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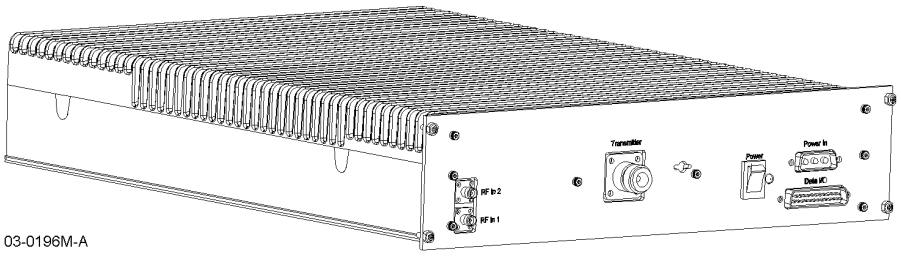
THE POWER IN WIRELESS™

Installation & Service Manual



03-0196M-A

Model NTUM30DA
Multi-Channel PCS Amplifier

044-05141 Rev. A

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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 NTUM30DA multichannel power amplifier (MCPA). 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 NTUM30DA is a linear, multichannel power amplifier that operates with an instantaneous bandwidth of 20 MHz (determined by the base station) in the 60 MHz frequency band from 1930 MHz to 1990 MHz. It provides either 30 watts (UMTS) or 45 watts of power, based on the selectable operating mode. It provides for two RF inputs: a primary input and a redundant input.

Each amplifier module has a power, and data I/O connector that allows the host system to monitor the amplifier module performance. Primary power for the amplifier is -48 Vdc.

