MOBILE RADIO

DESCRIPTION AND MAINTENANCE OF MASTR® EXECUTIVE II 138—174 MHz RECEIVER (WITH NOISE BLANKER)

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DESCRIPTION

MASTR®Executive II, 138 to 174 megahertz receivers are single conversion, superheterodyne FM receivers designed for one-through-four frequency operation. The solid state receiver utilizes integrated circuits (IC's), monolithic crystal filters and discrete components with each of the crystal filters located between gain stages to provide 90 dB selectivity and maximum protection from de-sensitization and intermodulation.

The receiver consists of the following modules:

- RF Assembly
- Mixer/IF/Noise Blanker (MIF/NB)
- Oscillator/Multiplier (Osc/Mult)
- Audio and Squelch circuits (part of System-Audio-Squelch (SAS) board)
- IF Detector (IF Det)

Audio, supply voltages and control functions are connected to the system board through P903 on the IF Det board, and through W401 to the Osc/Mult board. The regulated +10 Volts is used for all receiver stages except the audio PA stage which operates from the A+ system supply.

Centralized metering jack J601 on the IF Det board is provided for use with GE Test Set 4EX3A11 or Test Kit 4EX8K12. The test set meters the oscillator, multiplier, FM Detector and IF amplifier stages. Speaker high and low are metered on the system board metering jack.

A block diagram of the complete receiver is shown in Figure 1.

Refer to the appropriate Maintenance Manual for complete details on each receiver module as listed in the Table of Contents.

MAINTENANCE

DISASSEMBLY

To gain access to the receiver for servicing, unlock the radio and remove the two retaining screws in the front cover. Then pull the radio out of the mounting frame. To remove the receiver modules from the radio:

1. Remove all power to the radio.
2. Remove the three countersunk Phillips head screws in the siderail of the radio near the RF casting. NOTE: Do not remove the three screws in the bracket along the top edge of the RF casting.
3. Loosen the screws in the two locking tabs on the corners of the RF casting and release the tabs.
4. Remove the two screws securing the IF-Det board to the mounting frame.
5. Remove the screw securing the Osc/Mult board.
6. Unplug the receiver antenna connector. In multi-frequency units, unplug the lead on the Osc/Mult board.
7. Lift the receiver modules out of the radio with a gentle rocking motion.

