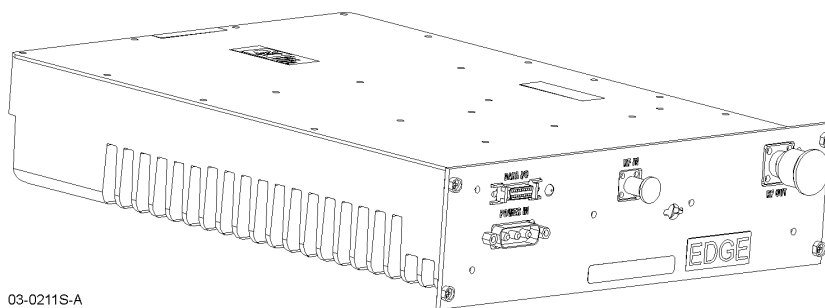


Powerwave®
technologies

THE POWER IN WIRELESS™

Installation & Service Manual



03-0211S-A

***Model SPA9323-30C
Single-Channel Cellular Amplifier***



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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 regulating body rules; (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 regulating body rules.

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Section 1 General Description

1-1 Introduction

This manual contains information and procedures for installation, operation, and maintenance of Powerwave's SPA9323-30C (Nortel Model No. NTQA50GA) single-channel cellular amplifier. The manual is organized into six sections as follows:

- Section 1. General Description
- Section 2. Installation
- Section 3. Operating Instructions
- Section 4. Principles of Operation
- Section 5. Maintenance
- Section 6. Troubleshooting

1-2 General Description

The SPA9323-30C (see figure 1-1) is a single-channel power amplifier that operates in the 60 MHz frequency band from 1930 MHz to 1990 MHz. It is designed for use in an amplifier system that is modular in design, and is ideally suited for use in GSM/EDGE base stations. The amplifier is capable of transmitting at 30 watts of power in either GMSK or EDGE modulation. All solid-state, the amplifier is designed to provide trouble-free operation with minimum maintenance. The system's modular construction and unique and highly effective operational status and fault monitoring circuitry help minimize downtime. The turn-on and turn-off sequences of voltages are fully automatic, as is overload protection.

Each amplifier module has an I/O connector that allows the host system to monitor the amplifier module performance. Primary power for the amplifier is -48 Vdc. The amplifier has an integrated heat sink for cooling.

1-3 Functional And Physical Specifications

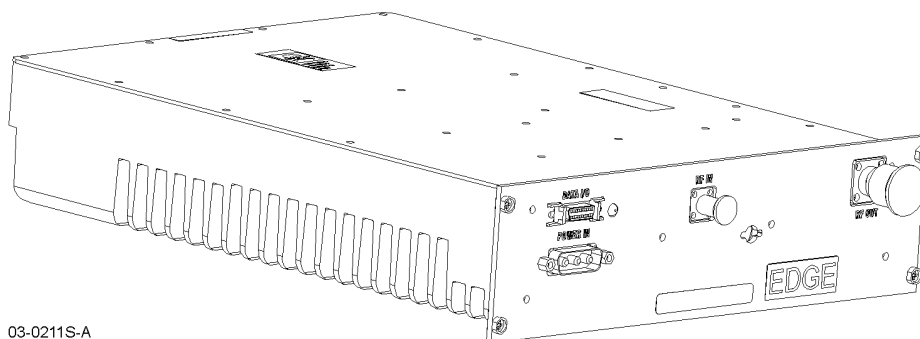
Functional and physical specifications for the amplifier are listed in table 1-1.

1-4 Equipment Changes

Powerwave Technologies, Inc. reserves the right to make minor changes to the equipment, including but not necessarily limited to component substitution and circuitry changes. Changes that impact this manual may subsequently be incorporated in a later revision of this manual.