1-3 Functional & Physical Specifications

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

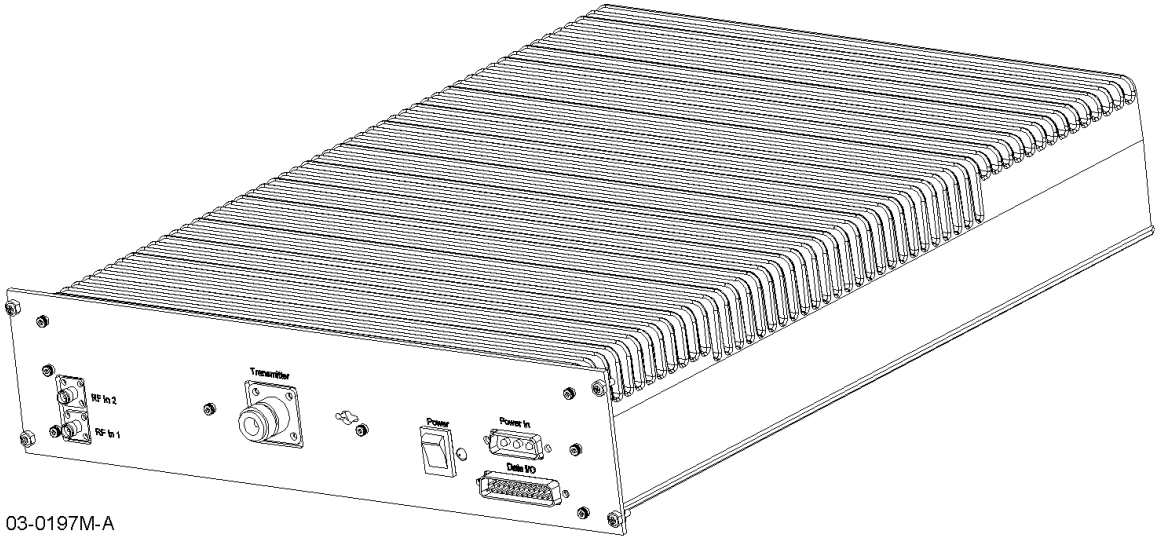


Figure 1-1. NTUM30DA Amplifier

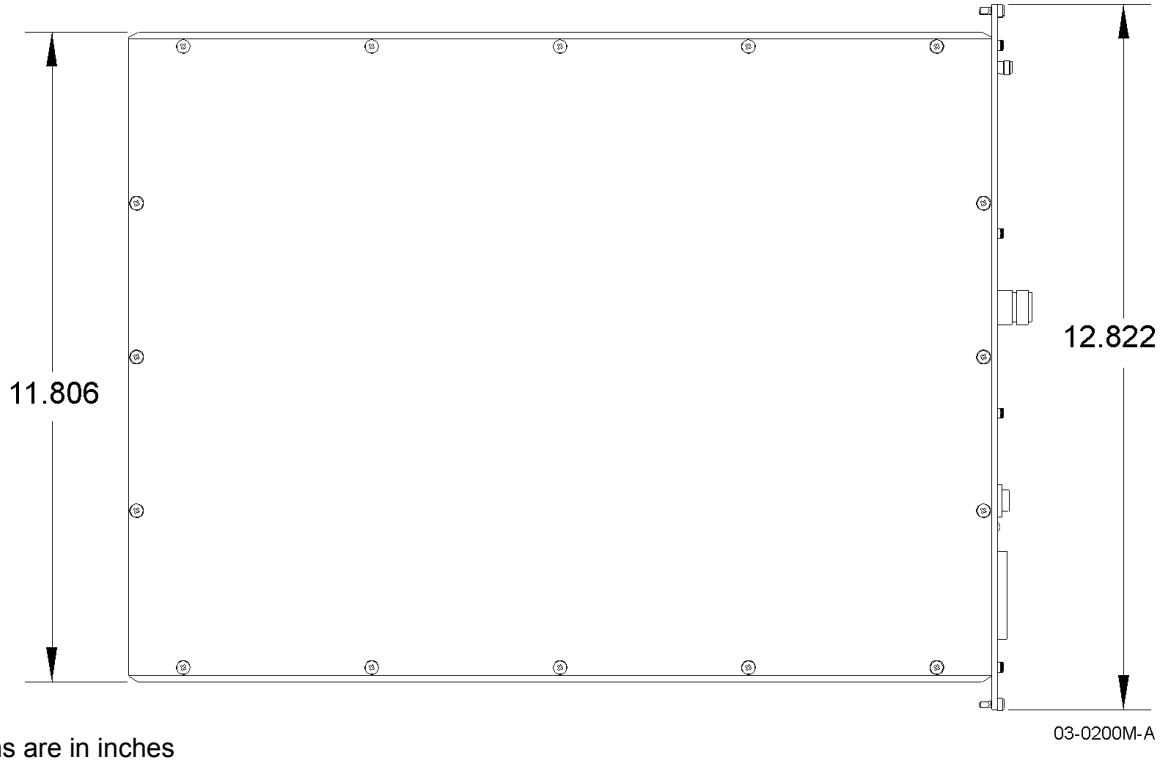
Table 1-1 NTUM30DA Multichannel Power Amplifier Functional Specifications

Frequency Range	1930-1990 MHz (60 MHz Bandwidth)		
*Instantaneous Bandwidth	20 MHz		
Input Power	1.4 dBm without damage (operating); 15 dBm without damage (non-operating)		
Continuous Average Output Power	45 Watts (46.53 dBm) Mode 1 30 Watts (44.77 dBm) Mode 2		
Spurious Emissions @ Maximum Rated Output Power	Frequency Offset Fcl: lower frequency center of the emission block. Fcu: upper frequency center of the emission block. ΔF = the frequency gap between the lower or the upper carrier of the emission block and the center of the measurement filter (BW)	Max Level dBm	Measurement filter BW
	Fcl- 2.780 MHz< ΔF ≤ Fcl- 2.515 MHz Fcu+ 2.515 MHz≤ ΔF < Fcu+ 2.780 MHz	- 16	30 kHz
	Fcl- 3.515 MHz< ΔF ≤ Fcl- 2.780 MHz Fcu+ 2.780 MHz≤ ΔF < Fcu+ 3.515 MHz	[-16-15*(Fo-2.780)]	30 kHz
	Fcl- 4.0 MHz< ΔF ≤ Fcl- 3.515 MHz Fcu+ 3.515 MHz≤ ΔF < Fcu+ 4.0 MHz	-27	30 kHz
	Fcl- 12.5 MHz< ΔF ≤ Fcl- 4.0 MHz Fcu+4.0 MHz≤ ΔF < Fcu+12.5 MHz	-14	1 MHz
RF Gain	46.5 ± 1 dB		
Output Dynamic Range Mode 1 Mode 2	 21.5 dB 19.77 dB		
Output Protection:	Mismatch Protected		
Input Port Return Loss:	< 1.43:1 Max.		
Out of Band Spurious:	Frequency band	Max Level (dBm)	Measurement filter BW
	9 kHz ↔ 150 kHz	-39 dBm	1 kHz
	150 kHz ↔ 30 MHz	-39 dBm	10 kHz
	30 MHz ↔ 1 GHz	-39 dBm	100 kHz
	1 GHz ↔ Fc1 - 60 MHz	-33 dBm	1 MHz
	Fcl - 60 MHz ↔ Fcl - 50 MHz	-28 dBm	1 MHz
	Fcl - 50 MHz ↔ Fcl – 12.5 MHz	-16 dBm	1 MHz
	Fcu + 12.5 MHz ↔ Fcu + 50 MHz	-16 dBm	1 MHz
	Fcu + 50 MHz ↔ Fcu + 60 MHz	-28 dBm	1 MHz
	Fcu + 60 MHz ↔ 12.75 GHz	-33 dBm	1 MHz
DC Input Power: Normal voltage range: Extended voltage range: Abnormal voltage range: Power Consumption: Mode 1 Mode 2	Reverse polarity protected -38 V to –58 V -36 V to –38 V and -58 V to –60 V 0 V to –36 V and -60 V to –72 V 375 W max. 300 W max.		

