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# TRICOM RESEARCH, INC.

## OPERATOR'S MANUAL

### AM-SAT-50

#### DAMA CERTIFIED UHF SATCOM REMOTE BI-DIRECTIONAL AMPLIFIER



## TABLE OF CONTENTS

<b>1.0</b>	<b>INTRODUCTION</b>	
1.1	General Information.....	1-1
1.2	Abbreviations and Glossary.....	1-2
1.3	Equipment Description .....	1-3
1.4	Features.....	1-3
1.5	AM-SAT-50 System .....	1-4
1.5.1	Bias Tee.....	1-4
1.5.2	Amplifier.....	1-4
1.5.3	Power Cable.....	1-4
1.6	Specifications.....	1-6
<b>2.0</b>	<b>OPERATION</b>	
2.1	General Information.....	2-1
2.2	Controls, Indicators, and Connectors.....	2-1
2.3	Operational Procedures.....	2-2
2.3.1	General Information.....	2-2
2.3.2	Equipment Set-up.....	2-2
2.3.3	Operating Procedures.....	2-3
2.3.3.1	Normal Operation .....	2-3
2.3.3.2	Bypass Operation.....	2-3
2.3.3.3	Improper Operation.....	2-4
<b>3.0</b>	<b>INSTALLATION</b>	
3.1	General Information.....	3-1
3.2	Preparation for Use .....	3-1
3.3	Cable Interconnections .....	3-1
3.4	Wiring Diagrams.....	3-3
3.5	Mounting Provisions.....	3-4

LIST OF TABLES

Table 1-1 AM-SAT-50 General Operating Parameters .....1-6  
Table 1-2 AM-SAT-50 Interconnect Characteristics .....1-7  
Table 1-3 AM-SAT-50 General Characteristics .....1-7  
Table 2-1 AM-SAT-50 Controls, Indicators, and Connectors .....2-2  
Table 2-2 AM-SAT-50 System Troubleshooting Guide .....2-4  
Table 3-1 AM-SAT-50 Coaxial Cable Length Guide .....3-1

LIST OF FIGURES

Figure 1-1 AM-SAT-50 System Components .....1-1  
Figure 1-2 AM-SAT-50 Functional Block Diagram .....1-5  
Figure 2-1 AM-SAT-50 Front Panel Controls, Indicators, and Connectors.....2-1  
Figure 3-1 AM-SAT-50 Coax Cable Length Guide.....3-2  
Figure 3-2 AM-SAT-50 Power Cable Wiring Diagram.....3-3  
Figure 3-3 Amplifier Mounting Dimensions.....3-4  
Figure 3-4 Bias Tee Mounting Dimensions .....3-5

Revision Control

90400-01078- Rev A

90400-01078- Rev B – Deleted 75 and 100 Watt power levels on paragraph 1.4.

