



**PROGRAMMABLE BI-DIRECTIONAL  
BOOSTER AMPLIFIER  
PBBA  
OPERATION  
INSTRUCTION MANUAL  
MODEL 50289-RBA-800MHz**

**MD Office:**

19516 Amaranth Drive  
Germantown, MD 20874  
Phone 301-540-0700  
Fax 301-540-5743

**NJ Office:**

560 Sylvan Avenue, 3<sup>rd</sup> Floor  
Englewood Cliffs, NJ 07632  
Phone 201-227-0066  
Fax 201-227-0067

Email [mail@aerocomm.cc](mailto:mail@aerocomm.cc)  
<http://www.aerocomm.cc>

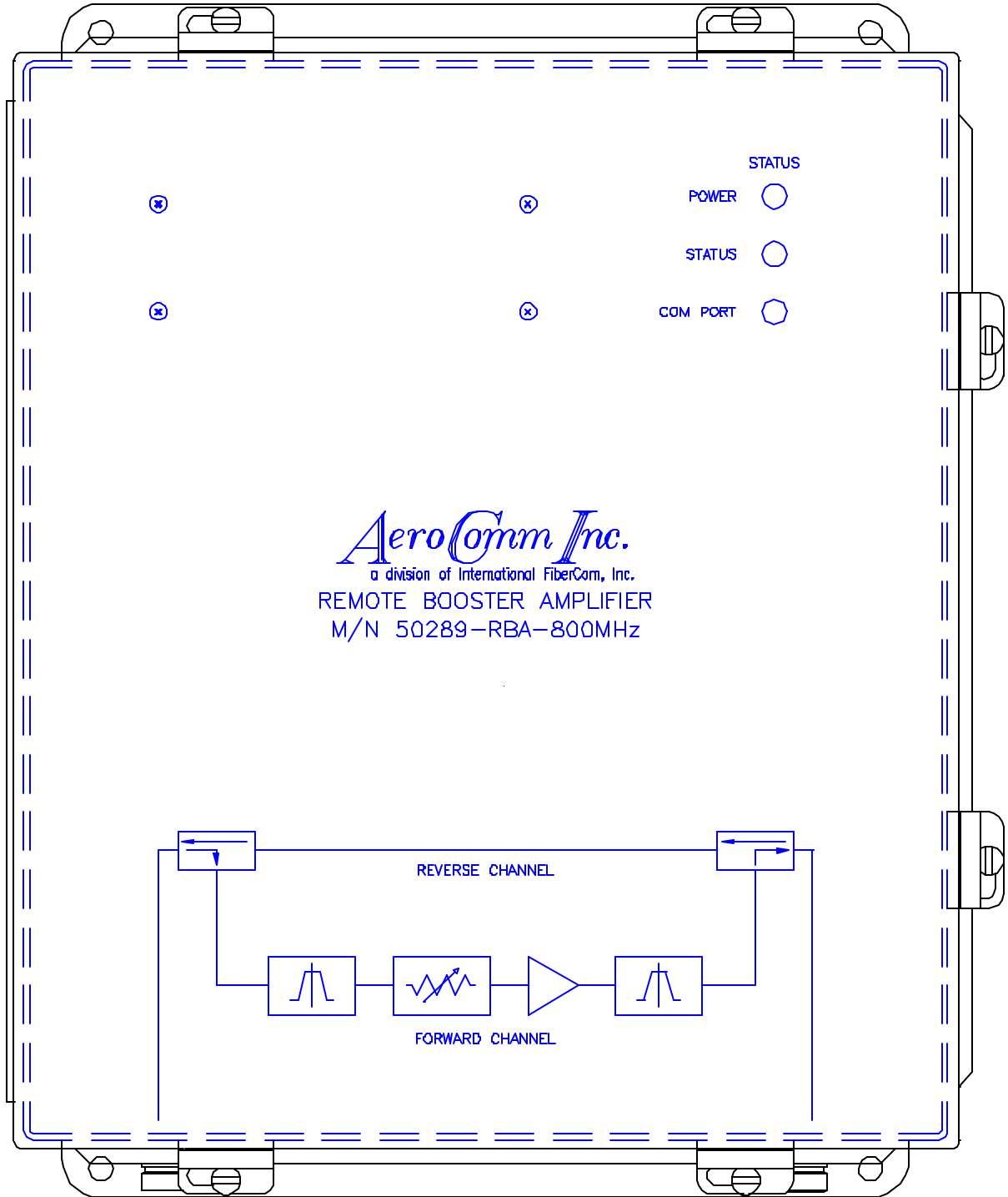
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PBBA  
MODEL 50289-RBA-800MHz  
P/N 50483-02-25





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# I. INTRODUCTION

## PURPOSE OF MANUAL:

The purpose of this manual is to outline the installation, describe the operation, and assist in the maintenance and trouble-shooting for the Programmable Bi-directional Booster Amplifier (PBBA), Model 50289-RBA-800MHz.

