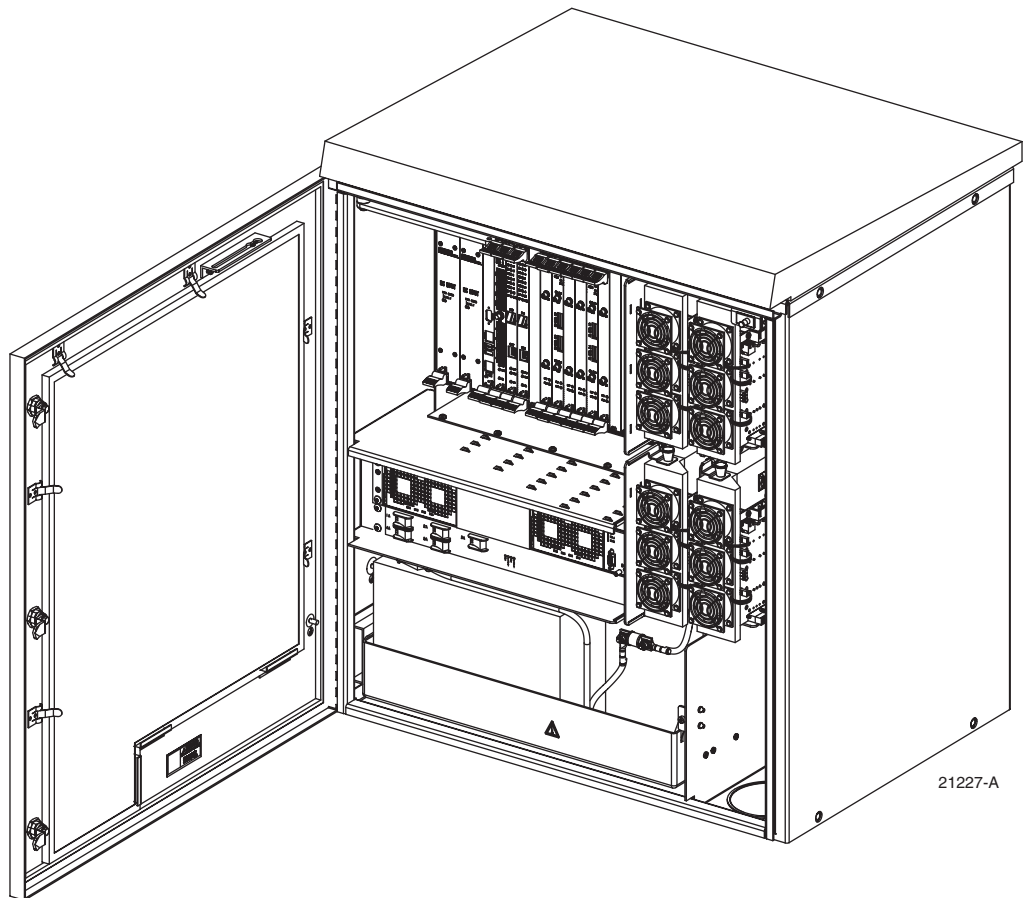




# Digivance<sup>®</sup> NXD Radio Access Node (RAN) Installation and Maintenance Manual

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ADC Telecommunications, Inc.  
P.O. Box 1101, Minneapolis, Minnesota 55440-1101  
In U.S.A. and Canada: 1-800-366-3891  
Outside U.S.A. and Canada: (952) 938-8080  
Fax: (952) 917-1717

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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](http://www.adc.com).

