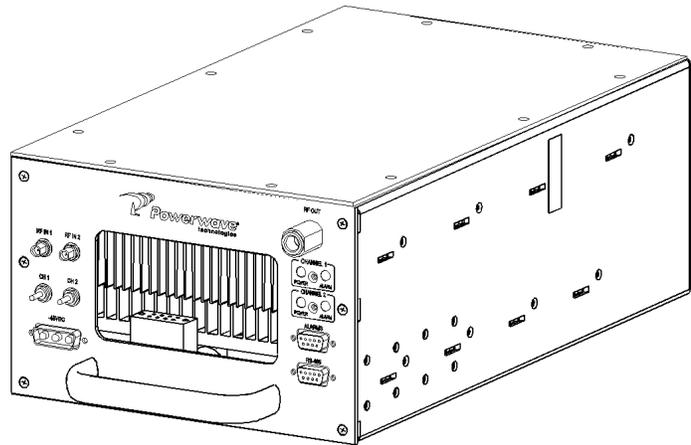


## *Installation and Service Manual*

**Powerwave**<sup>®</sup>  
technologies

**THE POWER IN WIRELESS**<sup>™</sup>



### *Model SPA9329-35N 2-Channel Booster Power Amplifier*



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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 model SPA9329-35N Two-Channel Power Booster Amplifier module. 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 SPA9329-35N is a linear, two-channel booster amplifier that operates in a bandwidth of 60 MHz from 1930 MHz to 1990 MHz providing 35 watts (45.5 dBm) per channel at the combiner output port with a nominal gain of 21 dB total gain. The amplifier is modular in design, and ideally suited for use in GSM base stations.

The amplifier, shown in figures 1-1 through 1-4, has a power input, two RF inputs, and one RF output. Controls and indicators consist of a DC power switch for each channel, corresponding LED power indicators, and alarm LED indicators (see section 3, table 3-1). Primary power for operating the amplifier is -48 VDC. Each amplifier module has a fan assembly contained in the rear of the module, as shown in figures 1-2, to provide cooling. Air is drawn through the front of the amplifier, over the internal heat sinks, and then exhausted by the fan.

## 1-3 Ordering Information

Table 1-1 lists major system component numbers and descriptions for use in ordering booster amplifiers or components.

**Table 1-1 Major System Components**

<b>Component Number</b>	<b>Description</b>
SPA9329-35N	35-Watt Amplifier, -48 VDC

### **NOTE**

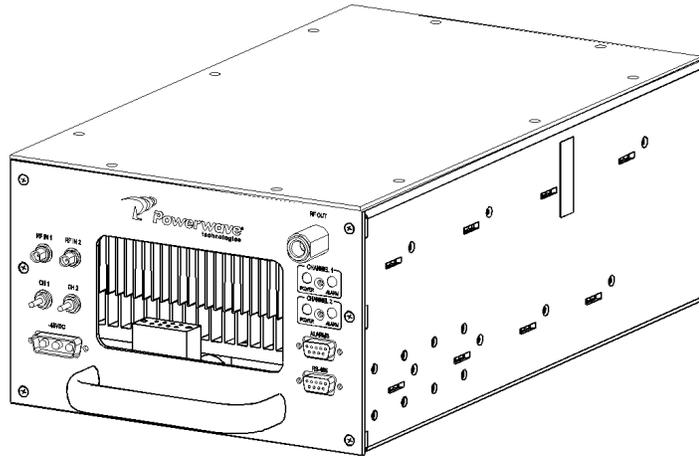
*A quality transmit filter or duplexer must be installed after this amplifier to ensure FCC Type Acceptance of the amplifier. The filter/duplexer should be rated for at least 200 Watts average power and 800 Watts instantaneous power (minimum).*

