

MODEL 0552RH - HIGH POWER AMPLIFIER (VHF) WITH REPEATER

Revised December 1991

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OPERATING AND SERVICE MANUAL

MODEL 0552 - HIGH POWER AMPLIFIER (UHF)

MODEL 0552G - HIGH POWER AMPLIFIER (UHF) WITH PREAMP

MODEL 0552RH - HIGH POWER AMPLIFIER (VHF) WITH REPEATER

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IMPORTANT NOTICE

The following manual is applicable to TE Systems 0552 series, including model numbers 0552, 0552G, and 0552RH.

The 0552G and 0552RH models contain optional equipment not found in other models. The 0552G contains a low noise GaAs FET preamp. All references within this manual to the GaAs preamp, operation of the preamp, or adjustment of the preamp are applicable to the 0552G only.

The 0552RH contains a repeater unit.

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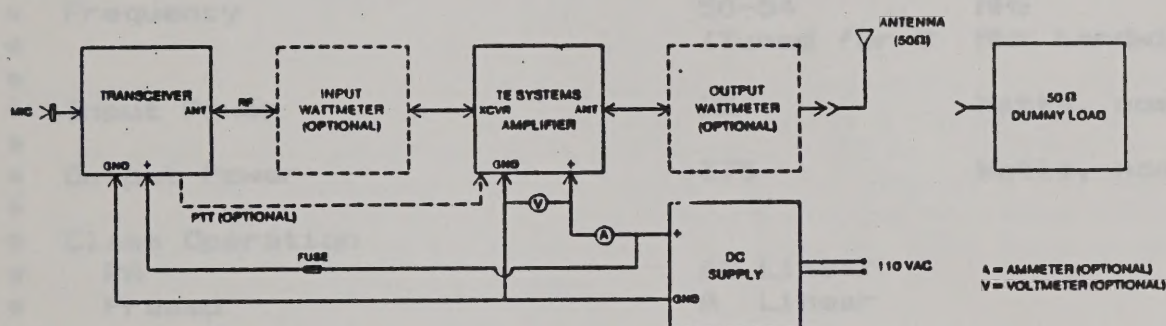
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Section I - General Information

Description

The TE Systems Model 05526 is an RF Amplifier subsystem designed to interface between a two-way transceiver and an antenna. This product uniquely integrates a high power RF amplifier with a very low noise GaAs FET receive preamp thereby providing performance unachievable heretofore. During transmit, the unit functions by linearly amplifying the transceiver's output signal up to the specified power level. When in the receive mode, it performs like an LNA (low-noise amplifier) by preamplifying the received signal with minimum noise figure.

A typical installation is shown below:



OPERATIONAL / TEST SET-UP FOR AMPLIFIER

The Model 05526 features front panel switches that control all RF functions. In normal transceive operation, the RF power amp may be used alone, the receive preamp LNA may be used alone, or both may be switched on. In the latter case, the power amp functions during transmit, and the receive LNA switches in during receive. This makes the unit fully compatible with a transceiver's two-way operation.

Further control can be obtained by using the remote control functions available through the remote jack on the rear of the unit. The following functions are controllable: switching delay, PTT (hard-keying), amplifier (in/out), preamplifier (in/out), and LED illumination. Additionally, the switching delay can be easily adjusted by a potentiometer control accessible on the rear panel.

The entire unit is housed in an attractively styled enclosure designed to fit securely together for maximum strength and minimum weight. Two of the front panel switches have LED status lights to provide visual monitoring of the unit's control condition, and additionally three separate LED lights are used to

provide readout of the unit's operating condition: RF on, over-temperature, and external PTT. All cable interconnection is done on the rear panel and is visually concealed to the operator. The unit is surface mounted on four rubber feet with the heatsink fins facing upwards thereby allowing the heat to convection cool. The unit's approximate size is 2.8 x 10 x 11.5" (H,W,L).

Specifications

TE Systems manufactures a complete line of high power linear RF amplifiers with or without low-noise GaAs FET preamplifiers. The specifications for this particular amplifier are shown below in the product specification summary table:

***	Model 0552G Performance Specifications		***

* Frequency	50-54	MHz	*
	(Tuned for 2 MHz bandwidth)		*
* Input Power	25	Watts, nominal	*
* Output Power	375	Watts, nominal	*
* Class Operation			*
PA	AB Linear		*
Preamp	A Linear		*
* T/R Switching Sensitivity	0.5	Watt, typical	*
* Antenna VSWR	3:1 Maximum		*
* Receive Preamp Gain	15	dB, nominal min	*
* Receive Preamp NF	0.6	dB, nominal	*
* DC Voltage	+13.8	Vdc	*
Current	55	A, nominal	*
* Size	2.8x10x11.5	Inches (H,W,L)	*
* Weight	8	Lbs (approx)	*

The required system impedance is 50 Ohms unbalanced. A proper antenna load impedance must be presented to the RF power amplifier during transmit. Load VSWR's exceeding 3:1 are not recommended and may cause transistor failure due to power imbalances within the unit or excessive device power dissipation. TE Systems recommends checking the antenna's VSWR before applying full power from the amplifier.

The rated duty of the amplifier is 50% using normal communication transmission periods (ICAS). Longer duty transmissions require either forced air cooling of the heatsink fins or power derating or both. Check with TE Systems or its agent for recommended operating changes for higher duty usage.

Instrument Identification

TE Systems' RF power amplifiers have their model numbers specified on the right side of the front operating panel beneath the TE Systems name. Additionally, the frequency range capability for the unit is identified in megahertz.

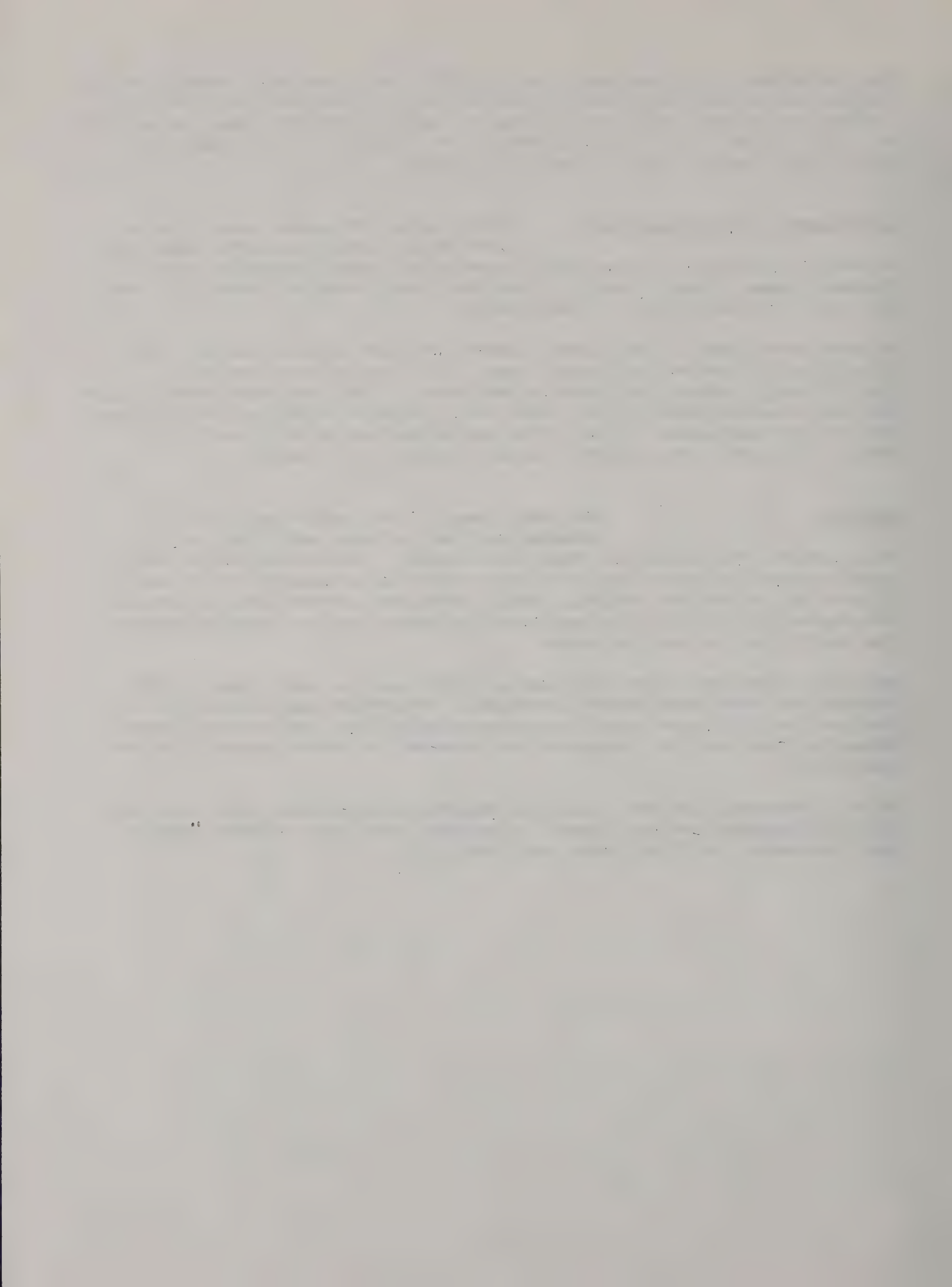
On the rear panel, the model number and the serial number are inscribed on the metallized label. This also has the FCC identifying number for type acceptance. The complete fabrication and performance history of each unit is maintained at TE Systems for record purposes. All correspondence concerning each unit should include the complete model and serial number.

Options

RF power amplifiers with no GaAs FET preamp can be factory modified to incorporate the internal receive preamp. This requires a front panel change, installation of the internal preamp with noise figure optimization tuning, and a complete performance checkout. Arrangements with TE Systems must be made on this matter before the modification can be made.

Retuning the amplifier, preamp or both can be performed by TE Systems at any date after purchase. Prearrangement with TE Systems or its agent must be made before this can be performed. Retuning the unit to frequencies covered by other models is not possible.

Other hardware options, such as mounting brackets, are available from TE Systems or its agent. Contact them for current option part numbers, pricing, and availability.



**TE
SYSTEMS**

WARRANTY

This TE Systems product is warranted against defects in materials and workmanship for a period of one year from the date of shipment, except that in the case of certain components listed below, the warranty shall be for the specified period.

SPECIFIC COMPONENTS	WARRANTY PERIOD
RF POWER TRANSISTORS	1 YEAR
LOW NOISE GAAS FET	6 MONTHS

TE Systems will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to TE Systems, or its Agent, and provided the proper operating specifications and preventive maintenance procedures as listed in this manual are followed. Repairs necessitated by misuse of the product are not covered by this warranty. No other warranties are expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. TE Systems is not liable for consequential damages.

WARNING

Power transistor damage and/or other component failure may occur if improper antenna load impedance is connected to the output port during transmit. See specifications section for proper antenna load impedance.

If a defect should occur during the warranty period, do not attempt to repair the amplifier. Instead, contact TE Systems or its agent for instructions on either retuning the unit per the maintenance section of this manual or returning it. Units returned must be freight prepaid, packaged carefully to prevent shipping damage, insured to the full value, and completely assembled. The warranty will be voided if the equipment is returned showing signs of attempted repairs or is altered in any way.

** NOTE -- The registration card must be submitted within 10 days of purchase to validate the equipment's warranty -- available only to the original owner.

Items Supplied

The following items are supplied with the RF power amplifier as parts required to properly operate the electronic equipment:

<u>Quantity</u>	<u>Description</u>
1	Operating Manual
2	DC Power Lug Terminals (#6 wire)
1	Remote Plug, 7 pin male

Section II - Installation

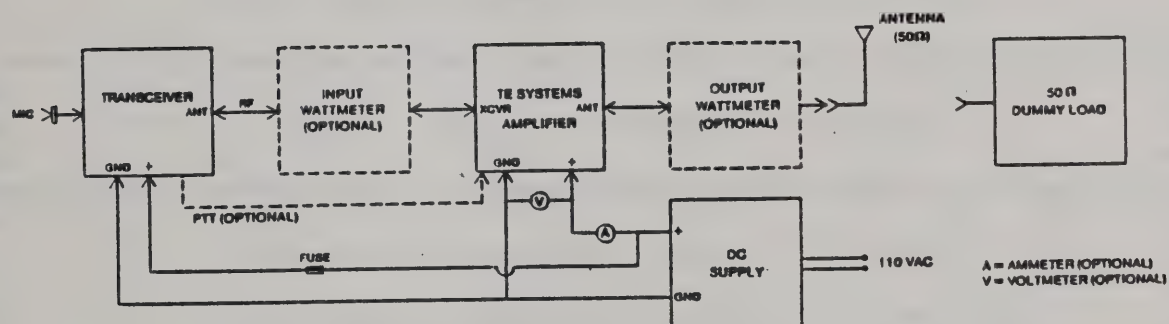
Initial Inspection

The RF amplifier has been carefully inspected both mechanically and electrically before shipment and it should be free of marks and scratches and in good electrical order upon receipt. The unit should be checked to verify that no physical damage has occurred in transit. If there is damage, please retain the shipping carton and padding material for the carrier's inspection, and immediately notify the carrier of shipment damage.