90400-01018- Rev C – Technical update for data sheet reconciliation

## 1.0 INTRODUCTION

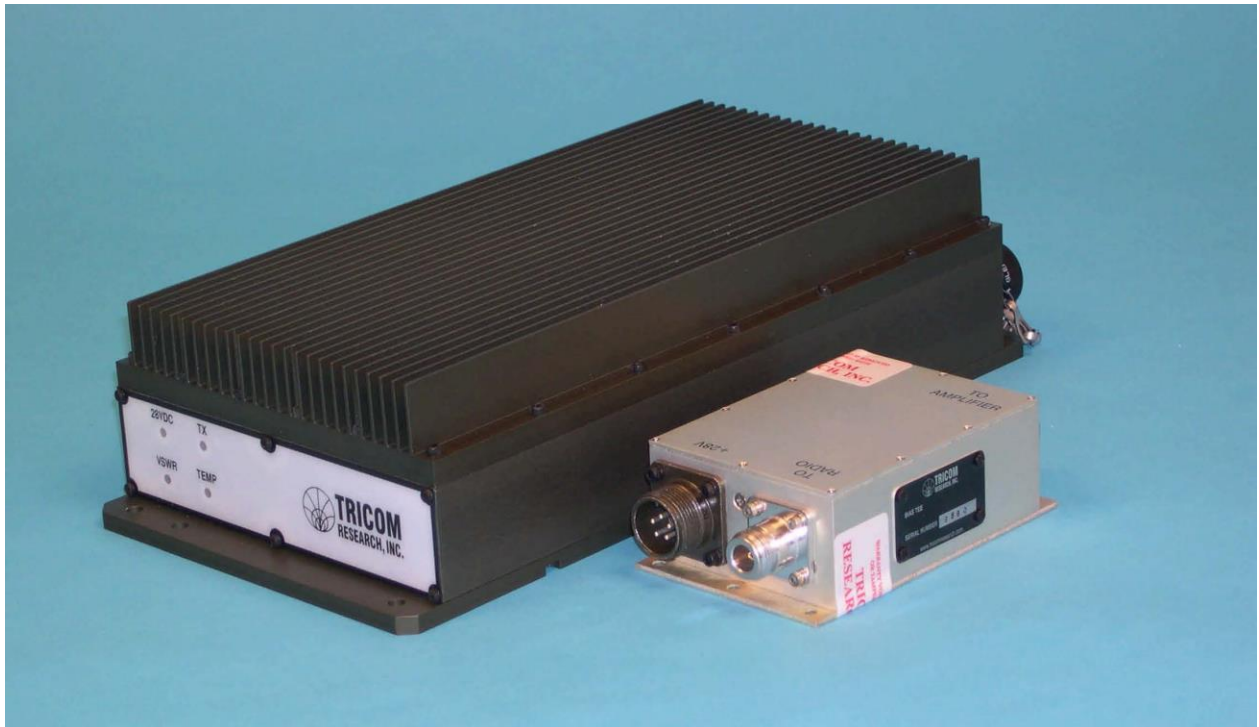
### 1.1 GENERAL INFORMATION

This manual provides operating instructions for the DAMA Certified AM-SAT-50 Remote Bi-Directional Amplifier System shown in Figure 1-1. The system is a amplifier/pre-amplifier designed to provide transmit and receive gain for UHF SATCOM channels, while eliminating disruptive cosite interference on DAMA and non-DAMA 5 KHz and 25 KHz channels.

The AM-SAT-50 has been DAMA Certified with several UHF SATCOM terminals. For a listing of the current certifications please see the Joint Interoperability Test Command (JITC) website.

Part number: 11000-00674 (with Bias Tee)  
11000-00519 (PA only)

Figure 1-1. AM-SAT-50 Amplifier



**1.2 ABBREVIATIONS AND GLOSSARY**

AGC	Automatic gain control
ALC	Automatic level control
AM	Amplitude modulation
ANT	Antenna
BPS	Bits per second
CT	Cipher text
CW	Continuous wave
COMSEC	Communications security
dB	Decibel
dBm	Decibel referenced to 1 milliwatt (0 dBm = 1 mW)
FM	Frequency modulation
Hz	Hertz
KHz	Kilohertz
LED	Light emitting diode
LOS	Line of sight
MHz	Megahertz
mW	Milliwatt
PT	Plain text
PTT	Push to talk
RCV	Receive
SATCOM	Satellite communications
UHF	Ultra-high frequency
VDC	Volts, direct current
VSWR	Voltage standing wave ratio
W	Watt
X-MODE	Connector for COMSEC equipment
XMT	Transmit

### 1.3 EQUIPMENT DESCRIPTION

The DAMA Certified AM-SAT-50 Remote Bi-Directional Amplifier System is used to provide transmit and receive amplification and cosite filtering for UHF SATCOM communications. It is suitable for vehicular, airborne, or fixed-station applications and is compatible with all UHF SATCOM radios. The Amplifier is weather-proof and is typically located outdoors with the antenna. The Bias Tee is splash-proof and is usually located with the radio, but may be placed anywhere between the radio and amplifier. The system connects in-line with the radio and antenna with coax cable, with a connection for DC power input located on the Bias Tee. There are operator controls located on the Bias Tee and the Amplifier. The Bias Tee has a Power On/Off circuit breaker. The amplifier also has an auxiliary DC connector for direct connection to a DC power source when a Bias-Tee is not needed (typically for vehicle applications). The Amplifier has a three position switch to control receive gain, and a Five position transmit power switch. The AM-SAT-50 interfaces with other equipment, including:

- Any UHF SATCOM antenna with a 50 Ohm impedance
- SATCOM terminals, including the AN/PSC-5 and AN/PRC-117
- Conditioned power from a source of +22 to +32 VDC

### 1.4 FEATURES

The AM-SAT-50 has the following features:

- JITC DAMA Certification
- Pre-amplification of received RF signals from remotely located antennas
- Power amplification of transmit signals to 25, 35, 50 Watts
- Transmit and receive band filtering to eliminate interference from co-located radios and amplifiers
- Amplifier front panel indication of system status

## 1.5 AM-SAT-50 SYSTEM

The AM-SAT-50 is pictured in Figure 1-1. A functional block diagram is shown in Figure 1-2.