## Functional & Physical Specifications

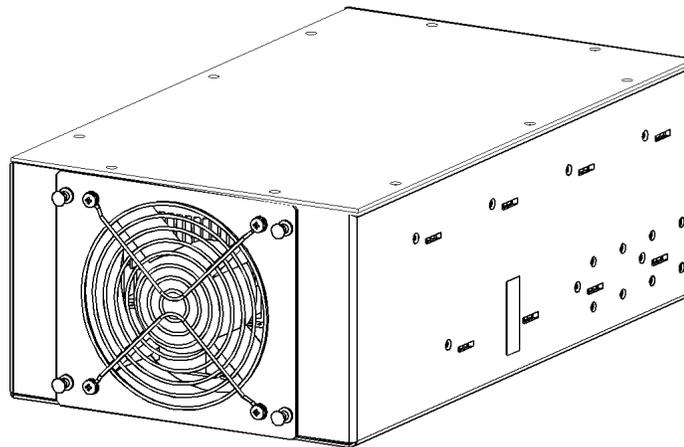
Functional and physical specifications for the SPA9329-35N amplifier are listed in table 1-2.

**Table 1-2 SPA9329-35N Booster Amplifier Functional Specifications**

Frequency Range	1930-1990 MHz
Carrier Spacing (center to center)	200 kHz nominal
Occupied Bandwidth	200 kHz/carrier
Max Power Output per Carrier	35 Watts (45.5 dBm)
Module Gain per Input	21 dB typical
Tx Input Level (per Input) for 35 Watts	10 mW (+10 dBm) to 10 Watts (+30 dBm)
Gain Flatness Across 20 MHz Band	≤ 0.5 dB Peak to Peak
IMD Performance	-65 dBc maximum with two CW tones (one for each channel) unmodulated @35 watts/tone
Operating Voltage	-38 VDC to -58 VDC
Operating Current (per Input Connector X2)	16 Amps @ -48 VDC (typical)
Inrush Current (Peak)	40 Amps Maximum
Operating Temperature:	0 °C to +50 °C
Tx Input Connector	SMA-F x 2 (One per Input)
Tx Output Connector	Type 'N' Female
Dimensions (+27 VDC Model)	5.25"H x 8.50"W x 15.30"D including handle
Mounting Options	19", 23", or 24" Relay Rack Mounted or Outdoor Enclosure Mounted
Weight	25 lbs



