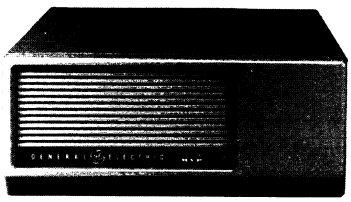
ERICSSON

Mobile Communications

MOBILE RADIO



AC POWER SUPPLY
OPTION

CUSTOM **MVP**

TWO-WAY FM RADIO COMBINATIONS

Maintenance Manual

TABLE OF CONTENTS

ILLUSTRATIONS

WARNING

Although the highest DC voltage in Custom MVP Mobile Equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits.

High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

SYSTEM SPECIFICATIONS*

BATTERY DRAIN

Receiver	
Squelched	0.25 Amperes
Unsquelched	0.70 Amperes
Transmitter	
KT-133-A, KT-134-A	5.8 Amperes @ 13.8 VDC
KT-135-A, KT-136-A	
KT-142-A, C	2.0 Amperes @ 13.8 VDC
KT-151-A	3.5 Amperes @ 13.8 VDC
KT-160-A	5.9 Amperes @ 13.8 VDC
KT-161-A, C	10.5 Amperes @ 13.6 VDC

DIMENSIONS (H X W X D)

Two-Way Radio	3.5" x 8.4" x 10.6"
AC Power Supply Option	3.5" x 8.4" x 10.6"
Mobile Speaker (less bracket)	5.1" x 5.1" x 2.8"

WEIGHT

Two-Way Radio	8.0 Pounds
AC Power Supply Option	13.0 Pounds
Speaker	1.0 Pound, 8 ounces

TEMPERATURE RANGE: -30°C to +60°C (-22°F to +140°F)

DUTY CAPABILITY

Intermittent: 20% transmit, 100% receive

* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

FCC FILING NUMBERS

TRANSMITTER	FREQUENCY RANGE (MHz)	FREQUENCY STABILITY	POWER OUTPUT
KT-133-A	29.7 - 50	5 PPM	25-Watt
KT-134-A	138 - 174	5 PPM	25-Watt
KT-135-A	406 - 420	5 PPM	20-Watt
	450 - 494	5 PPM	20-Watt
	420 - 450	5 PPM	20-Watt
	494 - 572	5 PPM	15-Watt
KT-136-C	406 - 420	2 PPM	20-Watt
	450 - 494	2 PPM	20-Watt
	420 - 450	2 PPM	15-Watt
	494 - 512	2 PPM	15-Watt
KT-142-A	450 - 512	5 PPM	5-Watt
KT-142-C	450 - 512	2 PPM	5-Watt
KT-151-A	138 - 174	5 PPM	10-Watt
KT-161-A	406 - 512	5 PPM	35-Watt
KT-161-C	406 - 512	2 PPM	35-Watt
KT-160-A	72 - 76*	5 PPM	25-Watt

* 66-88 MHz when operated outside United States.

COMBINATION NOMENCLATURE (MEDIUM POWER)

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6	Digit 7	Digits 8 & 9	Digit 10
Mechanical Package	System Voltage	Power Output	Channel Spacing	Frequency Capacity	Number of Freq.	Options	Frequency Range	Oscillator Stability
C Front Mount	**T** +12 VDC Negative Ground Only	**4** 8-20 Watts	**4** 20 kHz	**A** Single Freq.	**A** 1 Freq. Tx 1 Freq. Rx	**G** Channel Guard & UHS Receiver	**13** 29.7-36 MHz	**A** ±5 PPM
		5 21-40 Watts	**5** 25 kHz	**F** Multi-Freq.	**C** 2 Freq. Tx 2 Freq. Rx	**N** Noise Blanker	**23** 36-42 MHz	**B** ±2 PPM
			6 30 kHz		**E** 3 Freq. Tx 3 Freq. Rx	**P** UHS Receiver	**33** 42-50 MHz	
					F 4 Freq. Tx 4 Freq. Rx	**S** Standard	**44** 66-78 MHz	
						U Channel Guard	**45** 77-88 MHz	
						W Channel Guard & Noise Blanker	**56** 138-155 MHz	
							66 150.8-174 MHz	
							77 406-420 MHz	
							78 420-450 MHz	
							88 450-470 MHz	
							89 470-494 MHz	
							91 494-512 MHz	

COMBINATION NOMENCLATURE (LOW POWER)

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6	Digit 7	Digits 8 & 9	Digit 10	Digit 11
Mechanical Package	System Voltage	Power Output	Channel Spacing	Frequency Capacity	Number of Freq.	Options	Frequency Range	Oscillator Stability	PA Type
C Front Mount	**T** +12 VDC Negative Ground Only	**3** 1-7 Watts	**5** 25 kHz	**A** Single Freq.	**A** 1 Freq. Tx 1 Freq. Rx	**G** Channel Guard & UHS Receiver	**88** 450-470 MHz	**A** ±5 PPM	**L** Low Power
						P UHS Receiver	**89** 470-494 MHz	**B** ±2 PPM	
						S Standard	**91** 494-512 MHz		
						U Channel Guard			

DESCRIPTION

The General Electric Custom MVP radio combinations are fully transistorized-utilizing both discrete components and integrated circuits (IC's) for high reliability. The standard combinations may be equipped with the following:

- One through four frequencies (low power combinations are single frequency only)
- Plug-in crystal oscillator modules for ±0.0005% oscillator stability. (±0.0002%* stability is available for special UHF transmit single frequency applications).
- Channel Guard (tone squelch)
- Noise Blanker* (not available at UHF)
- Ultra High Sensitivity Receiver* (not available at low band)

The combination consists of a front cap attached to a module mounting frame which slides into a box-type cover. The frame is retained in the cover by one wing nut at the rear of the unit. Threaded nut fasteners are provided in the sides of the cover to secure the mounting bracket. The radio is designed for front-mount installations in mobile applications.

The control panel located on the front cap of the radio contains an ON/OFF-VOLUME control, Squelch and Channel Guard monitor slide switch, an optional 4-frequency control switch and a red transmit Light Emitting Diode (LED) indicator.

No power supply is required since the highest supply voltage used in the radio is provided by the vehicle battery. The radio is designed for operation only in 12-Volt, negative ground vehicle systems.

The radio is of modular construction. All major modules and tuning adjustments are easily accessible. Removal of one wing nut at the rear allows the radio to be removed from the cover. (See Figure 1) The transmitter PA and filter boards, RF Assembly and Mixer-IF Board are accessible from the top of the radio. The exciter, receiver oscillator/multiplier, IF/Detector and multi-frequency* boards are accessible when the radio is turned over.

Removing two screws at each side of the front cap allows the front cap to be removed, exposing the radio System-Audio-Squelch (SAS) board and Channel Guard Board (when used). The fixed squelch control and Channel Guard modulation control are accessible through slots in the top edge of the front cap without removing the cap. Centralized metering jacks for the transmitter and receiver are provided for simplified alignment and troubleshooting.