RF and DC Connections

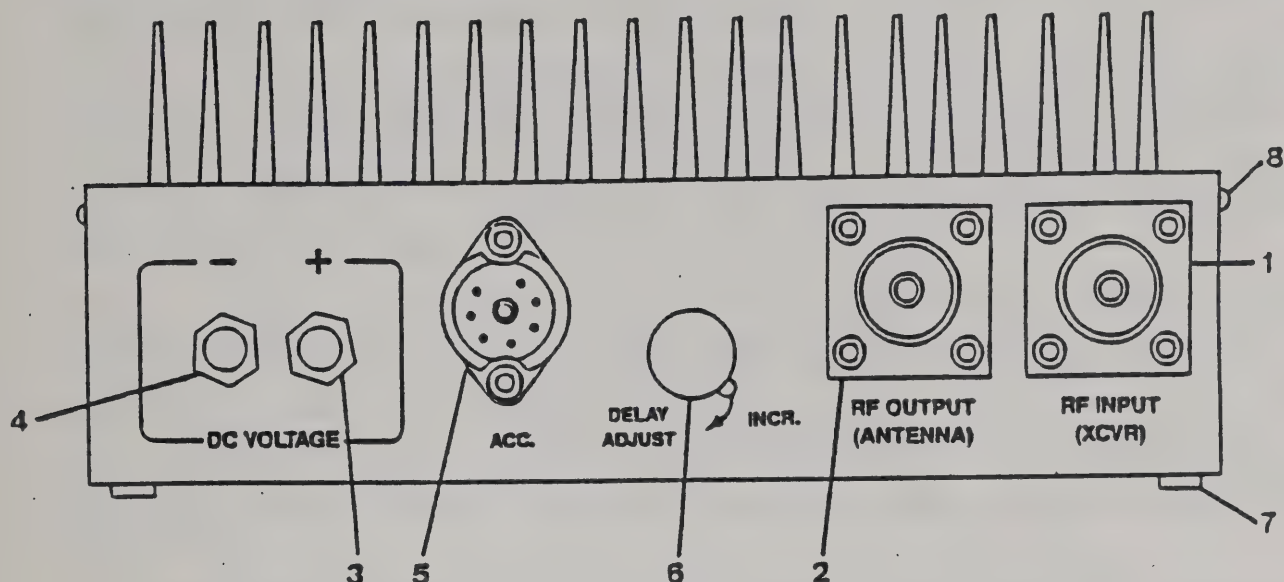
The TE Systems amplifier unit may be properly installed by inserting it between a transceiver and the antenna. The rear panel RF connector labelled "RF INPUT" is coaxially connected to the transceiver's antenna port. The connector labelled "RF OUTPUT" is then connected to the antenna. Good low-loss, high quality 50 Ohm coax cable and connectors should be used for both of these interconnections. Because of the amplifier's high output power, the antenna coax must be of suitable power rating to handle the high wattage without thermal build-up or performance degradation.

The installation connection is shown below:



OPERATIONAL / TEST SET-UP FOR AMPLIFIER

Power is supplied to the amplifier via the two high-amperage threaded terminals on the rear panel. Use the two terminal lugs supplied for DC cable attachment (#6 wire is recommended). Secure the two lugs onto the threaded terminals by strongly tightening the nuts after assembly. BE CAREFUL TO OBSERVE THE CORRECT POLARITY ! To reduce IR losses and maximize power, no fuse is used in the DC power line; correct DC polarity is mandatory to prevent irreversible damage to the HPA. See the rear panel diagram below:



BACK VIEW -- CONNECTION IDENTIFICATION

```
*****
***
***      REAR PANEL INTERCONNECTION TABLE      ***
***
*****
**
**      1.      RF Input Connector (connect to XCVR)      **
**
**      2.      RF Output Connector (connect to Antenna)  **
**
**      3.      + Vdc Terminal
**
**      4.      - Vdc Terminal (GND)
**
**      5.      Remote Accessory Socket
**
**      6.      Delay Adjust Control (CW-SSB mode only)
**
**      7.      Rubber Mounting Feet
**
**      8.      Cover Attachment Screws
**
*****
```


Additionally, the remote socket may be used for PTT or disabling the amplifier. Please refer to the section on remote control features for information on this connection.

Mounting

The RF amplifier is equipped with four rubber mounting feet on the bottom cover which function to keep the unit secure on a table top surface. The various cable interconnections should be attached on the rear panel and routed backwards out of sight.

Normal operation of the unit will have the black anodized fins upwards to allow maximum convection cooling. An air space must be allowed for the convection cooling to occur, otherwise overheating will occur. The user should experiment to determine how much air space is needed for his particular installation and operating technique.

As an option, a mounting bracket (TE Systems Model MMB-2) can be fitted to the amplifier unit to permit mounting the amplifier from either the top or bottom side. The bracket holds the amplifier firmly and allows a slight upward or downward tilt to provide ease of panel control. Attachment of the bracket onto the amplifier is made to the sides of the amplifier body using existing tapped holes - no additional hardware modifications are necessary.

In some applications, the user may want to mechanically attach his unit to another surface. In this case, the cover may be removed and holes drilled or punched in it as desired to allow the proper attachment. After securing the lid with the new attachment scheme, it is reunited with the amplifier body using the eight black holding screws.

Since the unit is supplied with a tight fitting cover to minimize RF radiation and reduce foreign particle contamination, any modifications to the cover should be consistent with the original design intent.

Power Supply Requirements

requirement:

The Model 0552G RF amplifier has the following maximum peak current

Model 0552G	55 Amps nominal
-------------	-----------------

TE Systems recommends a +13.8 Volt DC supply having at least a 20% higher continuous current rating than that required by the amplifier. If other equipment is to be operated also on the DC supply, then the cumulative amperage requirements should be used for computation. For the amplifier alone, the Astron VS-50M / RM-60M or equivalent will perform acceptably for SSB or short FM transmissions.

If excessively long transmissions are anticipated, then a higher current rated supply may be desirable. If the power supply enclosure temperature reaches 50 degrees Centigrade or higher during operation, fan cooling may be necessary to convection cool the unit down to its safe operating area. Check with the supply manufacturer to verify its capabilities.

Environmental Requirements

TE Systems HPA amplifiers are designed to operate over the ambient temperature range of 0 to +40 degrees Centigrade. The RF amplifier unit will meet the performance specifications when operating at 25 degrees C. It will operate properly, but with slight performance variance, within the temperature range of 0 to 40 degrees Centigrade. Above and below this range and within the temperature performance limits, the unit will operate satisfactorily but the parameters of performance may significantly deviate from the performance specifications.

The unit will probably operate satisfactorily well below 0 degrees Centigrade, but damage to the amplifier may occur with operation above +65 degrees Centigrade. The damage occurs due to the overheating of the transistor's active junction area and emitter finger resistors within the device. The result may be power and gain loss that is irretrievable.

A thermostat is incorporated within the unit to temporarily disable the amplifying mode once the heatsink temperature exceeds +65 degrees C. The switch has some hysteresis so that operation is not restored until the temperature drops down approximately 10 degrees C.

While the unit has a tight fitting cover that allows minimum foreign material collection within the unit, it is not a weather tight seal. Mounting of the amplifier at or near the antenna without environmental protection may severely degrade the mechanical integrity of the unit. If such operation is desirable, the unit must be protected fully from moisture collection, salt spray, or other detrimental environmental stresses.

Section III - Operating Instructions

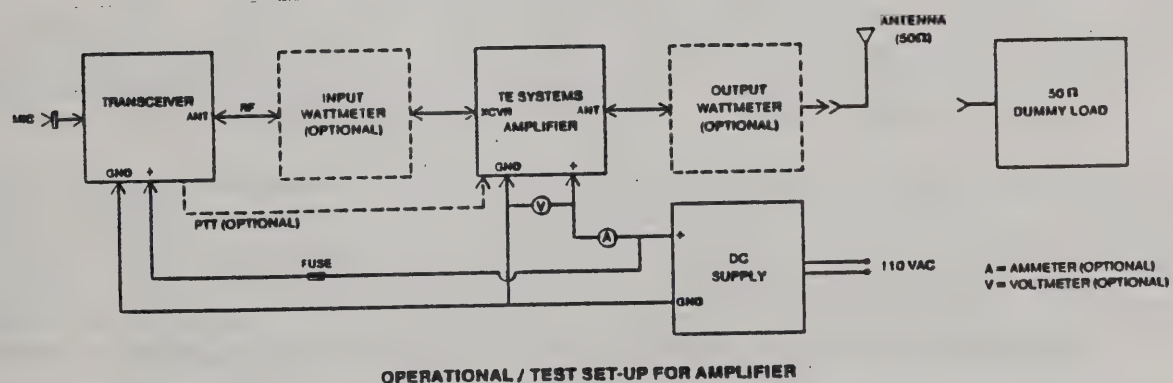
Introduction

The Model 0552G is an RF power amplifier and receive preamp combination housed together in one unit. Upon transmit the unit functions to amplify the transmitted signal up to the specified power level. Switching the transceiver back to the receive mode causes the amplifier to simultaneously switch into either the straight through or LNA preamp mode. The unit can function in various combinations of the above depending upon the user selected switch settings. Operation status lights mounted on the front control panel indicate the operating condition of the unit during operation. A complete procedure for operation of the unit in its various modes is detailed in the following paragraphs.

Operation

The Model 0552G RF amplifier is designed to amplify the transmitted input RF signal up to the specified output level and perform low noise signal amplification on receive. The result is a much stronger signal on transmit with a superior listening system on receive.

The basic operation of the unit is described in the sections below. Before becoming familiar with the features of this unit, the amplifier unit should be connected properly as shown below and described fully in the RF and DC connections section of this manual



NOTE -- In the Operational/Test Set-Up Block Diagram, the use of input and/or output wattmeters is optional, but they may be useful in determining the proper operation of the amp. For example, the amplifier's input tuning may be optimized for the proper match to the driving exciter. This is accomplished by tuning the amplifier's input tuning trimmer (located inside the unit) for minimum reflected power as measured on the input power meter. In the forward position, the power meter measures the

input power applied to the amplifier. This measurement should be done at the amplifier's input port. Refer to Section V for details on performing this procedure.

At the output of the amplifier, the impedance match to the antenna may be optimized by tuning the amplifier's output trimmer (located inside the unit if used) for maximum output power as measured on the output power meter. Refer to Section V for details on performing this procedure. The VSWR of the antenna may be checked by measuring the reflected power. The resultant VSWR can be calculated from the formula:

$$VSWR = \frac{1 + \text{SQRT } (R/F)}{1 - \text{SQRT } (R/F)}$$

Where R = reflected power in Watts, and F = forward power in Watts. In cases where there are large reflected powers, the actual power (P) delivered to the antenna is:

$$P = F - R \quad \text{Watts}$$

Remember that the accuracy of the input and output powers depends on the measuring equipment used. Power meters such as the Bird 43 are accurate to $\pm 5\%$ at full scale only and with output powers of 400 watts, the measurement error can be ± 20 watts or more when using a 500 Watt slug.

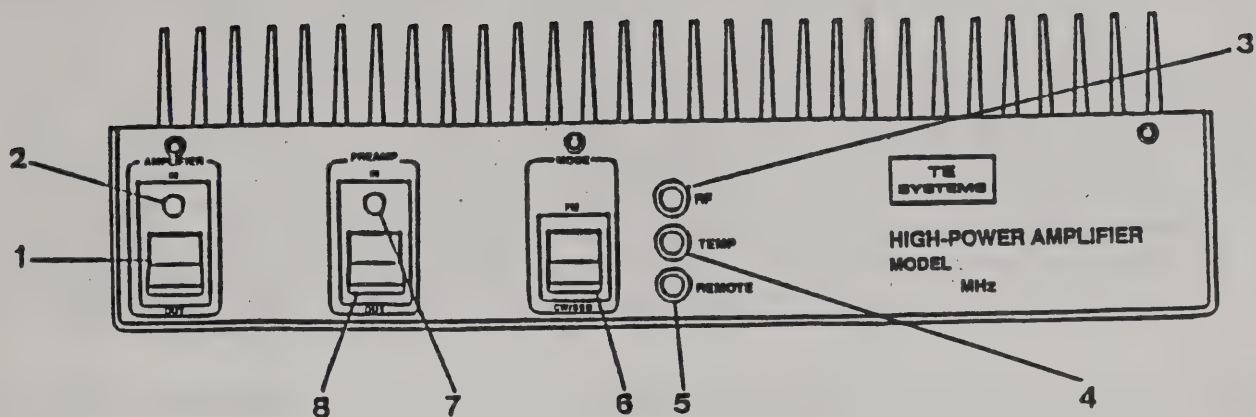
A) RF Power Amp Turn-On

With the unit connected as shown in the Operational/Test Setup Diagram

on Page 3-1, next refer to the front view diagram below. With all control switches in the "Off" position, the amplifier will not be functioned on and, therefore, it will act as a straight through interconnection providing no signal amplification.

Turning on the amplifier switch has no effect upon receive, but will switch "IN" the power amplifier during transmit. The green status light should illuminate to verify the "IN" ready condition of the amplifier. Please refer to the specifications for the particular model to determine the levels of RF input and output power. Also make sure a proper antenna load is connected.

The amplifier switches "IN" when it sees a RF transmitted signal applied from the transceiver. This technique is known as RF sensing, wherein, the transmitted signal activates the amplifier's relay switching circuits. Alternatively, the PTT remote connection may be used to "hard key" the amplifier. In this case the amplifier is switched in anytime the transceiver goes into transmit. Some users may find this advantageous to eliminate RF switching during no RF periods such as pauses in SSB transmission. The actual RF switching time is minimized too with PTT control (the mode switch should be in the FM mode for minimum time delay).



```
*****
***
***      FRONT PANEL DESCRIPTION TABLE
***
*****
**
**      1.      RF Power Amp IN/OUT Switch
**
**
**      2.      RF Power Amp IN/OUT Status Light (Green)
**
**
**      3.      RF Light (Red) - Illuminates when the unit goes
**                  into the RF power amplifying
**                  condition
**
**
**      4.      Temp Light (Red) - illuminates when the unit's
**                  heatsink temperature rises
**                  above +65 degrees C
**
**
**      5.      Remote Light (Red) - illuminates when the
**                  remote PTT input has been
**                  keyed
**
**
**      6.      Mode Switch - controls relay switch delay
**
**
**      7.      Preamp IN/OUT Status Light (Green)
**
**
**      8.      Preamp IN/OUT Switch
**
*****
```


B) Receive Preamp Turn-On

With the unit connected as shown in the Operational/Test Setup Diagram shown on Page 3-1, next refer to the front view diagram. With all control switches in the "OFF" position, the amplifier will not be functioned on and, therefore, it will act as a straight through interconnection providing no signal amplification.