Table 1-1 (Cont.) NTUM30DA Multichannel Power Amplifier Functional Specifications

Operating Temperature:	-15 ºC to +95 ºC (internal temperature sensor)
Storage Temperature:	-40 ºC to +85 ºC
Operating Humidity:	5 % - 95 % Relative Humidity (Non-condensing)
Storage Humidity:	5 % - 95 % Relative Humidity (Non-condensing)
Interface Connectors: RF Input RF Output -48 Vdc Power and Ground Alarms and Sensing	 SMA Female N Female 3W3 D-Sub 25-Pin D-Sub
Weight	22 lbs
Dimensions (inches):	12.82 (W) x 15.70 (D) x 2.94 (H)

*The base station reports the lowest carrier frequency and the activated RF carriers. The amplifier then sets the pilot frequency accordingly.



All dimensions are in inches
And are for reference only

Figure 1-2. NTUM30DA Amplifier Bottom View

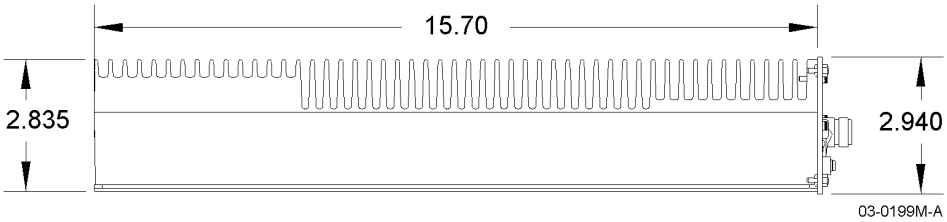


Figure 1-3. NTUM30DA Amplifier Side View

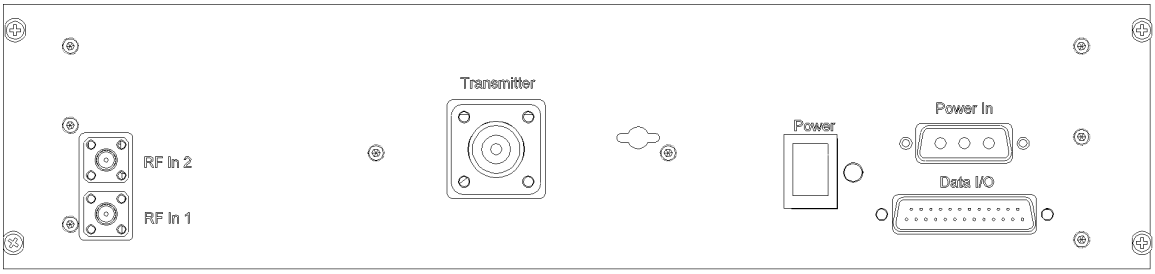


Figure 1-4. NTUM30DA Amplifier Front Panel

Section 2 Installation

2-1 Introduction

This section contains unpacking, inspection, and installation instructions and recommendations for the Model NTUM30DA Multi Channel Power 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 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 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.

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. 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 *(Refer to figure 1-1)*

The NTUM30DA amplifier module is designed for installation on a heatsink that permits access to the module for connection of the RF cables and the power, alarm, and control connectors.