### 1.5.1 Bias Tee

The Bias Tee consists of two printed circuit assemblies in a divided aluminum housing. The DC input connection and RF connection to the radio are located on one end of the Bias Tee. The Power On/Off switch and RF connection to the Amplifier are located on the opposite end. When assembled, the enclosure is splash-proof, and may be mounted in any convenient position.

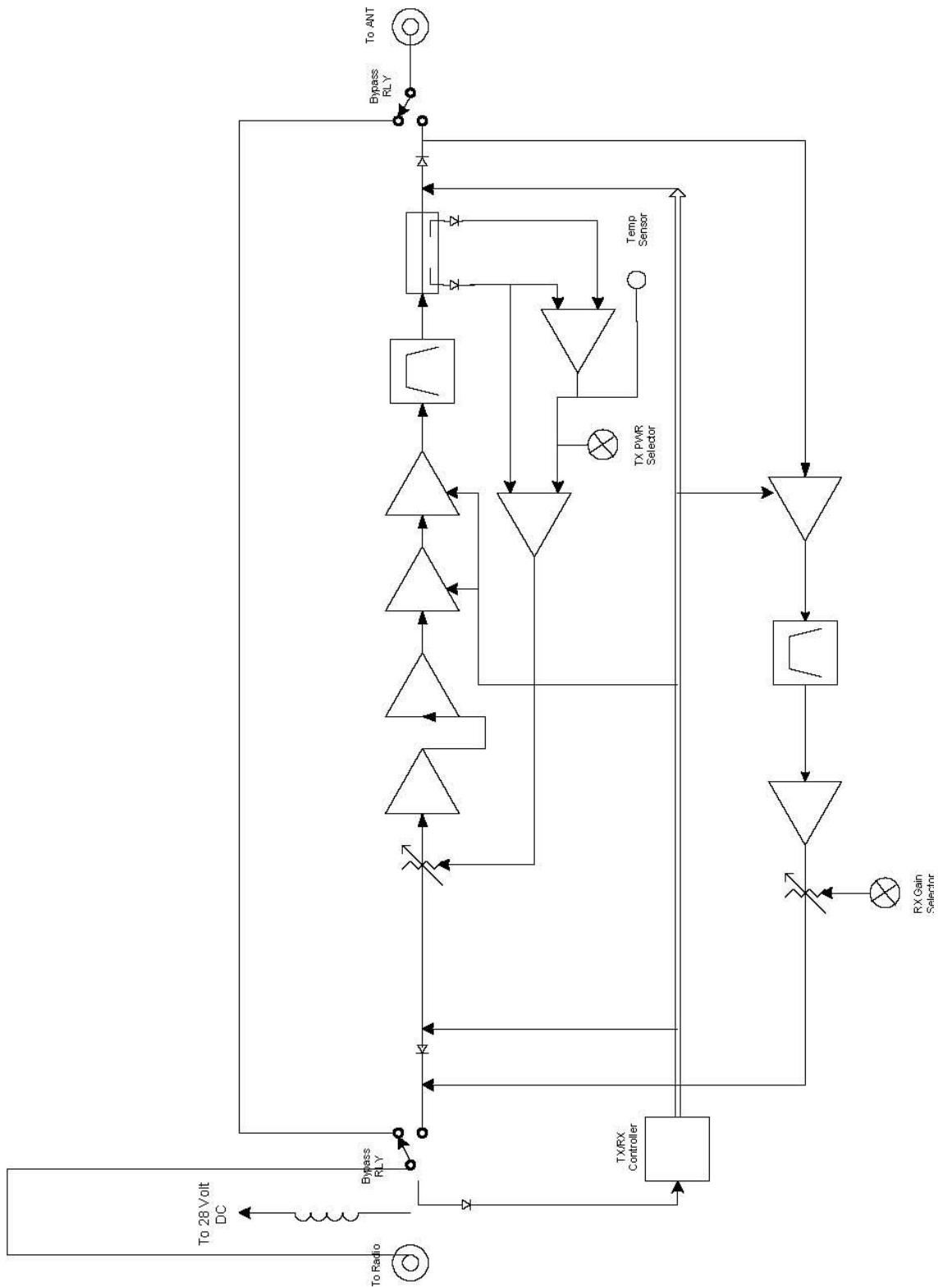
### 1.5.2 Amplifier

The Amplifier consists of several printed circuit assemblies, a filtering and switching network, and associated connectors and switches housed in a watertight aluminum housing. With normal care and maintenance, the assembly is highly resistant to corrosion from the elements. The interconnections to the Amplifier are made via two female type N connectors. Through holes are provided on the base plate for mounting purposes. A DC power connector is provided on the amplifier for connection to a DC power source when remote operation is not required, such as vehicle installations.

### 1.5.3 Power Cable

A five-conductor cable connects the AM-SAT-50 with a DC power source. A wiring diagram for the cable is shown in Section 3 of this manual. The power cable may be attached to either the Bias-Tee or directly to the amplifier.

Figure 1-2. AM-SAT-50 Functional Block Diagram





## 1.6 Specifications

The operating parameters, physical characteristics, and environmental specifications are shown in the following tables. Please review the latest data sheet or contact the factory for additional specifications.

Table 1-1. AM-SAT-50 Operating Parameters

### **TRANSMIT SECTION**

Frequency Range	292-318 MHz
RF Power Input	2-10 Watts (20W without damage)
RF Power Output	25/35/50 Watts
Harmonics	-60 dBc
DAMA Capability	Fully Compliant, including HPW

### **RECEIVE SECTION**

Frequency Range	242-268 MHz
Noise Figure	3.5 dB typical