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

## 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:

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

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

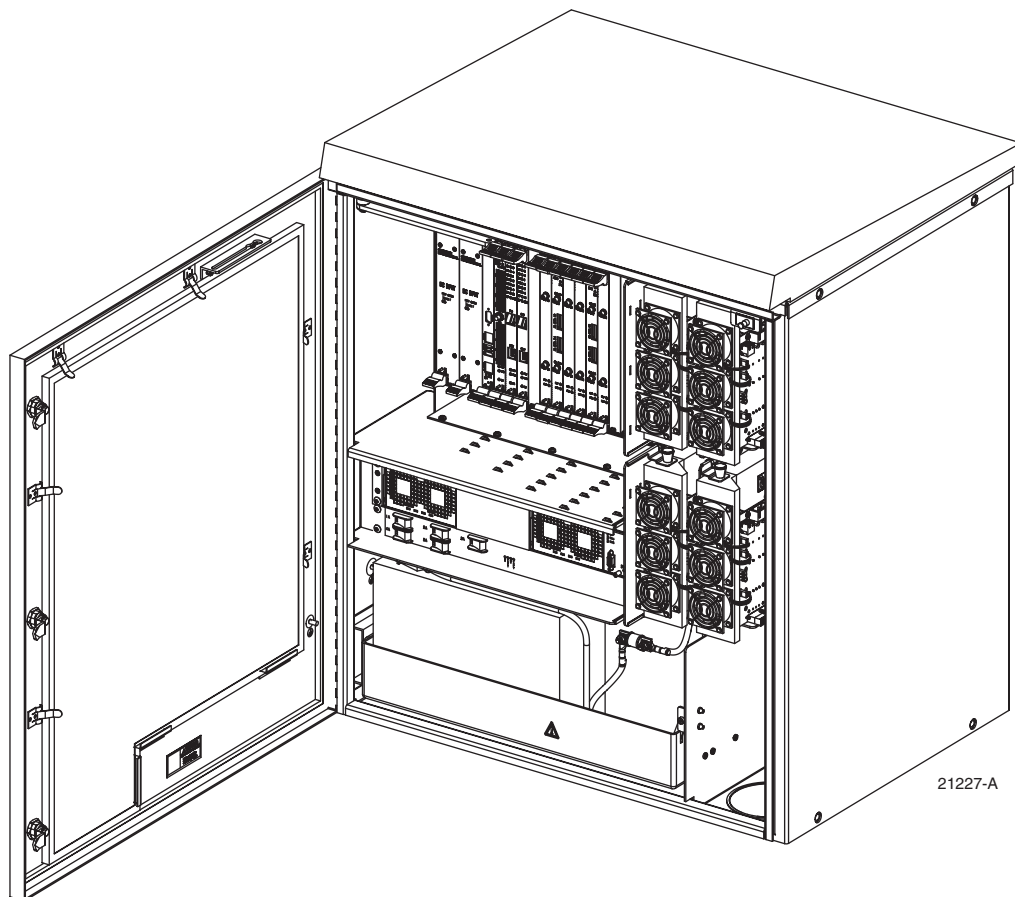


Figure 1. NXD RAN

## 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.

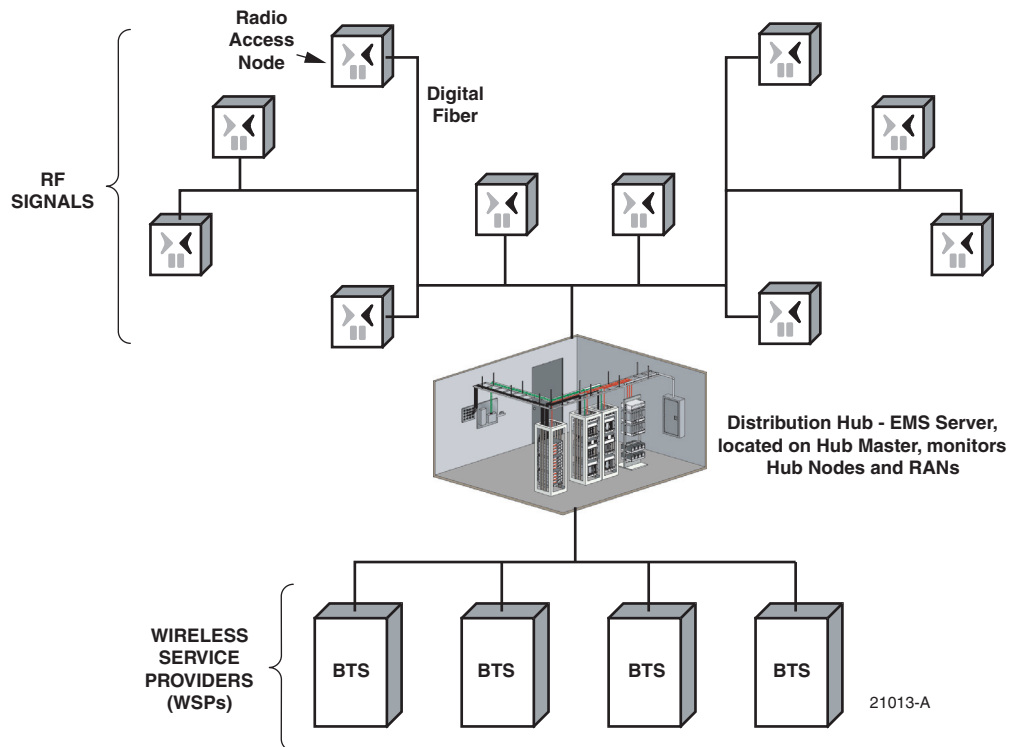
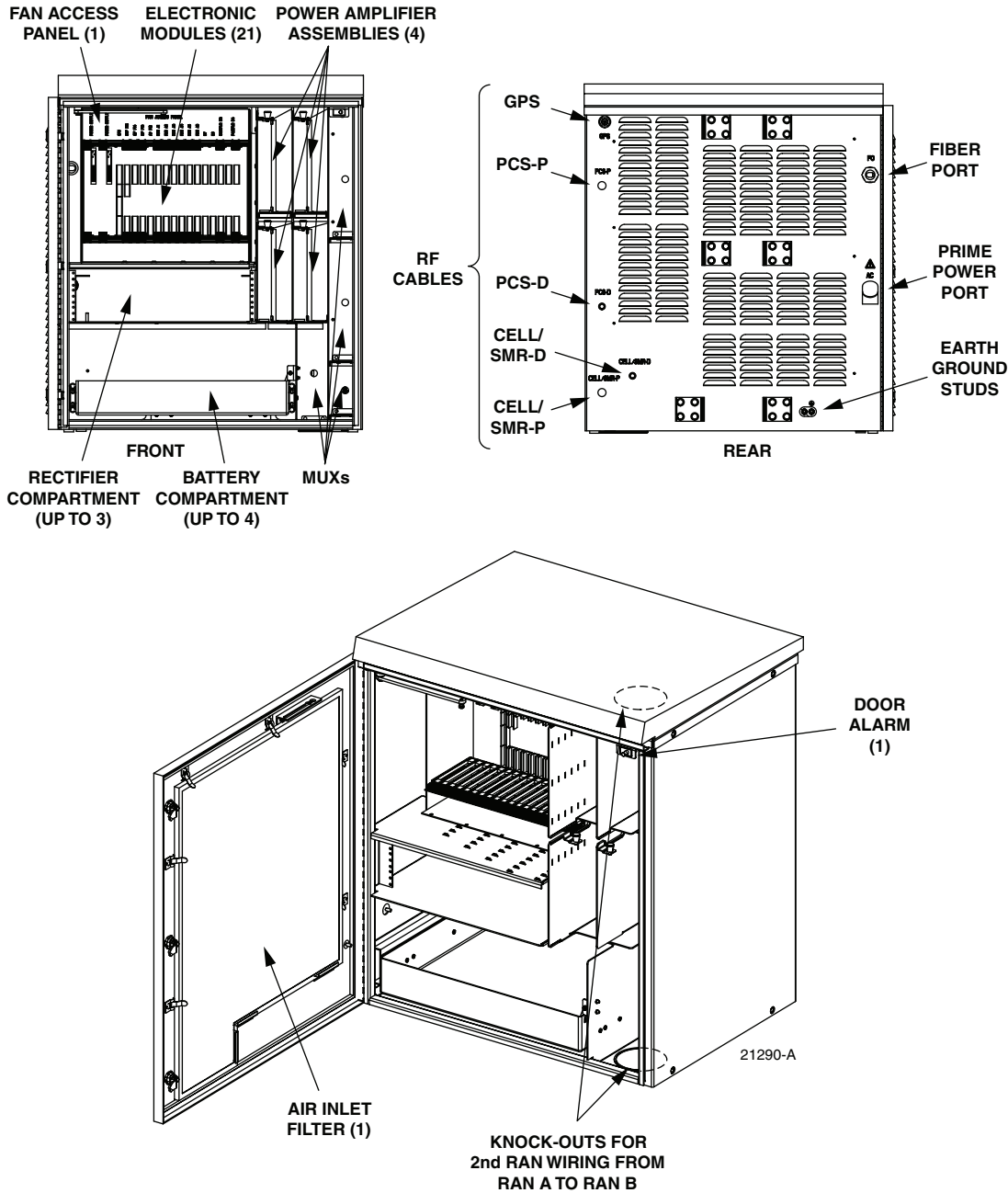


Figure 2. System Function



## 1.4 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**

<b>COMPONENT</b>	<b>WHY RELEVANT</b>	<b>FOR MORE INFORMATION</b>
<b>Front View</b>		
Fan Access Panel	Panel swings down providing access to internal fan compartment; fans can be replaced as required	<a href="#">Section 1.7.8 on Page 20</a>
Electronic Modules	Electronic modules have indicators monitored by the user	<a href="#">Section 1.7 on Page 10</a>
	Electronic modules can be installed and replaced as required	<a href="#">Section 4.1 on Page 57</a>
	Interconnection diagram summarizes connections between modules	<a href="#">Figure 39 on Page 58;</a> <a href="#">Figure 40 on Page 59</a>
Power Amplifier Assemblies	PAAs have indicators monitored by user	<a href="#">Section 1.9 on Page 25</a>