To install the amplifier proceed as follows:

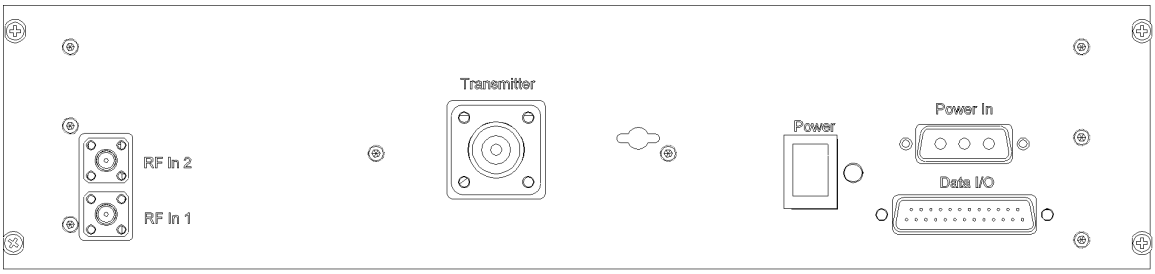


Figure 2-1 NTUM30DA Amplifier, Front Panel View

1. Install the amplifier and secure in place with appropriate mounting screws. See figure 2-1.
2. Connect the antenna cable to **TRANSMITTER** female N-type connector.
3. Connect the transceiver output cables to the **RF IN** female SMA connectors.

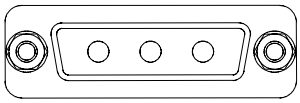
WARNING

Turn the front panel Power switch off before connecting the power cable.

4. Connect the power, and data cables to matching **Power In** and **Data I/O** connectors. Refer to paragraphs 2-5 and 2-6 following for appropriate port and pin connections.
5. Check your work before applying DC voltage to the system. Make certain all connections are tight and correct.
6. Measure primary DC input voltage. DC input voltage should be -48 ±0.5 Vdc. If the DC input voltage is above or below the limits, call and consult Powerwave before you turn on your amplifier system.
7. Refer to section 3 for initial turn-on and checkout procedures.

2-5 Power In Connector

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



3 2 1

Figure 2-2 Power In Connector

Table 2-1 Power In Connector Definition

Pin	Signal	Description
1	-48 V	-48 Vdc for MCPA
2	Chassis Gnd	Chassis Ground
3	.-48V_RTN	-48 Vdc return, grounded to MCPA chassis ground

2-6 Data I/O Connector

The alarms and sensing connections on the amplifier are made through a 14-pin micro-fit connector (figure 2-3) and are listed and described in table 2-2.

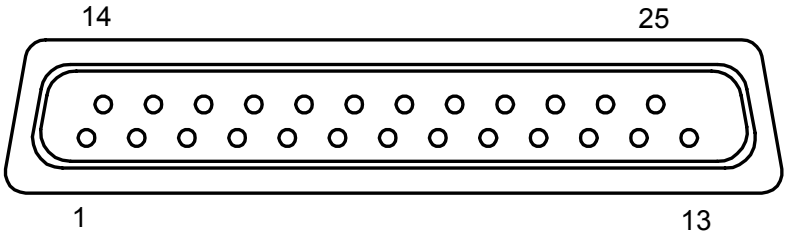


Figure 2-3 Data I/O Connector

Table 2-2 Data I/O Connector Definition

Pin	Signal	Description
1	Manuel control	Control ON/OFF
2	GND	Ground
3	PA-Enable-Actif +	Control
4	PA-Enable-Actif -	Control
5	PA_presence_reset	Towards µcontroller
6	GND_presence_reset	Ground
7	Reserved	Reserved
8	GND	Ground
9	Reserved	Reserved
10	Reserved	Reserved
11	GND	Ground
12	Reserved	Reserved
13	Reserved	Reserved
14	UART TX+ (TRM to MCPA)	Base Station Control and Alarm Signaling
15	UART TX- (TRM to MCPA)	Base Station Control and Alarm Signaling
16	Reserved	Reserved
17	UART RX+ (MCPA to TRM)	Base Station Control and Alarm Signaling
18	UART RX- (MCPA to TRM)	Base Station Control and Alarm Signaling
19	GND	Ground
20	Reserved	Reserved
21	Reserved	Reserved
22	Reserved	Reserved
23	Reserved	Reserved
24	Reserved	Reserved
25	Reserved	Reserved

Section 3 Operating Instructions

3-1 Introduction

This section contains operating instructions for the Multicarrier Cellular Amplifier.

3-2 Initial Start-Up & Operating Procedures

There are no operating controls or indicators on the NTUM30DA amplifier module. To perform the initial start-up, proceed as follows:

1. Verify that all input and output cables are properly connected, per 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 1-1 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.
3. Turn the amplifier front panel switch to On. The amplifier will run through built-in-test for a few seconds, and notify the BTS when the loops converge. The base station allows up to 30 seconds for this step to complete.
4. Turn on external exciter/transceiver and apply RF input signals.