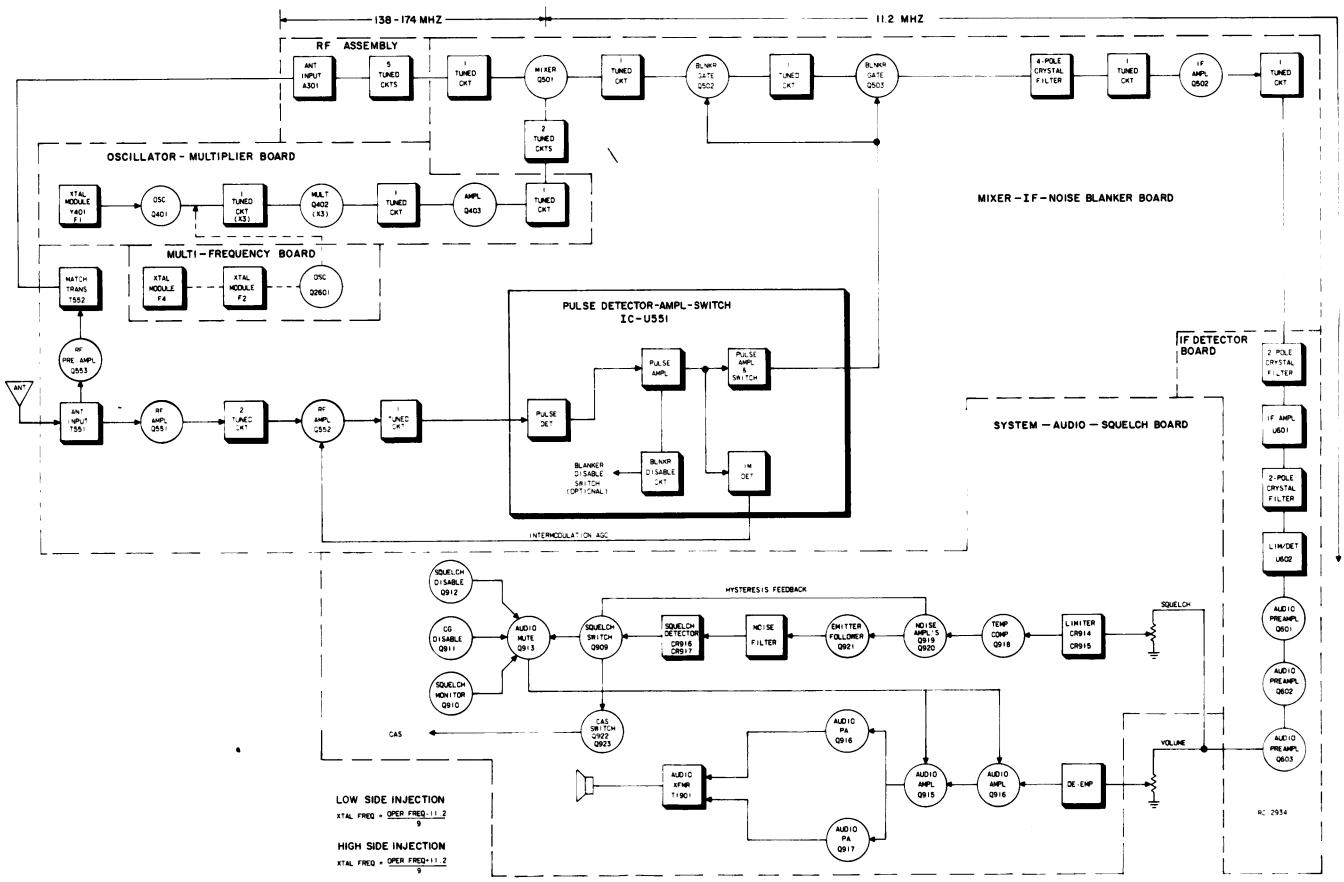


Figure 1 - Receiver Block Diagram

FRONT END ALIGNMENT

EQUIPMENT

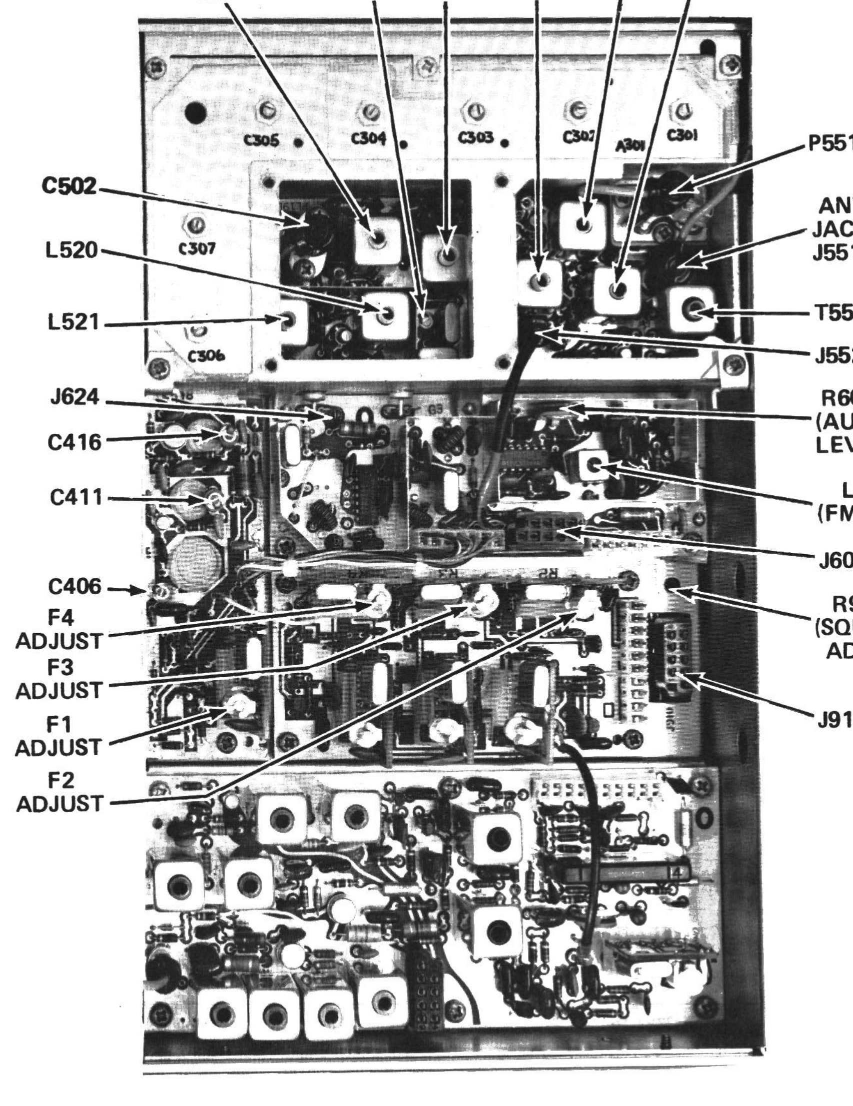
1. GE Test Set Models 4EX3A11, 4EX8K12, or 20,000 ohms-per-Volt multimeter with a 1-Volt scale.
2. A 138-174 MHz signal source.
3. Ammeter (capable of measuring 20 milliamperes).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect black plug from Test Set to Receiver Centralized Metering Jack J601, and red plug to system board metering jack J910. Set range selector switch to the TEST 1 position (or 1-Volt position on 4EX8K12).
2. For multi-frequency receivers with a frequency spacing up to 0.450 MHz for frequency range of 138-155 MHz, or 0.500 MHz for frequency range of 150.8-174 MHz, align the receiver on the channel nearest center frequency.