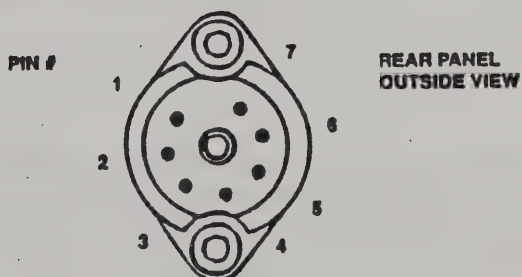
Turning "ON" the preamp switch causes the internal low-noise amplifier (LNA) to be switched in during receive and to be keyed out during transmit. This switch may be used together or separately from the amplifier IN/OUT switch. When switched "IN" the green status light should illuminate and the preamp should function per the specifications. Upon transmit, the RF sensing circuit switches out the preamp to prevent damage to the LNA system, and upon receive the preamp is switched back in.

C) Mode Control

With the mode switch upwards in the "FM" position, the T/R switching delay time is at a minimum. This allows FM operation with fast two-way transmissions and no noticeable amplifier switching delay time.

When the mode switch is in the "CW-SSB" position, a time delay is incorporated in the T/R switching, and the delay time is adjustable from the potentiometer located on the rear panel. This delay functions to hold the amplifier in the amplify (transmit) mode during pauses in voice transmission or breaks between CW sending. Delay periods of up to 2-4 seconds are available. Note that the amplifier is always operating in the linear mode regardless of the mode switch setting.

Remote Control Features




```

*****
***                                     ***
***      REMOTE ACCESSORY SOCKET PINOUT      ***
***                                     ***
*****
**                                     **
**      1.      FM/SSB external control      **
**              with front panel Mode Switch in the CW-SSB **
**              position, ground for FM, open for CW-SSB **
**                                     **
**      2.      Direct keying (PTT)          **
**              Ground for PA amplify mode    **
**                                     **
**      3.      +12.5 Vdc (1A Maximum)        **
**                                     **
**      4.      No connection                 **
**                                     **
**      5.      Remote control operation      **
**              When ungrounded, PA cannot be activated. **
**              (Cut internal ground to enable this) **
**                                     **
**      6.      Ground                        **
**                                     **
**      7.      LED illumination control      **
**              When ungrounded, front LED lights are **
**              inoperative, except for "RF" LED. **
**              (Cut internal ground to enable this) **
**                                     **
*****

```

Remote Control Operation

All amplifiers have new, improved remote control capabilities that can be used for distant remote control applications of the power amplifier as follows:

- Remote control the RF power amplifier
- Remote control of the GaAs FET preamplifier
- Remote control of both the PA and the preamplifier
- Improved GaAs FET preamp burnout protection

General Operation TE Systems amplifiers are factory wired for internal RF sensing operation with a capability for hard-keying. The hard-keying overrides the RF sensing and is done by wiring the remote socket's pin 2 to the transceiver's PTT.

Remote Operation Remote operation of the amplifier is done by cutting the internal shorting wire between pin 5 and pin 6 of the remote accessory socket. Remotely connecting these pins allows the amplifier to operate, and conversely, left unconnected the amplifier is disabled.

If the remote operation of the amplifier is needed, the following remote functions are available:

RF Sensing

- RF Amp Connect pin 5 and pin 6
 Amplifier switch "On"
- Preamp Connect pin 5 and pin 6
 Connect pin 3 and pin 4 (note pin 3 is +12 Vdc)
 Amplifier switch "Off"; Preamp switch "Off"
- RF Amp and Preamp
 Connect pin 5 and pin 6
 Connect pin 3 and pin 4 (note pin 3 is +12 Vdc)
 Amplifier switch "On"; Preamp switch "Off"
- RF Amp and Preamp disabled
 Disconnect pin 5 and pin 6

Hard-keying

- RF Amp Connect pin 5 and pin 6
 Connect pin 2 to transceiver PTT (gnd on xmit)
 Amplifier switch "On"
- Preamp Connect pin 5 and pin 6
 Connect pin 3 and pin 4 (note pin 3 is +12 Vdc)
 Connect pin 2 to transceiver PTT (gnd on xmit)
 Amplifier switch "Off"; Preamp switch "Off"
- RF Amp and Preamp
 Connect pin 5 and pin 6
 Connect pin 3 and pin 4 (note pin 3 is +12 Vdc)
 Connect pin 2 to transceiver PTT (gnd on xmit)
 Amplifier switch "On"; Preamp switch "Off"
- RF Amp and Preamp disabled
 Disconnect pin 5 and pin 6; disable PTT from pin 2

General Comment on PTT Operation

For hard keying the amp, put the front panel mode switch in "FM" mode (this assures fast relay switching). Then connect pin 2 of the remote plug to the transceiver's PTT output and pin 6 to the transceiver's ground. The transceiver's PTT should ground on transmit and remain near +12V on receive. Keying the transceiver's mic will key the power amplifier into the "RF ON" condition and return the amplifier to "RF OFF" immediately upon unkeying.

Temperature Considerations

Normal operation of the amplifier using

intermittent duty (ICAS ratings) will allow the internal dissipated power to adequately convection cool to the ambient air via the heatsink fins. The heatsink fins are anodized black to provide very high cooling efficiency to the ambient air. To maximize this cooling efficiency, the fins should be mounted facing upwards, and adequate air space must be allowed (see installation -- mounting).

It is important that the amplifier's heatsink temperature remain within acceptable levels in order to allow proper amplifier operation and to prevent damage to internal components. The acceptable duty levels are 50% or less with transmission durations less than one minute and heatsink temperatures less than +60 degrees Centigrade.

If the heatsink temperature does rise above +65 degrees Centigrade during operation, a temperature thermostat switch within the unit switches off the power amplifying mode. Upon switching, the unit must cool down 10 degrees before the switch resets to allow the amplifier to again operate. This failsafe feature prevents accidental keying or extended operation from causing amplifier damage.

If long transmissions are required, the unit's heatsink must be cooled by either forced air or conductively cooled to a cool body. Forced air is the best means and can be performed with a small boxer type fan. TE Systems suggests activating the fan from the remote accessory socket and incorporating a time delay to allow the fan to run slightly longer than the total transmission time. Contact TE Systems or its agent for application assistance on this.

Section IV - Theory of Operation

RF Power Amplification

When the transmitted signal from a transceiver is applied to the "XCVR" connector and the power amplifier is switched "on", a small amount of signal is coupled off, detected, and activates the T/R switching control circuitry. The T/R relays then close and the incoming signal travels to the RF power amplifier stages. Upon termination of the transmitter's signal, the T/R switching circuitry senses the loss of RF and causes the relays return to their normally closed position and RF amplification is terminated.

The RF power amplification scheme is accomplished in one stage consisting of four parallel-connected, high-gain transistors. The incoming signal is divided to drive all four devices equally in power and in phase. After amplification, the four output stage powers are combined in phase and the resultant signal passes through the T/R relay, the output filter, and to the "ANTENNA" connector.

Each amplifier stage is run in a class AB biased configuration that allows greatly improved linearity and smooth power transfer performance. The bias arrangement is hard biased to make DC bias voltage changes less sensitive to RF levels and silicon diodes are used to provide thermal bias tracking to the RF power transistors.

TE Systems has designed each amplifying stage to have a low Q performance. This allows wider bandwidth amplifier response while keeping RF losses at a minimum. The result is a RF amplifier with performance over a large segment of the band without retuning. Efficiency is kept high by state-of-the-art design and quality components that minimize heat dissipation and reduce current consumption.

All DC control circuits are appropriately bypassed to eliminate possible RF spurious products. Low frequency feedback circuits are installed where needed to prevent low frequency spurious products attributable to common emitter VHF/UHF power transistors.

Finally, the amplified signal is applied to the amplifier's low pass filter and on to the "ANTENNA" connector. All amplifiers incorporate a low-pass filter designed specifically for the frequency range which allows maximization of the stop-band attenuation for the harmonics and minimization of the loss in-band.

Receive Low-Noise Amplifier

When the front panel preamp switch is activated to the "on" position, the incoming signal is fed into the receive preamp.

The received signal is applied to the low-noise GaAs FET transistor by impedance matching the signal to the gate of the device. In this case, impedance matching is actually noise figure matching such that a minimum noise figure performance is achieved. The amplified signal is then impedance matched into a bandpass filter and then to the 50 Ohm output (antenna port).

Selectivity is achieved by the frequency selective input match and the single pole filter at the device's output. The use of the additional output selectivity further enhances out-of-band signal rejection with only minimal in-band signal attenuation. The gain variation is typically 1 - 2 dB within 2% of the center band. This is sufficiently broad to not cause receiving variations within the band.

Proprietary circuitry is employed to inhibit the transmit signal from damaging the sensitive low-noise GaAs FET device. Therefore, the application of high power transmit signals cannot cause GaAs FET device failure. Upon transmitting, the T/R relays activate immediately to switch the transmitted signal away from the preamp and into the RF power amplifier section. Additionally, since the preamplifier is protected from RF burnout, other atmospheric signal transients coming from the antenna are less likely to cause GaAs FET device failure.

T/R Switching

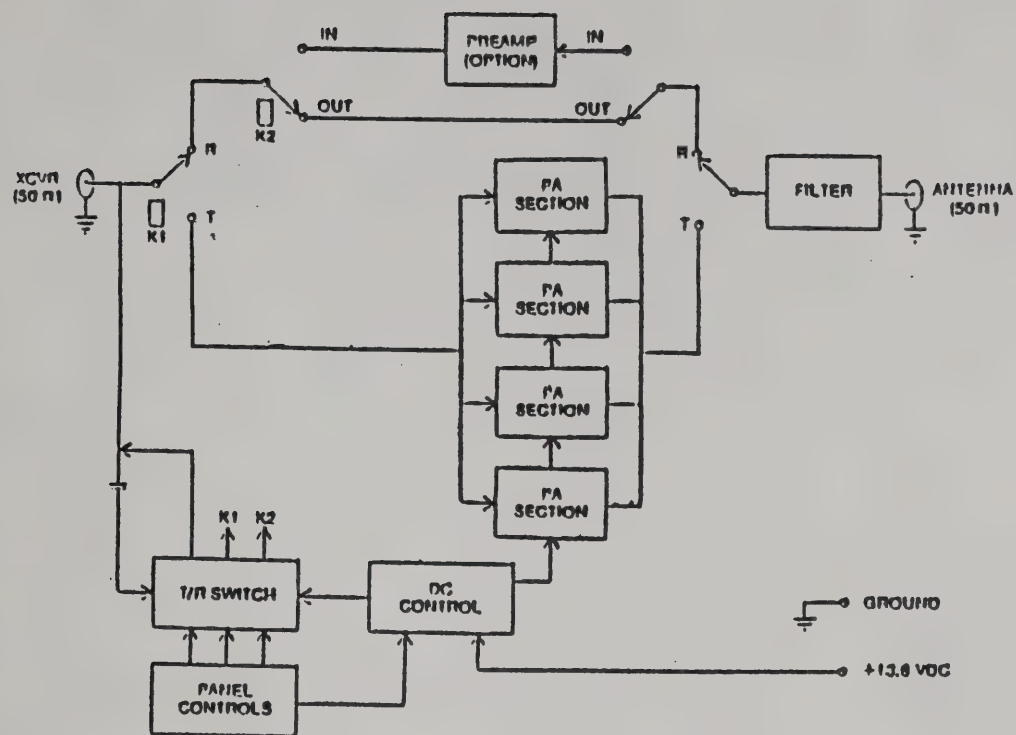
As mentioned in the section "RF Power Amplification", the

amplifier's transceive switching is done by relays driven by the T/R switching DC control circuit. With no transmitted signal applied, the main T/R relay remains in the receive position and (with the preamp option) the receive preamp relay may or may not be switched in.

When transmission commences, the main T/R relay is driven to switch the incoming signal to the amplifying stages. If optioned, the preamp relay is simultaneously driven to switch out the preamp and disconnect its DC voltage.

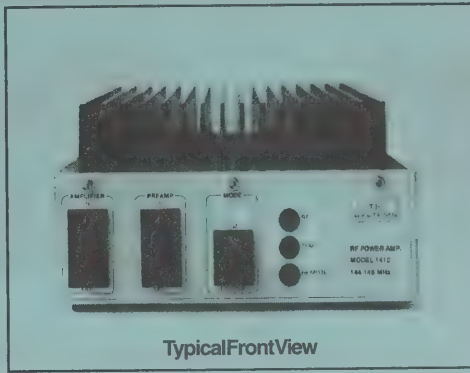
In all front panel switching configurations, the receive GaAs FET preamplifier is protected from RF burnout attributable to the incoming RF signal or the amplified signal. This unique feature allows the usage of high quality, low-noise GaAs FET transistors in the receive preamplifier thereby providing superior receiving performance unobtainable heretofore.

BLOCK DIAGRAM

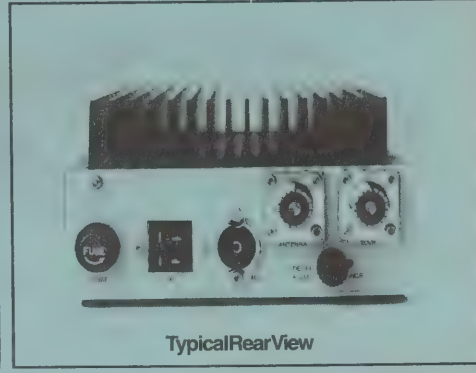


SYSTEM BLOCK DIAGRAM

RF AMPLIFIERS - VHF/UHF AMATEUR MOBILE/BASE STANDARD SERIES



Typical Front View



Typical Rear View

FEATURES

- Linear all-mode operation with automatic T/R or P.T.T. switching and adjustable relay delay control. Linear operation allows SSB, FM, or CW operation with drive power levels usable down to 1/2 watt.
- Receive GaAs FET pre-amplifier option available - factory installed or addable by us at a later date. Preamps use GaAs FET devices rated at .5db with +18 dbm 3rd-order intercept point. The result is superior weak signal reception with improved strong signal intermod rejection.
- Thermal shutdown protection built-in. Since extended transmission at full power produces temperature build-up in all amplifiers, a thermostatic switch is incorporated to protect the amplifier at temperatures exceeding +65°C.
- Remote control feature available to switch in/out the amplifier and to defeat LED illumination (to drop current drain for rear trunk-mounted amps).
- Excellent electrical and mechanical construction integrity using the best quality components and workmanship. User friendly controls are mounted on front panel with all RF and DC cables attached out of sight on rear panel. LED status lights on front continuously monitor the operating state of the unit. All models are manufactured in U.S.A. and carry a factory warranty.
- Designed to ICAS ratings and meets FCC part 97 regulations.

