

NEXUS FT RACK MOUNT RADIO

INSTALLATION AND SERVICE MANUAL

044-05326 REV. B | JULY 2010

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This Powerwave product is designed to operate within the Normal Operating (typical operating) ranges or conditions specified in this document. Operation of this equipment beyond the specified ranges in this document may cause (1) spurious emissions that violate regulatory requirements; (2) the equipment to be automatically removed from service when maximum thresholds are exceeded; or (3) the equipment to not perform in accordance with its specifications. It is the Operator's responsibility to ensure this equipment is properly installed and operated within Powerwave operating specifications to obtain proper performance from the equipment and to comply with regulatory requirements.

The rated output power of a Nexus FT is for multiple carriers. As long as the composite power does not exceed the rated power (20W for North America), derating is not required for multiple carriers. For situations where regulatory requirements require reduced interference to adjacent band users, the rating would have to be reduced by 3 dB. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device. Input power is rated at 115/230VAC, 50/60Hz, and should be protected based on the power and fuse specifications in Chapter 5 of this manual. Power strips should, at a minimum, conform to this requirement to prevent equipment damage and possible overload.

Federal Communications Commission (FCC)

This device complies with the technical standards governing mobile radio devices in accordance with FCC Rules. This device is intended to facilitate the reception and transmission of mobile radio devices in the cellular, PCS or other mobile services, and its operation by end users or others requires carrier consent under FCC rules. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to CRF47 part 15 of the FCC rules. This equipment is also certified to CRF47 part 22 (cellular), part 24 (PCS) and part 90 (iDEN800 and iDEN900) of the FCC Rules depending on the band of operation. Changes or modifications not expressly approved by Powerwave Technologies, Inc. for compliance could void the user's authority to operate this equipment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada

The measured Canadian RF output power for the RH905022/13B is 46.3dBm.

European Requirements

The Powerwave Nexus FT apparatus introduced in EU markets are certified to ESTI EN 300 609-4 (GSM900 and DCS1800) and ESTI EN 301 908-11 (WCDMA).

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Revision Record

Revision Letter	Date of Change	Reason for Change
Rev A	September 2008	Initial release
Rev B	July 2010	Updated manual to show new FT RMR product

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Warning, Cautions, and Notes

Warnings, Cautions, and Notes are found throughout this manual where applicable. The associated icons in warnings and cautions are used to quickly identify a potential condition that could result in the consequences described below if precautions are not taken. Notes clarify and provide additional information to assist the user.



WARNING: The warning symbol means danger. You are in a situation that could cause bodily injury or death. Before you work on any equipment, be aware of the hazards involved with electrical and RF circuitry and be familiar with standard practices for preventing accidents.



CAUTION: The caution symbol means the potential exists for equipment damage or loss of data.

NOTE: Notes contain helpful suggestions or references to material not covered in the document.

Safety

Any personnel involved in installation, operation, or service of units included in a Powerwave repeater system must understand and follow the points below:

- Powerwave Nexus FT Rack Mount Radios (RMR) are designed to receive and amplify signals from one or more base stations and retransmit the signals to one or more mobile stations. They also act the other way round, that is to receive signals from one or more mobile stations, then amplify and retransmit the signals to the base stations. Powerwave Nexus FT RMR systems must be used exclusively for this purpose and nothing else.
- Units supplied from the mains must be connected to grounded outlets and in conformity with the local prescriptions.
- Power supply units supplied from the mains contain dangerous voltage that can cause electric shock. Disconnect the mains prior to any work in such a unit. Local regulations are to be followed when servicing such units. Only authorized service personnel are allowed to service units while the mains are connected.
- All RF transmitting units, including Nexus FT RMRs, will generate radio signals and thereby give rise to electromagnetic fields that may be hazardous to the health of any person who is extensively exposed close to an antenna.



Human Exposure to RF Radiation

Safe distances must be kept when working around antennas. The following paragraphs describe the cautions to be aware of during the installation and maintenance of antenna systems and how to calculate safety distances needed for RF radiation at different antenna power and frequencies.

Repeater Antennas

To be able to receive and transmit signals, a repeater is connected to a donor antenna directed towards the base station and a service antenna directed towards the coverage area. A fiber optic cable from the base station might, however, be substituted for the donor antenna.

Installation and Maintenance of Antenna Systems

Installation and maintenance of all antenna systems must be performed with respect to the radiation exposure limits for public areas. The antenna radiation level is affected by the output power, antenna gain, and transmission devices such as cables, connectors, splitters and feeders. Also have in mind the system minimum coupling loss, typically between 25 dB and 35 dB, is determined by a standard with the purpose to protect base stations from noise and other performance dropping effects.

