



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

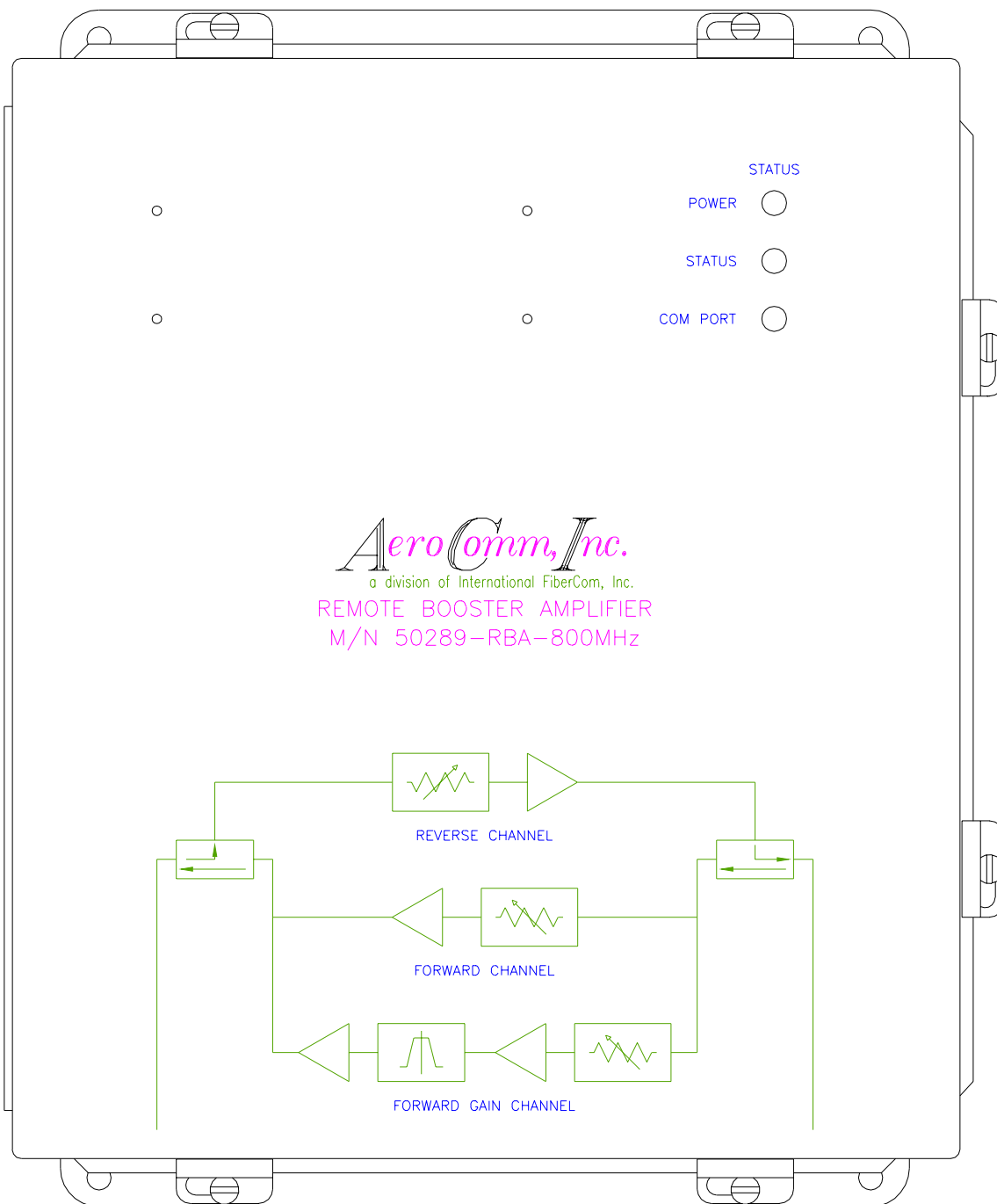
**PROGRAMMABLE BI-DIRECTIONAL  
BOOSTER AMPLIFIER  
PBBA  
OPERATION  
INSTRUCTION MANUAL  
MODEL 50289-RBA-800MHz**

**ALL INFORMATION CONTAINED IN THIS DOCUMENT IS PROPRIETARY TO AEROCOMM, AND SHALL NOT BE RELEASED, DISCLOSED OR DUPLICATED FOR ANY PURPOSE OTHER THAN EVALUATION, INSPECTION, OR MAINTENANCE OF EQUIPMENT DELINEATED HEREIN.**