Section 4 Principles of Operation

4-1 Introduction

This section contains a functional description of the multichannel power amplifier (MCPA).

4-2 RF Input Signal

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

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 Amplifier Functional Description

The NTUM30DA amplifier (figures 1-1 and 4-1) is a linear, MCPA that operates in the 60 MHz frequency band from 1930 MHz to 1990 MHz with an instantaneous bandwidth of 20 MHz. The operating band is determined by the operating frequency selection(s) of the base station (refer to table 1-1). The amplifier produces 45 watts of output power when operated in mode 1 or 30 watts of output power when operated in mode 2. Each amplifier is a self-contained module and is functionally independent of any other amplifier module(s) in the system. Each amplifier module has an alarm board that monitors the amplifier performance. If a failure or fault occurs in an amplifier module, it is transmitted to the host system via an RS-485 interface.

The amplifier is compliant to the requirements of FCC rules with respect to spurious emissions (see table 1-1). Constant gain is maintained by continuously comparing active paths with passive references, and correcting for small variations through the RF feedback controls. All gain variations, for example those due to temperature, are reduced to the passive reference variations. The amplifier module is comprised of:

An input amplifier

1st Loop Phase & Gain

A driver amplifier

A main amplifier

A multifunction board

4-4.1 Input Amplifier

RF is fed to the input amplifier, which consists of an isolator at the input, bandpass filter, voltage variable attenuators (VVA), and phase shifters for gain control and phase sweeping functions. The circuits in this section of the amplifier are controlled by a microprocessor on the Multifunction board. At its output, the input amplifier splits the signal to the 1st Loop Phase and Gain circuit, and the carrier cancellation circuit.

4-4.2 1st Loop Phase & Gain

The 1st Loop Phase & Gain circuit is a predistortion amplifier. The input signal is predistorted such that it linearizes the output of the main amp at the rated output power of the MCPA. It also contains the main loop VVAs and phase shifters. All the predistortion voltages and loop voltages are controlled by a microprocessor.

4-4.3 Driver Amplifier

The driver amplifier consists of two stages of class AB amplification, which provide the approximately 40% of the gain in the 60 MHz frequency band from 1930 MHz to 1990 MHz.

4-4.4 Main Amplifier

The main amplifier employs two class AB amplification stages for maximum efficiency. It provides approximately 40% of the gain in the 60 MHz frequency band. The output from the main amplifier is typically higher than the rated output power of the MCPA, to allow for losses associated with the components in the remaining RF path. The RF signals are then applied to a delay line and directional coupler, where the distortion products are cancelled out and the amplifier power performance is monitored.

4-4.5 Multifunction Board

The multifunction board consists of feed forward loop control and alarm circuits. The MCPA communicates to the host system through the multifunction board, which gathers the status information of the amplifier and reports to the host system via the RS-485 interface when instructed. It also protects the MCPA from adverse conditions such as overpower, input overdrive, overvoltage, etc. A microprocessor on the multifunction board also controls two loops in the feedforward system.