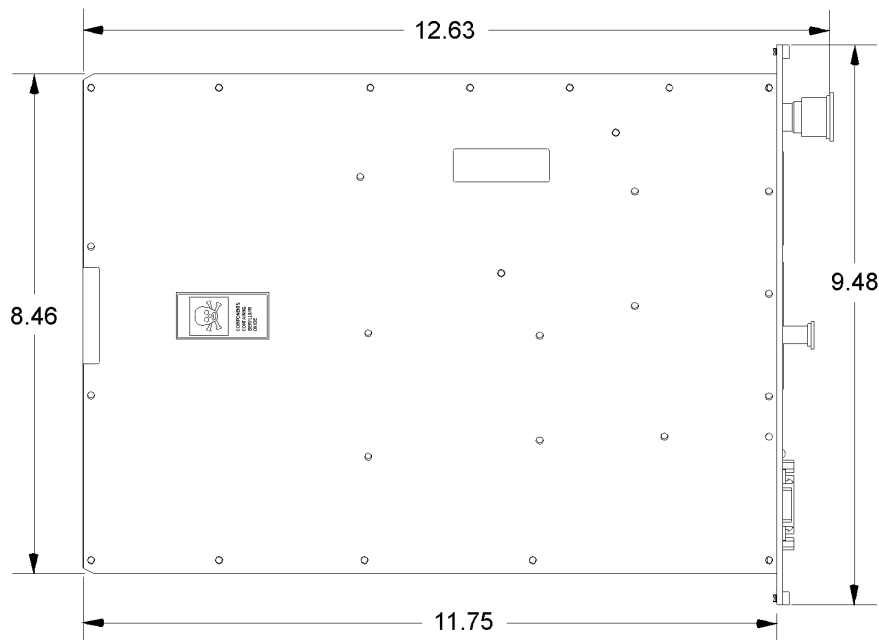
Table 1-1 SPA9323-30C Single-Channel Cellular Amplifier Functional Specifications

Frequency Range	1930-1990 MHz		
Nominal Input Power	-3.2 dBm		
Total Output Power	30 W (44.77 dBm) typical / 33 W (45.19 dBm) maximum		
RF Gain at 882 MHz	48 +/- 1.0 dB		
Gain Variation Over All Conditions:	±2.0 dB		
Output Protection:	Mismatch Protected		
Input Port Return Loss:	-14 dB (Min)		
Out of Band Spurious:	-40 dBm (max)		
Spectral Mask	Frequency Removed From Carrier	GSM	EDGE
	200 kHz	-31 dBc	-31 dBc
	250 kHz	-34 dBc	-34 dBc
	400 kHz	-61 dBc	-57 dBc
	600 kHz	-71 dBc	-71 dBc
	1200 kHz	-74 dBc	-74 dBc
	1800 kHz	-76 dBc	-76 dBc
	6000 kHz	-81 dBc	-81 dBc
Duty Cycle:	Continuous		
DC Input Power:	-48 VDC; 3.1 amps typical; 4.2 amps max. -36 to -60 VDC, 150 watts typical; 200 watts max.		
Heat Dissipation	375 BTUs typical		
Operating Temperature:	0 °C. to +60 °C.		
Storage Temperature:	-40 °C. to +75 °C.		
Operating Humidity:	5 % - 95 % Relative Humidity (Noncondensing)		
Storage Humidity:	5 % - 95 % Relative Humidity (Noncondensing)		
RF Input / Output Connector	SMA Female (Input) / Type N Female (Output)		
DC Power Connector	3-Pin D-Subminiature (20 A Contacts)		
Data I/O Connector	20-Pin SCSI		
Dimensions:	2.55" High, 9.48" Wide, 11.85" Deep		

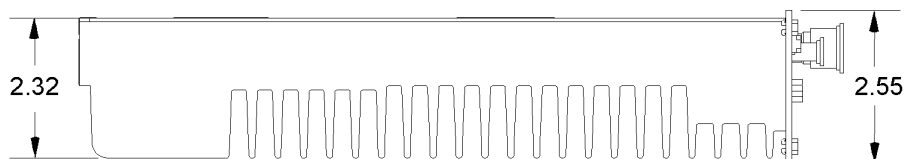


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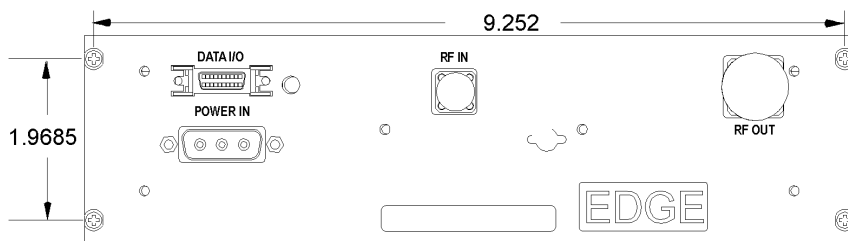
All dimensions are in inches
and are for reference only



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Figure 1-1. SPA9323-30C Amplifier

Section 2 Installation

2-1 Introduction

This section contains installation recommendations, unpacking, inspection, and installation instructions for the SPA9323-30C single channel cellular amplifier. Carefully read all material in this section prior to equipment unpacking or installation. Also read and review the operating procedures in Section 3 prior to installing the equipment. It is important that the licensee perform these tasks correctly and in good faith. If applicable, carefully read the Federal Communications Commission (FCC) rules to determine how they apply to your installation.