   For multi-frequency receivers with a frequency spacing exceeding the above but no greater than .900 MHz for frequency range of 138-155 MHz, or 1.00 MHz for frequency range of 150.8-174 MHz, align the receiver using a center frequency tune-up crystal module. These limits can be extended to 1.60 MHz, and 1.80 MHz respectively, with 3 dB degradation in standard receiver specifications.
3. With Test Set in Position J, check for regulated +10 Volts. If necessary, adjust R906 for 10 Volts. If using multimeter, measure between J910-3 (+) and J910-9 (-).
4. Set SQUELCH ADJUST R953 to unmute the receiver and VOLUME control to minimum. Disconnect J906 on the SAS board and connect the milliammeter in series with J906 (+) and P906 (-). Adjust audio BIAS control on SAS board for 20 milliamperes.
5. If using multimeter, connect the negative lead to J601-9 (A-).
6. Disable Channel Guard.

STEP	METERING POSITION GE Test Set	METERING POSITION Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			OSCILLATOR/MULTIPLIER		
1.	C (MULT-1)	Pin 3	C406	Maximum	Tune C406 for maximum meter reading.
2.			C411, C416, C306, C307	See Procedure	Preset C411 and C416 to a position similar to C406. Next, preset C306 and C307 fully counterclockwise (minimum capacity).
3.	D (MULT-2)	Pin 4	C411, C416, C406	See Procedure	Tune C411 and C416 for maximum meter reading. Next, retune C406, C411 and C416 for maximum meter reading, then, carefully dip C306 and tune C307 for maximum meter reading. Do NOT readjust C306 and C307.
			RF SELECTIVITY		
4.	B (IF AMP)	Pin 1	C502, C301 thru C305 and top slug of T551 (L555)	Maximum	Apply an on-frequency signal to J551, keeping the signal below saturation. Then tune C502 and C301 through C305 and T551 (top slug-L555) for maximum meter reading.
5.	B (IF AMP)	Pin 1	C502, C301 thru C307 and top slug of T551	Maximum	Apply an on-frequency signal to the antenna jack (J551) and slightly tune C301 through C305, T551 (top slug-L555) and C502 for best quieting sensitivity. C306 and C307 may also be tuned slightly (not to exceed 1/4 turn).



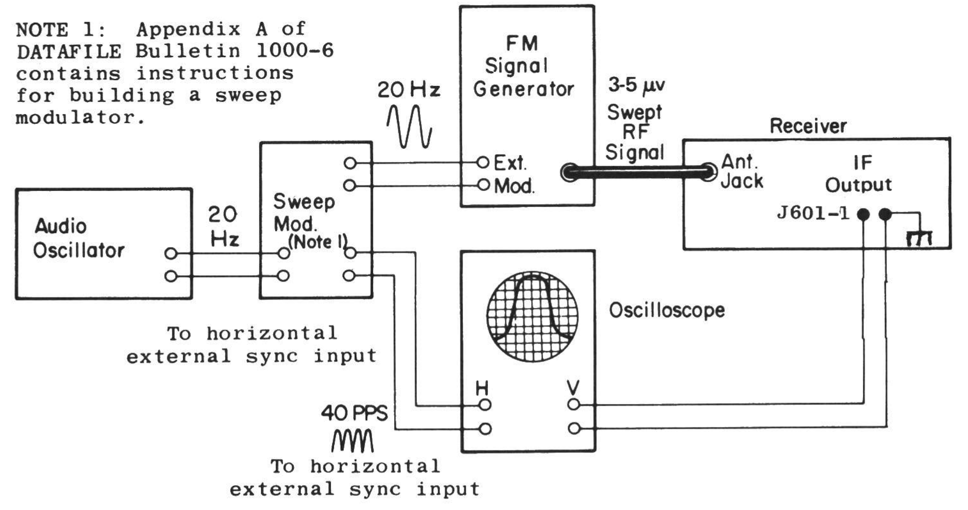


Figure 2 - Test Setup for 20-Hz Double-Trace Sweep Alignment

OSCILLATOR FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. (Refer to frequency offset chart, Figure 3.) The frequency measurement requires equipment with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained. When adjusting the frequency, the entire radio should be as near as possible to an ambient temperature of 30°C (86°F).