**AEROCOMM IS NOT RESPONSIBLE FOR ANY EQUIPMENT REPAIRED OR ALTERED BY PERSONS NOT AUTHORIZED BY AEROCOMM, OR NOT IN ACCORDANCE WITH INSTRUCTIONS FURNISHED BY AEROCOMM. AEROCOMM IS NOT RESPONSIBLE FOR EQUIPMENT RENDERED DEFECTIVE AS A RESULT OF MISUSE, IMPROPER REPAIR, OR ABNORMAL CONDITIONS OF OPERATION, NOR DOES AEROCOMM ASSUME ANY LIABILITY FOR ANY CONSEQUENTIAL DAMAGE CAUSED BY SUCH EQUIPMENT.**

**SERVICE CONTRACTS OR CUSTOMER ASSISTANCE AGREEMENTS ARE AVAILABLE FOR AEROCOMM PRODUCTS THAT REQUIRE MAINTENANCE AND/OR REPAIR. AEROCOMM ALSO HAS AVAILABLE SERVICE AND CONSULTATION CONTRACTS FOR ENTIRE SYSTEMS CONFIGURATIONS.**

PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMPLIFIER  
PBBA  
MODEL 50289-RBA-800MHz  
P/N 50483-02-25



## TABLE OF CONTENTS

<b>I. INTRODUCTION.....</b>	<b>4</b>
PURPOSE OF MANUAL: .....	4
GENERAL SYSTEM OVERVIEW:.....	5
PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMPLIFIER OVERVIEW:.....	6
<b>II. SPECIFICATIONS.....</b>	<b>8</b>
GENERAL SPECIFICATIONS: .....	8
PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMPLIFIER.....	8
SUB-ASSEMBLY SPECIFICATIONS: .....	9
ATTENUATOR AMP MODULE #1 & #2.....	9
ATTENUATOR AMP MODULE #3.....	9
MMIC #1.....	10
MMIC #2.....	10
<b>III. INSTALLATION.....</b>	<b>11</b>
<b>IV. EQUIPMENT INITIALIZATION.....</b>	<b>12</b>
<b>V. MAINTENANCE SCHEDULE.....</b>	<b>13</b>
<b>VI. THEORY OF OPERATION.....</b>	<b>14</b>
<b>VII. TROUBLESHOOTING.....</b>	<b>15</b>
<b>III. SCHEMATICS.....</b>	<b>16</b>
<b>ASSEMBLY DRAWINGS, PARTS LISTS.....</b>	<b>16</b>
PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMP.....	17
ATTENUATOR/AMPLIFIER MODULE #1 & #2.....	18
ATTENUATOR/AMPLIFIER MODULE #3.....	19
MMIC AMPLIFIER #1.....	20
MMIC AMPLIFIER #2.....	21
RBA BPF MODULE.....	22
<b>IX. PERTINENT DOCUMENTATION.....</b>	<b>23</b>
<b>X. RECOMMENDED SPARES.....</b>	<b>24</b>

# 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 of 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.

**Section IV:** Section IV covers equipment initialization.

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

**Section VI:** Section VI covers the general "Theory of Operation" of the logic and RF modules of a PBBA. This section is designed to aid in the understanding of the PBBA.

**Section VII:** Section VII consists of diagrams, tables and procedures to assist in the troubleshooting of a 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 VIII consists of the schematics, assembly drawings, and parts lists of the PBBA and its sub assemblies.

**Section IX:** Section IX consists of pertinent documents and supplemental equipment manuals.

**Section X:** Section X lists the recommended 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 general, the forward channel, talk-out signals are generated from lower power sources, e.g., handheld transceivers.

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.

**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 – 20dBm.

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 is also user settable and the factory default setting is 0dB. The reverse channel covers 100 to 2000MHz and has a user settable gain (see specifications for min/max gain/loss setting for the forward and reverse channels.) Each channel uses a broadband attenuator/amplifier module in which the attenuation is digitally set via computer interface.

There are two (2) parallel amplifiers in the forward channel. One of the forward channels called In-Band 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. User-friendly software enhances the unit's performance and user interface.

PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMPLIFIER  
PBBA  
MODEL 50289-RBA-800MHz  
P/N 50483-02-25