TRANSMITTER

The transmitter consists of an exciter board and a power amplifier assembly. The power amplifier assembly is composed of the PA and low-pass filter. The antenna relay is mounted on the filter module.

RECEIVER

The receiver consists of an RF assembly, an Oscillator/multiplier assembly (Osc/Mult), mixer/IF assembly (MIF) and IF-Detector assembly (IFD). The audio and squelch circuitry for the receiver is located on the SAS board. In receivers with noise blankers, the noise blanker circuit replaces the standard MIF board. In UHS receivers, the pre-amplifier mounts in the area near the antenna input board.

SYSTEM-AUDIO-SQUELCH BOARD

The System-Audio-Squelch (SAS) board mounts on the front of the radio frame behind the front control panel. The board contains the 10-Volt regulator, transmitter and receiver control circuits and the receiver audio and squelch circuits. The optional Channel Guard board or Carrier Defeat Timer mounts along-side and connects to the SAS board by means of a harness. The optional Carrier Control Timer mounts directly to the SAS board.

AC POWER SUPPLY OPTION

To use the radio as a base station, an optional AC power supply is required. This supply is housed similar to the radio. The radio and power supply may be stacked or located side-by-side. A 15-inch 6-conductor cable connects between the power supply and the radio. A speaker and green POWER ON LED are provided with the supply.

INITIAL ADJUSTMENT

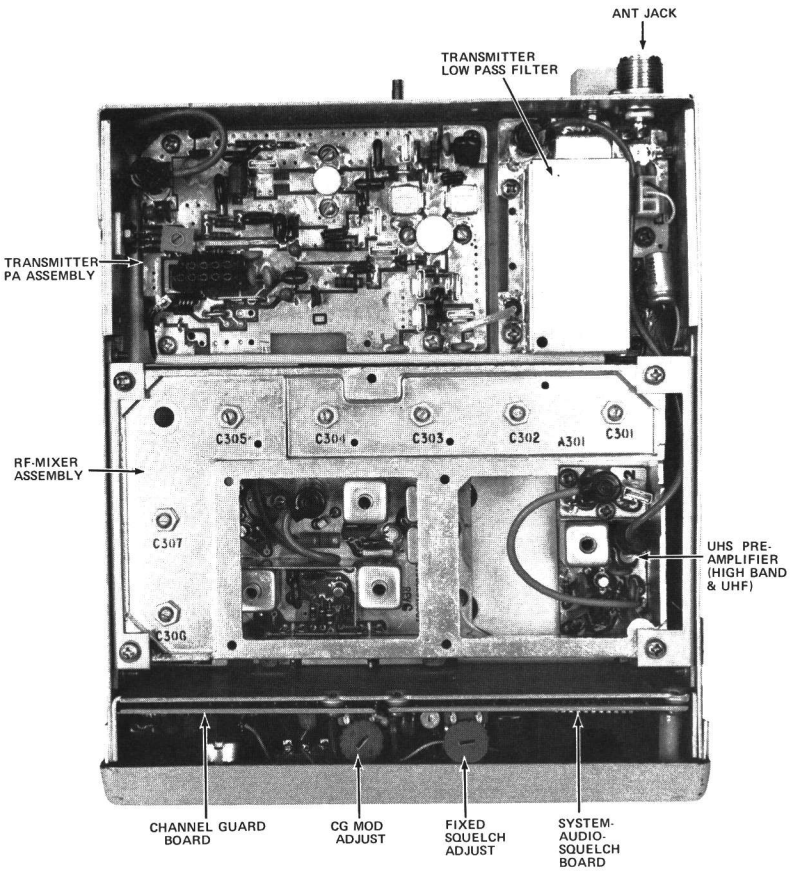
After the Custom MVP radio has been installed (as described in the Installation Manual), the following adjustments should be made by electronics technician. Make sure that a RADIO TRANSMITTER IDENTIFICATION FORM (General Electric Form NP270303) has been filled out and attached to the transmitter.

CAUTION

Before bench testing the Custom MVP Mobile Radio, be sure of the output voltage characteristic of your bench power supply.

* Does not apply to Combinations with 11th Digit "L" (low power)

TOP VIEW



BOTTOM VIEW

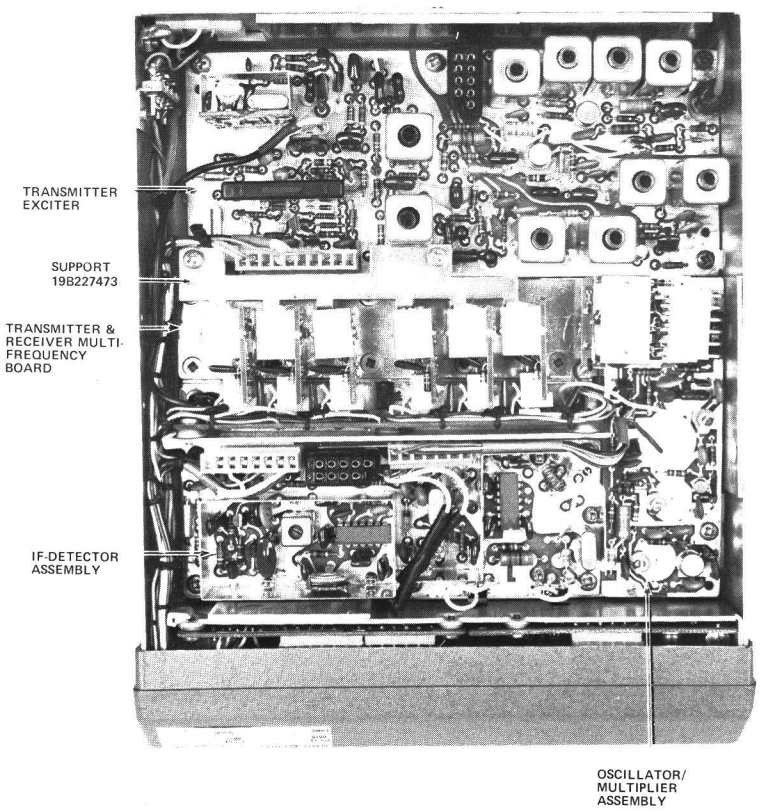


Figure 1 - Typical Custom MVP Module Layout

To protect the transmitter power output transistors from possible instant descruction, the following input voltages must not be exceeded:

Transmitter unkeyed: ..... 20 Volts

Transmitter keyed
(50 ohm resistive load): ..... 18 Volts

Transmitter keyed
(no load or non-resistive
load): ..... 15.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limit shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.8 VDC for loads up to 6 Amperes). Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12-Volt automotive storage battery. It is recommended that the AC Power Supply (Option 1901) be used for bench testing the Custom MVP.