*Figure 1-1. SPA9329-35N Front Isometric View*



*Figure 1-2. SPA9329-35N Rear Isometric View*

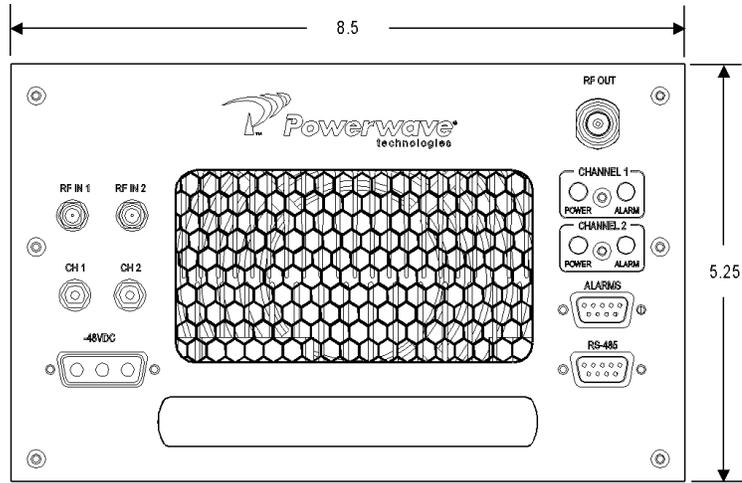


Figure 1-3. SPA9328-35N Front Panel

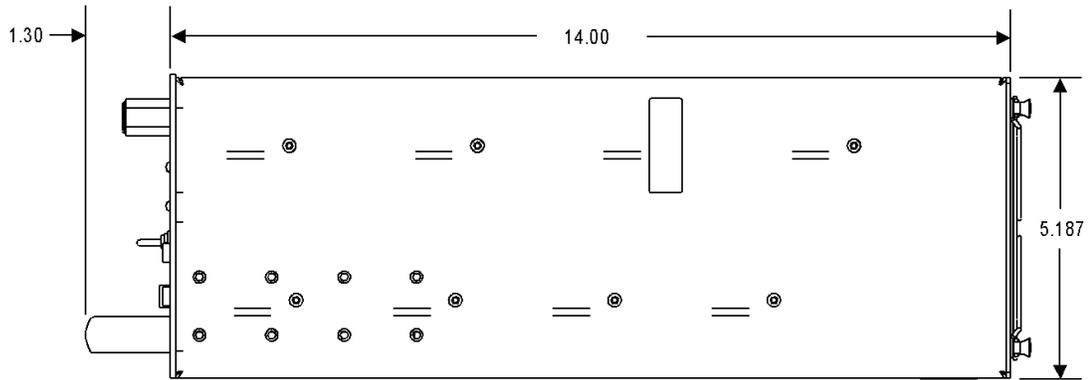


Figure 1-4. SPA9329-35N Side View

## Section 2 Installation

### 2-1 Introduction

This section contains unpacking, inspection, and installation instructions and recommendations for the Powerwave model SPA9329-35N Two-Channel Power Booster Amplifier module. 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. If applicable, carefully read the appropriate parts of the Federal Communications Commission (FCC) rules to determine how they apply to your installation. DON'T TAKE CHANCES WITH YOUR LICENSE.

### 2-2 Electrical Service Recommendations

Powerwave Technologies recommends that proper AC line conditioning and surge suppression be provided on the primary AC input. 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.

Each amplifier system should have its own circuit breaker, so a failure in one does not shut off the whole installation. Circuit breakers should be thermal type, capable of handling the maximum anticipated inrush current, in a load center with a master switch.

### 2-3 Unpacking & Inspection

This equipment has been operated, tested, and calibrated at the factory. 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, loose screws or nuts, or extraneous packing material in the connector. 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 paragraph 6.3). Powerwave may not accept returns without a return authorization. Claims for loss or damage may not be withheld from any payment to Powerwave, nor may any payment due be withheld pending the outcome thereof. WE CANNOT GUARANTEE THE FREIGHT CARRIER'S PERFORMANCE

## 2-4 Installation Instructions

The SPA9329-35N booster amplifier module is designed for installation in enclosures that permit access to the front of the module for connection of RF cables and the power connectors (refer to paragraphs 2-5, and 2-6 for connector descriptions).

### **WARNING**

*Turn external primary DC power off before connecting any cables.*

1. Connect the power source to the booster amplifier power input connector (see figure 2-1, 3-1, and table 2-1). Do not apply power at this time.
2. Connect the RF input cable(s) to the RF IN connector(s).
3. Connect an RF cable from the RF OUT (Type-N) to the transmit filter input.

### **CAUTION**

*It is highly recommended that the output of the SPA9329-35N Booster Amplifier be fed through an appropriate bandpass transmit filter prior to the transmit antenna input.*

4. Connect the antenna cable to the RF filter output connector.
5. Refer to section 3 for initial turn-on and checkout procedures.

## 2-5 RF Connectors

The amplifier has two SMA female RF IN connectors and one RF OUT connector (refer to figure 3-1 for locations). The input power to the RF IN connectors should not exceed the level specified in table 1-2. The RF OUT connector is Type-N female.

## 2-6 -48 VDC Power and Ground Connector

The -48 Vdc power and ground connections on the amplifier are made through a 3-pin female D-Sub connector (figure 2-1). Each pin and signal is listed and described in table 2-1.

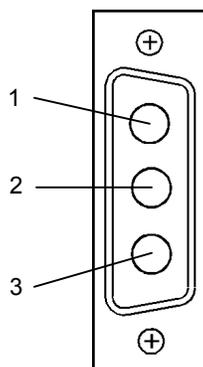


Figure 2-1 -48 Vdc Power and Ground Connector

**Table 2-1 -48 Vdc Power and Ground Connector Pin Descriptions**

Pin	Signal	Description
1	Open	Not Used
2	-48 Vdc	-48 Vdc
3	Return	DC Return

## 2-7 SPA9329-35N Alarm Connections

Alarm connections are defined for the SPA9329-35N booster amplifier modules in table 2-2.