2-2 Electrical Service Recommendations

Powerwave Technologies recommends that proper AC line conditioning and surge suppression be provided on the primary AC input to the -48 Vdc power source. All electrical service should be installed in accordance with the National Electrical Code, any applicable state or local codes, and good engineering practice. Special consideration should be given to lightning protection of all systems in view of the vulnerability of most transmitter sites to lightning. Lightning arrestors are recommended in the service entrance. Straight, short ground runs are recommended. The electrical service must be well grounded.

The amplifier has an internal fuse, so a failure in one does not shut off the whole installation.

2-3 Unpacking And Inspection

This equipment has been operated, tested and calibrated at the factory. Only in the event of severe shocks or other mistreatment should any substantial readjustment be required. Carefully open the container(s) and remove the amplifier module(s). Retain all packing material that can be reassembled in the event that the unit must be returned to the factory.

CAUTION

Exercise care in handling equipment during inspection to prevent damage caused by rough or careless handling.

Visually inspect the amplifier module for damage that may have occurred during shipment. Check for evidence of water damage, bent or warped chassis, or loose screws or nuts. Inspect the front panel for bent connector pins. If the equipment is damaged, a claim should be filed with the carrier once the extent of any damage is assessed. We cannot stress too strongly the importance of IMMEDIATE careful inspection of the equipment and the subsequent IMMEDIATE filing of the necessary claims against the carrier if necessary. If possible, inspect the equipment in the presence of the delivery person. If the equipment is damaged, the carrier is your first area of recourse. If the equipment is damaged and must be returned to the factory, write or phone for a return authorization (see section 6). Powerwave may not accept returns without a return authorization.

Installation Instructions (Refer to figures 1-1 and 2-1)

The SPA9323-30C is intended for installation in a Restricted Access Location.

The SPA9323-30C amplifier module is designed for installation in a subrack that permits access to the amplifier's front panel for connection of DC power, RF, and monitor cables.

To install the amplifier proceed as follows:

1. Install amplifier in the BTS rack and secure in place.
2. Connect the amplifier front panel RF Out (Type-N) connector to the antenna cable.
3. Connect the amplifier front panel RF In (Type-SMA) connector to the transceiver output(s).
4. Connect the BTS 20-pin Data I/O cable to the amplifier. Refer to section 2-5.1.

WARNING

Turn off external DC power before connecting DC power cables. Verify that the amplifier is terminated into a proper 50-Ohm load.

5. Connect the DC power cable to the rack and amplifier. Refer to section 2-5.3.
6. Check your work before applying DC voltage to the system. Make certain all connections are tight and correct.
7. Measure DC input voltage. DC input voltage should be -36 to -60 VDC. If the DC input voltage is above or below the limits, call and consult Powerwave before you turn on your amplifier system.
8. Refer to section 3 for initial turn-on and checkout procedures.

2-4 Amplifier Module Connectors

The amplifier has four connectors on the front of the module. These include a SCSI connector which provides the data I/O connections, SMA female RF input, Type N female RF output, and 3-pin high current contact DC input connectors. Refer to figure 2-1. Each is fully described in the paragraphs that follow.