TRANSMITTER ADJUSTMENT

The adjustment for the transmitter includes measuring the forward and reflected power and adjusting the antenna length for optimum radio, then setting the transmitter to rated power output. Next, measure the frequency and modulation and record these measurements for future reference. For the complete transmitter adjustment, refer to the ALIGNMENT PROCEDURE in the MAINTENANCE MANUAL for the transmitter.

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes tuning the input circuit to match the antenna. For the Receiver Initial Adjustment Procedure, refer to the FRONT END ALIGNMENT PROCEDURES in the MAINTENANCE MANUAL for the receiver.

OPERATION

Complete operating instructions for the Two-Way Radio are provided in the separate OPERATOR'S MANUAL. The basic procedures for receiving and transmitting messages follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the OFF-VOLUME control halfway to the right.

2. Slide the Squelch Switch on the Control panel to the TEST position and adjust the VOLUME control for a comfortable listening level.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Turn the radio on as directed in the "To Receive a Message" section.

2. Press the push-to-talk button on the microphone and speak across the face of the microphone in a normal voice. Release the button as soon as the message has been given. The red indicator light on the control panel will glow each time the microphone button is pressed, indicating that the transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

MAINTENANCE

REMOVING IC's (and all other soldered-in components) can be easily accomplished by using a vacuum de-soldering tool. To romove an IC, heat each lead separately on the solder side and remove the old solder with the de-soldering tool.

An alternate method is to use a special soldering tip that heats all of the pins simultaneously.

PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. This procedure should include the checks listed in the Table of Maintenance Checks.

TEST AND TROUBLESHOOTING PROCEDURES

The individual Maintenance Manual for the transmitter and receiver describe standard test procedures which the serviceman can use to compare the actual performance of the transmitter or receiver against the specifications of the unit when shipped from the factory. In addition, specific troubleshooting procedures are available to assist the serviceman in troubleshooting the transmitter and receiver.

RE-INSTALLATION

If the mobile combination is moved to a different vehicle, always check the battery polarity of the new system.

NOISE SUPPRESSION

After completing the initial adjustment of the transmitter and receiver, the serviceman should determine whether additional noise suppression is required. The following information should assist the serviceman in identifying and eliminating undesirable noise interference.

DISASSEMBLY

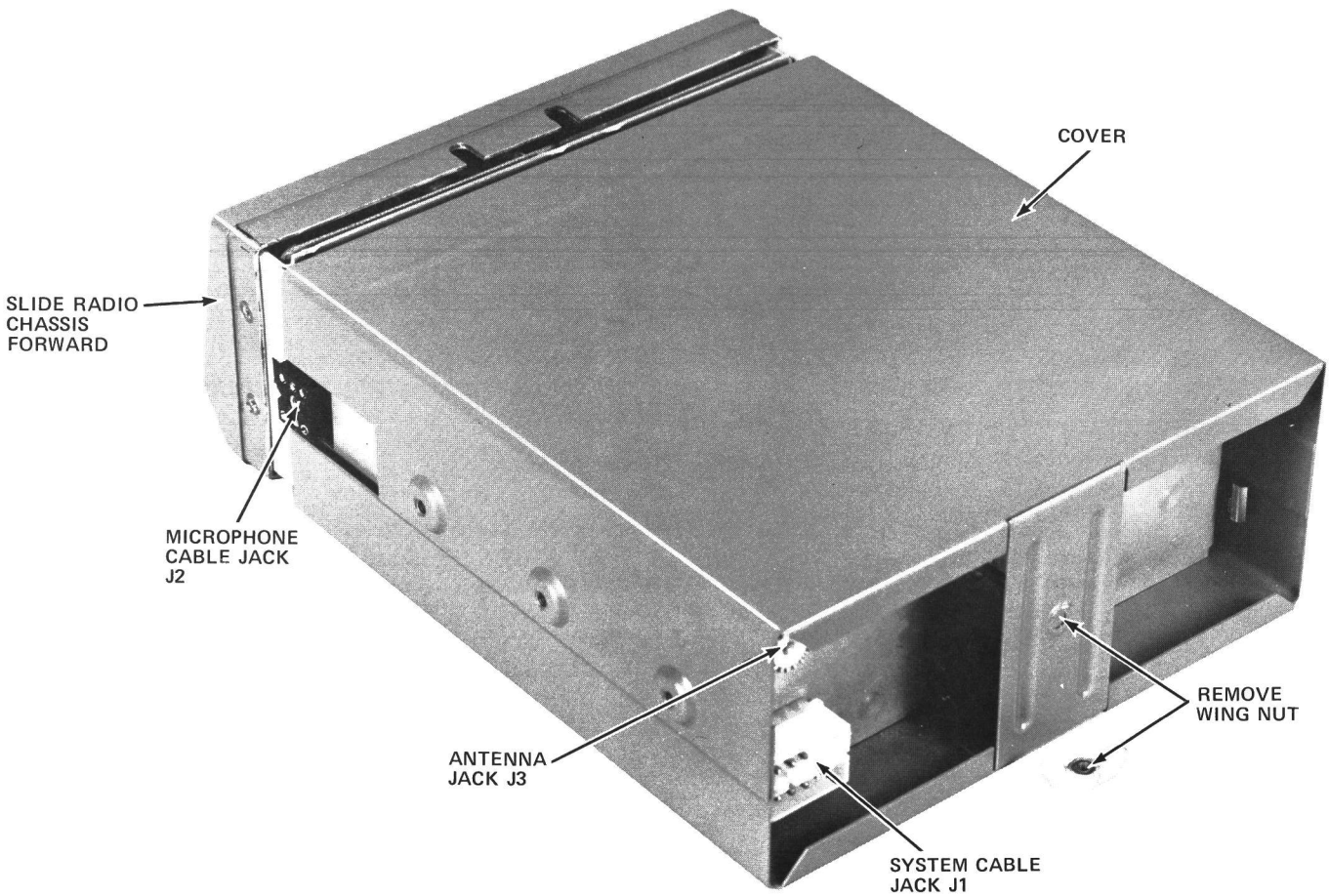


Figure 2 - Disassembly Procedure

MAINTENANCE CHECKS	INTERVAL	
	6 Months	As Required
CONNECTIONS - Ground connections and connections to the voltage source should be periodically checked for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation. When ground connections are not made directly to the battery, the connection from the battery to vehicle chassis must be checked for low impedance. A high impedance may cause excessive voltage drop and alternator noise problems.	X	
ELECTRICAL SYSTEM - Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. Over-voltage is indicated when the battery loses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation. A weak battery will often cause excessive noise or faulty operation.		X
MECHANICAL INSPECTION - Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws and parts to make sure that nothing is working loose.	X	
ANTENNA - The antenna, antenna base and all contacts should be kept clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss of radiation and a weak signal will result.	X	
ALIGNMENT - The transmitter and receiver meter readings should be checked periodically, and the alignment "touched up" when necessary. Refer to the applicable ALIGNMENT PROCEDURE and troubleshooting sheet for typical voltage readings.		X
FREQUENCY CHECK - Check transmitter frequency and deviation. Normally, these checks are made when the unit is first put into operation, after the first six months and once a year therafter.		X

Ignition Noise

Ignition noise sounds like a "popping" sound in the speaker, whose frequency varies with engine speed while a weak signal is being received. This type of interference is generated by the spark plugs, distributor and any poor connections in the high-voltage system which might cause arcing. Ignition noise may be identified by noting that the noise disappears as soon as the ignition switch is turned off.