SPECIFICATIONS

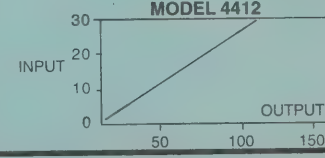
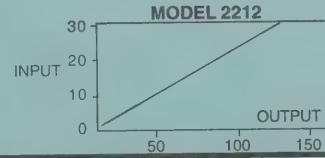
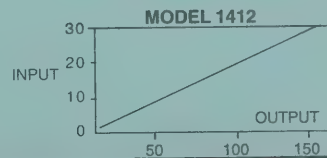
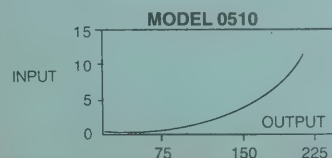
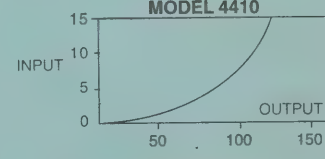
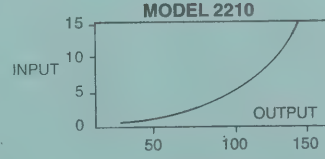
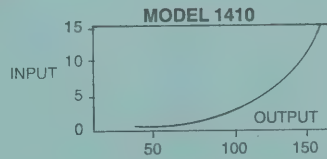
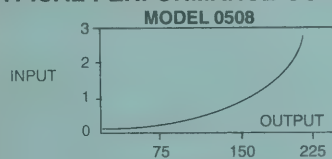
Model	Freq (MHz)	PowerOut (W)	PowerIn (W)	DCPower (Vdc) (A)	Preamp NF Gain	Connector (RF)	Size (Inches)
0505	50-54 ¹	80	4-8	13.8	12 - -	UHF	3x6x11
0505G	50-54 ¹	80	4-8	13.8	12 .6 15	UHF	3x6x11
0506	50-54 ¹	80	5	13.8	10 - -	UHF	3x6x11
0506G	50-54 ¹	80	5	13.8	10 .6 15	UHF	3x6x11
0508	50-54 ¹	170	1	13.8	28 - -	UHF	3x6x11
0508G	50-54 ¹	170	1	13.8	28 .6 15	UHF	3x6x11
0510	50-54 ¹	170	10	13.8	25 - -	UHF	3x6x11
0510G	50-54 ¹	170	10	13.8	25 .6 15	UHF	3x6x11
1405	144-148	100	1-2	13.8	14 - -	UHF	3x6x11
1405G	144-148	100	1-2	13.8	14 .6 15	UHF	3x6x11
1406	144-148	100	25	13.8	12 - -	UHF	3x6x11
1406G	144-148	100	25	13.8	12 .6 15	UHF	3x6x11
1409	144-148	150	2	13.8	25 - -	UHF	3x6x11
1409G	144-148	150	2	13.8	25 .6 15	UHF	3x6x11
1410	144-148	160	5-10	13.8	26 - -	UHF	3x6x11
1410G	144-148	160	5-10	13.8	26 .6 15	UHF	3x6x11
1412	144-148	160	25-45	13.8	20 - -	UHF	3x6x11
1412G	144-148	160	25-45	13.8	20 .6 15	UHF	3x6x11
Model	Freq (MHz)	PowerOut (W)	PowerIn (W)	DCPower (Vdc) (A)	Preamp NF Gain	Connector (RF)	Size (Inches)
2205	220-225	70	1-2	13.8	12 - -	UHF	3x6x11
2205G	220-225	70	1-2	13.8	12 .7 14	UHF	3x6x11
2206	220-225	70	10-25	13.8	10 - -	UHF	3x6x11
2206G	220-225	70	10-25	13.8	10 .7 14	UHF	3x6x11
2210	220-225	130	5-10	13.8	20 - -	UHF	3x6x11
2210G	220-225	130	5-10	13.8	20 .7 14	UHF	3x6x11
2212	220-225	130	25-45	13.8	16 - -	UHF	3x6x11
2212G	220-225	130	25-45	13.8	16 .7 14	UHF	3x6x11
4405	420-450	50	2-4	13.8	9 - -	N	3x6x11
4405G	420-450	50	2-4	13.8	9 1.1 12	N	3x6x11
4406	420-450	50	25	13.8	7 - -	N	3x6x11
4410	420-450 ²	100	10	13.8	19 - -	N	3x6x11
4410G	420-450 ²	100	10	13.8	19 1.1 12	N	3x6x11
4412	420-450 ²	100	15-30	13.8	19 - -	N	3x6x11
4412G	420-450 ²	100	15-30	13.8	19 1.1 12	N	3x6x11
4414	420-450	100	35-45	13.8	14 - -	N	3x6x11
4414G	420-450	100	35-45	13.8	14 1.1 12	N	3x6x11

1. 2 MHz bandwidth within band.
2. 10 MHz bandwidth within band.

ACCESSORIES:

- | | |
|-----------|---|
| MMB-1 | Mobile-Mount Bracket + Mounting Hardware |
| FAN-STD | Cooling Fan + Bracket |
| CML Cover | Commercial Cover with Mounting Lip for surface attachment |

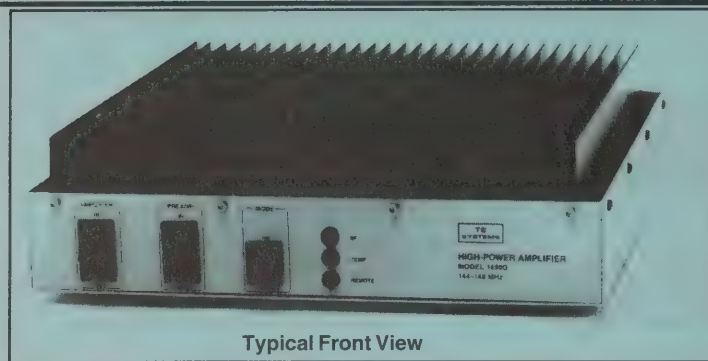
TYPICAL PERFORMANCE CURVES



ORDERING INFORMATION

- Dealer orders are recommended in order to provide best service and support to our customers. Standard models are tuned at midband for the power amplifier and preamp (-G models only). 50-54 MHz models are optimized at 50.2 MHz. All models include a complete operating/service manual.
- Factory orders are available for standard models as well as specials. Pricing for standard models is suggested list. Special designs/options pricing and terms are as quoted from the factory. All shipments are UPS (insured), FOB Los Angeles.
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RF AMPLIFIERS - VHF/UHF AMATEUR HPA SERIES



Typical Front View



Typical Rear View

FEATURES

- High-power linear RF amplifier with automatic RF switching or hard-keying and adjustable delay control. Linear operation allows SSB, FM or CW operation with drive levels usable down to 1/2 Watt.
- Receive GaAs FET preamplifier option in models with G suffix. Preamps use GaAs FET devices rated at .5 dB NF with +18 dB 3rd-order intercept point. The result is superior weak signal reception with improved strong signal intermod rejection.
- Thermal shutdown protection built-in. Since extended transmission at full power produces temperature build-up in all amplifiers, a thermostatic switch is incorporated to protect the amplifier at temperatures exceeding +65°C.
- Remote control features provide: amp in/out, preamp in/out, hard-keying, and LED illumination defeat.
- Excellent electrical and mechanical construction integrity using the best quality components and workmanship. User friendly controls are mounted on the front panel with all RF and DC cables attached out of sight on the rear panel. LED status lights on front continuously monitor the operating state of the unit. All models are manufactured in the U.S.A. and carry a factory warranty.
- Designed to ICAS ratings and meets FCC part 90 regulations.

SPECIFICATIONS

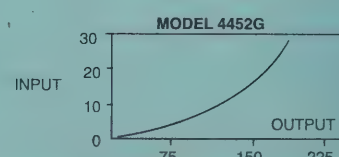
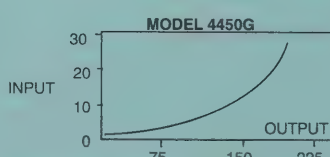
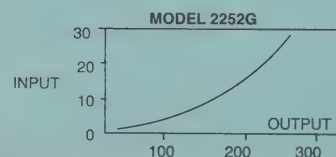
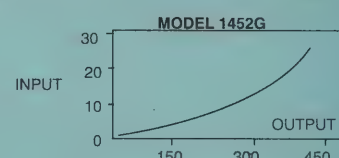
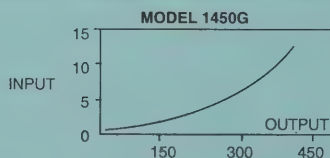
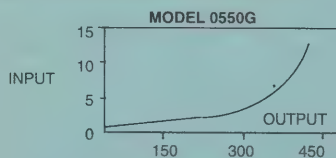
Model	Freq (MHz)	PowerOut (W)	PowerIn (W)	DCPower (Vdc) (A)	Preamp NF Gain	Connector (RF)	Size (Inches)	Model	Freq (MHz)	PowerOut ¹ (W)	PowerIn (W)	DCPower (Vdc) (A)	Preamp NF Gain	Connector (RF)	Size (Inches)
0548	50-54 ¹	170	.1-2	13.8 30	-	UHF	3 x 10 x 11	2248	220-225	130	.5-1	13.8 22	-	UHF	3 x 10 x 11
0548G	50-54 ¹	170	.1-2	13.8 30	.6 15	UHF	3 x 10 x 11	2248G	220-225	130	.5-1	13.8 22	.7 14	UHF	3 x 10 x 11
0550	50-54 ¹	375	10	13.8 59	-	UHF	3 x 10 x 11	2250	222-225	220	5-10	13.8 40	-	UHF	3 x 10 x 11
0550G	50-54 ¹	375	10	13.8 59	.6 15	UHF	3 x 10 x 11	2250G	222-225	220	5-10	13.8 40	.7 14	UHF	3 x 10 x 11
0552	50-54 ¹	375	40	13.8 54	-	UHF	3 x 10 x 11	2252	222-225	220	10-25	13.8 36	-	UHF	3 x 10 x 11
0552G	50-54 ¹	375	40	13.8 54	.6 15	UHF	3 x 10 x 11	2252G	222-225	220	10-25	13.8 36	.7 14	UHF	3 x 10 x 11
1448	144-148	160	.25-.5	13.8 27	-	UHF	3 x 10 x 11	2254	222-225	220	75	13.8 32	-	UHF	3 x 10 x 11
1448G	144-148	160	.25-.5	13.8 27	.6 .15	UHF	3 x 10 x 11	2254G	222-225	220	75	13.8 32	.7 14	UHF	3 x 10 x 11
1450	144-148	350	5-10	13.8 56	-	UHF	3 x 10 x 11	4448	420-450 ²	75-100	1-5	13.8 25	-	N	3 x 10 x 11
1450G	144-148	350	5-10	13.8 56	.6 15	UHF	3 x 10 x 11	4448G	420-450 ²	75-100	1-5	13.8 25	1.1 12	N	3 x 10 x 11
1452	144-148	350	10-25	13.8 50	-	UHF	3 x 10 x 11	4450	420-450 ²	170	2-6	13.8 34	-	N	3 x 10 x 11
1452G	144-148	350	10-25	13.8 50	.6 15	UHF	3 x 10 x 11	4450G	420-450 ²	170	2-6	13.8 34	1.1 12	N	3 x 10 x 11
1454	144-148	350	75	13.8 40	-	UHF	3 x 10 x 11	4452	420-450 ²	170	25	13.8 29	-	N	3 x 10 x 11
1454G	144-148	350	75	13.8 40	.6 15	UHF	3 x 10 x 11	4452G	420-450 ²	170	25	13.8 29	1.1 12	N	3 x 10 x 11
								4454	420-450 ²	170	60-80	13.8 25	-	N	3 x 10 x 11
								4454G	420-450 ²	170	60-80	13.8 25	1.1 12	N	3 x 10 x 11

1. 2 MHz bandwidth within band.
2. 10 MHz bandwidth within band.

ACCESSORIES:

- | | |
|------------|--|
| MMB-2 | Mobile-Mount Bracket + Mounting Hardware |
| FAN-HPA | Cooling Fan + Bracket |
| VENT COVER | Vented Cover to allow improved cooling. |

TYPICAL PERFORMANCE CURVES



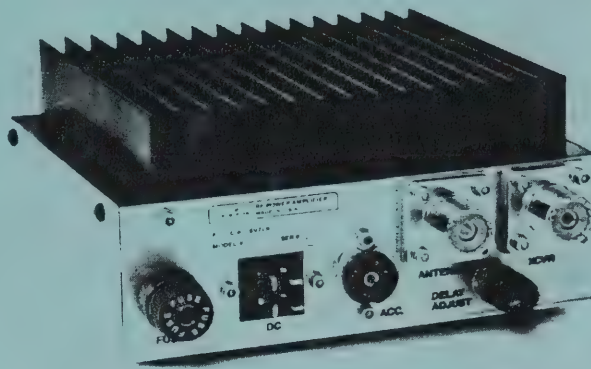
ORDERING INFORMATION

- Dealer orders are recommended in order to provide best service and support to our customers. Standard models are tuned at midband for the power amplifier and preamp (-G models only). 50-54 MHz models are optimized at 50.2 MHz. All models include a complete operating/service manual.
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RF AMPLIFIERS - VHF/UHF AMATEUR LPA SERIES



Typical Front View



Typical Rear View

FEATURES

- Linear all-mode operation with automatic T/R or P.T.T. switching and adjustable delay control. Linear operation allows SSB, FM or CW operation with drive power levels usable down to 1/2 Watt.
- Receive GaAs FET pre-amplifier option available - factory installed or addable by us at a later date. Preamps use GaAs FET devices rated at .5 dB NF with +18 dB 3rd-order intercept point. The result is superior weak signal reception with improved strong signal intermod rejection.
- Thermal shutdown protection built-in. Since extended transmission at full power produces temperature build-up in all amplifiers, a thermostatic switch is incorporated to protect the amplifier at temperatures exceeding +65°C.
- Remote control input available for "hard-keying" the amplifier.
- Excellent electrical and mechanical construction integrity using the best quality components and workmanship. User friendly controls are mounted on the front panel with all RF and DC cables attached out of sight on the rear panel. LED status lights on front continuously monitor the operating state of the unit. All models are manufactured in the U.S.A. and carry a factory warranty.
- Designed to ICAS ratings and meets FCC part 90 regulations.