## MANUAL OUTLINE:

**Section II:** Section II covers the general specifications of the PBBA. This section outlines the general, mechanical and electrical specifications including the module specifications (sub-assemblies).

**Section III:** Section III covers the instructions for installing the PBBA, site requirements, and equipment initialization.

**Section IV:** Section IV cover operating procedures.

**Section V:** Section V is the recommended schedule of periodic maintenance of the PBBA.

**Section VI:** Section VI covers the general “Theory of Operations” of the logic and modules of a PBBA. This section is designed to aid in the understating of the PBBA.

**Section VII:** Section VIII consists of diagrams, tables and procedures to assist in the troubleshooting of an PBBA. This section is designed to guide a technician in locating system fault(s) to the module. Included in the section is a list of recommended test equipment.

**Section VIII:** Section IX consists of the schematic, assembly drawings, and parts list of the PBBA and it’s sub assemblies/

**Section IX:** Section X consists of pertinent documents and equipment manuals to supplement sections III, VI, VIII and IX.

**Section X:** Section XI lists the recommend spares for the PBBA.



**GENERAL SYSTEM OVERVIEW:**  
***(refer to drawing 50483-01-19)***

In an off-the-air to radiating cable system, signals received from the air are rebroadcast onto the cable. Signals received on the cable are rebroadcast over the air, e.g., talk-in, talk-out.

In an off-the-air to radiating cable multiple Channel Booster application, the PBBA is utilized to enhance the performance of the talk-out in long cable systems.

In general, the forward channel, talk-out signals are generated from lower power sources, e.g., handheld transceivers.



## **PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMPLIFIER OVERVIEW: (refer to figure 1)**

The Programmable Bi-directional Booster Amplifier (PBBA) is a software-driven user-configurable unit for use in a multi-carrier low signal-level environment. It is capable of eight (8) carriers and a composite power of  $-20\text{dBm}$ .

The forward channel covers 100 to 2000MHz and within this band a bandpass filter defined window called the In-Band has a user settable gain. The factory default setting is 20dB. The Out-of-Band gain 0dB. The reverse channel covers 100 to 2000MHz and utilizes passive components/elements to pass these frequencies. This channel has fixed insertion loss due to the passive components/elements.

The forward In-Band channel uses a broadband attenuator/amplifier module in which the attenuation is digitally set via computer interface.

The forward In-Band channel has a high gain amplifier chain and a band pass filter to boost a specific window of frequencies within the 100 to 2000MHz frequency of operation.

Its small package and light-weight allows the user to conveniently install the unit. Indicator lights allow the user to determine the status of the unit from a distance. A user-friendly software enhances the unit's performance and user interface.