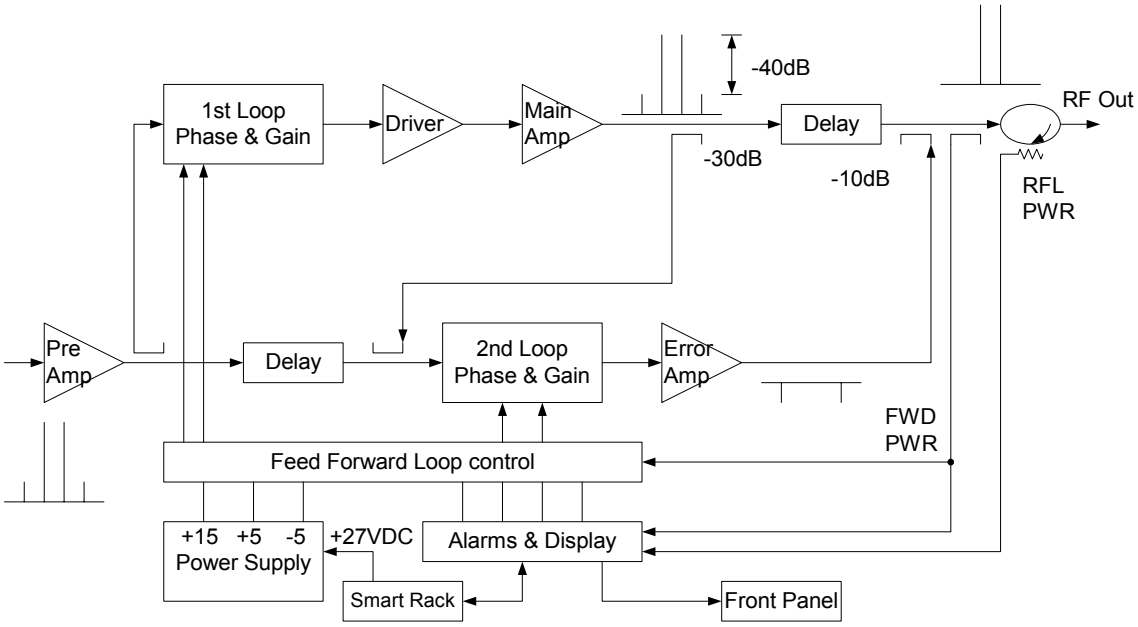


Figure 4-1 NTUM30DA Multichannel Power Amplifier Functional Block Diagram

4-5 Amplifier Module Cooling

Each amplifier module is contained within a thermally conductive chassis and properly mounted on an adequate thermal surface, which provides sufficient cooling when forced air is circulated over the heat sink fins to maintain the amplifier within the specified 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.

4-7 Amplifier Alarms

4-7.1 Minor Alarms

When a minor alarm condition occurs, the alarm is latched into a minor alarm condition. The amplifier alarm state is read by the BTS the next time the amplifier is poled by the BTS. After the alarm status is sent the minor alarm register is cleared, unless the alarm condition still exists. If the amplifier receives a “Enable Command” or “Clear Alarms Command”, all minor alarms will be cleared. If the amplifier is disabled, all minor alarms are also cleared.

Minor alarms do not directly affect amplifier functionality.

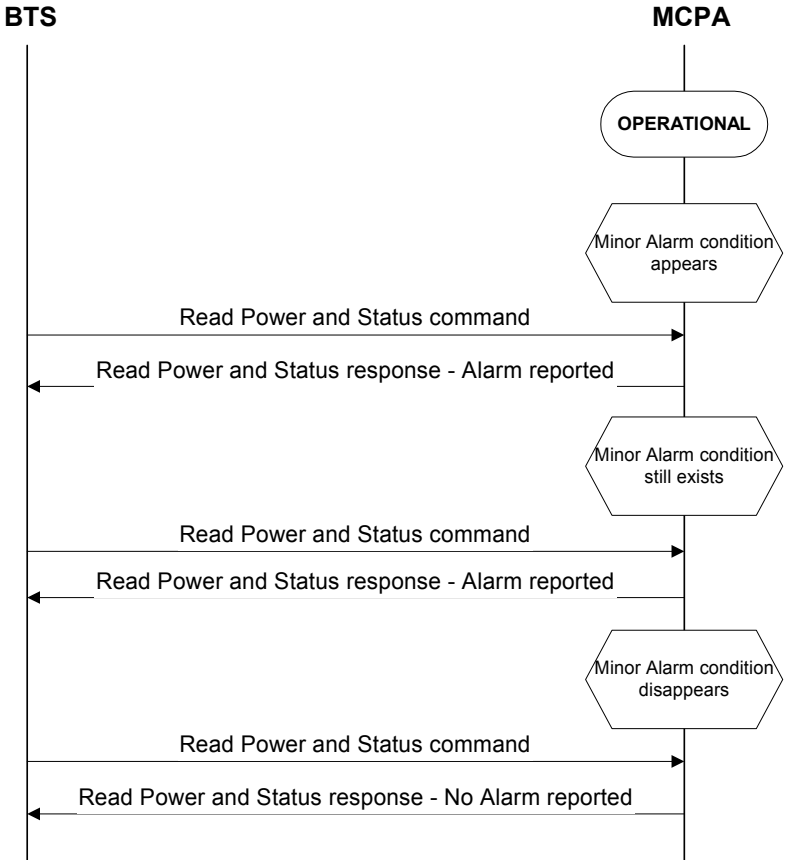


Figure 4-2 Minor Alarm Reporting Sequence

4-7.1.1 Main Loop Cancellation Alarm (1st Loop Alarm)

During normal operation, if the 1st Loop is not locked for 30 seconds a Main Loop Cancellation Alarm is declared. During power-up, the BTS waits for 30 seconds to allow the 1st Loop to lock. When the main amplifier is first turned on, the Main Loop Cancellation Alarm ON is on until the loops converge. The BTS allows 30 seconds for the alarm to clear after putting the amplifier into Operational mode before reporting the alarm.