Receive Gain	10/20/30 dB selectable

### **GENERAL**

Input VSWR	1.5:1
Output VSWR	1.5:1
VSWR Mismatch	High VSWR indication, no damage with mismatch
DC Power	24 to 28 VDC nominal

### **ENVIRONMENTAL**

Operating Temp/Cooling	-20 to +60 C, natural convection
Dimensions	3" H x 6" W x 12.25" D
Weight	10 lbs. PA 1 lb. Bias Tee

Table 1-2. AM-SAT-50 Interconnect Characteristics

Connection	Signal/Pin	Connector Function
<b>BIAS TEE</b>		
RF to Radio	RF to/from Radio	N female
RF to Amplifier	RF to/from Amplifier	N female
+28 VDC	DC Power in	MS3102E14S-5P
<b>AMPLIFIER</b>		
Bias Tee	RF to/from and +28 VDC from Bias Tee	N female
Antenna	RF to/from antenna	N female
+28 VDC	DC power in	MS3102E14S-5P

Table 1-3. AM-SAT-50 General Characteristics

Characteristic	Specification
Operating Voltage	24-28 VDC nominal, 22 to 32 VDC max
Operating Current	1 Amp typical receive, 8 Amps typical transmit
Operating Temp.	-20 to +60 C, over temperature protected
<b>Size</b>	
Bias Tee	1.5" H x 3" W x 5" D
Amplifier	3" H x 6" W x 12.25" D
<b>Construction</b>	
Amplifier	Weather-proof
Bias Tee	Splash-proof

## 2.0 OPERATION

### 2.1 General Information

This section provides information for operating the AM-SAT-50.

#### WARNING

**Electromagnetic radiation from the antenna can damage eyes and other body tissue when the system is transmitting. DO NOT stand directly in front of the antenna or in close proximity to the sides or back of the antenna when transmitting.**

### 2.2 Controls, Indicators, and Connectors

The AM-SAT-50 does not require user interaction once installed, inspected, and powered on. However, there are several helpful status indicators on the Amplifier's front panel. All of the controls, indicators, and connectors are located on the end panels of the Amplifier and Bias Tee as shown in Figure 2-1. The functions of these are specified in Table 2-1.