Radiation Exposure

The World Health Organization (WHO) and International Commission on Non-Ionising Radiation Protection (ICNIRP) have determined recommendations for radiation exposure. ICNIRP recommends not to exceed the following radiation power for public exposure:

Frequency Radiation power

800/900 MHz	4.5W/m ²
1800/1900 MHz	9.0W/m ²
2100 MHz	10.0W/m ²

For antennas larger than 20cm the maximum radiation power can be calculated by using the following formula:

$$S = P / (4\pi r^2)$$

S = Radiation power in W/m²
 P = Output power in W
 r = Distance between antenna and human in meters



Electrostatic Discharge (ESD)

ESD can severely damage essential parts of the equipment if not handled carefully. Parts on Printed Circuit Board Assemblies (PCBA) as well as other parts in the equipment are sensitive to ESD. Never touch the PCBA or uninsulated conductor surfaces unless absolutely necessary.

If you must handle the PCBAs or uninsulated conductor surfaces, use ESD protective equipment or first touch the chassis with your hand. Never let your clothes touch PCBAs or uninsulated conductor surfaces and always store PCBAs in ESD-safe bags.

Chapter 1

Product Description

Introduction

This manual contains information and procedures for installation, operation, and maintenance of the Rack Mount Radio module as part of the Nexus FT Rack Mount Repeater. In this manual, the Nexus FT Rack Mount Radio is referred to as the RMR. The manual is organized into chapters as follows:

- ❑ Chapter 1- Product Description
- ❑ Chapter 2- Indicators
- ❑ Chapter 3- Installation
- ❑ Chapter 4- Maintenance
- ❑ Chapter 5- Specifications

Scope of Manual

This manual is intended for use by service technicians familiar with similar types of equipment. It contains required service information for the RMR and is current as of the printing date. Changes which occur after the printing date may be incorporated by a complete manual revision or alternatively as additions.

Overview

The RMR is a repeater designed to be part of a Distributed Antenna System (DAS). The components are mounted on a 19 in. rack and are intended for use in an indoor, temperature controlled environment.

As part of a DAS, the RMR extends coverage into uncovered areas in wireless mobile systems such as base station fringe areas, tunnels, convention centers, airports, and buildings. It receives, amplifies, and transmits signals to/from a Base Transceiver Station (BTS) and to/from Mobile Stations (MS).

The RMR unit is a dual wide band, bi-directional, RF amplifier with two separate donor ports and a common (duplexed) service port per band. It connects to a Fiber Base Distribution Unit (FBU) that combines, splits and converts RF signals to an optical signal in the Uplink (UL) direction. In the Downlink (DL) direction, the FBU converts optical signals to RF signals and splits the signal to RF outputs. Two separate full-duplex fibers handle signal transport between the BTS Master Unit and the FBU. See the Fiber Base Unit Installation and Service Manual (part number 044-05348) for more details. The DL signal and the UL signal combine onto one optical fiber through a Wavelength Division Multiplexer (WDM). Wideband 4-way combiners handle RF splitting and combining. The UL output signal is connected to the FBU via RF coax cable, converted to light, and sent via fiber toward the BTS.

A Wireless Portal module distributes the DL/UL signals to/from the DAS.

The RMR is microprocessor controlled with alarm and operational status LEDs visible on the front. Cooling is provided through forced air fans. Operational parameters are set using a PC running Powerwave OM-Online software which communicates with the RMRs through the FBU or through a system solution. Remote operation can be accomplished via Public Switched Telephone Network (PSTN) or a GSM net. The Operation and Maintenance System (OMS) provides for Network Operations Center (NOC) configuration and alarm monitoring.

Cabinet Design

The Nexus FT RMR modules are intended to be mounted in a 482 mm (19 in) cabinet at least 600 mm (23 in) deep, similar to the one shown Figure 1-1.

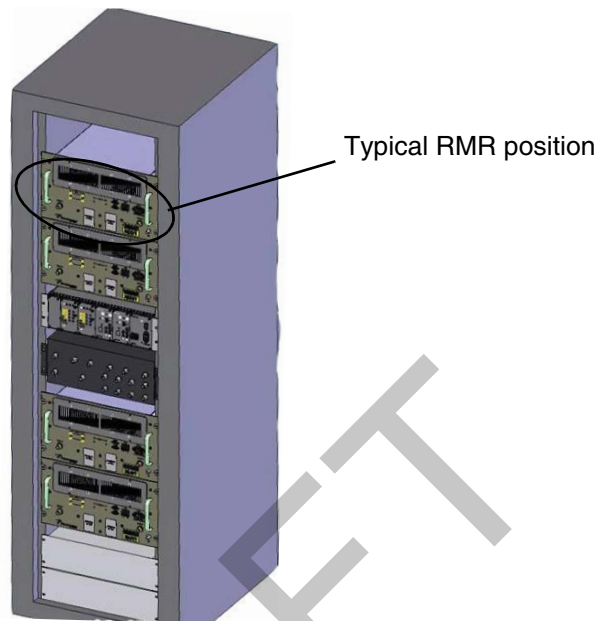


Figure 1-1 Powerwave Nexus FT RM rack- fully equipped

Rack Mount Radio module (RMR)

RMRs can handle multiple carriers over a wide band. The cabinet can be equipped with up to four RMRs.