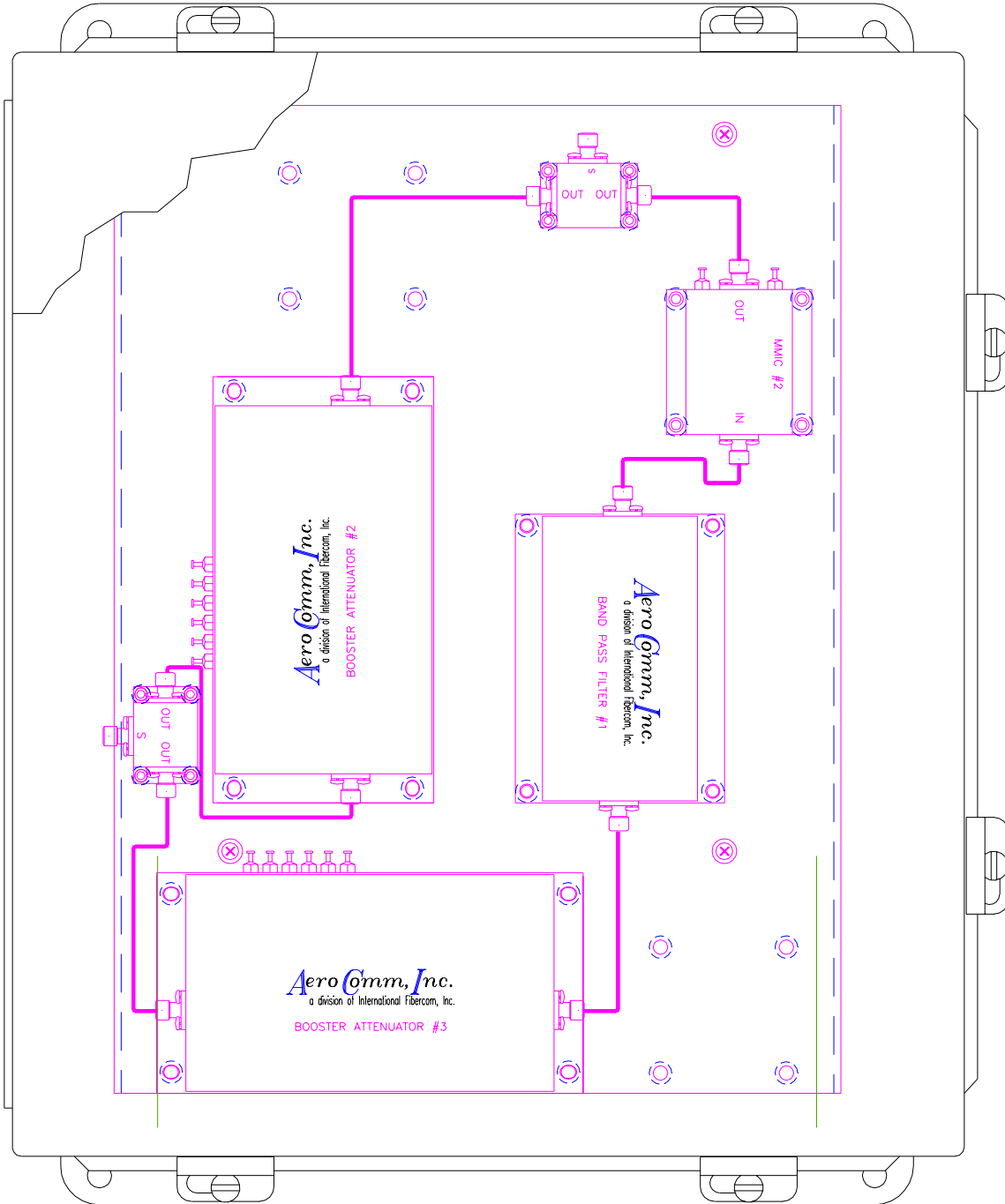


FIGURE 1

# II. SPECIFICATIONS

## GENERAL SPECIFICATIONS:

**PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMPLIFIER  
P/N 50483-02-25  
MODEL # 50289-RBA-800 MHz**

SPECIFICATIONS	DEFAULT NOMINAL	ADJUSTMENT RANGE
Forward Channel: Reverse Channel: Forward Freq. Range (Out-of-Band): Forward Freq. Range (In-Band): Forward GAIN Range (Out-of-Band): Forward GAIN Range (In-Band): Reverse gain 100 to 2000 MHz: RF Power out, 1 carrier, 1 dB compression: Max Power input 8 tone no damage: Max Power input: Amp Flatness: Intermodulation Distortion: Second Harmonic Output: Spurious Outputs: Noise Figures: Input/Output VSWR: Power Requirement: Input/Output Connector: AC Power Input: Comm. Port: Housing (Enclosure) Type: Enclosure Size: Operation Temp.:	Talk-Out (Outbound) Talk-In (Inbound) 100 to 819/826 to 2000 MHz 821 to 824 MHz 20 ± 2dB 0 ± 2dB -1dB ± 1dB +17dBm -12dBm/carrier -20dBm +0, -2dB -50dBc -40dBc -80dBc <20dB 1.3:1 120VAC Type N ¾" Conduit DB9F NEMA 4x 14"x12"x6" (LxWxD) -30 to +60°C	11 to 26

FCC type acceptance



**SUB-ASSEMBLY SPECIFICATIONS:**

**ATTENUATOR AMP MODULE #1 & #2  
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

**ATTENUATOR AMP MODULE #3  
P/N 50483-02-26-01  
MODEL #**

SPECIFICATIONS	
Frequency Range:	819 – 826 MHz
Attenuation:	0dB min, -15db max
Gain @ 0dB attenuation:	18dB min, 20 dB max
Flatness:	$\pm 1$ dB
Power:	12VDC @ 19mADC
Isolation:	20dB min
I/O Connection:	SMA female

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

SPECIFICATIONS	
Frequency Range:	100 - 2000 MHz
Gain:	10dB typical
Gain Flatness:	<±1dB
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
Gain:	20dB typical
Gain Flatness:	±0.1dB
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 see also figure XX.
- 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 lower plate assembly at the center of the lower edge. To access the lower assembly, the upper plate must be removed.