The frequency of the crystal module should only be reset when the measured frequency error exceeds the following limits:

A. ±0.6 PPM when the ambient temperature of the radio is 30°C (86°F).

B. ±5 PPM at any other temperature within the range of -30°C to +75°C (-22°F to +167°F).

If frequency adjustment is required, refer to one of the procedures below (depending on equipment available) for proper adjustment.

A. DIRECT MEASUREMENT IN THE INJECTION CHAIN

1. WITH A FREQUENCY COUNTER. "Count" the frequency at the junction of C418 and C419 on the Oscillator-Multiplier board. The frequency measured at this point is 9 times the crystal frequency.
2. WITH A COMMUNICATION MONITOR (for example Cushman Model CE-3). "Monitor" frequency at the junction of C416 and L403 on the Oscillator-Multiplier board. The frequency monitored at this point is 9 times the crystal frequency. NOTE This frequency will not always fall within an available measuring range of all monitors at all receiver operating frequencies.

B. STANDARD "ON FREQUENCY" SIGNAL AT THE RECEIVER INPUT (Generated from a COMMUNICATION MONITOR, for example: Cushman Model CE-3).

1. WITH A FREQUENCY COUNTER. "Count" the developed IF frequency at the tap of Z602-R2 on the IF-DET board. The deviation from the nominal IF frequency (11.2 MHz) in Hz is compared to the receiver operating frequency (also in Hz) to calculate the frequency error.
2. WITH AN 11.2 MHz IF FREQUENCY STANDARD (for example: General Electric Model 4EX9A10). Loosely couple the IF frequency standard to the IF signal path to create a heterodyne with the developed IF frequency. The resultant "beat frequency" can be monitored by any of the following methods:

> NOTE
>
> To set crystal frequency using "beat frequency" method, the temperature should be at 30°C (86°F). If the temperature is not 30°C, then offset the "ON FREQUENCY" signal (at the receivers input), as a function of actual temperature, by the frequency ERROR FACTOR shown in Figure 3.

a. Audible "beat frequency" from the receiver speaker (this requires careful frequency adjustment of the frequency standard).

b. Observe "beat frequency" at J601-1 with an oscilloscope.

c. With GE TEST SET (Meter Position B) connected to J601 on the IF-DET board, visually observe the "beat frequency" indicated by meter movement.

The frequency of the "beat" is the frequency error related to the IF frequency. This deviation, in Hz, is compared to the receiver operating frequency, also in Hz, to calculate the frequency error.

> NOTE
>
> The FM Detector output (meter position A of the test set) has a DC voltage of .35 to .50 Volts at the assigned frequency and is provided for routine test and measurement only. The resolution of this reading (approximately .025 V per Hz as read on a GE Test Set in meter position A, or 0.1 V per kHz as measured with a VTVM at J601-2 on the IF-DET board) is inadequate for oscillator frequency setting.

If the radio is at an ambient temperature of 30°C (86°F) set the oscillator for the correct mixer frequency (crystal FREQ. X 9).

If the radio is not at an ambient temperature of 30°C setting errors can be minimized as follows:

A. To hold setting error to ±0.6 PPM (which is considered reasonable for 5 PPM oscillators):

1. Maintain the radio at 30°C (±5°C) and set the oscillator to required mixer injection frequency, or
2. Maintain the radio at 30°C (±5°C, -10°C) and offset the oscillator, as a function of actual temperature, by the frequency error shown in Figure 3.

For example: Assume the ambient temperature of the radio is 20°C (68°F). At that temperature, the curve shows a correction factor of 225 Hz.

Adjust the oscillator for a corrected mixer injection frequency 225 Hz higher. If a negative correction factor is obtained (at temperatures above 30°C) set the oscillator for the indicated frequency lower than the calculated mixer injection frequency.