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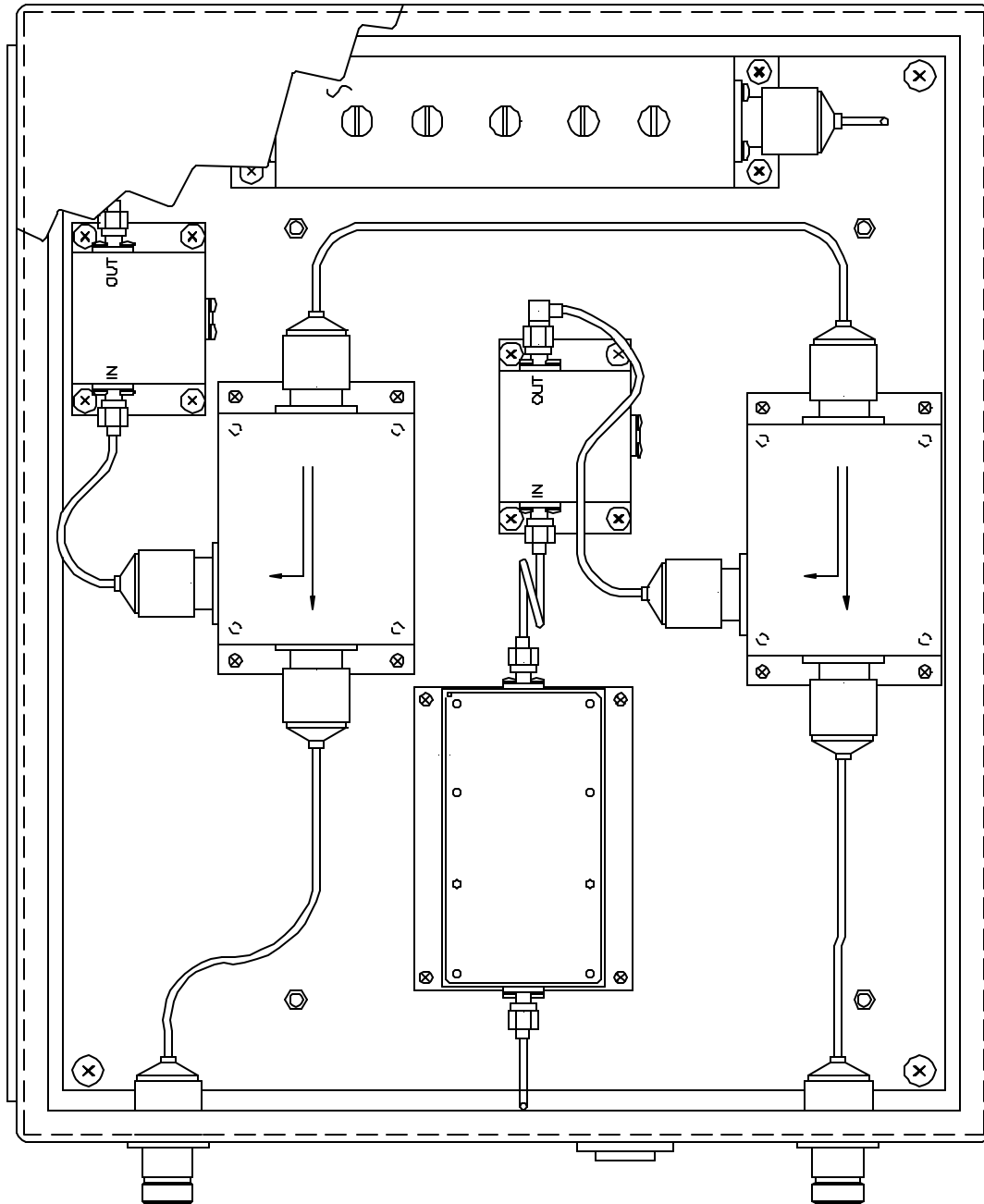


FIGURE 1



# II. SPECIFICATIONS

## GENERAL SPECIFICATIONS:

	Forward In Band	Forward Out of Band	Reverse
Frequency Range:	821 – 824MHz	100 – 819MHz / 826 – 2000MHz	100 – 2000MHz
Gain:	20dB +2dB / -2dB	0dB nominal	0dB nominal
Flatness Gain:	±1dB	+0 / -2dB	+0 / -2dB
RF Power Output Capability (1 carrier) 1dB Compression Point:	+17dBm	N/A	N/A
Maximum Input Power:	-20dBm Composite	+30dBm (1Watt) Composite	+40dBm (10Watts) Composite
Maximum Input Power, No Damage (8 tones):	-12dBm/carrier	-12dBm/carrier	N/A
IM Distortion:	-50dBc	N/A	N/A
Second Harmonic Output:	-40dBc	N/A	N/A
Spurious Outputs:	-80dBc	N/A	N/A
Noise Figure:	20dB	N/A	N/A
I/O VSWR:	≤1.3:1	≤1.3:1	≤1.3:1
I/O Connector:	Type N Female (Passivated Stainless Steel)	Type N Female (Passivated Stainless Steel)	Type N Female (Passivated Stainless Steel)
Operating Temperature Range:	-30°C to +60°C	-30°C to +60°C	-30°C to +60°C
Supply Voltage:	120VAC / 60Hz	120VAC / 60Hz	120VAC / 60Hz
Housing:	NEMA 4X	NEMA 4X	NEMA 4X