**Table 2-2 Alarm Connector Definitions**

Pin Number	1	2	3	6	7	8
Contact Point With Respect To Common	NO	C	NC	NO	C	NC
Amp 1 No Alarm	Open	C	Closed	Open	C	Closed
Amp 1 Alarm	Closed	C	Open	Closed	C	Open
Amp 1 DC Off	Closed	C	Open	Closed	C	Open
Amp 2 No Alarm	Open	C	Closed	Open	C	Closed
Amp 2 Alarm	Closed	C	Open	Closed	C	Open
Amp 2 DC Off	Closed	C	Open	Closed	C	Open

# Section 3 Operating Instructions

## 3-1 Introduction

This section contains operating instructions for the SPA9329-35N Two-Channel Power Booster Amplifier module.

## 3-2 Initial Start-Up and Operating Procedures

Operating controls, indicators, and connectors located on the SPA9329-35N booster amplifier module are listed in table 3-1 and corresponding locations for each are shown in figure 3-1. To perform the initial start-up, proceed as follows:

1. Verify that all power and RF input and output cables are properly connected as described in section 2.

### 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 1-2 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. Use of any other cable will distort the output.*

2. Set the power ON–OFF switch to ON. The corresponding PWR and ALARM LED indicators should illuminate.

**Table 3-1 SPA9329-35N Controls, Indicators, and Connectors**

Function	Description
RF IN (2)	RF channel input connectors
RF OUT (1)	RF output connector
PWR IN	-48 VDC power input connector
ON–OFF	ON–OFF switches. Apply DC power to amplifier channel
PWR	LED indicators – Illuminates when corresponding amplifier channel ON–OFF switch is set to ON
ALARM	LED indicators – Illuminates when corresponding amplifier channel disables because of an alarm.
ALARMS Connector	Alarms cable interface connector (see section 2 for definitions).