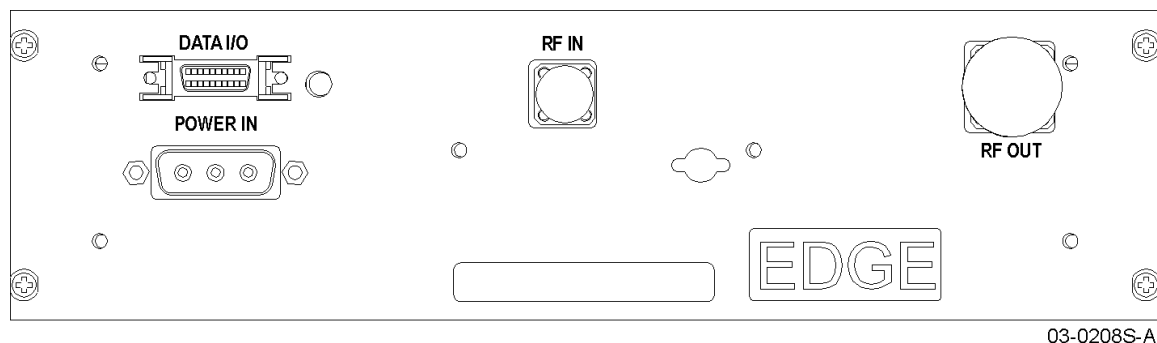


Figure 2-1 SPA9323-30C Front Panel View

2-4.1 Data I/O Connector

The amplifier has a separate remote alarm and control connector that may be used by the host system to monitor and control the individual amplifier modules. The status, alarm, and control connections on the amplifier connector are made through a 20-pin SCSI connector (figure 2-2) and are listed and described in table 2-1.

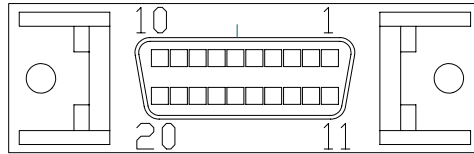


Figure 2-2 Data I/O Connector (on Front Panel)

Table 2-1 Data I/O Connector Pin Definition

Pin	Function	Description
1	Ground	Ground
2	Ground	Ground
3	Synchro Signal +	Synchro Signal from TRX
4	UART TX +	Information Exchange (TRX to PA)
5	Manual Control	To Set PA in Test Mode
6	Not Connected	
7	UART RX +	Information Exchange (PA to TRX)
8	Not Connected	
9	Not Connected	
10	Not Connected	
11	Ground	Ground
12	Ground	Ground
13	Synchro Signal -	Synchro Signal from TRX
14	UART TX -	Information Exchange (TRX to PA)
15	Not Connected	
16	Not Connected	
17	UART RX -	Information Exchange (PA to TRX)
18	Not Connected	
19	Not Connected	
20	Not Connected	

2-4.2 Amplifier RF Connectors

The amplifier has two RF connectors. The RF Input connector is a SMA female. The input power on this port should not exceed the level specified in table 1-1. The RF Output connector is Type N female. They are listed and described in table 2-2.

Table 2-2 Amplifier RF Connector Definition

Function	Description
RF Input	SMA Female
RF Output	Type N Female

2-4.3 DC Power Connector

The DC power connector is a three-pin high current contact D-subminiature connector. The pin configuration is listed in table 2-3 and shown in figure 2-3.

Table 2-3 DC Power Connector Definition

Pin	Description
1	-48 V
2	Chassis Ground
3	Battery Return

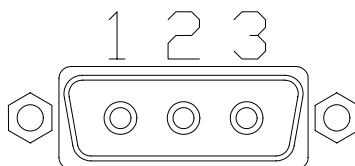


Figure 2-3 DC Power Connector

Section 3 Operating Instructions

3-1 Introduction

This section contains operating instructions for the single channel cellular amplifier system.

3-2 Location And Function Of Amplifier Indicators

The front panel LED, located to the right of the 20-pin data connector, indicates the amplifier status.

- Green indicates the amplifier is operating properly.
- Red indicates an alarm or off condition.

The nature of the alarm can only be determined through the software interface of the Base-Transceiver System (BTS). Please consult the BTS manual for details on monitoring amplifier status.

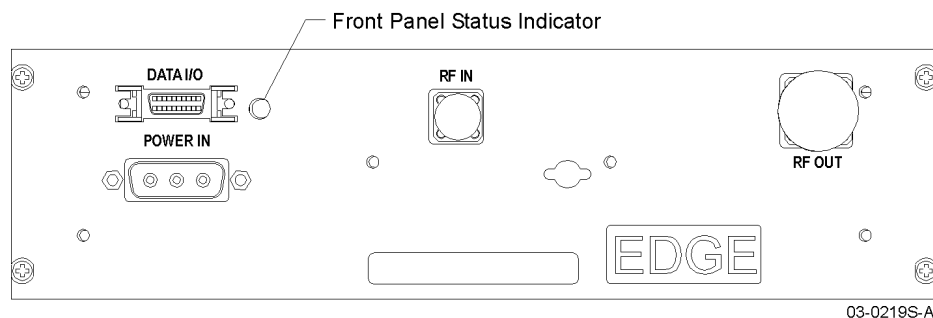


Figure 3-1 Front Panel Indicators

3-3 Initial Start-Up And Operating Procedures

To perform the initial start-up, proceed as follows:

1. Verify that all input and output cables are properly connected.

CAUTION

Before applying power, make sure that the input and output of the amplifier are properly terminated at 50 ohms. Do not operate the amplifier without a load attached. Refer to table 1-1 for input power requirements. Excessive input power may damage the amplifier.