	PAAs can be installed or replaced as required	<a href="#">Section 4.5 on Page 68</a>
Rectifier Compartment	Rectifiers have four unmarked LEDs	<a href="#">Section 1.8 on Page 23</a>
	Rectifiers can be individually installed and replaced as required	<a href="#">Section 4.3 on Page 66</a>
Battery Compartment	Batteries are packaged separately and installed in a standard installation; they can be replaced as required	<a href="#">Section 2.7.6 on Page 50</a>
<b>Rear Access</b>		
GPS, PCS-P, PCS-D, CELL/SMR-D, CELL/SMR-P	Connection points for RF cables connecting RAN with GPS antenna and RF antenna.	<a href="#">Section 2.7.3 on Page 45;</a> <a href="#">Table 21 on page 47</a>
Fiber Optic Cables Connection Point	Connection point for fiber optic cable from Hub	<a href="#">Section 2.7.4 on Page 47</a>
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	<a href="#">Section 2.7.5 on Page 49</a>
Earth Ground Studs	Connection point for ground wires	<a href="#">Section 2.7.2 on Page 44</a>
<b>Oblique View</b>		
Air Inlet Filter	Filters are replaced per maintenance schedule	<a href="#">Section 5.2 on Page 70</a>
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	<a href="#">Section 3 on Page 54</a>