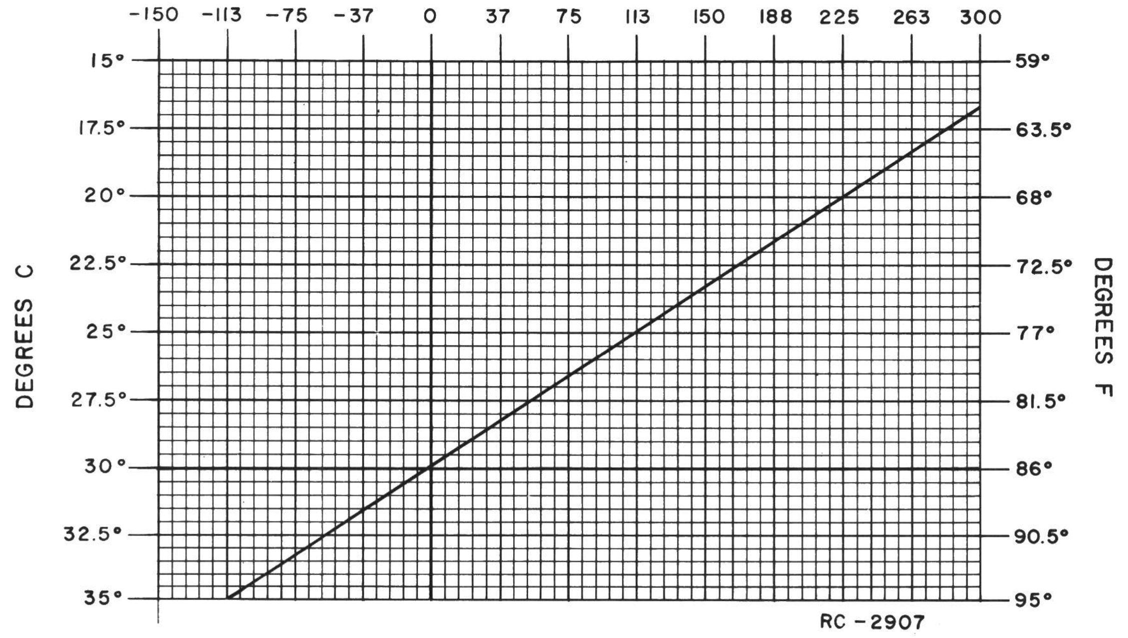


Figure 3 - Frequency Characteristics Vs. Temperature

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Models 4EX3A11, 4EX8K12 (or 20,000 ohms-per-volt multimeter with a 1-Volt scale.
2. An 11.2 MHz signal source (GE Test Set Model 4EX9A10). Also a 138-174 MHz signal source (Measurements 803) with a one-inch piece of insulated wire no larger than .065 inch diameter connected to generator probe.
3. Ammeter (capable of measuring 20 milliamperes).
4. A VTVM.
5. Distortion Analyzer.

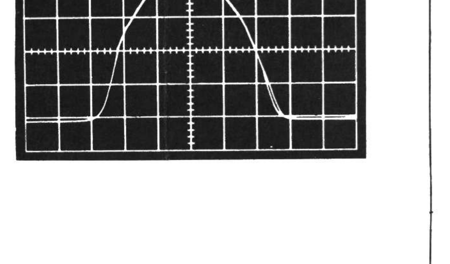
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect the black plug from the Test Set to receiver metering jack J601, and the red plug to system board metering jack J910. Set the range selector switch to the Test 1 (or 1-Volt position on the 4EX8K12).
2. For multi-frequency receivers with a frequency spacing up to 0.450 MHz for frequency range of 138-155 MHz, or 0.500 MHz for frequency range of 150.8-174 MHz, align the receiver on the channel nearest center frequency.