1. If the vehicle does not have a resistance lead from the coil to the center of the distributor cap, disconnect the lead at the distributor and cut the lead so that a Cable-Type Suppressor may be inserted in it close to the distributor. Screw the cut ends of the lead into the suppressor.

NOTE

A resistance lead operates as a very effective noise suppressor as long as there are no breaks anywhere along its length. Never cut a resistance lead to insert a suppressor. A loose knot is often tied in the lead to prevent excess flexing, which might break the conductor.

2. Check to see that:

   -- the distributor points and condenser are in good condition.

   -- the high-voltage leads from the distributor are not broken and are making good contact at each end.

   -- the spark plugs have clean, dry insulators and their electrodes are clean and properly adjusted.

   -- the timing has been properly adjusted.

3. Use a 0.5-mFd by-pass capacitor to by-pass the battery lead to the ignition coil. Mount the capacitor under a screw which will provide a good ground and connect the capacitor lead to the terminal of the coil which is connected to the ignition.

4. Remove the ignition coil and its mounting bracket. Clean paint from coil (where the bracket mounts), from the bracket and from the engine block. Remount the coil so as to obtain a good ground for the coil case.

5. If the vehicle has been driven 30,000 or 40,000 miles or more, the cap and rotor of the distributor will probably need replacing. This will not only reduce ignition noise, but also improve the overall performance of the engine.

6. High-voltage ignition wires can become capacitively coupled to the low-voltage systems, causing ignition noise to appear in the low-voltage system. This coupling can be minimized by separating the high- and low-voltage leads, or if necessary, separately shielding the leads.

7. If one of the ignition leads happens to have the critical length for radiating at the receiver's frequency, the noise can be reduced by changing the length of the lead. A noise source of this type is not common and can only be found by using a noise meter or by trial and error.

8. If the preceding steps fail to reduce ignition noise to a satisfactory level, it may be necessary to install resistance-type spark plugs, individual suppressors on each spark plug, or a shielded ignition wire harness.

Alternator Noise

Alternator noise shows up as a high-pitched "whine", whose pitch varies with engine speed. To check for this type of noise, run the engine at a moderate speed and then shut off the engine, while listening to the noise on the receiver. Alternator noise will continue as long as the engine turns, lowering in pitch as the engine slows down.

It may be necessary to install a coaxial type, 0.5 mFd filter capacitor from the ungrounded alternator terminal to ground.

CAUTION

Do not install this capacitor on alternators that are equipped with a factory-supplied capacitor for protecting the rectifiers and suppressing noise.

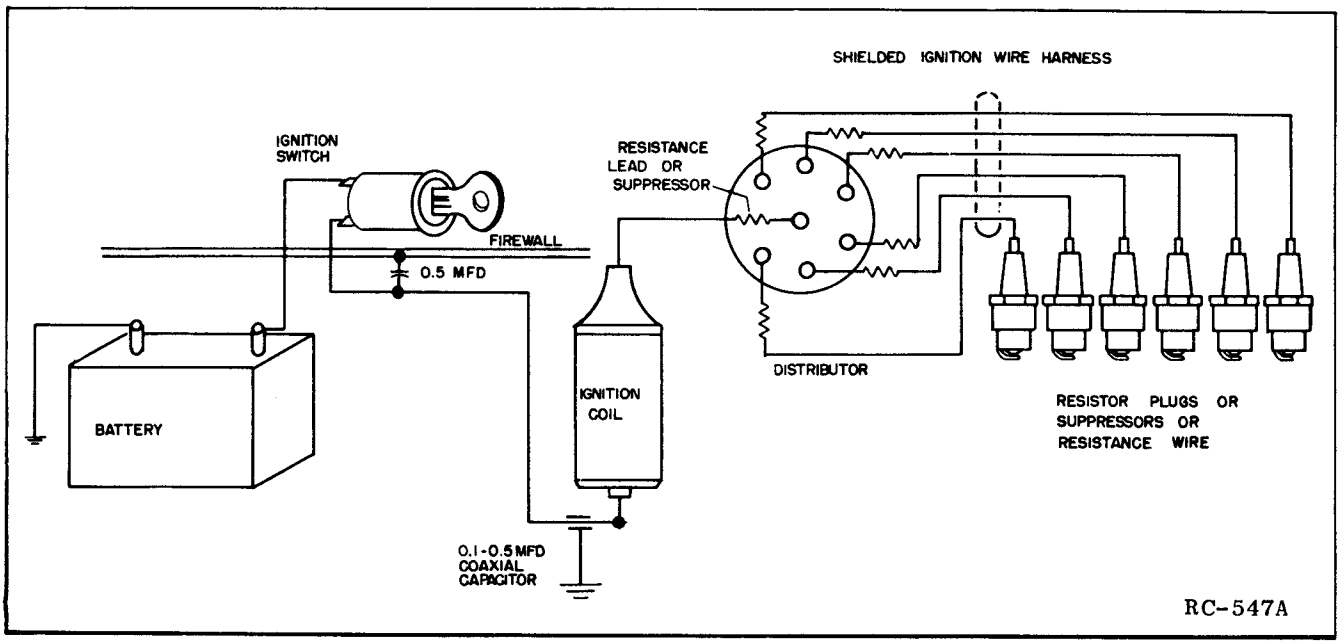


Figure 3 - Ignition Circuit with Noise Suppression Components

NOTE

It is recommended that the radio power leads be connected directly to the battery, since alternator noise levels are lowest at the battery. If ignition switch control is required, a special lead is required (refer to Installation Instructions). The high current transmitter should always be connected to the battery.

Generator Noise

Generator noise shows up as a high-pitched "whine", whose pitch varies with engine speed. To check for this type of noise, run the engine at a moderate speed and then shut off the engine, while listening to the noise on the receiver. Generator noise will continue as long as the engine turns, lowering in pitch as the engine slows down.

By-pass the armature terminal on the generator to ground with a 0.5 mFd, 40 or 50-amp coaxial capacitor. Be sure to scrape the area where the capacitor is to be mounted, so that its case will be well grounded.

CAUTION

Do not by-pass the field terminal (F), as this will damage the voltage regulator contacts.

Generator Regulator Noise

Generator regulator noise shows up as a "raspy" sound which is generated by the contacts in the regulator and radiated by the leads coming out to the regulator. If suppression of regulator noise is necessary, connect a 5-ohm resistor in series with a .002-mFd capacitor from the field terminal (F) of the regulator to ground. If possible, these components should be mounted inside regulator case. The battery terminal (BAT) and armature terminal (ARM) can be by-passed to ground with 0.5-mFd capacitors.