SPECIFICATIONS

Model	Frequency (MHz)	PowerOut (W)	PowerIn (W)	DCPower (Vdc)	DCPower (A)	Preamp NF Gain	Connector	Size (RF)	(Inches)
0503	50-54	10-50	1-5	13.8	6	-	-	UHF	3 x 6 x 5
0503G	50-54	10-50	1-5	13.8	6	.6	15	UHF	3 x 6 x 5
1403	144-148	10-50	1-5	13.8	6	-	-	UHF	3 x 6 x 5
1403G	144-148	10-50	1-5	13.8	6	.6	15	UHF	3 x 6 x 5
2203	220-225	8-40	1-5	13.8	5	-	-	UHF	3 x 6 x 5
2203G	220-225	8-40	1-5	13.8	5	.7	14	UHF	3 x 6 x 5
4403	420-450 ¹	7-25	1-5	13.8	4	-	-	UHF	3 x 6 x 5
4403G	420-450 ¹	7-25	1-5	13.8	4	1.1	12	UHF	3 x 6 x 5

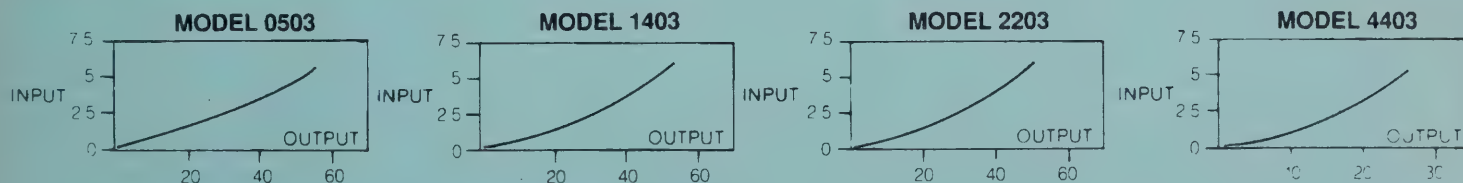
1. 10 MHz bandwidth within band.

ACCESSORIES:

MMB-3
FAN-LPA

Mobile - Mount Bracket + Mounting Hardware
Cooling Fan + Bracket

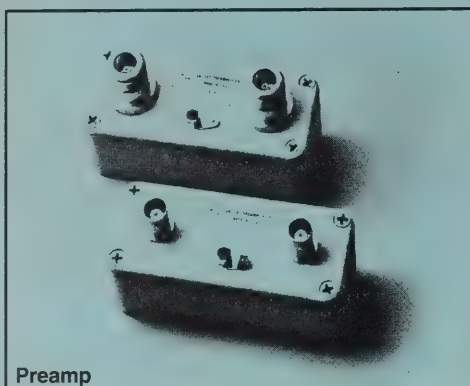
TYPICAL PERFORMANCE CURVES



ORDERING INFORMATION

- Dealer orders are recommended in order to provide best service and support to our costumers. Standard models are tuned at midband for the power amplifier and preamp (-G models only). 50-54 MHz models are optimized at 50.2 MHz. All models include a complete operating/service manual.
- Factory orders are available for standard models as well as specials. Pricing for standard models is suggested list. Special designs/options pricing and terms are as quoted from the factory. All shipments are UPS (insured), FOB Los Angeles.
- Although product information and descriptions are current, TE Systems reserves the right to improve or change its products, specifications, designs, and pricing without notice.

LOW-NOISE PREAMPLIFIERS - VHF/UHF AMATEUR COMMUNICATIONS SERIES


Preamp

Switching Preamp

Mast-Mount Preamp

FEATURES

PREAMP - Straight RF amplifier providing a minimum noise figure with highest associated gain. High quality GaAs FET transistors are used that have very low noise figure performance (.5dB typically). Additionally, they are rated at +18 dBm 3rd-order intercept point which minimizes intermod susceptibility. All units are housed in an RF tight finished enclosure with DC feedthru capacitor for RF bypassing.

SWITCHING PREAMP - Performance features are the same as the preamp except that the unit RF switches to a "thru" condition upon sensing transmitted RF power from a transceiver. Controls are provided to turn on/off, adjust the relay switching speed or hard key the unit from the transceiver's PTT line. All units are housed in a finished metal enclosure.

MAST-MOUNT PREAMP - Performance features are the same as the switching preamp except that this unit is separated into an RF section and a DC bias unit. The RF enclosure is weather tight and is mounted at the antenna (hardware bracket supplied) for minimum system noise performance. The DC control unit is operated in conjunction with the two-way radio and controls the operation of the RF preamp section remotely. Both units are housed in attractively styled finished metal enclosures.

SPECIFICATIONS

Model	Function	Frequency ¹ (MHz)	Preamp ² NF	Gain	MAX. RF Input (W)	DC Power (+Vdc)	(mA)	Connector (RF)	Size (h, w, d")
0520B	Preamp	50-54	.5	25	-	8-20	25	BNC	1 x 2 x 3
0520N	Preamp	50-54	.5	25	-	8-20	25	N	1 x 2 x 3
0525B	SW Preamp	50-54	.5	18	100	11-14	100	BNC	3 x 4 x 5
0535N	MM Preamp	50-54	.5	18	100	11-14	100	N	3 x 4 x 5
1420B	Preamp	144-148	.5	24	-	8-20	25	BNC	1 x 2 x 3
1420N	Preamp	144-148	.5	24	-	8-20	25	N	1 x 2 x 3
1425B	SW Preamp	144-148	.5	18	100	11-14	100	BNC	3 x 4 x 5
1435N	MM Preamp	144-148	.5	18	100	11-14	100	N	3 x 4 x 5
2220B	Preamp	220-225	.5	22	-	8-20	25	BNC	1 x 2 x 3
2220N	Preamp	220-225	.5	22	-	8-20	25	N	1 x 2 x 3
2225B	SW Preamp	220-225	.7	18	100	11-14	100	BNC	3 x 4 x 5
2235N	MM Preamp	220-225	.7	18	100	11-14	100	N	3 x 4 x 5
4420B	Preamp	420-450	.5	18	-	8-20	25	BNC	1 x 2 x 3
4420N	Preamp	420-450	.5	18	-	8-20	25	N	1 x 2 x 3
4425B	SW Preamp	420-450	.8	14	50	11-14	100	BNC	3 x 4 x 5
4435N	MM Preamp	420-450	.8	14	50	11-14	100	N	3 x 4 x 5
8820B	Preamp	806-960	.7	15	-	8-20	25	BNC	1 x 2 x 3
8820N	Preamp	806-960	.7	15	-	8-20	25	N	1 x 2 x 3
1020B	Preamp	1.2-1.3	.9	14	-	8-20	25	BNC	1 x 2 x 3
1020N	Preamp	1.2-1.3	.9	14	-	8-20	25	N	1 x 2 x 3

1. Specify exact frequency. 2. Preamp BW_{3dB} = 4% nom. SW and MM Preamp BW_{3dB} = 2% nom.

ORDERING INFORMATION

- Orders may be placed factory direct or through our authorized representative or dealer in your area.
- Specify model # and center frequency desired.
- All models include complete operating documentation, and are shipped UPS (insured), FOB Los Angeles.
- Although product information and descriptions are current, TE Systems reserves the right to improve or change its products, specifications, designs, and pricing without notice.

RF AMPLIFIERS - VHF/UHF AMATEUR REPEATER SERIES (MEDIUM POWER)



Typical Front View



Typical Rear View

FEATURES

- Amplifiers are rated for **continuous duty** and are configured for class C operation (best efficiency, lowest current draw).
- Cooling is by **convection** from the vertically-mounted, large heatsink area on the front side of the rack panel.
- All repeater amplifiers can be optionally configured with internal relay switching. Remote low-level control allows for either amplifier "on" performance or "rf-thru" operation. Specify relay/bypass option when ordering.
- Excellent electrical and mechanical construction integrity using the best quality components and workmanship. All models are manufactured in the U.S.A. and carry a 1 year factory warranty.
- Designed for continuous operation at the rated frequency and power and meets FCC part 97 regulations.

SPECIFICATIONS

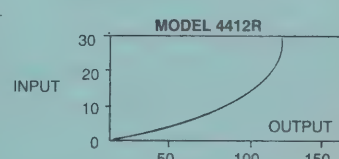
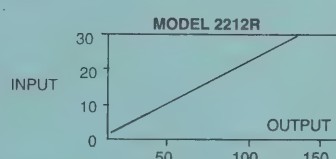
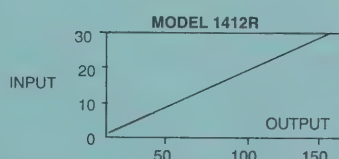
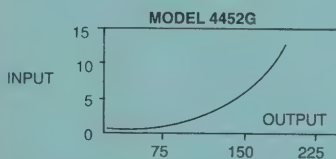
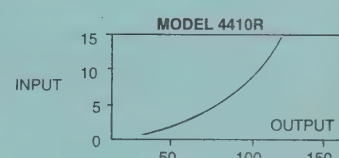
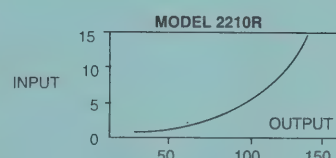
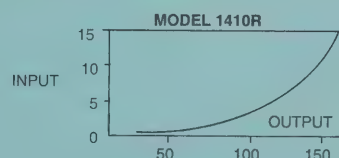
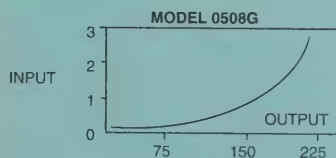
Model	Freq (MHz)	PowerOut (W)	PowerIn (W)	DCPower (Vdc)	(A)	Weight (lbs)	Connector (RF)	Size (inches)	Model	Freq (MHz)	PowerOut (W)	PowerIn (W)	DCPower (Vdc)	(A)	Weight (lbs)	Connector (RF)	Size (inches)
0508R	50-54 ¹	170	1	13.8	28	15	UHF	4 x 12 x 19	2206RN	220-225	70	10-25	13.8	10	14	UHF	4 x 9 x 19
0510R	50-54 ¹	170	10	13.8	25	15	UHF	4 x 12 x 19	2210R	222-225	130	5-10	13.8	20	15	UHF	4 x 12 x 19
0548R	50-54 ¹	170	.1-2	13.8	30	17	UHF	4 x 12 x 19	2212R	222-225	130	25-45	13.8	16	15	UHF	4 x 12 x 19
1406RN	144-148	100	25	13.8	12	14	UHF	4 x 9 x 19	2248R	220-225	130	.5-1	13.8	22	17	UHF	4 x 12 x 19
1409R	144-148	150	2	13.8	25	15	UHF	4 x 12 x 19	4410R	420-450 ²	100	10	13.8	19	15	N	4 x 12 x 19
1410R	144-148	160	5-10	13.8	26	15	UHF	4 x 12 x 19	4412R	420-450 ²	100	15-30	13.8	19	15	N	4 x 12 x 19
1412R	144-148	160	25-45	13.8	20	15	UHF	4 x 12 x 19	4414R	420-450 ²	100	35-45	13.8	14	17	N	4 x 12 x 19
1448R	144-148	160	.25-.5	13.8	27	17	UHF	4 x 12 x 19	4448R	420-450 ²	75-100	1-5	13.8	25	17	N	4 x 12 x 19

1. 2 MHz bandwidth within band.
2. 10 MHz bandwidth within band.

ACCESSORIES:

FAN-R Cooling Fan + Bracket

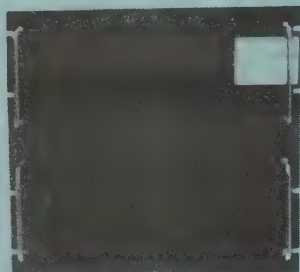
TYPICAL PERFORMANCE CURVES



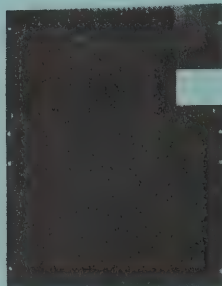
ORDERING INFORMATION

- Dealer orders are recommended in order to provide best service and support to our customers. All repeater amps are tuned at midband or at customer's exact frequency. All models include a complete operating/service manual.
- Factory orders are available for standard models as well as specials. Pricing for standard models is suggested list. Special designs/options pricing and terms are as quoted from the factory. All shipments are UPS (insured), FOB Los Angeles.
- Although product information and descriptions are current, TE Systems reserves the right to improve or change its products, specifications, designs, and pricing without notice.

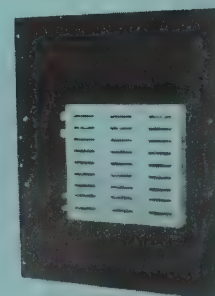
RF AMPLIFIERS - VHF/UHF AMATEUR REPEATER SERIES (HIGH POWER)



Front View - RE



Front View - RH



Typical Rear View

FEATURES

- High-Power Amplifiers (HPA's) are rated for **continuous duty** high output power operation and are configured for class C operation (best efficiency, lowest current draw).
- Cooling is by **convection** from the vertically-mounted, large heatsink area on the front side of the rack panel. VHF amplifiers require a 19 x 24.5 x 5" (w,h,d) size; UHF amplifiers require a 19 x 17.5 x 5" (w,h,d) size. Smaller EIA vertical sizes can be supplied but require use of our optional fan cooling hardware.
- Proven design integrity using best quality components and workmanship assure long-lasting continuous duty performance. All models are manufactured in the U.S.A. and carry a 1 year factory warranty.
- Designed for continuous operation at the rated frequency and power and meets FCC part 97 regulations.