Figure 1-2 Nexus FT Rack Mount Radio (RMR)

Chapter 2 Indicators

Introduction

This chapter contains descriptions of the controls, indicators, and connectors for the Nexus FT RMR.

Indicators

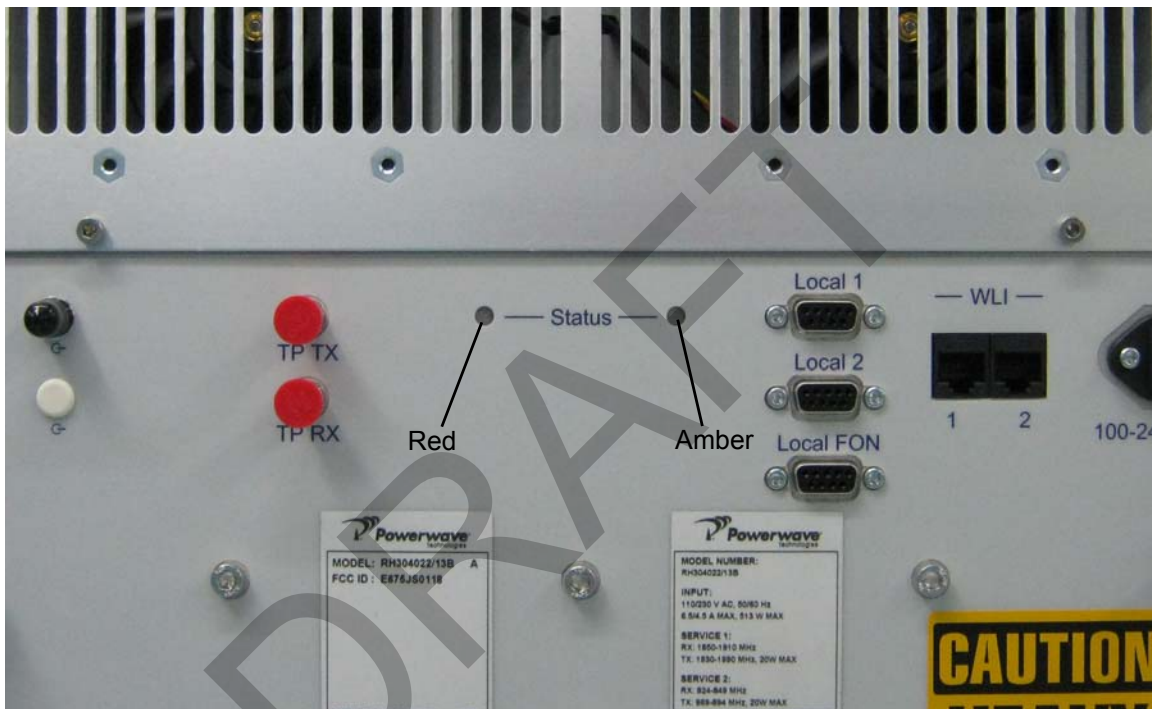


Figure 2-1 External Indicators

The LEDs, shown in Figure 2-1, provide easy identification of a fault in the system. The amber operation LED lights up approximately 15 seconds after the main power is switched on. When the LED is steady, the RMR is ready for operation. The red alarm LED indicates a system error alarm when flashing and a critical alarm when steady.

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Chapter 3 Installation

Introduction

This chapter contains unpacking, inspection, and installation instructions for installing and powering up the Nexus FT RMR.

Site Survey

Powerwave recommends that a site survey be performed prior to equipment ordering or installation. Performing a detailed site survey reduces or eliminates installation and turn-up delays. Pay particular attention to power plant capacity, cooling needs, floor space, and RF/DC cabling/breaker requirements. Cabinet dimensions and weights are listed in Chapter 5.

Unpacking and Inspection

This equipment has been operated, tested, and calibrated at the factory. Carefully open the container to remove the equipment. Retain all packing material so it can be reassembled in the event the unit must be returned to the factory. Perform the following steps:

- Visually inspect equipment for damage that may have occurred during shipment. If possible, in the presence of the delivery person, if possible.
- Check for evidence of water damage, bent or warped chassis, loose screws or nuts, or extraneous packing material in connectors.

If the equipment is damaged, file a claim with the carrier once the extent of the damage is assessed.

If the equipment must be returned to the factory, please contact the factory for a Return Material Authorization (RMA). See Chapter 4.

RMR Cabinet Location

The RMR is designed for use in an indoor, temperature controlled environment mounted in a 19 inch cabinet. Ensure the rear of the unit is supported properly. The RMR should be placed in an area that is free of obstructions, easily accessible, and allows for proper air-flow and ventilation.

Rack Mounting the RMR

1. Set the RMR in the required position.
2. Align the mounting holes with the holes on the rack.
3. Insert the four mounting screws and tighten until secure.
4. Ensure the rear of the unit is supported properly.