CAUTION

If the regulator is opened to install the capacitor or resistor, remember that one wrong connection or shorted wire can damage the regulator or generator.

Gauge noise produces a "hissing" or "crackling" sound. Tapping the face of each gauge while the engine is running usually shows up which gauge is at fault. By-pass the gauge lead to ground with a 0.5-mFd capacitor, connected close to the sensing element.

Static and Arcing Noise

The following suggestions may help to cure other unusual types of interference:

1. Use bonding braid to electrically bond the hood and each corner of the engine block to the vehicle's frame. Scrape paint and dirt from bonding points to obtain a good ground.
2. Treat noisy tires with anti-static powder.
3. Use front-wheel static collectors for irregulator "popping" noise which disappears when the brakes are applied.
4. Use heavily graphited penetrating oil on the exhaust pipe and muffler supports if they are producing noise.

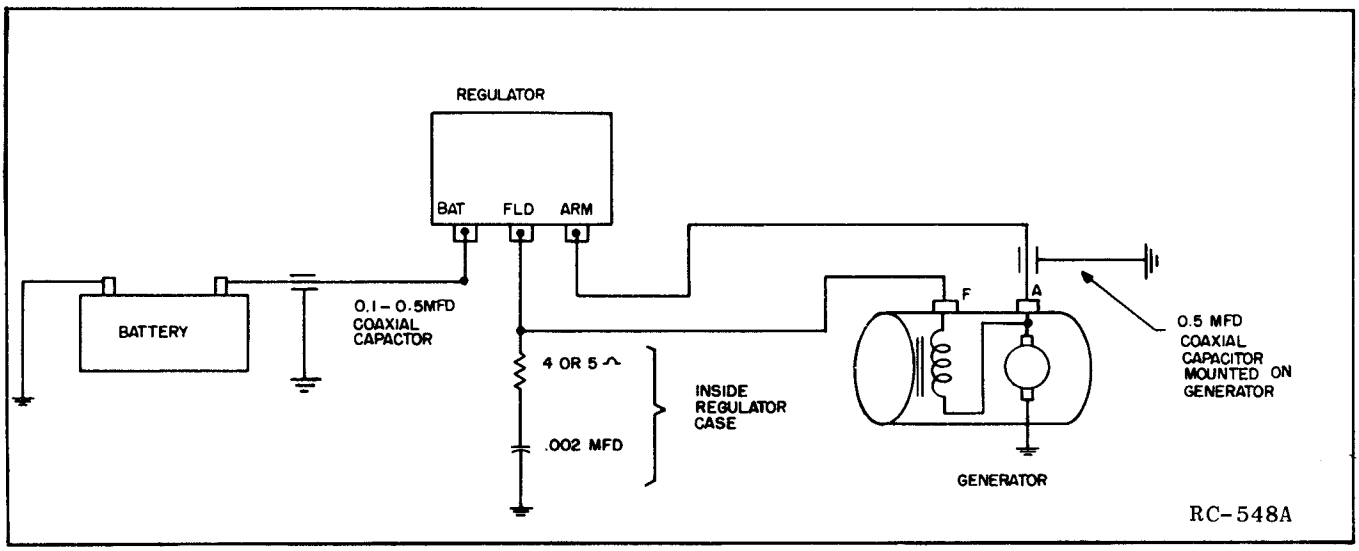


Figure 4 - Generator Circuit with Noise Suppression Components

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Mountain View Road • Lynchburg, Virginia 24502

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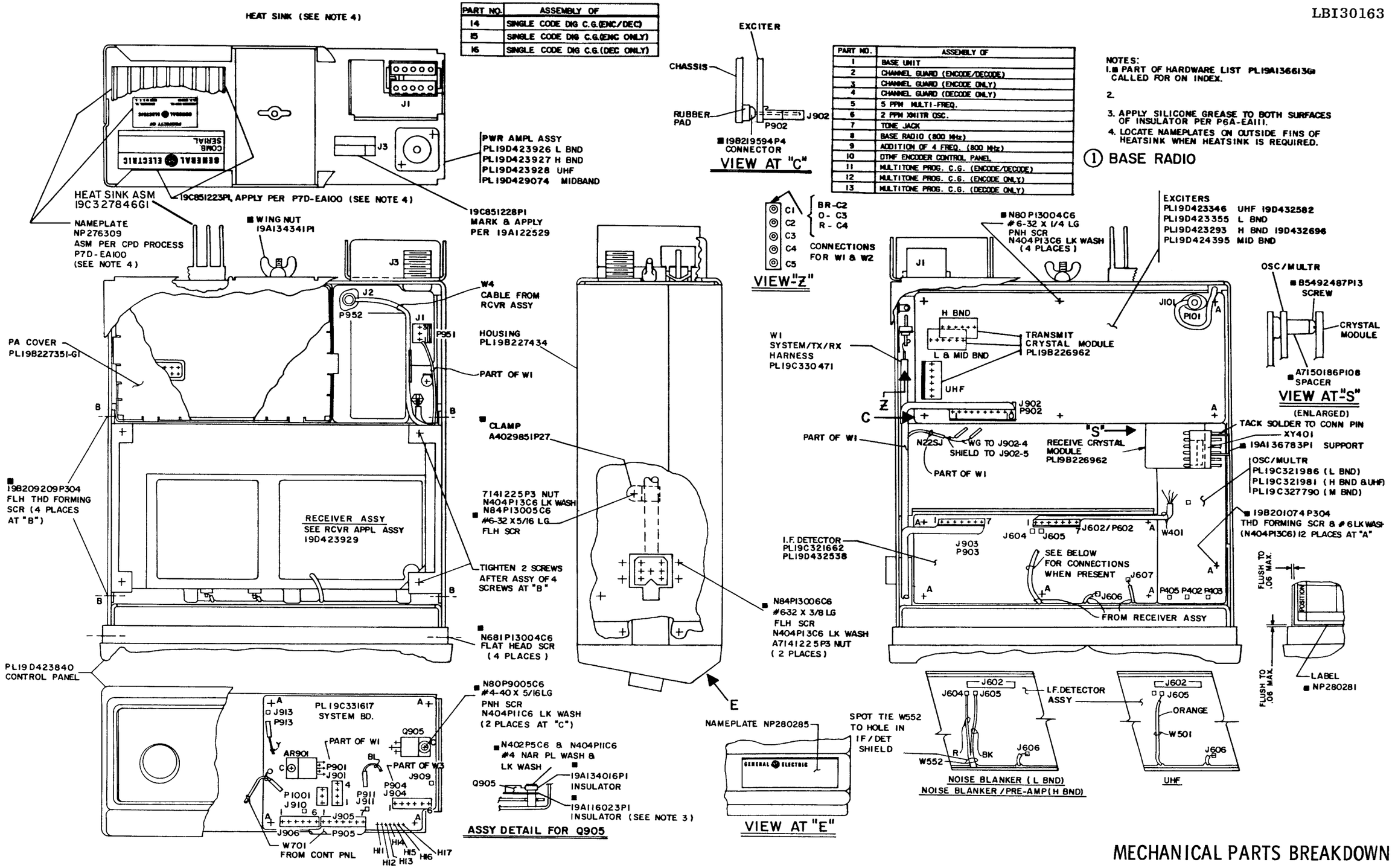
PART NO.	ASSEMBLY OF
14	SINGLE CODE DIG C.G.(ENC/DEC)
15	SINGLE CODE DIG C.G.(ENC ONLY)
16	SINGLE CODE DIG C.G.(DEC ONLY)