NOTE

The output coaxial cable between the amplifier and the antenna must be 50-ohm coaxial cable. Use of any other cable will distort the output.

2. Turn on supply that provides -48 Vdc to the amplifier system. Do not apply an RF signal to the amplifier system
3. Verify that the LED is lit and the color Green.
4. Turn on external exciter/transceiver and apply RF input signals. Adjust the input power to achieve the desired output power. Refer to the BTS manual for instructions on performing this step.

Section 4 Principles of Operation

4-1 Introduction

This section contains a functional description of the single-carrier SPA9323-30C amplifier.

4-2 RF Input Signal

The maximum input power should not exceed the levels to produce the maximum rated RF output power in table 1-1. This level is approximately -3.2 dBm, but should be set through the base-transceiver station's software interface. See the BTS manual for detailed instructions.

4-3 RF Output Load

The load impedance should be as good as possible (1.5:1 or better) in the working band for good power transfer to the load.

4-4 SPA9323-30C Amplifier

The amplifier, figure 4-1, has an average output power of 30 watts, and is designed to support transmission in GMSK and EDGE modulation. With an input signal of approximately -3.2 dBm, the amplifier operates at its rated output power. The amplifier is comprised of:

- Driver Amplifier
- Main Amplifier
- Multifunction Board
- DC/DC Converter Module

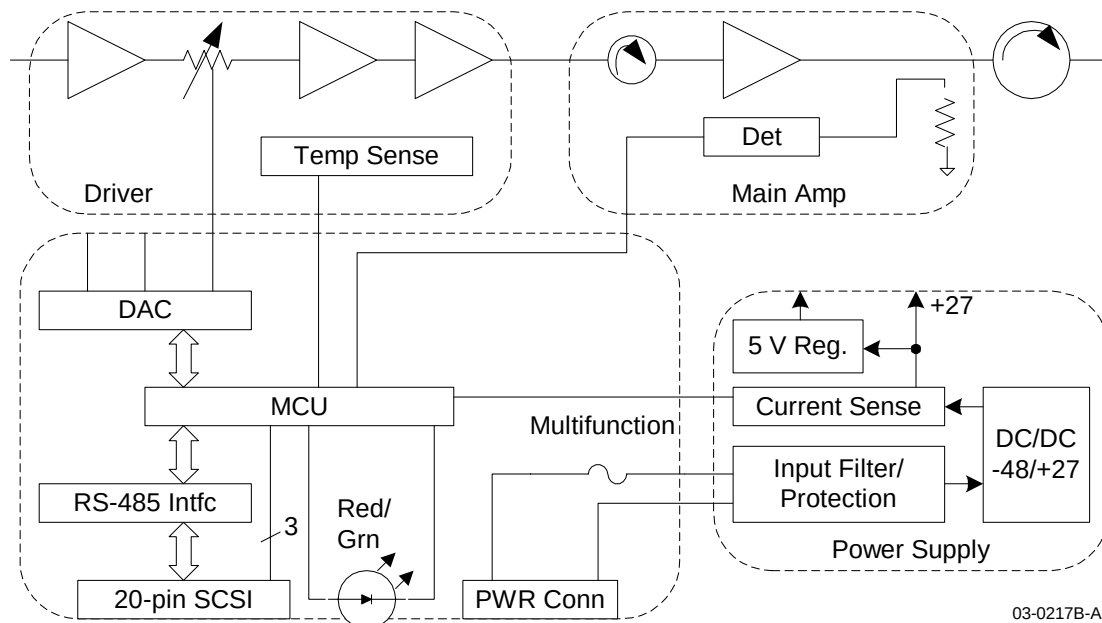


Figure 4-1 SPA9323-30C Amplifier Block Diagram

4-4.1 Driver Amplifier

The driver amplifier is a two-stage amplifier that provides approximately 28 dB of gain in the 60 MHz frequency band from 1930 to 1960 MHz. The amplifier is mounted directly on a heat sink, which is temperature monitored by a thermal sensor.