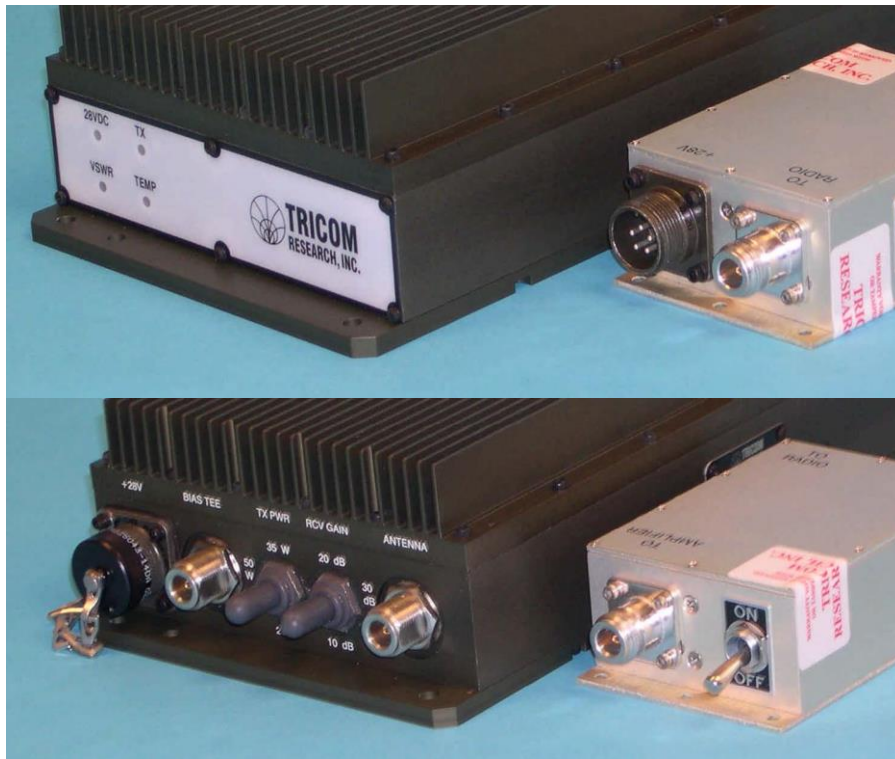


Figure 2-1. AM-SAT-50 Controls, Indicators, and Connectors

Table 2-1. AM-SAT-50 Controls, Indicators, and Connectors

CONTROL, INDICATOR, CONNECTOR	TYPE	FUNCTION
<b>BIAS TEE</b>		
POWER	25 Amp circuit breaker/switch	Switches the AM-SAT-50 on & off. Note: A low loss RF path is provided through the system when in the off position
+28 VDC	MS3102E14S-5P connector	DC power input (mating cable connector is a MS3106F14S-5S)
TO RADIO	N female connector	Connects to the SATCOM radio
TO AMPLIFIER	N female connector	Connects to the Amplifier
<b>AMPLIFIER</b>		
TX POWER	Transmit power level Switch	Sets the transmit power level of the Amplifier to 25, 35 or 50 Watts
RCV GAIN	Receive gain level switch	Sets the receive gain to 10, 20 or 30 dB
BIAS TEE	N female connector	Connects to the Bias Tee
ANTENNA	N female connector	Connects to a UHF SATCOM Antenna
+28 VDC	MS3102E14S-5P connector	DC Power input (mating cable connector is a MS3106F14S-5S)
28 VDC	Green LED	Indicates DC power is reaching the Amplifier
TX	Yellow LED	Indicates that the Amplifier has switched to the transmit mode
VSWR	Red LED	Indicates that the Amplifier has Sensed a high VSWR on the antenna Connection
TEMP	Red LED	Indicates that the Amplifier has Sensed a high temperature condition

## 2.3 Operational Procedures

### 2.3.1 General Information

The AM-SAT-50 can be used for operation once it has been installed as described in Section 3.

### 2.3.2 Equipment Set-up

Refer to Paragraph 2.2 for the locations and functional description of the controls and indicators. Make sure that the AM-SAT-50 has been installed according to the instructions provided in Section 3.

### 2.3.3 Operating Procedures

#### 2.3.3.1 Normal Operation

In normal operation, the AM-SAT-50 provides receive gain and transmit power amplification for radios operating in the UHF SATCOM band.

NOTE: Operating outside of the UHF SATCOM frequency bands will not harm the system, however, the equipment may not appear to be operating correctly and proper communications will not be established. To operate outside of the SATCOM frequency bands see Paragraph 2.3.3.2.

To operate the system in the normal (power on) mode:

1. Select the desired transmit power setting
2. Set the desired receive gain setting
3. Turn the ON/OFF switch to ON
4. Note that the 28 VDC light is illuminated
5. Begin UHF SATCOM communications
6. Note that the TX light is illuminated whenever the radio is keyed
7. Note that the VSWR and TEMP lights are not illuminated

Paragraph 3.1 contains appropriate Amplifier receive pre-amp gain setting guidelines.