PART NO.	ASSEMBLY OF
1	BASE UNIT
2	CHANNEL GUARD (ENCODE/DECODE)
3	CHANNEL GUARD (ENCODE ONLY)
4	CHANNEL GUARD (DECODE ONLY)
5	5 PPM MULTI-FREQ.
6	2 PPM XMITR OSC.
7	TONE JACK
8	BASE RADIO (800 MHz)
9	ADDITION OF 4 FREQ. (800 MHz)
10	DTMF ENCODER CONTROL PANEL
11	MULTITONE PROG. C.G. (ENCODE/DECODE)
12	MULTITONE PROG. C.G. (ENCODE ONLY)
13	MULTITONE PROG. C.G. (DECODE ONLY)

NOTES:
1. ■ PART OF HARDWARE LIST PL19A136613G1 CALLED FOR ON INDEX.
2.
3. APPLY SILICONE GREASE TO BOTH SURFACES OF INSULATOR PER P6A-EAIII.
4. LOCATE NAMEPLATES ON OUTSIDE FINS OF HEATSINK WHEN HEATSINK IS REQUIRED.

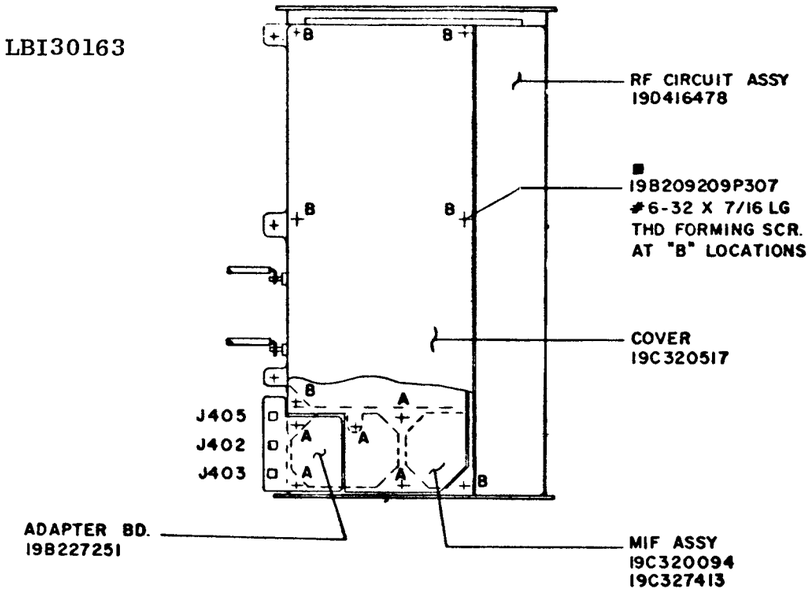
① BASE RADIO



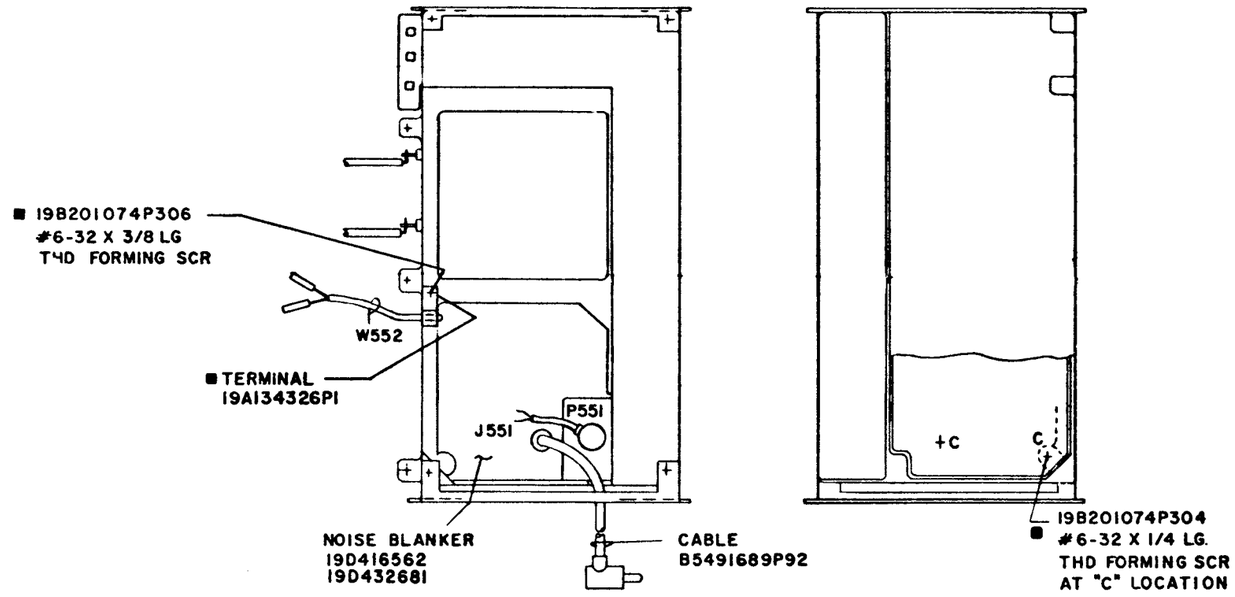
(19D423962, Sh. 1, Rev. 24)