SPECIFICATIONS

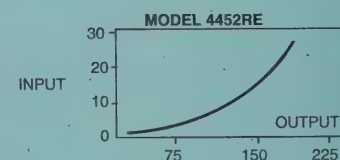
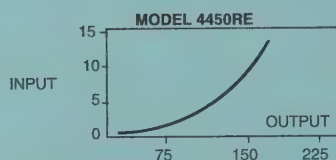
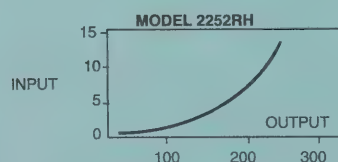
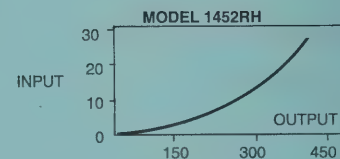
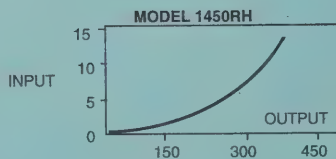
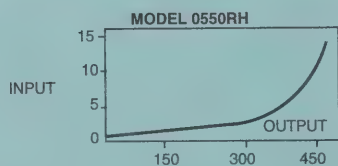
Model	Frequency (MHz)	PowerOut (W)	PowerIn (W)	DCPower (Vdc)	Weight (A)	Connector (lbs)	Size (RF)	(inches)
0550RH	50-54 ¹	375	5-10	13.8	59	27	UHF	19 x 24.5 x 5
0552RH	50-54 ¹	375	40	13.8	54	27	UHF	19 x 24.5 x 5
1450RH	144-148	350	2-6	13.8	56	27	UHF	19 x 24.5 x 5
1452RH	144-148	350	10-25	13.8	50	27	UHF	19 x 24.5 x 5
1454RH	144-148	350	75	13.8	40	27	UHF	19 x 24.5 x 5
2250RH	222-225	220	2-6	13.8	40	27	UHF	19 x 24.5 x 5
2252RH	222-225	220	10-25	13.8	36	27	UHF	19 x 24.5 x 5
2254RH	222-225	220	75	13.8	32	27	UHF	19 x 24.5 x 5
4450RE	420-450 ²	175	2-6	13.8	34	23	N	19 x 17.5 x 5
4452RE	420-450 ²	175	25	13.8	29	23	N	19 x 17.5 x 5
4454RE	420-450 ²	175	60-80	13.8	25	23	N	19 x 17.5 x 5

1. 2 MHz bandwidth within band.
2. 10 MHz bandwidth within band.

ACCESSORIES:

- FAN-RE Cooling fan+bracket (12 Vdc Fits all -RE repeater amplifiers)
FAN-RH Cooling fan+bracket (12 Vdc Fits all -RH repeater amplifiers)

TYPICAL PERFORMANCE CURVES



ORDERING INFORMATION

- Dealer orders are recommended in order to provide best service and support to our costumers. All repeater amps are tuned at midband or at costumers exact frequency. All models include a complete operating/service manual.
- Factory orders are available for standard models as well as specials. Pricing for standard models is suggested list. Special designs/options pricing and terms are as quoted from the factory. All shipments are UPS (insured), FOB Los Angeles.
- Although product information and descriptions are current, TE Systems reserves the right to improve or change its products, specifications, designs, and pricing without notice.

PRICE SHEET - AMATEUR SERIES AMPLIFIER AND PREAMP PRODUCTS

50 MHz

Model#	Type	Freq (MHz)	P(in) (W)	P(out) (W)	Ic (A)	Options	Size (h,w,d")	Price \$
0503	LPA	50-54	1-5	10-50	6		3x6x5	185
0503G	LPA	50-54	1-5	10-50	6	Preamp	3x6x5	198
0505	Mobile	50-54	4-8	80	12		3x6x11	293
0505G	Mobile	50-54	4-8	80	12	Preamp	3x6x11	311
0506	Mobile	50-54	5	80	10		3x6x11	272
0506G	Mobile	50-54	5	80	10	Preamp	3x6x11	290
0508	Mobile	50-54	1	170	28		3x6x11	336
0508G	Mobile	50-54	1	170	28	Preamp	3x6x11	349
0508R	Cont Duty	50-54	1	170	28		12x19x4	521
0510	Mobile	50-54	10	170	25		3x6x11	281
0510G	Mobile	50-54	10	170	25	Preamp	3x6x11	299
0510R	Cont Duty	50-54	10	170	25		12x19x4	466

Model#	Type	Freq (MHz)	P(in) (W)	P(out) (W)	Ic (A)	Options	Size (h,w,d")	Price \$
0548	HPA	50-54	1-2	170	30		3x10x11	381
0548G	HPA	50-54	1-2	170	30	Preamp	3x10x11	399
0548R	Cont Duty	50-54	1-2	170	30		12x19x4	566
0550	HPA	50-54	5-10	375	59		3x10x11	456
0550G	HPA	50-54	5-10	375	59	Preamp	3x10x11	475
0550RH	Cont Duty	50-54	2-6	375	59		24x19x4	706
0552	HPA	50-54	40	375	54		3x10x11	418
0552G	HPA	50-54	40	375	54	Preamp	3x10x11	437
0552RH	Cont Duty	50-54	40	375	54		24x19x4	668

144 MHz

Model#	Type	Freq (MHz)	P(in) (W)	P(out) (W)	Ic (A)	Options	Size (h,w,d")	Price \$
1403	LPA	144-148	1-5	10-50	6		3x6x5	134
1403G	LPA	144-148	1-5	10-50	6	Preamp	3x6x5	153
1405	Mobile	144-148	1-2	100	14		3x6x11	257
1405G	Mobile	144-148	1-2	100	14	Preamp	3x6x11	278
1406	Mobile	144-148	25	100	12		3x6x11	226
1406G	Mobile	144-148	25	100	12	Preamp	3x6x11	244
1406RH	Cont Duty	144-148	25	100	12		9x19x4	401
1409	Mobile	144-148	2	150	25		3x6x11	281
1409G	Mobile	144-148	2	150	25	Preamp	3x6x11	299
1409R	Cont Duty	144-148	2	150	25		12x19x4	466
1410	Mobile	144-148	5-10	160	26		3x6x11	289
1410G	Mobile	144-148	5-10	160	26	Preamp	3x6x11	308
1410R	Cont Duty	144-148	5-10	160	26		12x19x4	474
1412	Mobile	144-148	25-45	160	20		3x6x11	254
1412G	Mobile	144-148	25-45	160	20	Preamp	3x6x11	269
1412R	Cont Duty	144-148	25-45	160	20		12x19x4	439

Model#	Type	Freq (MHz)	P(in) (W)	P(out) (W)	Ic (A)	Options	Size (h,w,d")	Price \$
1448	HPA	144-148	25-5	160	27		3x10x11	421
1448G	HPA	144-148	25-5	160	27	Preamp	3x10x11	439
1448R	Cont Duty	144-148	25-5	160	27		12x19x4	606
1450	HPA	144-148	5-10	350	56		3x10x11	512
1450G	HPA	144-148	5-10	350	56	Preamp	3x10x11	531
1450RH	Cont Duty	144-148	5-10	350	56		24x19x4	762
1452	HPA	144-148	10-25	350	50		3x10x11	468
1452G	HPA	144-148	10-25	350	50	Preamp	3x10x11	487
1452RH	Cont Duty	144-148	10-25	350	50		24x19x4	718
1454	HPA	144-148	75	350	40		3x10x11	439
1454G	HPA	144-148	75	350	40	Preamp	3x10x11	458
1454RH	Cont Duty	144-148	75	350	40		24x19x4	689

220 MHz

Model#	Type	Freq (MHz)	P(in) (W)	P(out) (W)	Ic (A)	Options	Size (h,w,d")	Price \$
2203	LPA	220-225	1-5	8-40	5		3x6x5	138
2203G	LPA	220-225	1-5	8-40	5	Preamp	3x6x5	156
2205	Mobile	220-225	1-2	70	12		3x6x11	268
2205G	Mobile	220-225	1-2	70	12	Preamp	3x6x11	286
2206	Mobile	220-225	10-25	70	10		3x6x11	244
2206G	Mobile	220-225	10-25	70	10	Preamp	3x6x11	263
2206RH	Cont Duty	220-225	10-25	70	10		9x19x4	419
2210	Mobile	220-225	5-10	130	20		3x6x11	297
2210G	Mobile	220-225	5-10	130	20	Preamp	3x6x11	321
2210R	Cont Duty	220-225	5-10	130	20		12x19x4	482
2212	Mobile	220-225	25-45	130	16		3x6x11	270
2212G	Mobile	220-225	25-45	130	16	Preamp	3x6x11	295
2212R	Cont Duty	220-225	25-45	130	16		12x19x4	455

Model#	Type	Freq (MHz)	P(in) (W)	P(out) (W)	Ic (A)	Options	Size (h,w,d")	Price \$
2248	HPA	220-225	5-1	130	22		3x10x11	381
2248G	HPA	220-225	5-1	130	22	Preamp	3x10x11	399
2248R	Cont Duty	220-225	5-1	130	22		12x19x4	566
2250	HPA	220-225	5-10	220	40		3x10x11	517
2250G	HPA	220-225	5-10	220	40	Preamp	3x10x11	536
2250RH	Cont Duty	220-225	5-10	220	40		24x19x4	767
2252	HPA	220-225	10-25	220	36		3x10x11	477
2252G	HPA	220-225	10-25	220	36	Preamp	3x10x11	495
2252RH	Cont Duty	220-225	10-25	220	36		24x19x4	727
2254	HPA	220-225	75	220	32		3x10x11	456
2254G	HPA	220-225	75	220	32	Preamp	3x10x11	475
2254RH	Cont Duty	220-225	75	220	32		24x19x4	706

440 MHz

Model#	Type	Freq (MHz)	P(in) (W)	P(out) (W)	Ic (A)	Options	Size (h,w,d")	Price \$
4403	LPA	420-450	1-5	7-25	4		3x6x5	167
4403G	LPA	420-450	1-5	7-25	4	Preamp	3x6x5	185
4405	Mobile	420-450	2-4	50	9		3x6x11	269
4405G	Mobile	420-450	2-4	50	9	Preamp	3x6x11	288
4406	Mobile	420-450	25	50	7		3x6x11	247
4406G	Mobile	420-450	25	50	7	Preamp	3x6x11	265
4410	Mobile	420-450	10	100	19		3x6x11	323
4410G	Mobile	420-450	10	100	19	Preamp	3x6x11	341
4410R	Cont Duty	420-450	10	100	19		12x19x4	508
4412	Mobile	420-450	15-30	100	19		3x6x11	314
4412G	Mobile	420-450	15-30	100	19	Preamp	3x6x11	332
4412R	Cont Duty	420-450	15-30	100	19		12x19x4	499
4414	Mobile	420-450	35-45	100	14		3x6x11	293
4414G	Mobile	420-450	35-45	100	14	Preamp	3x6x11	311
4414R	Cont Duty	420-450	35-45	100	14		12x19x4	478

Model#	Type	Freq (MHz)	P(in) (W)	P(out) (W)	Ic (A)	Options	Size (h,w,d")	Price \$
4448	HPA	420-450	1-5	75-100	25		3x10x11	381
4448G	HPA	420-450	1-5	75-100	25	Preamp	3x10x11	399
4448R	Cont Duty	420-450	1-5	75-100	25		12x19x4	566
4450	HPA	420-450	2-6	175	34		3x10x11	517
4450G	HPA	420-450	2-6	175	34	Preamp	3x10x11	536
4450RE	Cont Duty	420-450	2-6	175	34		17x19x4	737
4452	HPA	420-450	25	175	29		3x10x11	480
4452G	HPA	420-450	25	175	29	Preamp	3x10x11	499
4452RE	Cont Duty	420-450	25	175	29		17x19x4	700
4454	HPA	420-450	60-80	175	25		3x10x11	466
4454G	HPA	420-450	60-80	175	25	Preamp	3x10x11	484
4454RE	Cont Duty	420-450	60-80	175	25		17x19x4	686

PRICE SHEET - AMATEUR SERIES AMPLIFIER AND PREAMP PRODUCTS

LOW-NOISE PREAMPLIFIERS								ACCESSORIES		
Model#	Type	Freq (MHz)	NF	Gain	DC (Vdc)	Conn	Price \$	Model #	Description	Price \$
0520B	Preamp	50-54	.5	25	8-20	BNC	69	MMB-1	Mobile Mount Bracket (fits all 3x6x11" Mobile Amplifiers)	15
0520N	Preamp	50-54	.5	25	8-20	N	79	MMB-2	Mobile Mount Bracket (fits all 3x10x11" HPA Amplifiers)	15
0525B	SWPreamp	50-54	.5	18	11-14	BNC	134	MMB-3	Mobile Mount Bracket (fits all 3x6x5" LPA Amplifiers)	15
0535N	MMPreamp	50-54	.5	18	11-14	N	185	FAN-LPA	Cooling Fan + Bracket (12Vdc, fits all 3x6x5" LPA Amplifiers)	60
1420B	Preamp	144-148	.5	24	8-20	BNC	69	FAN-STD	Cooling Fan + Bracket (12Vdc, fits all 3x6x11" Mobile Amplifiers)	68
1420N	Preamp	144-148	.5	24	8-20	N	79	FAN-HPA	Cooling Fan + Bracket (12 Vdc, fits all 3x10x11" HPA Amplifiers)	72
1425B	SWPreamp	144-148	.5	18	11-14	BNC	134	FAN-RN	Cooling Fan + Bracket (12 Vdc, fits all -RN Repeater Amplifiers)	90
1435N	MMPreamp	144-148	.5	18	11-14	N	185	FAN-R	Cooling Fan + Bracket (12 Vdc, fits all -R Repeater Amplifiers)	90
2220B	Preamp	220-225	.5	22	8-20	BNC	69	FAN-RE	Cooling Fan + Bracket (12 Vdc, fits all -RE Repeater Amplifiers)	109
2220N	Preamp	220-225	.5	22	8-20	N	79	FAN-RH	Cooling Fan + Bracket (12 Vdc, fits all -RH Repeater Amplifiers)	109
2225B	SWPreamp	220-225	.5	18	11-14	BNC	134			
2235N	MMPreamp	220-225	.5	18	11-14	N	185			
4420B	Preamp	420-450	.5	18	8-20	BNC	69	Summary of Options for Repeater/Continuous Duty RN Continuous Duty/Conv cool 8.75x19x5" (19" rack-mount) Use RN for reduced height applications and lower Pout amps R Continuous Duty/Conv cool 12.25x19x5" (19" rack-mount) Use R for all VHF amps w/Pout=160W or UHF amps w/Pout=100W RE Continuous Duty/Conv cool 17.5x19x5" (19" rack-mount) Use RE for all UHF amps w/Pout=175W RH Continuous Duty/Conv cool 24x19x5" (19" rack-mount) Use RH for all VHF amps w/Pout=350W		
4420N	Preamp	420-450	.5	18	8-20	N	79			
4425B	SWPreamp	420-450	.5	14	11-14	BNC	134			
4435N	MMPreamp	420-450	.5	14	11-14	N	185			
8820B	Preamp	806-960	.7	15	8-20	BNC	125			
8820N	Preamp	806-960	.7	15	8-20	N	135			
1020B	Preamp	1200-1300	.9	14	8-20	BNC	125			
1020N	Preamp	1200-1300	.9	14	8-20	N	135			

COMPANY TE SYSTEMS designs and manufactures RF Amplifiers, RF Preamplifiers and RF Power Systems for Commercial and Military requirements. All design and manufacturing is done in Los Angeles at the company headquarters.