FCC type acceptance





**SUB-ASSEMBLY SPECIFICATIONS:**

**ATTENUATOR AMP MODULE  
P/N 50483-02-26-01  
MODEL #**

SPECIFICATIONS	
Frequency Range:	100 – 2000 MHz
Attenuation:	0dB min, -15dB max
Gain @ 0dB attenuation:	18dB min, 20 dB max
Flatness:	$\pm 1$ dB
Power:	12VDC @ 19mADC
I/O Connection:	SMA female
Zin/Zout:	50 ohm

**MMIC #1  
P/N 50483-02-27  
MODEL #**

SPECIFICATIONS	
Frequency Range:	819 – 826 MHz
Gain:	10dB typical
Gain Flatness:	$< \pm 1$ dB
Power:	12VDC @ 85mA
I/O Connection:	SMA female
Zin/Zout:	50 ohm

**MMIC #2  
P/N 50483-02-30  
MODEL #**

SPECIFICATIONS	
Frequency Range:	819 – 826 MHz
Attenuation:	20dB typical
Gain Flatness:	$\pm 1$ dB
Power:	12VDC @ 120mA
I/O Connection:	SMA female
Zin/Zout:	50 ohm



### III. INSTALLATION

The Programmable Bi-Directional Booster Amplifier is housed in a steel NEMA 4 enclosure. The enclosure has four mounting tabs on its rear surface (*refer to drawing 50483-05-17*). In selecting a mounting surface, the size and weight of the unit must be considered.

The RF cables to the radiators (distribution system) are connected to female N-connectors on the bottom of the enclosure. Special care should be taken in the dress and separation of these cables to prevent signal coupling between the input and output of the PBBA.

The PBBA requires a 110VAC power source. It is recommended, to maintain the integrity of the NEMA enclosure, that the AC power should enter using conduit or a connector. A cutout for a  $\frac{3}{4}$  conduit connector is provided at the bottom of the enclosure.

Connect the unit as follows:

#### RF CABLE CONNECTIONS (*refer to drawing 50483-01-18*):

- 1) Talk Out: to radiating cable run to 8-Channel Booster Amplifier.
- 2) Power: to AC conduit.
- 3) Com Port: for calibration only no connection required at installation.
- 4) Talk In: to radiating cable run to end of tunnel.

#### AC POWER INTERCONNECT (*refer to drawing 50483-01-15*):

The AC power signals are connected to an internal terminal block. The terminal block is located on the top plate assembly at the right of the lower edge.

Connect the AC sources as follows:

- 1) The ground wire from the AC conduit connects to terminal 1.
- 2) The AC high wire from the AC conduit connects to terminal 2.
- 3) The neutral wire from the AC conduit connects to terminal 3.



## **IV. OPERATION OF EQUIPMENT**

The PBBA requires no operator settings or operation. It is designed for unattended operation.

The following is all that is necessary for operation:

- INSTALL
- CONNECT
- TURN-ON
- WATCH LED



## V. MAINTENANCE SCHEDULE

The Programmable Bi-directional Booster Amplifier is designed for unattended operation requiring minimal maintenance. General maintenance consists of equipment inspection and operational tests. Periodical equipment tune-up and alignment is recommended.

### Cable Inspection:

The external and internal cables and connectors should be checked for indication of corrosion.

### Enclosure Inspection:

The interior of the enclosures should be inspected for evidence of condensation.

### LED Inspection:

Power LED: ON  
Status LED: Flashing at a rate of 1Hz  
Com LED: OFF

The performance of operations testing is recommended to be done bi-yearly. Operational testing will indicate equipment status determining if an alignment is necessary.



## **VI. THEORY OF OPERATION**

The PBBA is a broadband bi-directional amplifier. It has two channels, one is the Forward In-Band and the other is Forward Out-of-Band/Reverse. The Forward In-Band channel has a high gain amplifier chain and a band pass filter. This channel boosts the signals that come through the filter. These are the inbound signals. Above and below the filter passband are the outbound signals which are within the 100 to 2000 MHz range and are handled by the other channel. The Forward In-Band channel uses a broadband attenuator/amplifier module which has a 15dB dynamic range and a gain of around 20dB at 0dB attenuation setting. The attenuation, therefore the overall module gain/loss, is digitally set via computer interface.

The Forward Out-of-Band/Reverse channel covers the frequency range of 100 to 2000 MHz. Due to the configuration of this channel it has a fixed insertion loss. With the two channels integrated, the unit provides bi-directional amplification of inbound signals.