MECHANICAL PARTS BREAKDOWN

CUSTOM MVP RADIO CHASSIS

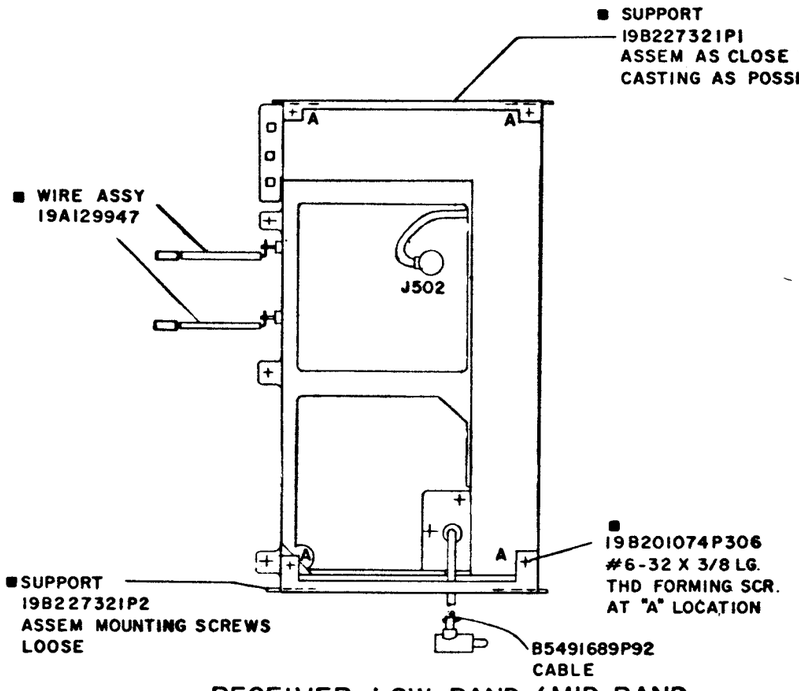


BOTTOM VIEW



TOP VIEW BOTTOM VIEW

NOISE BLANKER FOR LOW BAND



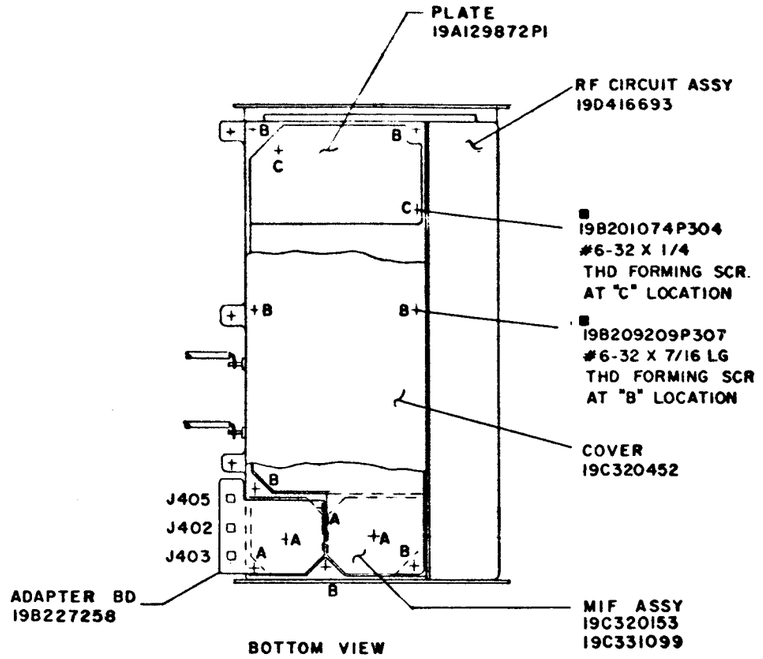
RECEIVER LOW BAND / MID BAND

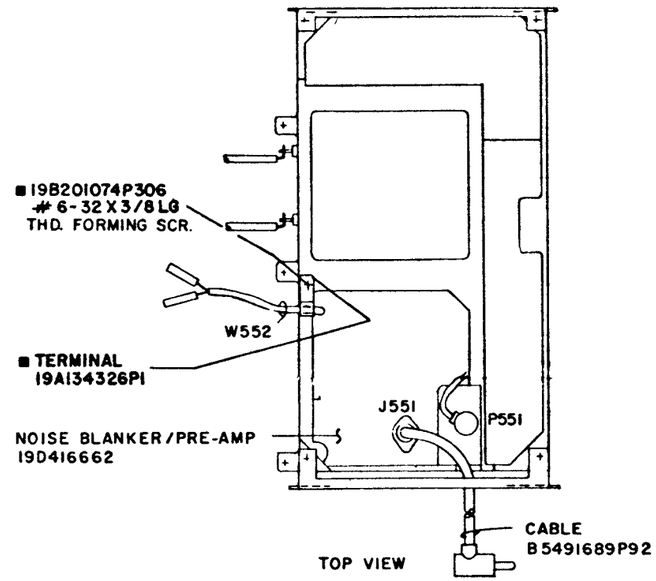
TOP VIEW

NOTES:
1. ■ PART OF HARDWARE LIST PLI9A136613G2 CALLED FOR ON INDEX.
2. ▲ PART OF HARDWARE LIST PLI9A136613G3 CALLED FOR ON INDEX.

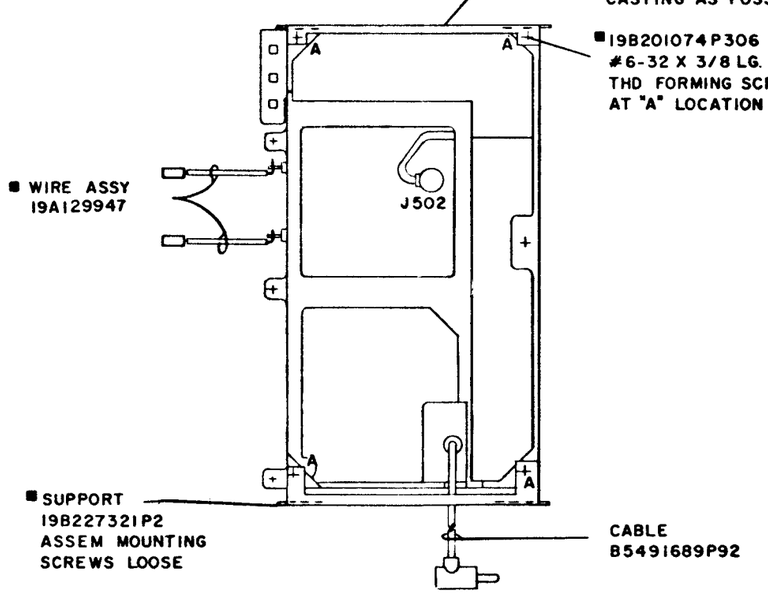
(1) ASSEMBLY OF LOW OR MID BAND RECEIVER