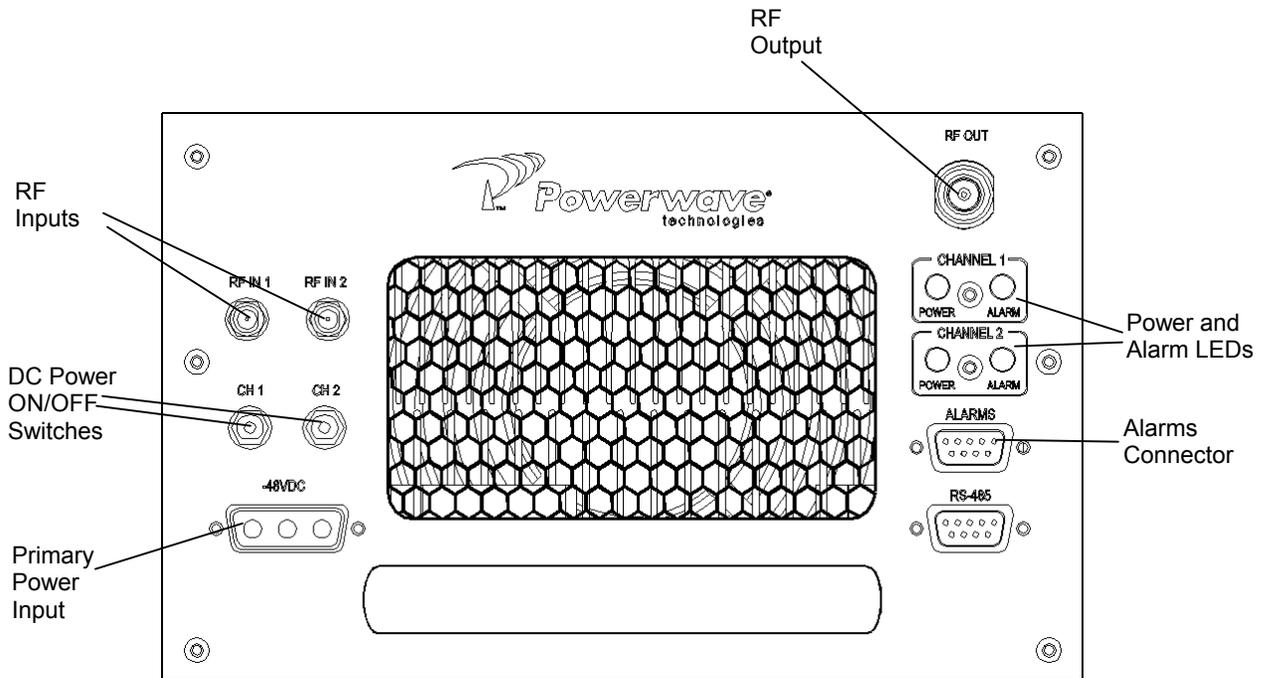


Figure 3-1 SPA9329-35N Controls, Indicators, and Connector Locations

### 3-3 Power Setting Procedure

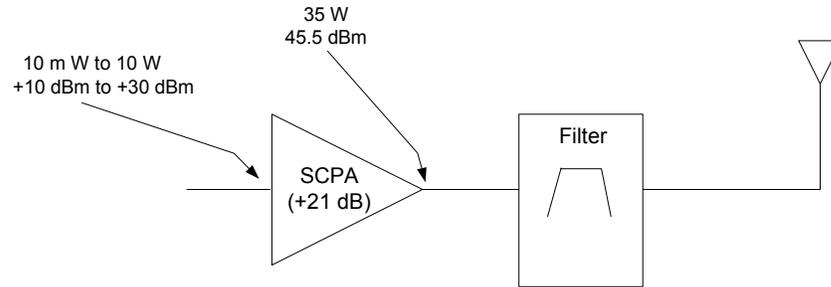
**Note**

*The power amplifier must be warmed up for a minimum of 20 minutes prior to setting power levels. Failure to properly warm the amplifiers may result in lower output power, once the amplifiers reach operating temperature.*

**WARNING**

*Turn the amplifier off when disconnecting and moving amplifier RF cables. Never remove or install coaxial cables on either the input or output port when the power amplifier is turned on. Operating the power amplifier while disconnecting and connecting RF cables may damage the equipment and/or cause personal injury.*

A simplified power-setting example is shown in figure 3-2.



*Figure 3-2 Gain Example Block Diagram*

1. Turn on external exciter/transceiver and apply RF input signal. Adjust the input power to achieve the desired output power (refer to table 1-2).

# Section 4 Principles of Operation

## 4-1 Introduction

This section contains functional descriptions for the SPA9329-35N Two-Channel Power Booster Amplifier module.

## 4-2 RF Input Signal

The maximum input power should not exceed the limits specified in table 1-2.

## 4-3 RF Output Load

The load impedance should be as good as possible ( $VSWR \leq 1.5:1$ ) in the operating band for good power transfer to the load.

## 4-4 Amplifier Functional Description

The SPA9329-35N power booster amplifier, shown in figure 4-1, operates in the 1930 MHz to 1990 MHz range. The operating band is determined by the operating frequency selection(s) of the base station (refer to tables 1-2 and 1-3). The amplifier module consists of two single-carrier amplifier pallets with necessary combining and filtering to produce up to 35 watts (45.5 dBm) of output power with a typical gain of 21 dB. The amplifier employs class AB bias for maximum efficiency. The amplifier operates from a -48 Vdc power source.

The amplifier is compliant to requirements of FCC rules with respect to spurious emissions (see tables 1-2 and 1-3). Most of the amplifier gain vs temperature variations are due to LDMOS transistor characteristics.