Connections

Downlink and Uplink

RF and fiber cable connections should be verified both internally and externally before powering up the equipment. Verify these connections with the as-built drawings and documents for your specific system configuration. Table 3-1 and Figure 3-1 show the steps to connect the RMR module to the Nexus Fiber Base Unit (FBU) at the head end.

Table 3-1 Connection Procedure

Step	Action
1	Connect a fiber cable between the RMR fiber terminal and a head end device, such as the FBU.
2	Connect an RF cable between the customer's system and the Service 1 and Service 2 ports on the RMR.

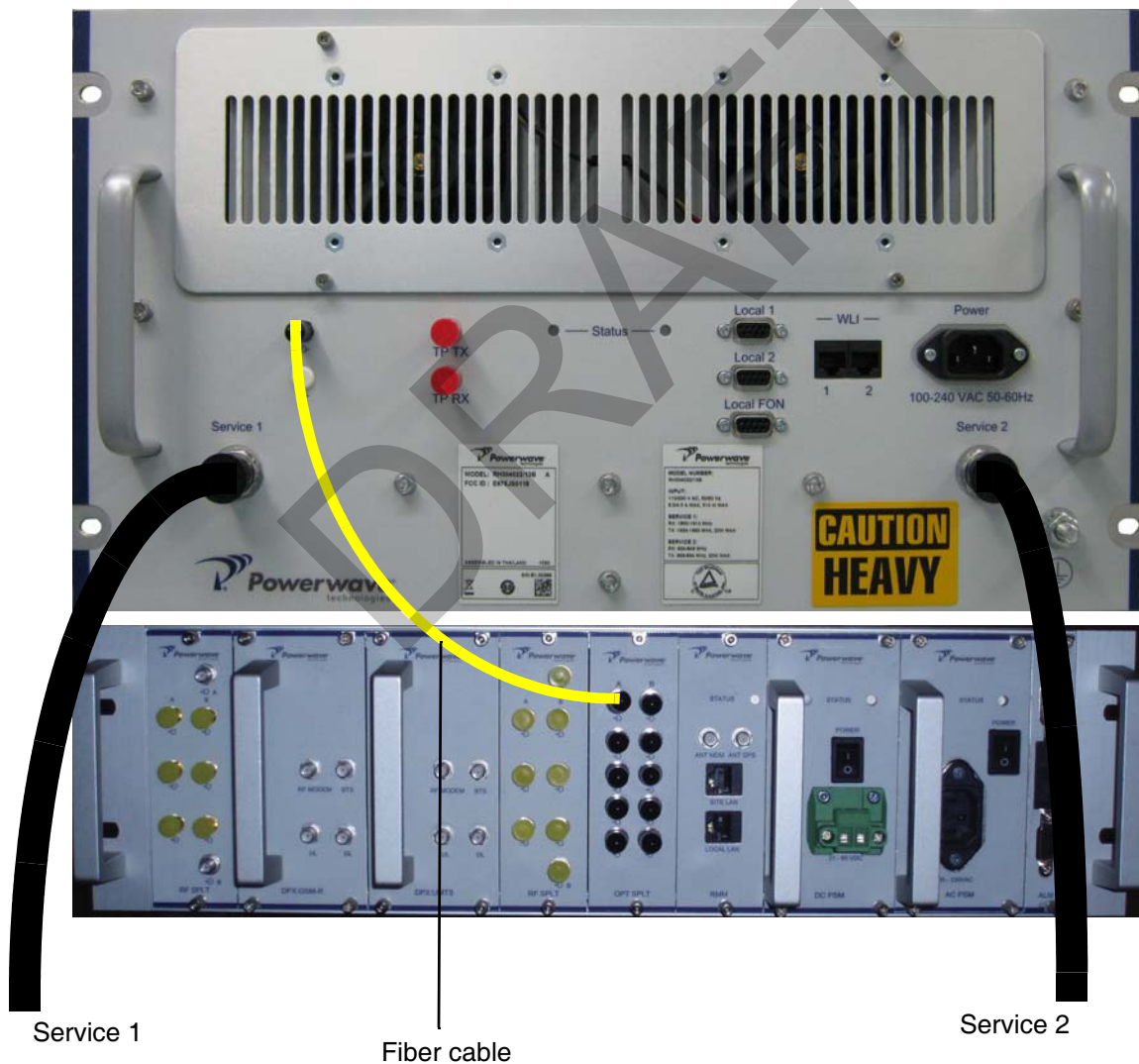


Figure 3-1 RMR to FBU and Service 1/2 Connections

Main Power and Grounding

Local regulations need to be followed for the main power connection. Nexus FT RMRs are approved in accordance with EN and UL/cUL regulations. This is, however, only valid if a classified power cord is used. For the Nexus FT RMR to meet these regulations you must select one of the following classified and approved cord types:

- EN – H 05 W5 - F HMR
- UL – AWM Style 2587
- CSA– AWM 1 A/B 11 A/B



WARNING: For Nexus FT RMRs supplied from the main power source, the main outlet must be grounded.

