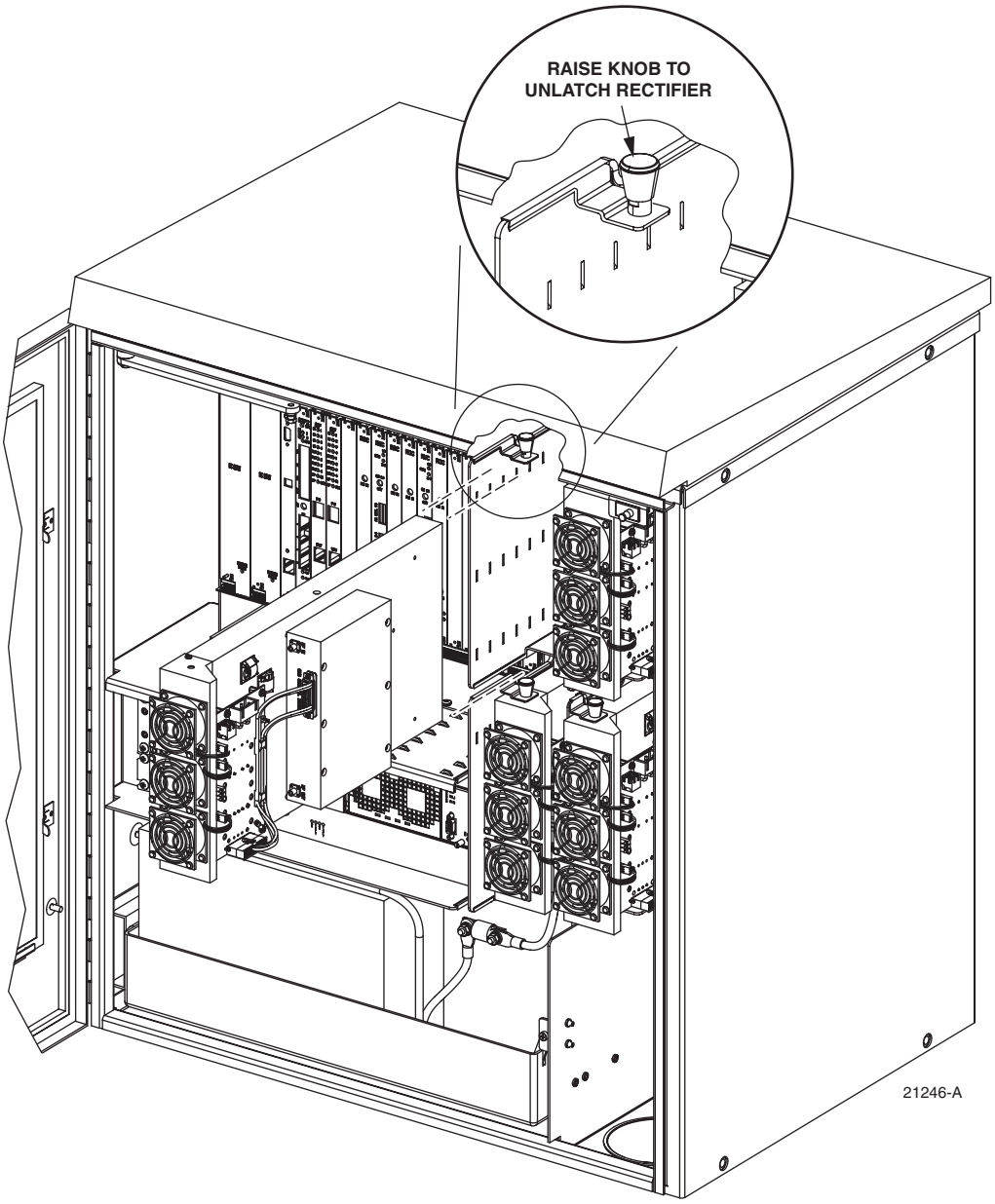


**Figure 48. Installing a PAA**

# 5 MAINTENANCE PROCEDURES

This section provides procedures for completing various maintenance tasks at the RAN. Refer to the procedures in this section as necessary when scheduled maintenance is required. For fault and troubleshooting procedures, refer to the system operation and maintenance manual, ADCP-75-209.

## 5.1 cPCI Fan Replacement Procedure

The RAN chassis is equipped with a cooling fan that exhausts heated air from the chassis assembly. Cool air enters the cPCI chassis through vent openings on the front door of the cabinet. The recommended replacement interval is 60 months.

Use the following procedure to remove and replace the cPCI cooling fan.

1. Loosen the two thumbscrews that secure the fan access panel front door.
2. Open the hinged door (it swings down) to access the fan compartment.
3. Slide out the fan being replaced, note how it is connected, and then disconnect the fan.
4. Connect the new fan like the previous fan and slide it into the fan compartment.
5. Verify that the fan is running properly.
6. Close the fan panel door and secure it with the thumbscrews.