## 1.5 Dimensions and Specifications

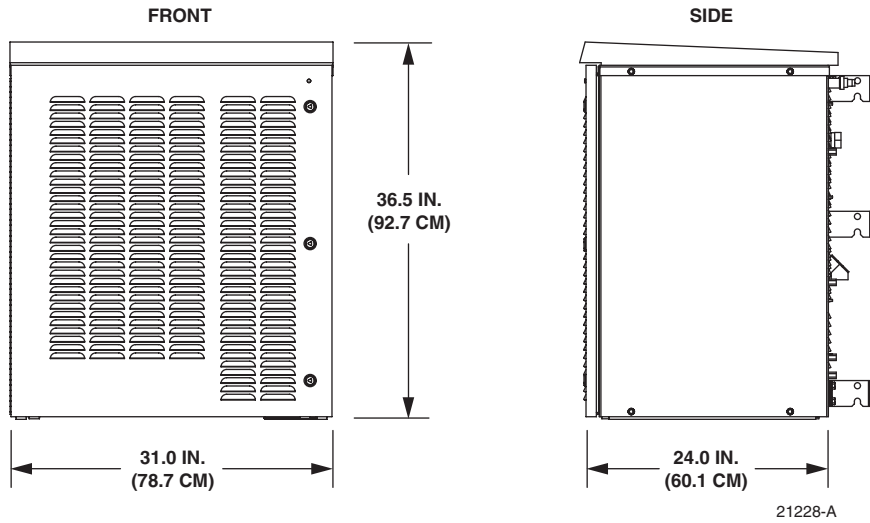


Figure 5. NXD RAN Dimensions

Table 2. RAN Specifications

ITEM	SPECIFICATION	COMMENT
<b>Physical and Mechanical</b>		
Dimensions (HxWxD)	36.5 x 31.0 x 24.0 inches (92.7 x 78.7 x 60.1 cm)	See also <a href="#">Figure 5</a>
Weight with extended batteries (4)	300 lbs. (136.4 kg) 625 lbs. (284.1 kg)	RAN without batteries 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 5 Type N plugs	Cable type: CommScope PN 540ANM or equivalent
<b>Environmental and Thermal</b>		
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
<b>Power</b>		
AC power ingress	240 VAC, 20 Amps, single phase	
Battery backup options extended glitch	120 minutes 5 minutes	-48 volts @25 degrees C (degrees F) for four bands
RAN box power use	2700 Watts Max. 16 Amps Max.	
cPCI rack power	-48 VDC	
<b>Optical</b>		
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 <a href="#">Section 1.6.2 on Page 9</a> .
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 with WDM option with CWDM option	1 (1310 nm) 2 (1310/1550) 8 (1470-1610)	Without WDM/CWDM option  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
<b>RF</b>		
Tuning frequency PCS band Cellular band SMR 800 band SMR 900 band	Receive Path 1850-1910 MHz 824-849 MHz 806-824 MHz 896-901 MHz	Transmit Path 1930-1990 MHz 869-894 MHz 851-869 MHz 935-940 MHz
Instantaneous bandwidth	15 MHz	
Receiver noise figure PCS band Cellular band	6 dB 5 dB	Measured at Hub output connec- tor (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		RDC capability (at cabinet input) A/D clip level, single RF channel Selectivity (function of SAW filter) Selectivity Selectivity
In band	-41 dBm	
Out of band +/- 8.5 MHz	-3 dB	
Out of band +11/-13 MHz	-43 dB	
Out of band +13/-16 MHz	-83 dB	
Automatic gain control		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
Detector integration time	10 usec	
Attack time	0 usec	
Decay time	0 usec	
Gain control range	30 dB	
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
Gain resolution	1 dB	
Gain measurement		Configured at startup using fac- tory calibration of modules and user data

## 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.