   For multi-frequency receivers with a frequency spacing exceeding the above but no greater than .900 MHz for frequency range of 138-155 MHz, or 1.00 MHz for frequency range of 150.8-174 MHz, align the receiver using a center frequency tune-up crystal module. These limits can be extended to 1.60 MHz, and 1.80 MHz respectively, with 3 dB degradation in standard receiver specifications.
3. With Test Set in Position J, check for regulated +10 Volts. If necessary, adjust R906 for 10 Volts. If using multimeter, measure between J910-3 (+) and J910-9 (-).
4. Set SQUELCH ADJUST R953 to unmute the receiver and VOLUME control to minimum. Disconnect J906 on the SAS board and connect the milliammeter in series with J906 (+) and P906 (-). Adjust audio BIAS control on SAS board for 20 milliamperes.
5. If using multimeter, connect the negative lead to J601-9 (A-).
6. Disable Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION GE Test Set	METERING POSITION Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			FM DETECTOR		
1.	A (FM DET)	Pin 2	L603	0.38 Volt	With no signal applied, adjust L603 for a meter reading of approximately 0.38 Volt.
			OSCILLATOR/MULTIPLIER		
2.	C (MULT-1)	Pin 3	C406	Maximum	Re-connect the Test Set metering plug to J601. Tune C406 for maximum meter reading.
3.			C411, C416, C306, C307	See Procedure	Preset C411 and C416 for a position similar to C406. Next, preset C306 and C307 fully counterclockwise (minimum capacity).
4.	D (MULT-2)	Pin 4	C411, C416 C406	See Procedure	Tune C411 and C416 for maximum meter reading. Next, retune C406 and C416 for maximum meter reading, then, carefully dip C306 and tune C307 for maximum meter reading. Do NOT readjust C306 and C307.
			RF SELECTIVITY		
5.	B (IF AMP)	Pin 1	C502	Maximum	Apply an on-frequency signal in the hole adjacent to C305 and tune C502 for maximum meter reading.
6.	B (IF AMP)	Pin 1	C305	Maximum	Apply an on-frequency signal in the hole adjacent to C304, keeping the signal below saturation. Then tune C305 for maximum meter reading.
7.	B (IF AMP)	Pin 1	C304	Maximum	Apply an on-frequency signal in the hole adjacent to C303, keeping the signal below saturation. Then tune C304 for maximum meter reading.
8.	B (IF AMP)	Pin 1	C303	Maximum	Apply an on-frequency signal in the hole adjacent to C302, keeping the signal below saturation. Then tune C303 for maximum meter reading.
9.	B (IF AMP)	Pin 1	C302 and C301	Maximum	Apply an on-frequency signal to A301-J1, keeping the signal below saturation. Then tune C302 and C301 for maximum meter reading.
10.	B (IF AMP)	Pin 1	C502, C301 thru C307 and T551 (top slug-L555)	Maximum	Apply an on-frequency signal to the antenna jack (J551), keeping the signal below saturation. Then tune C502 and C301 through C305 and T551 (top slug-L555) for maximum meter reading.
11.	B (IF AMP)	Pin 1	C502, C301 thru C305 and T551 (top slug-L555)	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C301 through C305, T551 (top slug-L555) and C502 for best quieting sensitivity. C306 and C307 also may be tuned slightly (not to exceed 1/4 turn).
12.			R608	See Procedure	Remove the Test Set metering plug from J601. Apply a 1000 microvolt signal with 1 kHz modulation and 3.0 kHz deviation to the antenna jack. Tune L603 for maximum voltage at 1.0 kHz and adjust R608 for 1 Volt RMS measured with a VTVM at 903-1 (VOL/SQ HI) and 903-6 (A-).

STEP	METERING POSITION GE Test Set	METERING POSITION Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			MIXER & IF		
	The mixer and IF circuits have been aligned at the factory and will normally require no further adjustment. If adjustment is necessary, use the procedure outlined in Step 13. NOTE Refer to DATAFILE BULLETIN 1000-6 (IF Alignment of Two-Way Radio FM Receivers) for helpful suggestions on how to determine when IF Alignment is required.				
13.			L503, L505, L520, L521 and C521		Connect scope, signal generator, and probe as shown in Figure 2. Set signal generator level for 3 to 5 μV and modulate with 10 kHz at 20 Hz. With probe between J601-1 and A- tune L503, L505, L520, L521 and C521, for double trace as shown on scope pattern.
14.				See Procedure	Check to see that modulation acceptance bandwidth is greater than ±7 kHz.
15.	F (BLANKER)	J601-Pin 7	L554, L553, L552 & L551	Maximum	Set generator output to maximum. Connect generator to Receive antenna jack J551 and adjust generator frequency in accordance with the following table: Recover RF Range (MHz) / Tuneable Range of Noise Blanker (MHz) / Align Noise Blanker to: 138-155 / 128-148 / Receiver freq. -10 MHz 150.8-174 / 128-148 / 130 MHz Tune L554, L553, L552 and L551 (Bottom slug of T551) in the order given, reducing the generator output as necessary to keep the noise blanker metering point out of saturation. NOTE In some instances the noise blanker circuit may be tuned to a specific frequency in order to minimize interference. The noise blanker must never be tuned closer than 8 MHz to the operating frequency of the receiver.
16.	F (BLANKER)	J601-Pin 7		Greater than VDC 0.07	Apply a 1000-microvolt signal on blanker frequency to antenna jack J551. The meter reading should be greater than 0.07 VDC.
			SQUELCH ADJUST		
17.				30°	Set SQUELCH ADJUST control R953 to open with a 4 dB SINAD signal (approximately 30° counterclockwise of critical squelch position).

TEST PROCEDURES

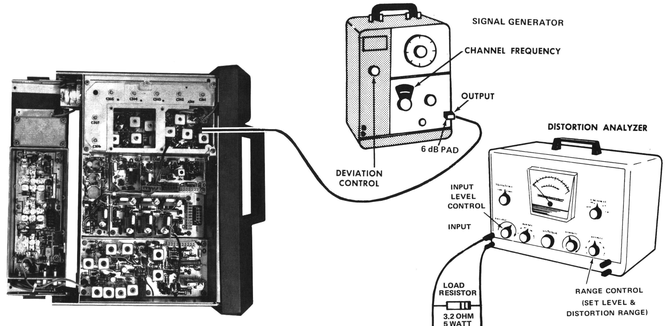
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to:
  Heath IM-12
- Signal Generator similar to:
  Measurements 803
- 6-dB attenuation pad, and 3.2-ohm, 5-Watt resistor

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.