# VII.

# TROUBLESHOOTING

PROBLEM	SOLUTION	ON-SITE-REMEDY
1) Power Indicator is off	a) Check if the unit is plugged into a 120VAC source. b) Check if the internal circuit breaker on/off switch is depressed	Plug in the unit to 120VAC or depress internal circuit breaker.
2) Power indication on but status light is not blinking	Check connection to the microprocessor board	Microprocessor board fault. Pull out for repair
3) a) Com port does not light up when unit is programmed	Check serial cable connections	
4) Unit does not respond when programmed	Check serial cable connections	
5) Unit does not provide designed gain or unit does not have gain at all or intermittent operation	a) Check RF connection between modules b) Check Talk In/Talk Out RF connections	



# III. SCHEMATICS, ASSEMBLY DRAWINGS, PARTS LISTS

## Programmable Bi-directional Booster Amplifier

### **50483-02-35 ASSEMBLY PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMPLIFIER**

- PL50703-02-35 PARTS LIST PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMPLIFIER
- 50483-05-55 POWER SUPPLY MOUNTING PLATE
- 50483-05-56 POWER SUPPLY SHIELD
- 50483-05-88 LOWER COMPONENT PLATE
- 50483-05-89 UPPER COMPONENT PLATE
- 50483-05-90 ROD FILTER MOUNTING PLATE
- 50483-05-92 DIRECTIONAL COUPLER MOUNTING PLATE
- 50483-05-93 ENCLOSURE

#### **50483-03-45 PCB ASSY MICROPROCESSOR**

- PL50483-03-45 PARTS LIST MICROPROCESSOR

#### **50483-04-45 SCHEMATIC MICROPROCESSOR**

#### **50483-07-45 FABRICATION MICROPROCESSOR**

### **50483-02-26 ASSEMBLY ATTENUATOR AMP MODULE**

- PL50483-02-26 PARTS LIST ATTENUATOR AMP MODULE
- 50483-05-46 HOUSING
- 50483-05-47 COVER

#### **50483-03-72 PCB ASSY PBBA ATTENUATOR / LNA**

- PL50483-03-72 PARTS LIST PBBA ATTENUATOR / LNA

#### **50483-04-72 SCHEMATIC PBBA ATTENUATOR / LNA**

#### **50483-07-72 FABRICATION PBBA ATTENUATOR / LNA**

- 50483-07-47 FABRICATION ISOLATOR INTERFACE

### **50483-02-27 ASSEMBLY MMIC AMP MODULE #1**

- PL50483-02-27 PARTS LIST MMIC AMP MODULE #1
- 50294-05-01 LNA HOUSING
- 50294-05-02 COVER MOUNTING PLATE
- 50483-03-46 PCB ASSY MMIC AMPLIFIER
- PL50483-03-46 PARTS LIST MMIC AMPLIFIER
- 50483-04-46 SCHEMATIC MMIC AMPLIFIER
- 50483-07-46 FABRICATION MMIC AMPLIFIER

### **50483-02-30 ASSEMBLY MMIC AMP MODULE #2**

- PL50483-02-30 PARTS LIST MMIC AMP MODULE #2
- 50294-05-01 LNA HOUSING
- 50294-05-02 COVER MOUNTING PLATE
- 50483-03-54 PCB ASSY MMIC AMP #2
- PL50483-03-54 PARTS LIST MMIC AMP #2**
- 50483-04-54 SCHEMATIC MMIC AMP #2
- 50483-07-54 FABRICATION MMIC AMP #2



## **PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMP**





## **ATTENUATOR/AMPLIFIER MODULE**



## **MMIC AMPLIFIER #1**



## **MMIC AMPLIFIER #2**



## **IX. PERTINENT DOCUMENTATION**

Other documents needed for the operation of the Programmable Bi-directional Booster Amplifier Include the following:

- 1) Programmable Bi-directional Booster Amplifier software manual



## **X. RECOMMENDED SPARES**

The following spares are recommended:

Due to the installation location of the Programmable Bi-directional Booster Amplifier we recommend a complete upper and lower component plate .

For modification services we recommend the following spares for an easy replacement:

- 1 Attenuator Amplifier Module
- 1 MMIC Amplifier #1
- 1 MMIC Amplifier #2
- 1 RBA Band Pass Filter Module