## 5.2 Cleaning or Replacing an Air Inlet Filter

The RAN cabinet air filter cleans the intake air before it enters the cabinets. The filter should be cleaned approximately once per year and more often in extremely dirty environments. If the cabinet temperature gradually rises over a long period of time and there are no fan failures, it is possible that the filter is dirty and requires cleaning. Use the following procedure to clean the cabinet air filter:

1. Open the RAN enclosure door and remove the inlet air filter tray door as shown in Figure 49.
2. Pull the filter and away from its mounting slot at the bottom of the cabinet.
3. Gently tap the filter against your hand to dislodge the dirt. If necessary, use compressed air or a vacuum cleaner to remove the dirt.
4. Carefully inspect the filter for holes or tears and replace if it is damaged.
5. Orient the filter with the airflow arrows pointed inside the RAN.
6. Close and secure the inlet air filter tray.

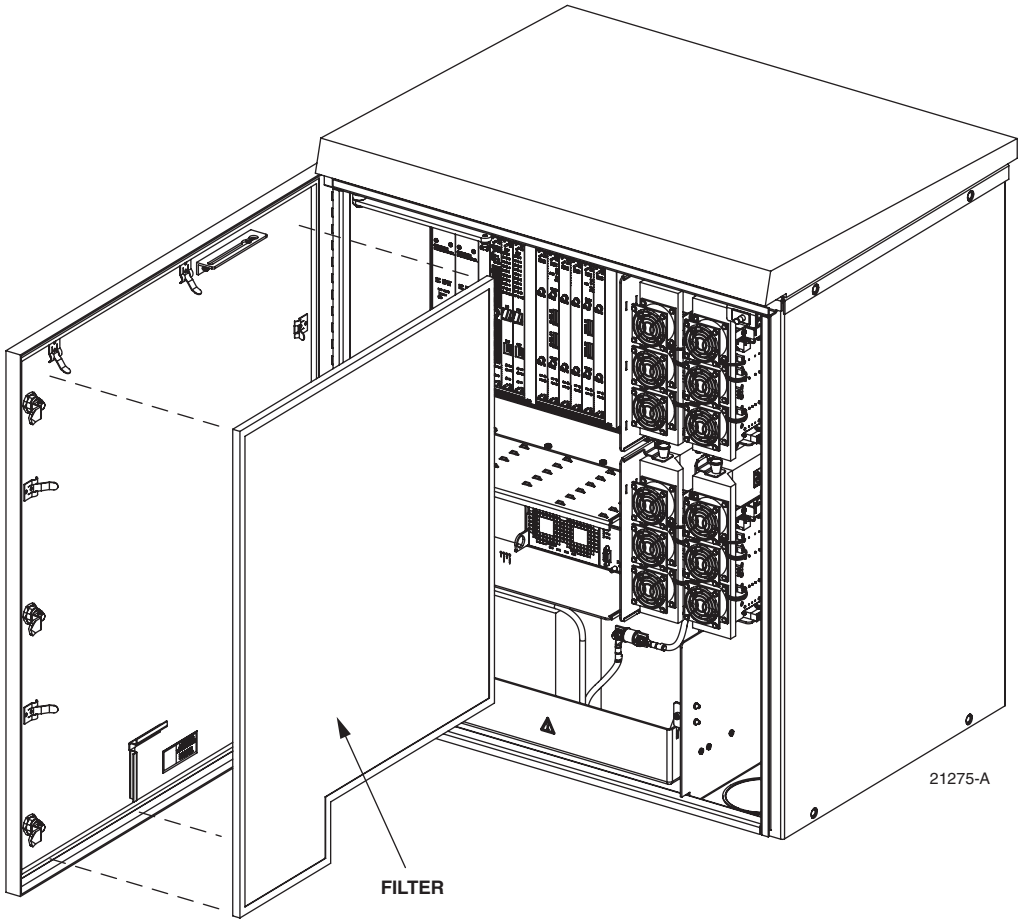


**Figure 49. Air Inlet Filter Tray**

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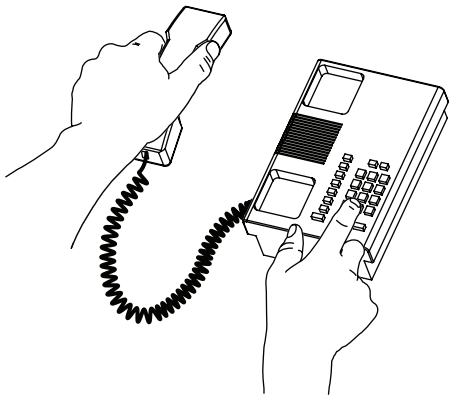

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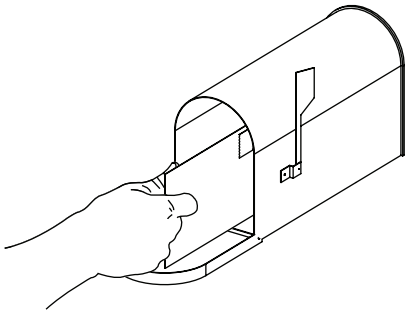

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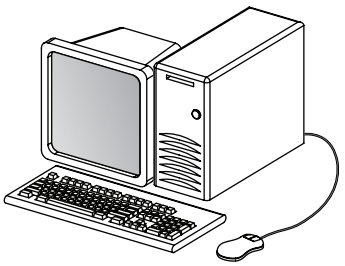

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