4-4.2 Main Amplifier

The main amplifier is a single-stage Class AB amplifier with approximately 13 dB gain and a P1dB of +50 dBm. The amplifier's output is protected from output mismatches. The amplifier is designed to meet spectral mask requirements for GSM and EDGE signals when operated up to +45.2 dBm. The amplifier is mounted directly on a heat sink.

4-4.3 Power Distribution

The amplifier module operates on a -48 VDC nominal power supply consuming 2.9 amps (typically) current at full power. A DC/DC converter supplies internal circuitry with +26 VDC and +5 VDC.

4-4.4 Multifunction Board

The multifunction board enables communication between the amplifier and the base-transceiver station in which it is installed, and stores information about the amplifier. It includes gain control and two gain stages providing a 7 dB gain. The multifunction board also monitors several amplifier performance parameters and reports output power so that the BTS can maintain the output power within specified limits. When these parameters are beyond acceptable levels, the amplifier alarms. The multifunction board is mounted directly on a heat sink, which is temperature monitored by a thermal sensor.

The alarms are:

Temperature Alarm - If the internal temperature reaches 90°C, the PA shuts down and communicates an alarm through the digital interface.

DC/DC Alarm - If the output voltage of the converter falls below 23.5V, the PA shuts down and communicates an alarm through the digital interface.

Over-current Alarm - If the output current of the DC/DC converter goes above a nominal threshold (7.5 A), the PA shuts down and communicates an alarm through the digital interface.

Communication Alarm - If the serial interface detects an error in transmission (parity, overrun, framing), an alarm is sent for one burst only during the very next burst. The PA operation is not affected.

Section 5 Maintenance

5-1 Introduction

The amplifier is designed to be operated without any periodic maintenance other than that recommended by the manufacturer of the BTS. Please consult your BTS manual for guidance.

Section 6 Troubleshooting

6-1 Introduction

This section contains a list of problems and a few suggested actions that may correct the problem. If the suggested corrective action does not eliminate the problem, please contact your Powerwave field representative or the factory for further instructions.

NOTE

Check your sales order and equipment warranty before attempting to service or repair the unit. Do not break the seals on equipment under warranty or the warranty will be null and void. Do not return equipment for warranty or repair service until proper shipping instructions are received from the factory.

6-2 Troubleshooting

Refer to table 6-1 for troubleshooting suggestions.

Table 6-1 Troubleshooting

Symptom	Suggested Action
LED not lit	1. Check that rack power connection is secure. 2. Check for proper power supply voltage. 3. Check that power switch is ON position.
LED is red	1. Verify amplifier is enabled. 2. A large RF input overdrive has caused an alarm. Reduce input power and re-enable the amplifier. 3. Follow recommendations of BTS operating manual.
No RF Output	1. Check input and output connections and cables for integrity and tightness. 2. Check RF input power to verify that it is present and within specification range. 3. Contact Powerwave field representative or factory.

6-3 Return For Service Procedures

Before returning products to Powerwave, obtain a Return Material Authorization (RMA) number and repackage the equipment as described in the following paragraphs.

6-3.1 Obtaining An RMA

An RMA number must be obtained by contacting our Repair Department at (888) 797-9283 or (714) 466-1000, or FAX your request to (714) 466-5816. Failure to obtain this RMA number may result in delays in receiving repair service.

6-3.2 Repackaging For Shipment

To ensure safe shipment of the amplifier, it is recommended to reuse the package designed for the amplifier. The original packaging material is reusable. If it is not available, contact Powerwave's Customer Service Department for further instructions.

Field Failure Report:

RMA No.: _____ S/N: _____ Customer: _____

Region: _____ Technician: _____ Phone No.: _____

Manufacture Date: _____ Failure Date: _____ Site ID: _____

Does customer want a *Failure Analysis Report*? Y / N

Failure Mode (please circle all that apply):

Loop Fail	VSWR	Low Pwr	Ovr Pwr	DC	LPA Disable
Ovr Temp	Alarm	No RF Out	Firmware	Shipping Damage	
Missing Hardware		Connector Damaged			

Failed During (please circle all that apply):

Installation	Normal Operation	Scheduled Maintenance
High Traffic Hour	Medium Traffic Hour	Low Traffic Hour
DOA? Y / N		

Failure Frequency:

Intermittent	Permanent
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Failure Details: _____

Did other equipment fail at the same time? (Please describe) _____