Remove the upper plate as follows:

- 1) Disconnect the Talk Out and the Talk In cables.
- 2) Remove the four #10-32 screws.

Connect the AC sources as follows:

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

Re-install upper plate:

- 1) Secure plate to standoff.
- 2) Reconnect the two cables; check all cables are tightly secured.

# IV. EQUIPMENT INITIALIZATION

To Initialize Equipment:

- 1) Depress in the Circuit Breaker On/Off switch.
- 2) Observe on the front door:  
Power LED: On  
Status LED: Flashing at 1 Hz rate  
Con LED: Off
- 3) Close panel and secure door locks.

There is no special requirement to operate the equipment; it is designed for unattended operation. Turn on and secure, close the door.

# 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 1 Hz rate  
Con LED OFF

The performance of operations testing is recommended to be done semi-annually. 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 3 channels, 2 in the forward direction and 1 in the reverse direction. In the forward direction are two parallel channels. One 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 in the forward direction. Both channels use 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 filter in the inbound channel attenuates the outbound signals from 100 to 2000 MHz, but is amplified again in the out of band channel. The difference in these two channels is the high gain amplifier in the In-band channel.

The reverse channel also uses the same broadband attenuator module, and covers the same frequency range, 100 to 2000 MHz. Due to the configuration of the reverse channel its losses are higher and a medium gain amplifier follows the attenuator module to enhance channel gain.

With the 3 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 indicator on but status light is not blinking	Check connection to the microprocessor board	Microprocessor board is faulty. Pull out for repair.
3) Comport 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

## Remote Booster Amplifier 800 MHz

**50483-02-25 ASSEMBLY REMOTE BOOSTER AMPLIFIER 800 MHz**  
50483-02-25 PARTS LIST REMOTE BOOSTER AMPLIFIER 800 MHz

**50483-02-26 ASSEMBLY ATTENUATOR AMP MODULE #1**  
50483-02-26 PARTS LIST ATTENUATOR AMP MODULE #1  
50483-03-55 PCB ASSY BOOSTER ATTENUATOR  
50483-03-55 PARTS LIST BOOSTER ATTENUATOR  
50483-04-55 SCHEMATIC DIAGRAM BOOSTER ATTENUATOR  
50483-07-55 PCB FABRICATION BOOSTER ATTENUATOR  
50483-07-47 PCB FABRICATION ISOLATOR INTERFACE  
50483-05-46 HOUSING  
50483-05-47 COVER

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

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

**50483-02-28 ASSEMBLY RBA BPF MODULE**  
50483-02-28 PARTS LIST RBA BPF MODULE  
50483-03-24 PARTS LIST LNA BPF  
**50483-04-24 SCHEMATIC LNA BPF**  
50483-07-24 FABRICATION LNA BPF  
50483-05-51 MECHANICAL ASSY BPF HOUSING  
50483-05-52 MECHANICAL ASSY BPF COVER  
50483-05-49 MECHANICAL ASSY MOUNTING PLATE FILTER  
50483-05-83 MYLAR CUTOUTS BPF HOUSING  
50483-05-50 MECHANICAL ASSY ENCLOSURE  
50483-05-53 MECHANICAL ASSY LOWER COMPONENT PLATE  
50483-05-54 MECHANICAL ASSY UPPER COMPONENT PLATE  
50583-05-55 MECHANICAL ASSY POWER SUPPLY MOUNTING PLATE  
50483-05-56 MECHANICAL ASSY POWER SHIELD



**PROGRAMMABLE BI-DIRECTIONAL BOOSTER AMP**

**ATTENUATOR/AMPLIFIER MODULE #1 & #2**

**ATTENUATOR/AMPLIFIER MODULE #3**

**MMIC AMPLIFIER #1**

**MMIC AMPLIFIER #2**

**RBA BPF MODULE**

# 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 assembly spare. For quick in field service, swap.

For shop/repair service, we recommend the following spares as module replacements:

- 1 Attenuator Amplifier Module #1
- 1 Attenuator Amplifier Module #2
- 1 Attenuator Amplifier Module #3
- 1 MMIC Amplifier #1
- 1 MMIC Amplifier #2
- 1 RBA Band Pass Filter Module