#### 2.3.3.2 Bypass Operation

When powered off, the amplifier systems provide a low loss RF path through both the Bias Tee and Amplifier. Communications are possible across the 30-512 MHz band in this mode of operation. This way a single equipment configuration can be changed from a highly cosite immune UHF SATCOM system to multi-band system simply by powering the Bias Tee OFF. However, there is no filtering when in bypass mode, so interference with co-located SATCOM radios may occur. To operate the system in the bypass (power off) mode:

1. Turn the ON/OFF switch to OFF
2. Note that the DC ON light is not illuminated
3. Begin multi-band communications

Note: Operation in the bypass mode may interfere with other co-located UHF SATCOM radios, since none of the AM-SAT-50s filtering is used when powered off.

**2.3.3.3 Improper Operation**

If the communications system seems to be operating improperly, check to make sure that the equipment is configured in accordance with Section 3. If the problem persists follow the instructions below.

Table 2-2. AM-SAT-50 System Troubleshooting Guide

SYMPTOM	PROBABLE CAUSE	SUGGESTED FIX
DC ON light fails to illuminate	ON/OFF switch in off position	Turn switch ON
	DC power source not operating Power cable faulty	Inspect power source Inspect power cable
TX light fails to illuminate	Radio power set too low	Increase radio output power
	Cable between Bias Tee and Amplifier faulty	Inspect coax cable Shorten coax cable
VSWR light illuminates	Cable between Bias Tee and Amplifier excessively long TX frequency is outside of UHF SATCOM band	Set TX frequency between 292 and 318 MHz
TEMP light Illuminates	Heat sink is obstructed	Move objects which block air flow around the heat sink
	Sun is adding additional heat	Block direct sun light from shining on Amplifier
	Amplifier cannot dissipate enough heat	Decrease radio power to the minimum required to operate system properly
	If above does not work	Decrease transmission time

### 3.0 INSTALLATION

#### 3.1 General Information

This section contains information necessary for preparing the AM-SAT-50 for use. Included are cable interconnections, wiring diagrams, and mounting dimensions for the Bias Tee and Amplifier.

#### 3.2 Preparation for Use

After unpacking the system and inspecting for physical damage, select an appropriate location for the Bias Tee and Amplifier. The Bias Tee is usually installed with the radio and power amplifier, in a location protected from the weather. The Amplifier is located close to the antenna. Although the Amplifier is weather-proof, placing it in a location where it is protected from direct salt spray, rain, and sunlight will tend to increase its service life.