4-7.1.2 Error Loop Cancellation Alarm (2nd Loop Alarm)

During normal operation, if the 2nd Loop is not locked for 30 seconds a Error Loop Cancellation Alarm is declared. During power-up, the BTS waits for 30 seconds to allow the 2nd Loop to lock. When the error amplifier is first turned on, the Error Loop Cancellation Alarm ON status is on until the loops converge. The BTS allows 30 seconds for the alarm to clear after putting the amplifier into Operational mode before reporting the alarm.

Detected loss of pilot signal with the error amplifier on, also leads to an Error Loop Cancellation Alarm.

4-7.1.3 Gain Alarm

The gain alarm is caused by either of the following conditions:

- No output power with a nominal input power.
  (P_{in} > -3.8 dBm and P_{out} < 25 dBm for five seconds.
- P_{in} > +2.5 dB for five seconds.

4-7.1.4 Partial Failure of Main Amplifier Alarm (Transistor/Device Fail)

A sensor detects a main or error amplifier transistor failure. A transistor failure is detected as follows:

- When the main and error amplifiers are first turned on and converged, the Main VVA and Error VVA convergence points are compared to the Default Main VVA and Default Error VVA values (with temperature compensation). If either of the VVAs is significantly lower than its default value, the Partial Failure of Main Amplifier alarm is set.
- After the above test is performed, the Main VVA and Error VVA are continually monitored. If the Main VVA or Error VVA significantly drop then the Partial Failure of Main Amplifier alarm is set.

4-7.1.5 Over Temperature Warning Alarm

The MCPA will alarm if the temperature exceeds the normal operation temperature threshold (90ºC internal temperature sensor) for five seconds. This threshold is a few degrees below the Over Temperature Shutdown Alarm.

4-7.1.6 Power Supply Warning Alarm

The MCPA monitors the non-converter voltages, 15V, 5V and -5V power supply voltages and alarms when of any of these DC voltages fail for at least five seconds. The normal operating range for these voltages is: 15V $\pm$ 1.5V, 5V $\pm$ 0.5V and –5V $\pm$ 0.5.

4-7.1.7 High DC Power Consumption Warning Alarm

If input DC power exceeds 375W in Mode 1 or 300W in Mode 2, for five seconds, the High DC Power Consumption Warning Alarm is set.

4-7.2 Major Alarms

When a major alarm condition occurs, the alarm is latched into a major alarm condition. The amplifier alarm state is read by the BTS the next time the amplifier is poled by the BTS. After the alarm status is sent the major alarm register is not cleared. If the amplifier receives a "Enable Command" or "Clear Alarms Command", all major alarms will be cleared. If the amplifier is disabled, all major alarms are also cleared.

Major alarms cause the amplifier to enter a STANDBY state, and the transceiver(s) associated with the amplifier will be off-the-air. The error amplifier and main amplifier are turned off.