PRODUCTS RF Amplifier products are either standards selectable from catalog or special designs customized to particular application. Frequency coverage is HF through Microwave in either narrowband or wideband designs. All products are shipped with mating connectors and a complete operating/service manual. **TE SYSTEMS** maintains a large inventory of tested, ready-to-ship amps at the factory and has many distributors who maintain stock on popular models. Consult your local distributor or the factory for product availability.

WARRANTY All products carry a limited one year warranty covering replacement parts, labor and return shipment.

ORDERING Consult your local dealer or call factory direct. Specify model number and preferred frequency range as required. Orders may be placed via phone, fax or letter.

TERMS Factory orders may be MC/VISA, prepaid check or COD (add \$4.50 COD charge). Corporate orders are N30 with approved credit.

SHIPPING UPS (ground, 2-day, next-day), Fed-X, or Air Parcel-Post are available, UPS ground is the normal ship method. Export shipment is also available. Ship rates vary according to weight, distance and method.

SERVICING Most servicing is done at the factory because of the complexity of the unit. Normal turnaround is 3 weeks. All units receive factory design updates while servicing.

TECHNICAL ASSISTANCE TE SYSTEMS provides limited phone technical assistance and has a number of technical bulletins covering product updates and advice on operating/improved performance. Consult factory for details.


**TE
SYSTEMS**

P.O. Box 25845
Los Angeles, CA 90025

Affix
stamp
here

TO:

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*****
****          ***** Number: PL0552G          ****
****          PARTS LIST          ***** Dated: Jun 1991          ****
****          ***** Page: 1 of 2          ****
*****

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* Ref. Designation	* Quantity	* Description	*
* A1	1	Main amp board	*
* A2	1	T/R switch PC board	*
* A3	1	GaAs FET preamp (VHF)	*
* A1C1,A1C2,A1C3	3	560pF chip cap	*
* A1C4,A1C11,-1C38	3	.001mF disc cap.	*
* A1C8,A1C10	2	60pF variable cap.	*
* A1C9,	1	200pF metal cap.	*
* A1C13	1	Selected metal cap.	*
* A1C14	1	Selected metal cap.	*
* A1C15,A1C35	2	500pF metal cap.	*
* A1C16,A1C17,A1C36,A1C37	9	1000pF metal cap.	*
* A1C22,A1C23,A1C42,A1C43,A1C50			*
* A1C20,A1C21,A1C40,A1C41	6	.05uF disc cap.	*
* A1C46,A1C49			*
* A1C24,A1C44	2	750pF metal cap.	*
* A1C27	1	600pF metal cap.	*
* A1C28	1	150pF metal cap.	*
* A1C45	1	1000pF sm cap.	*
* A1C47	1	.1uF disc cap.	*
* A1C48	1	470uF electrolytic cap.	*
* A1C5,A1C6,A1C7,A1C12		Not used	*
* A1C18,A1C19,A1C26,A1C29,A1C38,A1C39,			*
* A2C1	1	Selected disc cap.	*
* A2C2	1	5uF electrolytic	*
* A2C3	1	.001uf disc cap.	*
* A2C4	1	Not used	*
* A1CR1	1	Silicon diode, 3A	*
* A1CR3	1	Silicon diode, 6A	*
* A1CR5,A1CR7,A1CR8	3	T 1 3/4 LED-red	*
* A1CR9,A1CR10	2	T 1 3/4 LED-green	*
* A2CR1,A2CR2,A2CR5	3	1N914B diode	*
* A2CR3,A2CR4,A2CR5,A2CR6	5	Silicon diode, 1A	*
* A1CR7			*
* A1F1	1	35A fuse	*
* A1FH1	1	Fuseholder	*
* A1H1	12	4-40 X 1/4 SHCS	*
* A1H2	6	4-40 X 5/16 SHCS	*
* A1H3	12	4-40 X 3/8 SHCS	*
* A1H4	4	4-40 X 1/2 SHCS	*
* A1H5	38	#4 Split 1kwshrs	*
* A1H6	2	#4 Flat washers .016	*
* A1H7	18	#4 Flat washers .032	*
* A1H8	8	4-40 X 1/4 Black ox	*

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****                                **** Number: PL0552G          ****
**** PARTS LIST                      **** Dated: Jun 1991         ****
****                                **** Page: 2 of 2             ****
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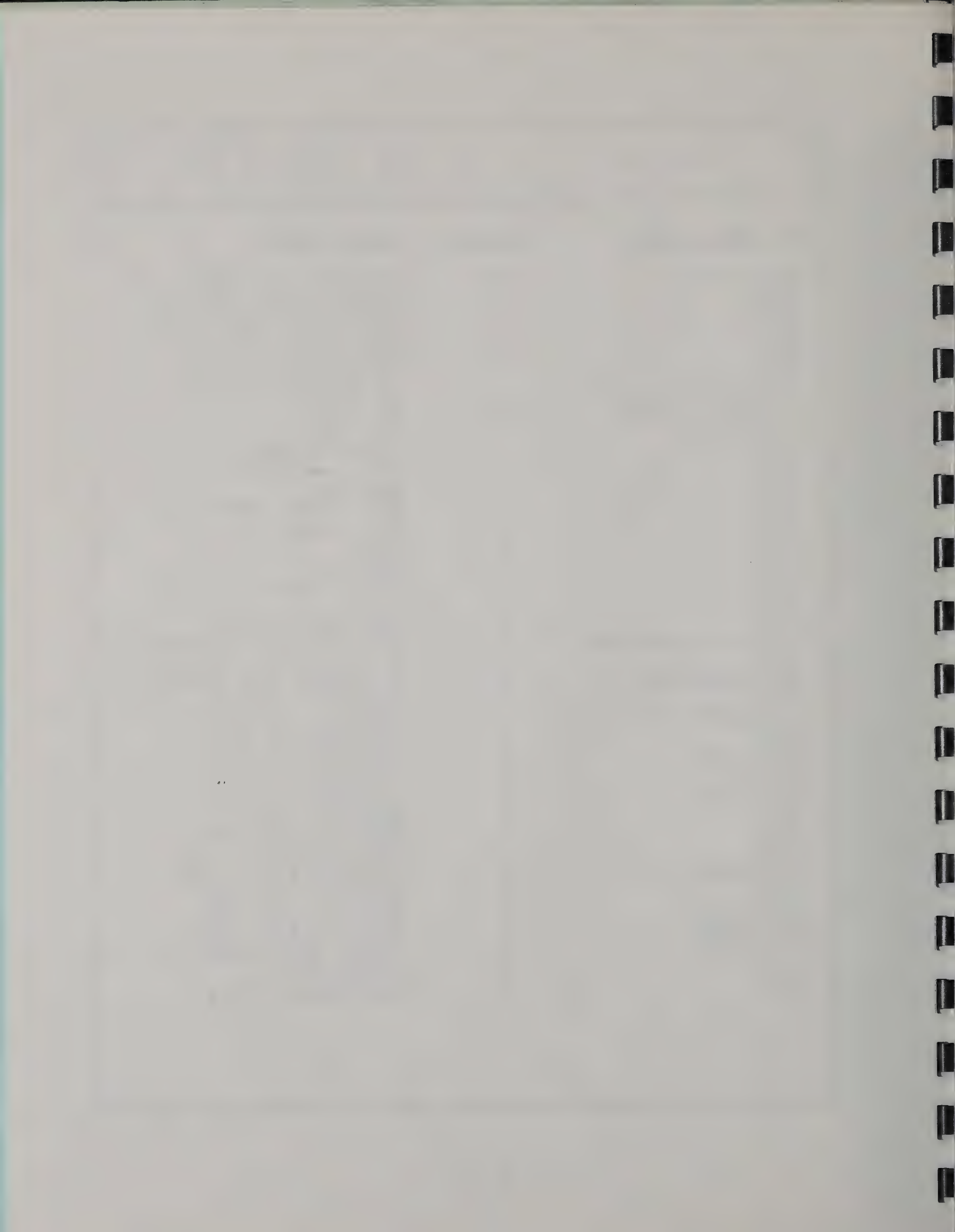
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<u>Ref.</u>	<u>Designation</u>	<u>Quantity</u>	<u>Description</u>
*			
*	A1J1,A1J2	2	RF connector (UHF)
*	A1J3	1	Remote jack (7 pin F)
*	A1J4	1	1/4-28 threaded studs (2)
*	A1J5	1	Remote plug (7 pin M)
*	A1K1	1	Relay-large 2formC
*	A1K2	1	Relay-small 2formC
*	A1L1,A1L2,A1L3,A1L4	4	RF choke
*	A1L8,A1L22,A1L23	3	RF choke
*	A1L11,A1L29	2	Coil choke
*	A1L30	1	Large FB choke
*	A1L31	1	Coil, selected
*	A1MP1	1	Heatsink
*	A1MP2	1	Front panel 0552G
*	A1MP3	1	Rear Panel
*	A1MP4	1	Cover
*	A1MP5	1	Heat plate
*	A1MP6	2	Conn. spacer
*	A1MP7	1	Knob
*	A1MP8	4	Threaded standoff
*	A1Q2,A1Q3,A1Q4,A1Q5	4	RF Transistor MRF247/equiv
*	A2Q1	1	Transistor NPN MPS-A13
*	A2Q2,A2Q3,A2Q4	3	Transistor PNP 2N4402
*	A1R1	1	Resistor, selected
*	A1R2,A1R3	2	Resistor, selected
*	A1R4	1	Resistor 3.3 ohm, 1W
*	A1R5,A1R6	2	Resistor 15 ohm, 1W
*	A1R10	1	Pot 500K, .5W
*	A1R11-16	6	Resistor 1K, .25W
*	A2R1	1	Resistor 100, 1W
*	A2R2	1	Resistor 22K, .25W
*	A2R4	1	Resistor 5.6K, .25W
*	A2R5,A2R9	2	Resistor 4.7K, .25W
*	A2R6	1	Resistor 1K, .25W
*	A2R7,A2R11	2	Resistor 10K, .25W
*	A2R8,A2R10	2	Resistor 470, .25W
*	A1S1,A1S2	2	Switch SPDT w/LED
*	A1S3	1	Switch SPDT
*	A1S4	1	Thermostat 65 deg C
*			
*			
*			
*			
*			

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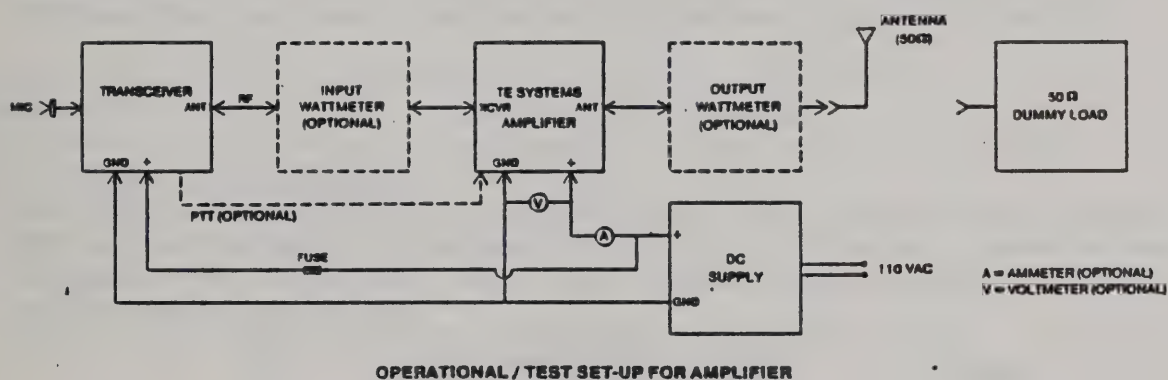
Section V - Maintenance

Introduction

This section of the manual contains performance test and adjustment procedures designed to allow field checks and adjustment of the amplifier unit. As with all electronic equipment, such adjustments may be necessary from time to time to allow the unit to perform at its optimum performance level. The following tests and adjustments should be performed by persons technically knowledgeable in the specific area of concern. Accuracy of results will depend on the quality of measurement equipment; therefore, the use of high-grade, lab quality test equipment is recommended.