#### 3.3 Cable Interconnections

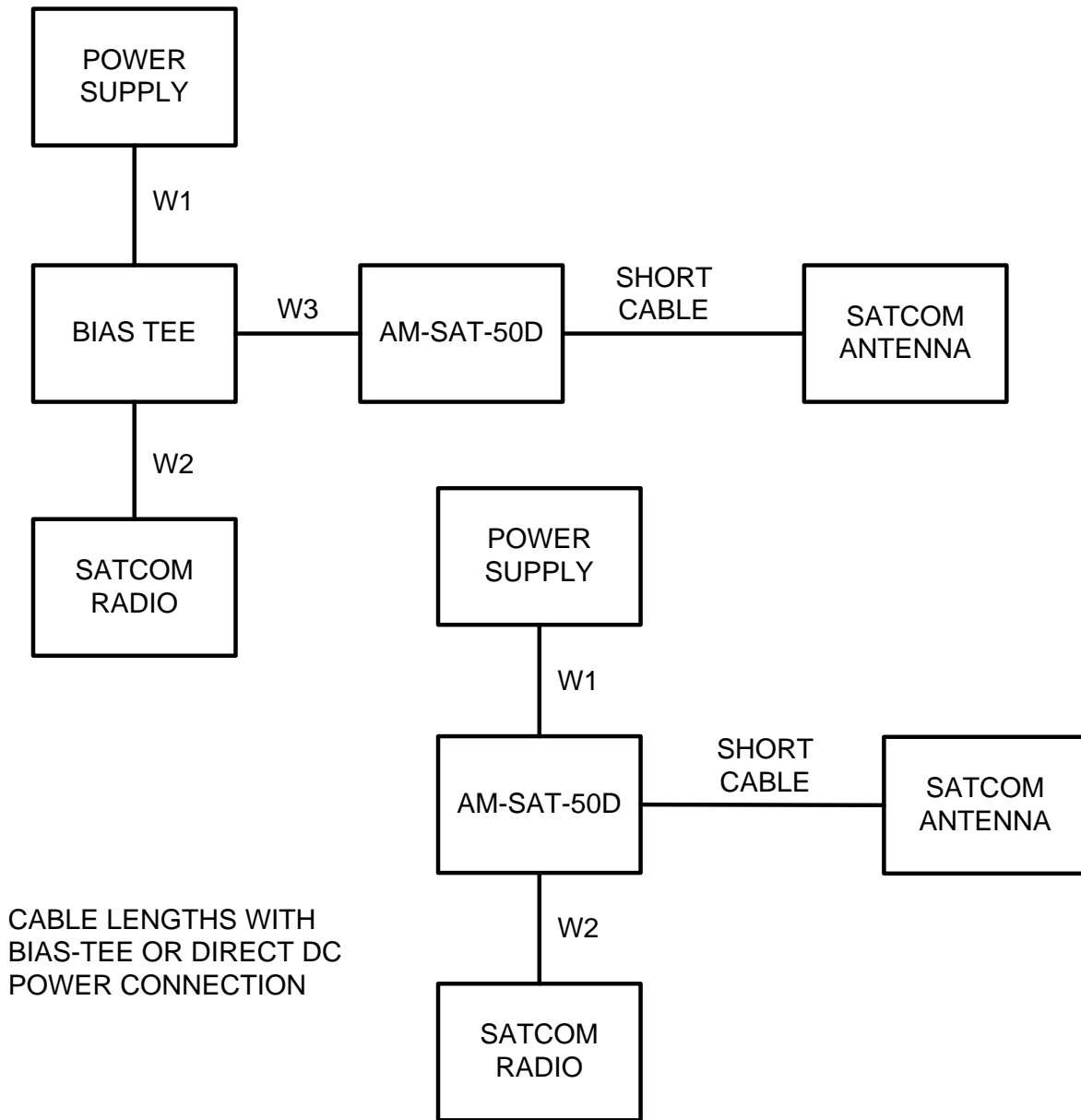
Attach the cables to the system as shown in Figure 3-1. Cable W1 is supplied with the system and is detailed in Paragraph 3.4. Cables W2 and W4 may be RG-58, RG-223, etc. Cable W3 should be RG-214 or better. The loss through cable W4 should be kept below 0.75 dB for best performance. For example, 5 to 20 feet of RG-214 or 5 feet of RG-223 is acceptable. Table 3-1 provides some guidelines for cable length and receive preamplifier gain settings.

Low-loss high performance Heliax cable may be used to greatly extend the remote distance of the amplifier.

Table 3-1. AM-SAT-50 Coaxial Cable Length Guide

CABLE	CABLE TYPE	LENGTH	GAIN SETTING
W2	RG-223	10'	
W3	RG-214	100'-250'	10 dB or 20 dB
(OR)			
W2	RG-223	100'	
W3	RG-214	10' – 100'	20 dB or 30 dB

Figure 3-1. Coax Cable Length Guide





3.4 Wiring Diagrams

Figure 3-2 shows the wiring diagram for the Power cable. Table 3-2 provides the pin numbers, names, and specifications of the signals. Conductors are 16 AWG and are covered with a mesh nylon jacket. The power supply ends are terminated with 5/16" ring terminals. The cable is approximately four feet long.

Figure 3-2. AM-SAT-50 Power Cable Wiring Diagram

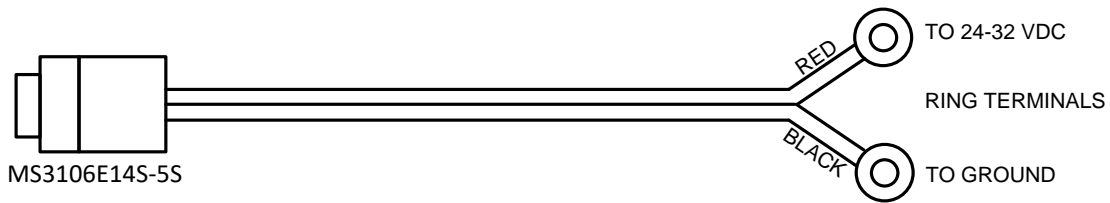


Table 3-2. AM-SAT-50 Power Cable Signal Description

PIN	SIGNAL NAME	COLOR	SPECIFICATION
A, B, E	DC Power	Red	+24 to +32 VDC
C, D	DC Ground	Black	DC Ground

3.5 Mounting Provisions

Figures 3-3 and 3-4 provide the mounting hole locations for the AM-SAT-50.