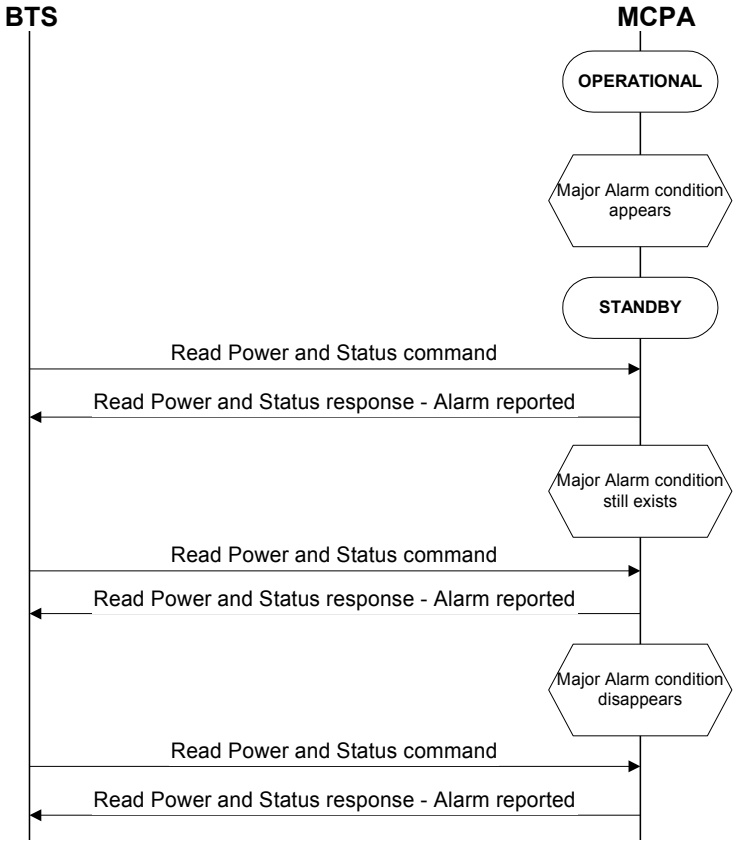


Figure 4-3 Major Alarm Reporting Sequence

4-7.2.1 Over Temperature Shutdown Alarm

The MCPA will alarm if the base plate temperature exceeds the temperature threshold at which the MCPA can be damaged (95ºC) for five seconds. This condition does not auto-recover and will require a reset command when the condition is corrected and the amplifier module has cooled sufficiently.

4-7.2.2 Power Supply Shutdown Alarm

The MCPA monitors the converter power supply output voltages, 28V (23V in Mode 2) and 9V, and sets the Power Supply Shutdown Alarm if a power supply converter fails for five seconds or longer. The alarm is set under the following conditions and does not auto-recover:

- 28V > 30.8V or 28V < 24.8V in Mode 1 or 24V > 25.75V or 24V < 20.25V in Mode 2.
- 9V > 9.9V or 9V < 8.1V

4-7.2.3 High DC Power Consumption Shutdown Alarm

If input power exceeds 417W in Mode 1 or 330W in Mode 2, for one second, the High DC Power Consumption Shutdown Alarm is set.

Table 4-1 Alarm Summary

Alarm Definition	Implementation	Persistence Time
Temperature Overload (Major)	Temp Sensor Temperature > 90ºC	5 seconds
High Temperature (Minor)	Temp Sensor Temperature > 85ºC	5 seconds
DC/DC Converter Shutdown (Major)	9V or 28V (23V in Mode 2) more than 10% out of tolerance	5 seconds
DC Voltage Regulation Failure (Minor)	5V, -5V, +15V more than 10% out of tolerance	5 seconds
DC Power Consumption Overload (Major)	Mode 1: Input DC power > 417W Mode 2: Input DC power > 330W	1 second
High DC Power Consumption (Minor)	Mode 1: Input DC power > 375W Mode 2: Input DC power > 300W	5 seconds
Gain Control (Minor)	1. Input Power > +2.5 dB OR 2. Input Power > -3.8 dB AND Output Power < 25 dBm	5 seconds (both)
Partial Failure of Main Amplifier (Minor)	Main Amp or Error Amp transistor failure detected.	---
Main Cancellation Loop (Minor)	1st Loop Error > 2.5V (No persistence when amplifier first enabled.)	30 seconds
Error Cancellation Loop (Minor)	2nd Loop Error > 2000 (No persistence when amplifier first enabled.) Loss of Pilot detected.	30 seconds (on item 1)

Section 5 Maintenance

5-1 Introduction

This section contains periodic maintenance and performance test procedures for the multichannel power amplifier. It also contains a list of test equipment required to perform the identified tasks.

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.

5-2 Periodic Maintenance

Periodic maintenance requirements are listed in table 5-1. Table 5-1 also lists the intervals at which the tasks should be performed.

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 Field Replacement Of The Module

The NTUM30DA multichannel power amplifier module can be replaced in the field on site by a qualified technician with adequate ESD protection and experience maintaining RF power amplifiers and similar equipment.

To replace a power amplifier module, proceed as follows:

1. Turn off that specific module.
2. Disconnect the three RF cables and D-sub connectors (*Power In* and *Data I/O*).
3. Loosen 4 front panel captive screws that secure amplifier module to the base station.
4. Carefully remove amplifier module from the base station.
5. Install replacement in reverse order of steps 1 through 4 above.

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
MCPA Inoperative	Check for proper power supply voltage.
MCPA Not Enabled	Verify HPA-Allow-Enable line is high.
Alarm Output is (RS 422) High	Verify input RF is within specified power and frequency limits

6-3 Return For Service Procedures

When returning products to Powerwave, the following procedures 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 be used. The original packaging material is reusable. If it is not available, contact Powerwave's Customer Service Department for packing materials and information.

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

Failure Details: _____

_____

_____

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

_____

_____