Table 3-2 RMR Main Power and Grounding

Step	Action
1	Connect a power cable between the RMR and an appropriate power supply.
2	Connect a ground cable between the ground terminal on the RMR and an appropriate ground at the installation site.

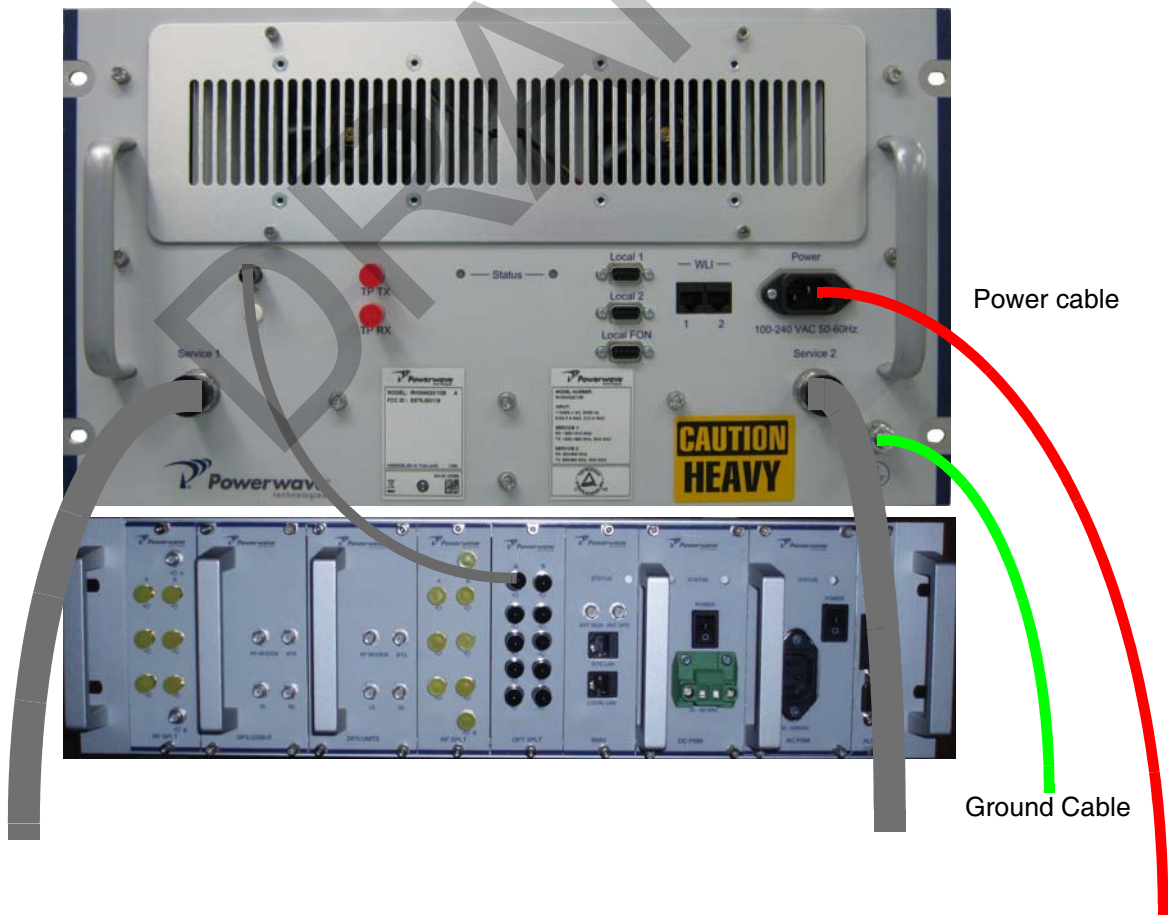


Figure 3-2 RMR Main Power and Grounding Connections

Commissioning

Before proceeding, carefully read the Safety section and check all connections made during the installation. Ensure cables are properly tightened and not damaged.

The RMR can be configured locally with OM-Online by connecting a standard serial cable from the COM port on the PC to the P31 PC port (RS-232) located on the front of the RMR. Details on using OM-Online are described in the OM-Online User Manual - Connecting a PC for Local Access

Initial Startup

To complete the initial start-up of the Nexus FT RMR, follow the steps listed in Table 3-4.

Table 3-3 Initial Startup Procedure

Step	Action
1	Turn main power on.
2	Check the LEDs on the RMR. Refer to Figure 2-1 in Chapter 2 for correct power up indications.

NOTE: When optimizing RMRs, offset the UL gain 20 dB less than the DL gain as a starting point. Always monitor the UL pass bands for noise levels and/or IMDs when optimizing and commissioning.

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Chapter 4 Maintenance

Introduction

This chapter contains periodic maintenance and performance test procedures for the Nexus FT RMR.

Periodic Maintenance

Periodic maintenance requirements are listed in Table 4-1, as well as the intervals at which the tasks should be performed.