STEP 1
AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1,000-microvolt, on-frequency test signal modulated by 1,000 hertz with ±3.0 kHz deviation to antenna jack J551.

B. With 5-Watt Speaker:

Disconnect speaker and connect a 3.2-ohm, 5-Watt load resistor from J910-1 (speaker H1) to J910-2 (A-).

Connect the Distortion Analyzer input across the resistor as shown.

OR

With Handset:

Lift the handset off of the hookswitch. Connect the Distortion Analyzer input from J910-1 to J910-2.

C. Adjust the VOLUME control for 5-Watt output using the Distortion Analyzer as a VTVM (4 Vrms).

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than 5.0 Watts, make the following checks:

E. Battery and regulator voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages).

F. Audio Gain (Refer to Receiver Troubleshooting Procedure).

G. FM Detector Adjustment (Refer to Receiver Alignment on reverse side of page).

STEP 2
USABLE SENSITIVITY (12-dB SINAD)

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.0-kHz deviation to Antenna Jack J551.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12-dB difference (Signal plus Noise and Distortion to noise plug distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least 2.5 Watts (2.8 Volts RMS across the 3.2-ohm receiver load using the Distortion Analyzer as a VTVM).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3
MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7.0 kHz.

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

TROUBLESHOOTING PROCEDURE

STEP 1—PERFORMANCE CHECK

Before starting the Noise Blanker troubleshooting procedure, make sure the receiver is operating properly. Align the Noise Blanker circuits as described for the ALIGNMENT PROCEDURE. Perform the following checks:

Equipment Required:

1. RF Signal Generator coupled through a 6 dB pad.
2. Pulse Generator with repetition rate and level controls (Similar to General Electric Model 4EX4A10).
3. T-Connector.
4. AC VTVM or Distortion Analyzer.
5. Oscilloscope.

Procedure:

Noise Blanker Threshold Sensitivity

1. Connect Pulse Generator and RF Signal Generator to receiver antenna jack (J551) through a T-Connector, and connect AC VTVM to receive audio output (Speaker LO, P904-18, Speaker P904-19) as shown in Figure 1.
2. Apply an unmodulated RF signal and check the 20 dB quieting sensitivity of the receiver. (Measure with Model 4EX4A10 Pulse Generator connected but turned OFF). Then adjust the RF level for an additional 10 dB on the signal generator.
3. Set the pulse generator (Model 4EX4A10) for 10 KHz continuous pulses. Slowly increase the pulse output level, degrading the receiver quieting level as measured on the AC VTVM. Prior to the sudden drop in quieting, the degradation should not exceed 20 dB quieting. The noise blanking pulse may be observed where indicated on the Troubleshooting block diagram.

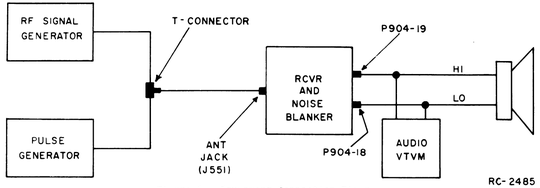


Figure 1 - Equipment Connection Diagram

IF Attenuation

1. Disable the noise blanker by connecting J604 on IFAS module or pin 5 of P904 to A-. (Use noise blanker disable switch on Control Unit if present).
2. Measure the 20 dB quieting sensitivity as in Step 2 of Threshold sensitivity measurement.
3. Adjust the RF output of the signal generator for 40 dB greater RF level than that established for 20 dB quieting sensitivity.
4. Adjust the pulse generator (Model 4EX4A10) for a repetition rate up to 30 KHz. Adjust the pulse level until the receiver is degraded to 20 dB quieting.
5. Remove the noise blanker disabling jumper from J604 (or if noise blanker disable switch is provided, place to operate position), and then adjust the signal generator RF level for 20 dB quieting. The receiver sensitivity should restore to within 5 dB of 20 dB quieting level obtained in Step 2.

STEP 2—QUICK CHECKS

Equipment Required:

1. RF Voltmeter (similar to Boonton Model 91-CA or Millivac type MV-18C).
2. RF Signal Generator.
3. AC VTVM or Distortion Analyzer.