(4) ASSEMBLY OF LOW BAND NOISE BLANKER





NOISE BLANKER-PRE AMP HIGH BAND



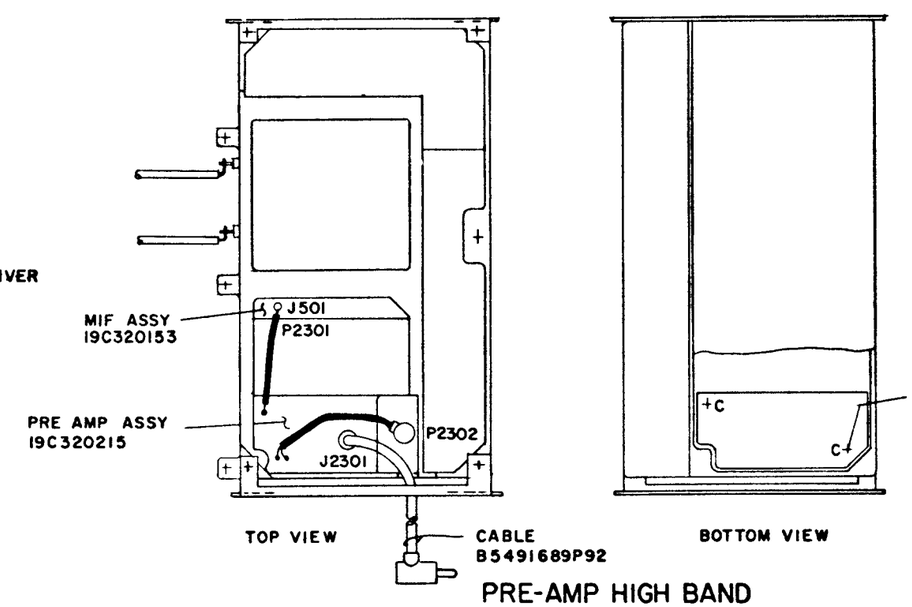
RECEIVER HIGH BAND

TOP VIEW

(2) ASSEMBLY OF HIGH BAND RECEIVER

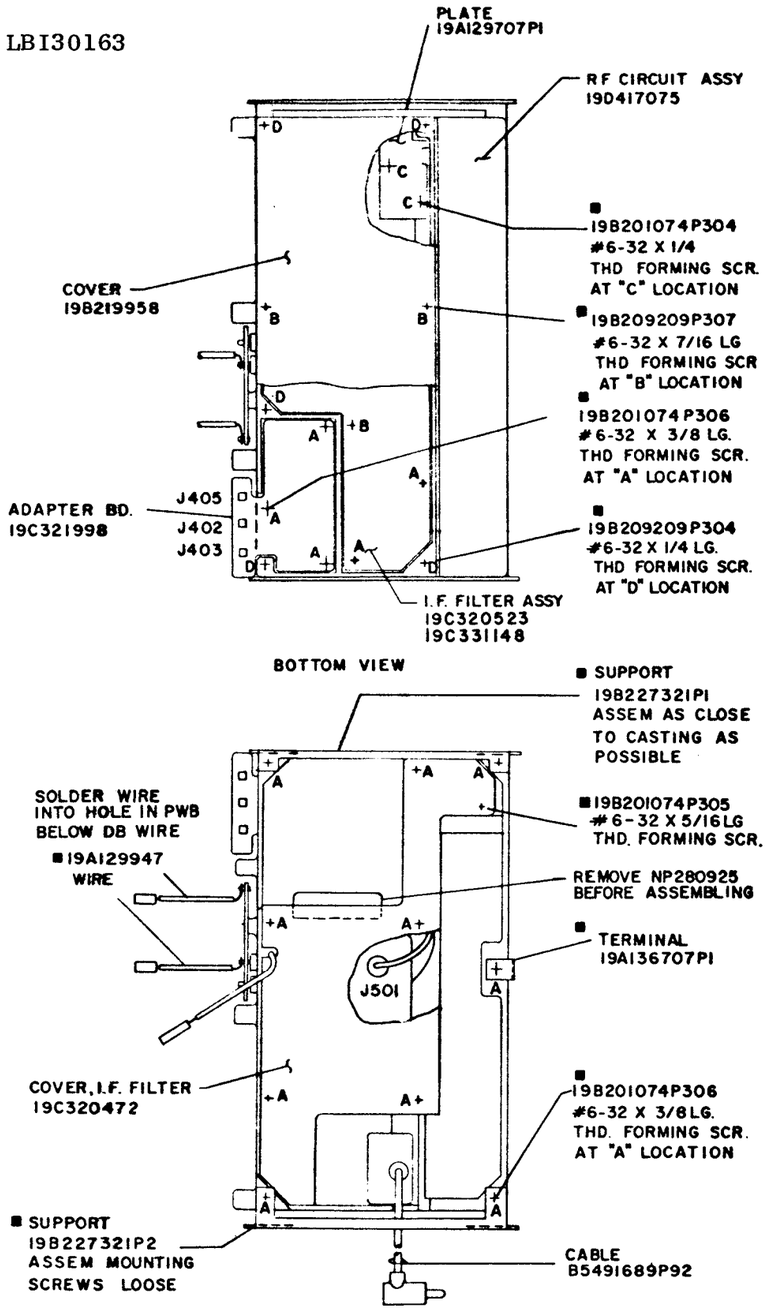
(5) ASSEMBLY OF HIGH BAND NOISE BLANKER

(6) ASSEMBLY OF HIGH BAND PRE-AMP



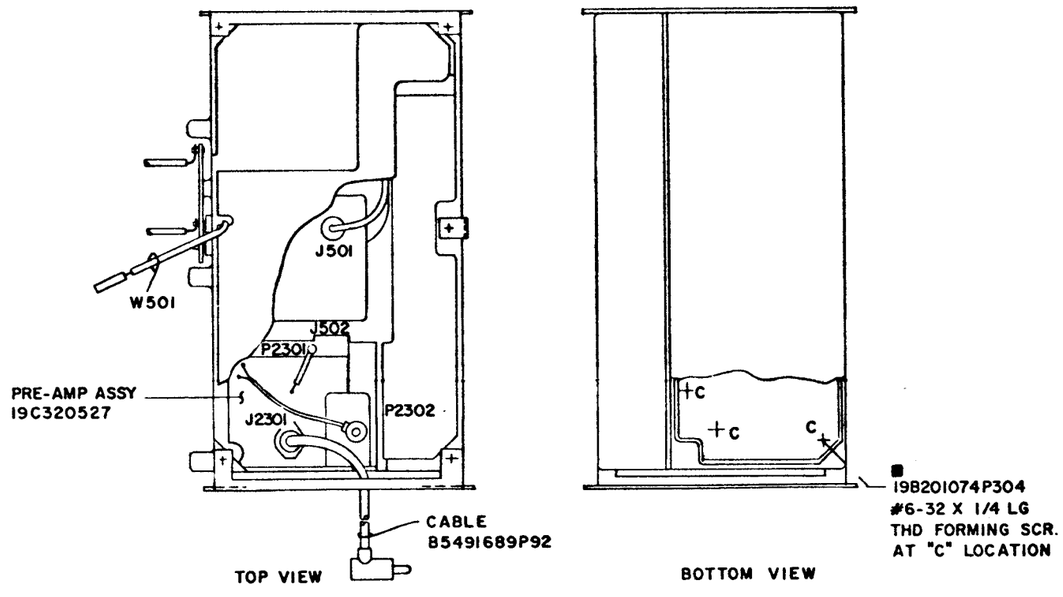
PRE-AMP HIGH BAND

(19D423929, Sh. 2, Rev. 6)



RECEIVER UHF I.F. FILTER

TOP VIEW



PRE AMP UHF

(3) ASSEMBLY OF UHF RECEIVER

(7) ASSEMBLY OF UHF PRE-AMP

(19D423929, Sh. 3, Rev. 6)