Table 4-1 Recommended Periodic Maintenance

Task	Interval	Action
Inspection of cables and connectors	12 months	Inspect power, RF, and Fiber cables for signs of damage or wear (frayed insulation, cracks, punctures, etc.) Check connections to be sure they are tight.
Clean cooling fans	12 months	Clean any dirt or debris that may potentially block air flow.
	Optional	Perform cable sweeps.
Clean equipment	Clean as required depending on operating environment.	

Troubleshooting

The sections that follow contain a list of problems that could occur and a few suggested actions that might correct each problem. If the suggested corrective action does not eliminate the problem, please contact your Powerwave field representative or help line for further instruction.

Clearing Alarm Faults

Table 4-2 lists the alarms that can be generated in the Nexus FT RMR. Critical, Error, and Warning alarms are sent automatically from a Nexus FT RMR to OM-Online, stored and then viewed in the Alarm window.

Table 4-2 Alarm Troubleshooting

ID	Alarm Text	Alarm Unit	Alarm	Description
1	Power	PSM	Critical	PSM does not work properly. A sum signal from the PSM indicates that at least one voltage output has dropped. If no mains breakdown relay is used, then the alarm will also be sent at mains breakdown
			Ceasing	PSM. Ceasing is sent if the PSM works at start-up, and there is a corresponding critical PSM alarm logged in the Events log. The RMR will restart when the power is back and this alarm will be sent
			Ceasing	The cause of the alarm has ceased

Table 4-2 Alarm Troubleshooting (Continued)

ID	Alarm Text	Alarm Unit	Alarm	Description
2	RMR restart	CU	None	Power on start, or user ordered reboot. Logged to indicate a normal power up, or a restart ordered by the operator
			Warning	Software error restart, 1st – 7th time. Restart 1st to 7th time during a 14 day period. The counter is reset every 14th day, counted from power up
			Error	Software error restart 8th – 10th time. Restart 8th to 10th time during the 14 day period. At the 11th time, the SW bank will be blocked and not used anymore until a user ordered reset is performed, or power is switched off/on
3	Mains breakdown	External	Critical	The mains power is gone. Used with an external relay indicating mains breakdown. The external relay should be connected to External Alarm 1 and the RMR configured to indicate this alarm. If no relay is used, a mains breakdown will be reported as a PSM fault
			Ceasing	The mains power is back. Sent if there is a corresponding critical mains breakdown alarm logged in the Events Log. The RMR will restart when the power is back
4	Alarm reset	CU	None	Alarm reset by the user. All alarms are reset. The cause of the alarm will be re-evaluated and reported, if still active
5	Local bus error	WBA #, MCPA#	Error	Error when communicating on the bus. The CU has no contact with the WBA, or MCPA PCBA, which is taken out of service
6	Main bkd w backup	External	Error	Used to indicate that the mains is no longer available. RMR is powered by external battery backup unit. Suggested remedy: Check the mains power
			Ceasing	The cause of the alarm has ceased
7	Err in AD-converter		Warning	The analog-to-digital converter on the CU PCBA does not give reliable values
8	New unit detected		None	Compared to the last power on, the CU has recognized at least one additional hardware unit
9	Inst. unit lost		Error	Compared to the last power on, the CU lacks at least one hardware unit
10	EEPROM error	CU	Error	EEP read or write fail. Data cannot be written or read from the EEPROM on the CU PCBA. User parameters are stored in the EEPROM
11	Log memory fault		Error	Log memory fault. Indicates that the log memory on the CU PCBA is faulty. The RMR will not work. Not available in all CU software versions
12	High temp	CU	Warning	The CU PCBA temperature is higher than 90°C
			Ceasing	The CU PCBA temperature has fallen below 90°C
13	REFO error		Error	Significant REFO drift or error detected by CU
14	Ext REFO error		Warning	Suggested remedy: Check the reference source and the cables

Table 4-2 Alarm Troubleshooting (Continued)