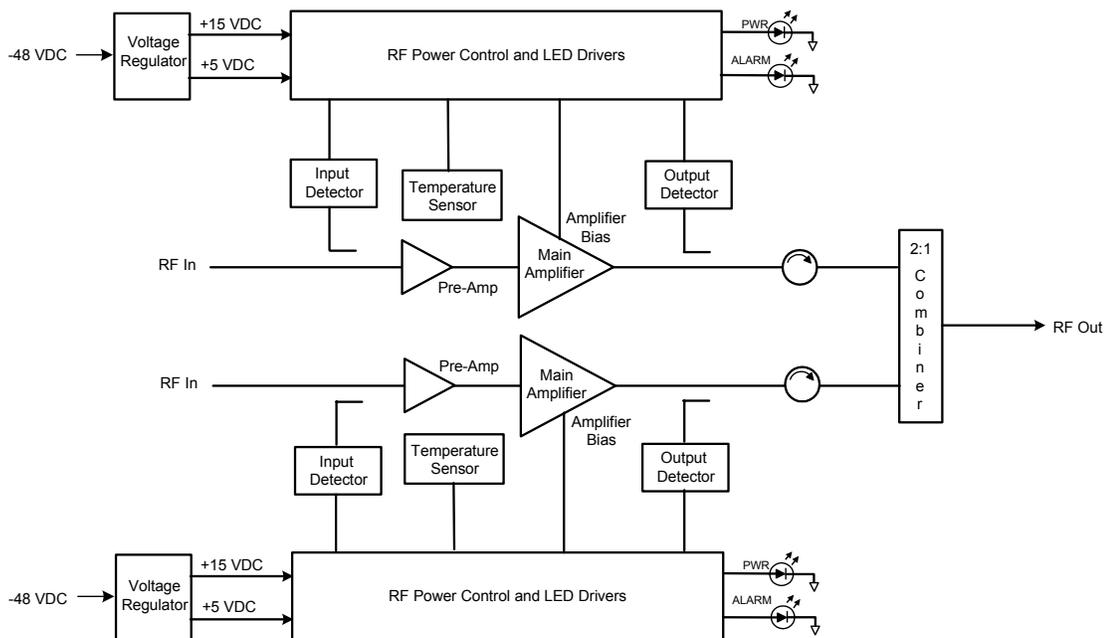


Figure 4-1 SPA9329-35N Booster Amplifier Block Diagram

### ***4-5 Amplifier Module Cooling***

Each amplifier module is cooled using an enclosed rear-mounted fan circulating airflow across the amplifier heat sinks. Air is pulled from the front of the module and exits at the rear. This provides sufficient cooling to maintain the amplifier within its safe operating temperature range.

### ***4-6 Power Distribution***

Primary DC power for the amplifier is provided by the host system. The amplifier generates all the required voltages internally from the main source.

# Section 5 Maintenance

## 5-1 Introduction

This section contains periodic maintenance and field replacement procedures for the SPA9329-35N Two-Channel Power Booster Amplifier module.

### **NOTE**

*Check your sales order and equipment warranty before attempting to service or repair the unit. Do not break 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.*

## 5-2 Periodic Maintenance

Periodic maintenance tasks, performance intervals, and the appropriate actions to be taken are listed in table 5-1.

**Table 5-1 Periodic Maintenance**

Task	Interval	Action
Inspection:		
Cables & Connectors	12 Months	Inspect signal and power cables for frayed insulation. Check RF connectors to be sure that they are tight.
Performance Tests		No periodic maintenance is necessary beyond that recommended by the base station manufacturer.

## 5-3 Module Field Replacement

The SPA9329-35N power booster amplifier modules can be replaced in the field on site by a qualified technician with experience maintaining RF power amplifiers and similar equipment.

To replace a power amplifier module, proceed as follows:

1. Set the amplifier module DC power ON-OFF switches to OFF.
2. Disconnect the DC power cable from the amplifier module.
3. Disconnect the RF IN cables.
4. Disconnect the RF OUT cable.
5. Carefully remove the amplifier module.
6. Install replacement amplifier module in reverse order.

# Section 6 Troubleshooting

## 6-1 Introduction

This section contains a list of problems and suggested actions that may correct problems encountered with the SPA9329-35N Two-Channel Power Booster Amplifier module. 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**

<b>Problem</b>	<b>Suggested Corrective Action</b>
Amplifier Module Inoperative	Check for proper power supply voltage and that power input connector is properly seated in mating connector.
Amplifier Module Not Enabled	Check that the channel ON-OFF power switch is set to the ON position.

## 6-3 Return For Service Procedures

When returning products to Powerwave, following the guidelines in the paragraphs that follow will ensure optimum response.

### 6-3.1 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 (888) 797-9283 or (714) 466-1000 to obtain this number, 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 that the package designed for the amplifier (original packaging material) be used for reshipment. If it is not available, contact Powerwave's Customer Service Department for the proper packing materials and information.