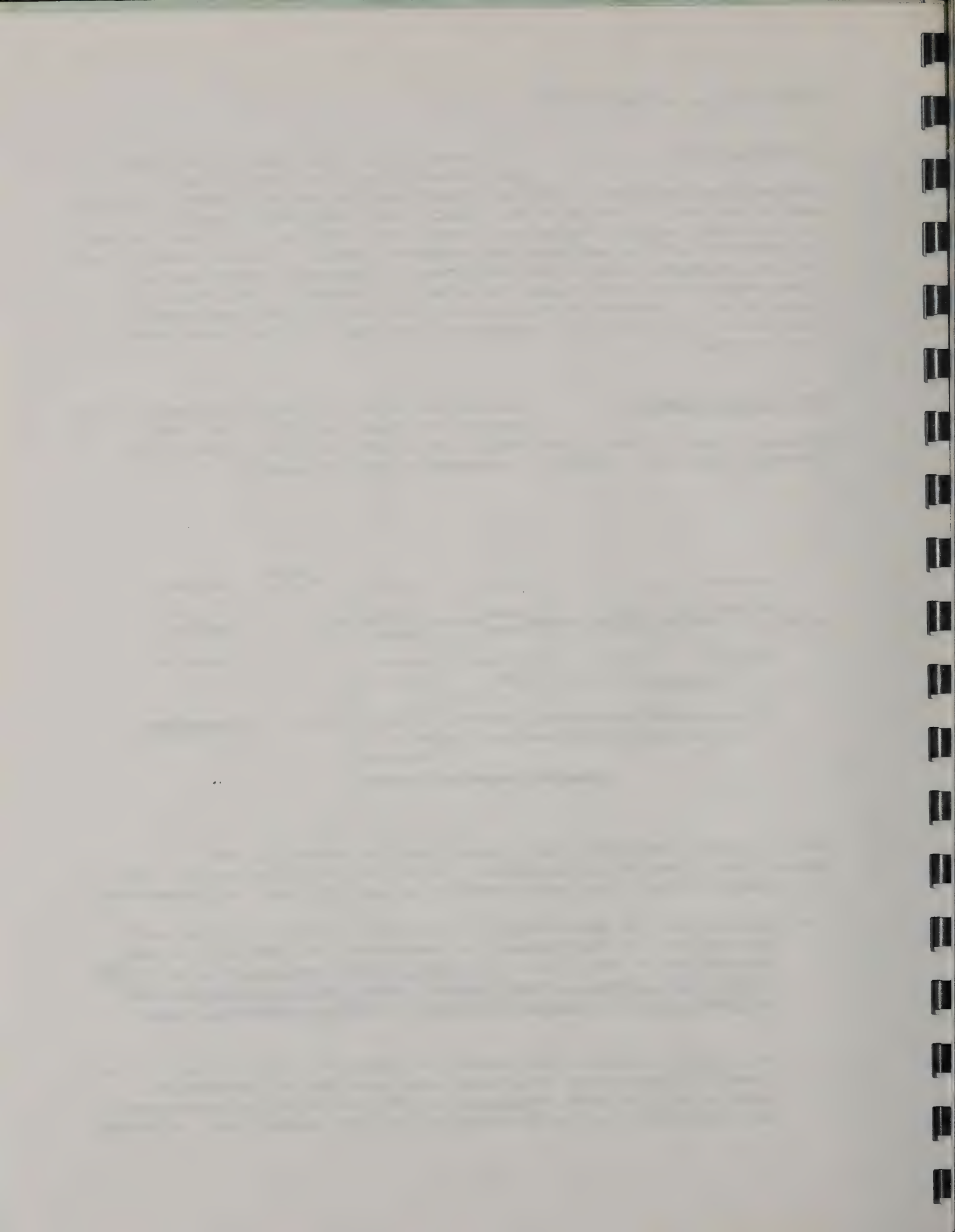
RF PA Adjustment

Remove the eight screws that secure the amplifier cover and lift off the U-shaped cover. Mount the amplifier under test with the fins downward and the internal components facing upwards.



Next connect the amplifier under test as shown in the operational/test diagram above. The following technical points of interest should be noted before actual RF testing commences:

- A) Capability of measuring the voltage applied to the unit during full output power is necessary in assuring proper operation of the unit. If the DC voltage is not +13.8 VDC under full load, a significant power output drop may be evident, thereby assuring specification noncompliance.
- B) All cable connections should be done with high quality low loss 50 Ohm cables that use good quality RF connectors usable at the test frequency. BNC and N style connectors are excellent up to 500 MHz while UHF connectors, although



not as good, may be used also if proper attention is given to their assembly and connection.

- C) The antenna or 50 Ohm load should present a very low VSWR to the amplifier so that tuning adjustments can be optimized for a 50 Ohm system and maximum forward power is obtainable.

Performance Checks

1. Output Power

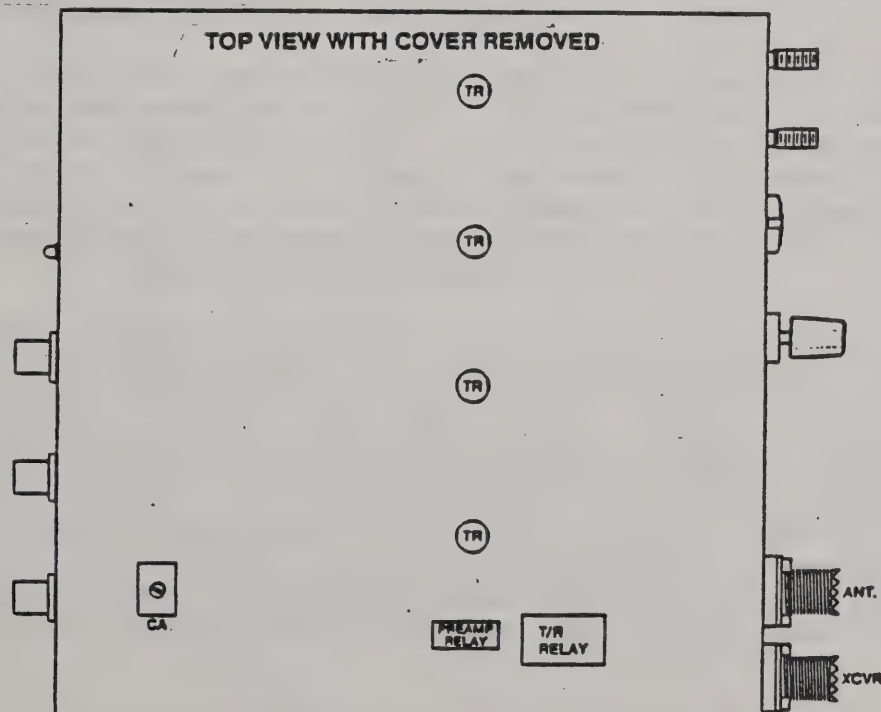
With the system connected as shown above in the "Operational/Test Set-up Diagram" and all switches "off", apply DC voltage and full RF drive. The output meter should show power out slightly less than the input drive power. At VHF frequencies this loss is less than 1 dB.

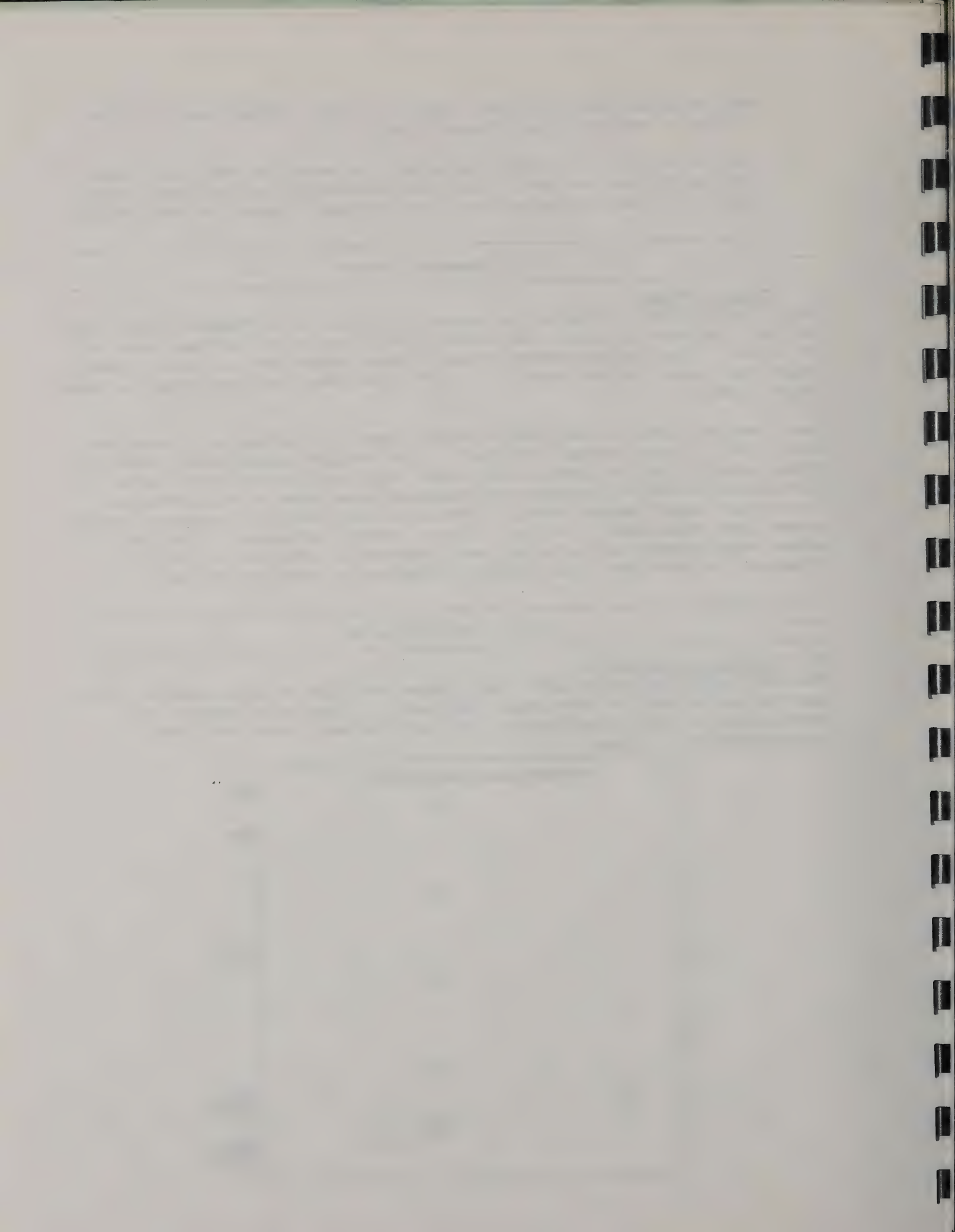
Next making sure a low VSWR antenna load is connected, turn the amplifier in/out switch to "on". The output power meter should rise greatly to the specified power out and the current meter (if connected) should indicate the approximate specified current. The input power meter should indicate the level of applied input power and show very little, if any, reflected power. If the power specifications are not met within 5%, the unit can be checked further per the tuning adjustments section below.

Tuning Adjustments

2. Tuning Adjustments

The following diagram and chart show the tuning adjustments that can be performed to the amplifier unit. The unit should be connected as described above and calibrated, accurate test instrumentation used.





```

*****
***                                     ***
***      Model 0552B Tuning Capacitor Key      ***
***                                     ***
*****
**                                     **
**      CA - Input VSWR tuning adjustment      **
**      CB - Not used                          **
**      CC - Not used                          **
**      CD - Not used                          **
**                                     **
*****

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A. Input VSWR

With the amplifier-under-test connected as shown above in the Operational/Test Set-up Diagram and input power applied at the frequency specified, adjust trimmer capacitor "CA" for minimum reflected power as measured on the input power meter. The final input VSWR should be <1.5:1 across the band.

B. Output Power

Next check the unit for output power as measured by the output power meter. The reading should be no less than 5% of the specified level. Output tuning has been optimized at the factory at the time of final testing and no field tuning is required. Use of the fixed output tuning capacitors assure proper matching to a 50 Ohm load and minimize heat and moisture problems that can occur with variable capacitors.

As a final check, the amplifier should be checked for spectrum cleanliness using a high quality laboratory spectrum analyzer.

Receive Low-Noise Amplifier Adjustment

Proper alignment of the LNA can only be

performed using instrumentation capable of measuring amplifier noise figure and associated gain. Equipment such as the Hewlett Packard 8970A or the Eaton 2075 are ideal for such measurements and an RF tight screen room should be used. Alternatively, separate gain and noise figure measurements can be made using other equipment but the measurement accuracy may not be good, especially with noise figures below one dB.

Assuming good, calibrated noise figure instrumentation is available, the noise source is connected to the "ANT" port of the amplifier-under-test, and the instrument's I.F. input is connected to the amplifier's "XCVR" port. Using a swept oscilloscope display across the specified frequency band, all the trimmers and tuning coils are adjusted for minimum noise figure and maximum associated gain. The final tuning results should agree with the specified data to the following tolerance percentages: noise figure 20%, gain 10%. Note that the input trimmers can be tuned either side of the maximum gain with the

noise figure minimization occurring on only one side. The input trimmer(s) should always be tuned for minimum noise figure at the frequency of interest.

TE Systems LNA design employs an additional output selectivity section to enhance out-of-band signal rejection. This increased amplification Q has minimal in-band gain reduction but greatly removes the possibility of adjacent out-of-band signal mixes occurring from undesired adjacent signal overloading.

noise figure minimization occurring on only one side. The input
circuit should always be tuned for minimum noise figure at the
frequency of interest.

The System LNA design employs an additional output selectivity
section to enhance out-of-band signal rejection. This increased
amplification Q has minimal in-band gain reduction but greatly
reduces the possibility of adjacent out-of-band signal alias
occurring from undesired adjacent signal overloading.

noise figure minimization occurring on only one side. The input
attenuator should always be tuned for minimum noise figure at the
frequency of interest.

The System LNA design employs an additional output selectivity
section to enhance out-of-band signal rejection. This increased
selectivity has minimal in-band gain reduction but greatly
reduces the possibility of adjacent out-of-band signal noise
occurring from undesired adjacent signal overloading.