ID	Alarm Text	Alarm Unit	Alarm	Description
15	CU battery fault	CU	Warning	CU RAM battery fault. The battery for the RAM on the CU PCBA has a voltage outside the normal 2.7 to 3.5 Volt. An alarm may be initiated at start-up if the RMR has been stored out of power for a long time. Suggested remedy: Ensure jumper P3 on the CU PCBA is mounted to charge the battery
			Ceasing	The cause of the alarm has ceased
16	SW load error	CU	Error	Software load error. An error has occurred during a software load process. The flash memory does not contain a proper software. Suggested remedy: Check the CU software using the OM-Online SW Manager. Do NOT restart the RMR
17	Log cleared	CU	None	Log memory has been cleared. The check sum in the Events Log memory is faulty. The log is cleared. Can be caused by a bad RAM battery backup or low voltage to the RAM
18	RTC restarted	CU	None	The time is changed by the operator (logged to keep track of changes made to the RTC)
			Warning	Time reset to 1994-01-01. The RTC was unable to keep track of the time and did a reset. Suggested remedy: Ensure jumper P3 on the CU PCBA is mounted to charge the battery
19	RTC error		Error	RTC does not operate. The CU has detected an error in the RTC operation which makes the time unreliable. Suggested remedy: Replace the CU PCBA
20	Door open alarm	External	Config	The door has been open 30 seconds without disabling the alarm
			Ceasing	The door has been closed 30 seconds, or the alarm is disabled
21	External alarm 1	External	Config	External alarm input EA1 active more than 1 second
			Ceasing	External alarm input EA1 no longer active
22	External alarm 2	External	Config	External alarm input EA2 active more than 1 second
			Ceasing	External alarm input EA2 no longer active
23	Fan failure alarm 3	External	Config	External alarm input EA3 active more than 1 second
			Ceasing	External alarm input EA3 no longer active
24	Fan failure alarm 4	External	Config	External alarm input EA4 active more than 1 second
			Ceasing	External alarm input EA4 no longer active
34	Login failed		None	Invalid RMR password
40	Battery fault	RCU, FON charger	Error	The backup battery on the RCU or the FON PCBA does not work properly. Suggested remedy: Check cables or replace battery
			Ceasing	The cause of the alarm has ceased

Table 4-2 Alarm Troubleshooting (Continued)

ID	Alarm Text	Alarm Unit	Alarm	Description
42	Antenna isolation	WBA #, Channel #, UL/DL	Warning	Low antenna isolation. The antenna isolation is lower than the gain set. Gain is reduced by 10dB – 13dB below the oscillation point. Suggested remedy: Decrease gain or increase antenna isolation
			Error	Low antenna isolation at lowest gain. The gain has been reduced as much as possible but the oscillation still remains. The amplifier is turned off. Suggested remedy: Decrease gain or increase antenna isolation
			Ceasing	Normal operation again, that is no oscillation can be detected 13dB above the gain set
48	Battery backup fault	External	Error	If a battery backup unit alarm is connected to external alarm 2, then the operator can configure the RMR to display this alarm when the battery backup unit indicates alarm
			Ceasing	The cause of the alarm has ceased
70	Bad table alarm	CU	Error	Requested table contains incorrect information (SW error)
71	Table not found	CU	Error	Requested table not found in the database (SW or calibration error)
72	Table database error	CU	Error	Table database not found (calibration error)
80	Antenna SWR alarm	Donor antenna service antenna	Error	Too low antenna return loss, caused either by cables, connectors, or antenna problems. Suggested remedy: Check antenna and cables
			Ceasing	The cause of the alarm has ceased
90	FON power alarm	FON RF	Error	A DC voltage on a FON PCBA is out of range. Suggested remedy: Replace the FON PCBA.
			Ceasing	The cause of the alarm has ceased
245	Not In Allowed Area	CU	None	RMR is moved from the operating area and the RF HW is switched on or off

Field Replaceable Units

The fan assembly is the only field replaceable unit. If any other components fail, please contact Powerwave for service.

Fan Removal and Replacement

Refer to Table 4-3 and figures 4-1 and 4-2.

Table 4-3 Fan Removal

Step	Action
1	Disconnect power from the RMR.
2	Remove four retaining screws from the fan assembly housing. See Figure 4-1.
3	Remove the fan assembly and disconnect the plug. See Figure 4-2.
4	Install the new fan assembly in reverse order.