Figure 3-3. Amplifier Mounting Dimensions

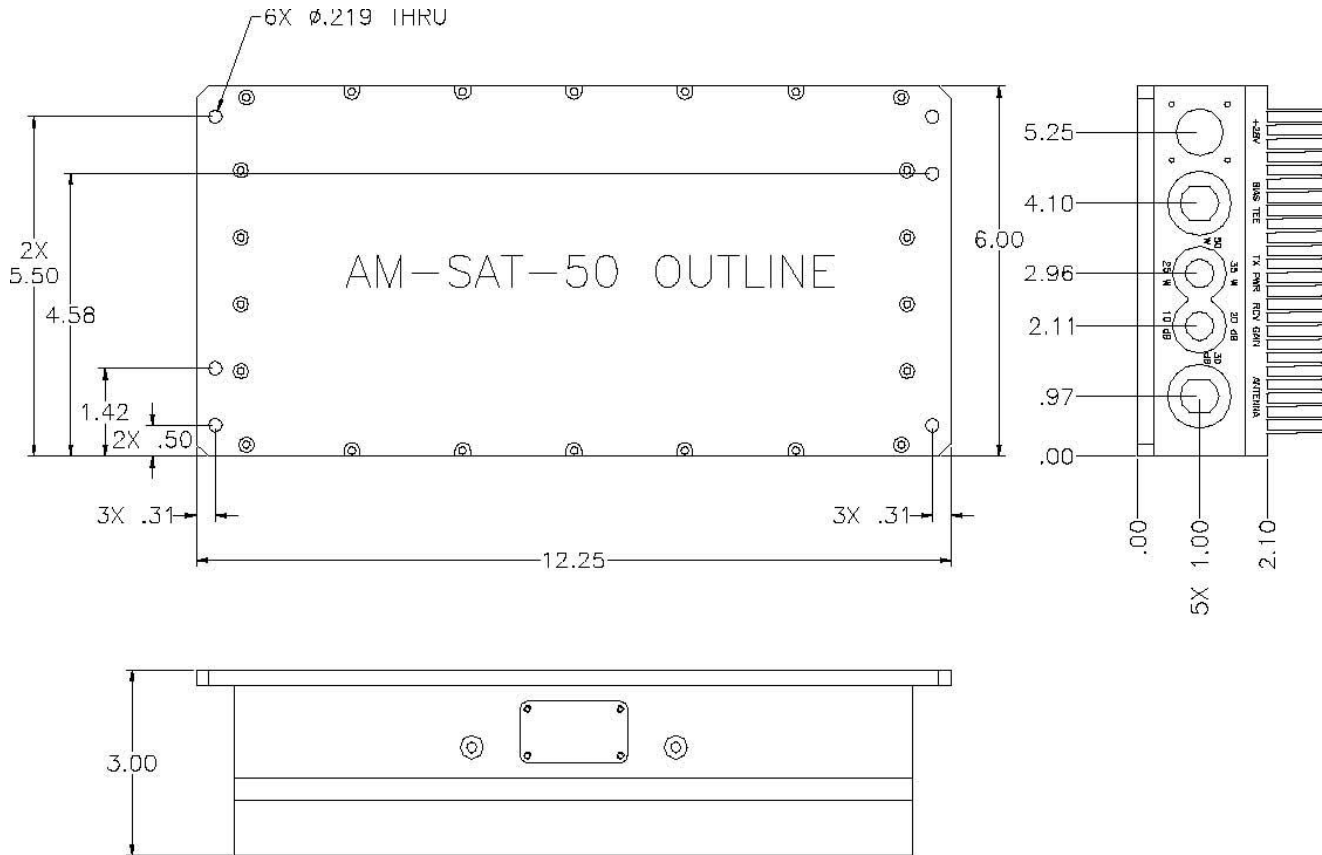


Figure 3-4. Bias Tee Mounting Dimensions