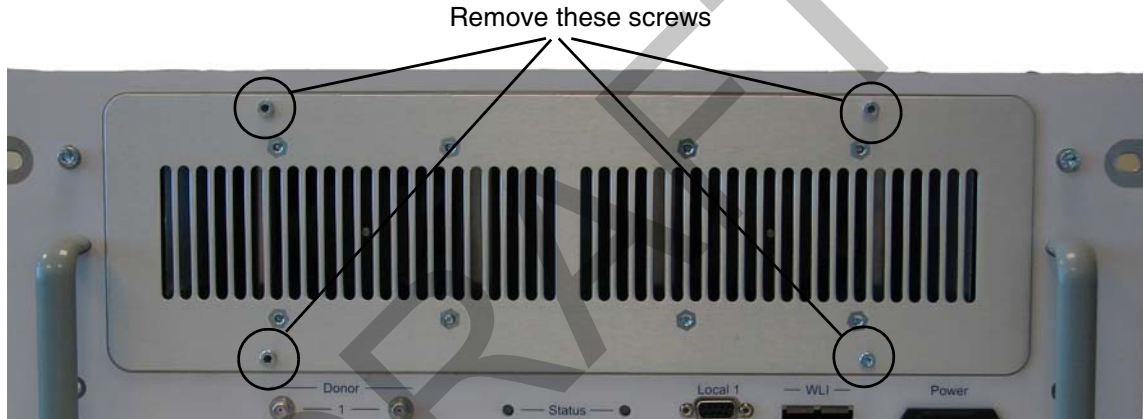


Figure 4-1 Fan Assembly Screws

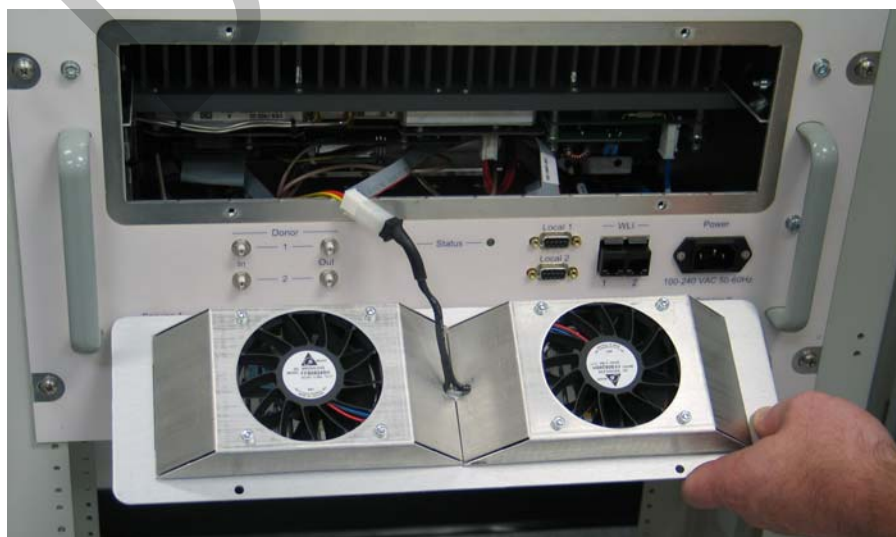


Figure 4-2 Fan Assembly

NetWay Manager (NWM)

NWM is a Powerwave software package for network management. NWM can be used to access repeaters for alarm reception, radio parameter configuration, software downloading, and scheduling activities.

Return For Service Procedures

When returning products to Powerwave, the following procedures will ensure optimum response.

Obtaining an RMA

A Return Material Authorization (RMA) number must be obtained prior to returning equipment to the factory for service. Please contact our Repair Department at +1-714-466-1000 to obtain this number, or FAX your request to +1-714-466-5800. Failure to obtain this RMA number may result in delays in receiving repair service.

Repackaging for Shipment

To ensure safe shipment of the unit, it is recommended that the original package designed for shipping the unit be reused. If it is not available, contact Powerwave's Customer Service Department at 1-800-797-9283, +1-714-466-100 or by e-mail at support@pwav.com for packing material.

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Chapter 5 Specifications

Introduction

This chapter provides specifications for the Nexus FT RMR.

Table 5-1: RMR Specifications

Electrical	
Frequency band UL	824 to 849 MHz (Cellular) 806 to 824 MHz (800 iDEN) 896 to 902 MHz (900 iDEN) 1850 to 1910 MHz (PCS)
Frequency band DL	869 to 894 MHz (Cellular) 851 to 869 MHz (800 iDEN) 935 to 941 MHz (900 iDEN) 1930 to 1990 MHz (PCS)
Max absolute delay	<300 ns
Gain adjustment range (in 1 dB steps)	30 dB
Gain Uplink Downlink Variation *These are typical values and may vary due to cable length.	35 to 60 dB typical - Excluding fiber link 45 to 70 dB typical - Excluding fiber link Typically ± 1.5 dB versus temperature ± 2.0 dB versus DL frequency ± 0.5 dB versus DL output power ± 0.5 dB versus input voltage ± 2.0 dB versus UL frequency
Instantaneous bandwidth	25 MHz (Cellular) 18 MHz (800 iDEN) 5 MHz (900 iDEN) 60 MHz (PCS) 45 MHz (AWS)
Uplink AGC limit	0 dBm at FON input
Downlink AGC limit	43 dBm at antenna port
Return Loss	11 dB (Service Port), 14 dB (Donor Port)
Downlink, Spurious and Emissions level	-13 dBm/1 MHz (FCC)
Downlink power	+46.3 dBm RMS (20 Watts)
Noise figure excluding Uplink	4 dB
Power supply voltage	85 - 265VAC
Current Rating	.6A RMS
Maximum Current Draw (Dual Band)	6.5 A @ 115 VAC 3 A @ 230 VAC

Table 5-1: RMR Specifications (Continued)

Recommend Fuse Size	10 - 20 A for AC Voltage
Power consumption	420 W typical, 600 W max
Impedance Input Output	Not Applicable 50 Ω
Mechanical	
Dimensions (W x H x D in inches)	403 x 265.9 x 551 mm (15.9 x 10.5x 21.7 in)
Weight	< 30 kg (66 lbs)
Service Antenna port connector	Female N-Type
Donor Port Connector	SMA
Environmental	
Operating Temperature Range	-0 °C to +55 °C (32°F to +131°F)
Altitude	-142 m to 4000 m (-466 ft. to 13100 ft.)
Casing class	IP21

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