SYMPTOMS	PROCEDURE
NO Blanking	Check voltage ratios (STEP 3)
Partial or no Blanking	a. Check IF attenuation of Noise Blanker Gates as follows: Connect signal generator to antenna jack (J551). Adjust the signal generator for on frequency signal and output level for 20 dB quieting sensitivity (Level A). Connect +10 VDC directly to the gates of Q502 and Q503. Increase the RF output level to achieve 20 dB quieting (Level B). The difference between "Level A" and "Level B" must be 60 dB or greater.
Intermodulation Interference (AGC action)	b. Check gain of Noise blanker RF circuit (IM/AGC ACTION) as follows: Connect signal generator to antenna Jack (J551). Adjust the frequency of the signal generator to the noise blanker channel frequency and adjust the RF level for 1 Millivolt (see Alignment Procedure, Step 15 for frequencies). Measure RF signal level at pin 6 of U551. This level should be 56 millivolts or greater. Apply +10 VDC through a 270 ohm resistor to the source pin of Q552 (or pin 13 of U551). (This applies approximately +3 VDC bias to Q552, simulating intermodulation AGC voltage). The RF voltage measured at pin 6 of U551 should be approximately 1.8 millivolts (Corresponds to approx. 30 dB decrease of gain in RF amplifier Q552).

STEP 3—VOLTAGE RATIO READINGS

Equipment Required:

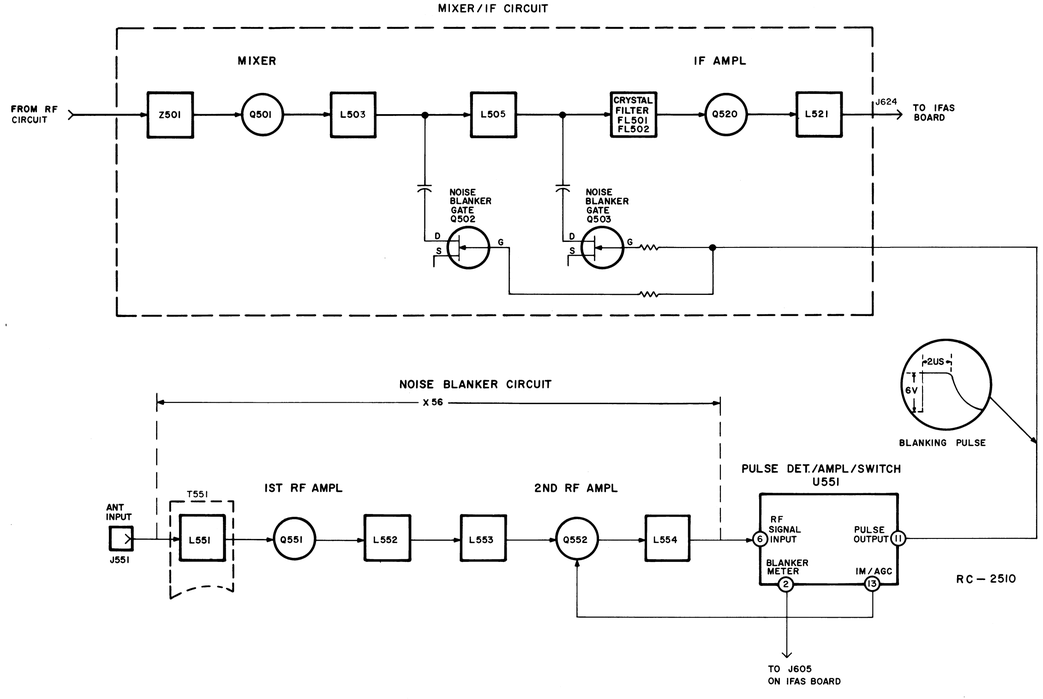
1. RF Voltmeter (Similar to Boonton Model 91-CA or Millivac Type MV-18C).
2. Signal generator.

Procedure:

1. Connect signal generator to Antenna Jack (J551). Adjust the frequency of the signal generator to the channel frequency of the noise blanker (see Alignment procedure, Step 15). Adjust the RF level for 1 Millivolt output.
2. Apply probe of RF Voltmeter to Antenna Jack (J551). Peak resonant circuit L551 (Bottom Slug of T551) and take voltage reading (E1).
3. Move probe to input of IC-V551 (pin 6). Repeak first resonant circuit L551 (Bottom Slug of T551). Then peak resonant circuit L554 and take reading (E2).
4. Convert reading by means of the following formula:

   Voltage Ratio = $\frac{E2}{E1}$

5. Check results with the typical voltage ratio shown on diagram.



STEP 1 - QUICK CHECKS

TEST SET CHECKS

These checks are typical voltage readings measured with GE Test Set Model 4EX3A11 in the Test 1 position, or model 4EX8K12 in the 1-Volt position.

Metering Position	Reading With No Signal In	Reading With 2-Microvolts Unmodulated
A (FM DET)	0.35-0.50 VDC	
B (IF Amp)		0.2 VDC
C (MULT-1)	0.45 VDC	
D (MULT-2)	0.1 VDC	
J (Reg. +10 Volts at System Metering jack)	+10 VDC	

SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	• Check power connections and continuity of supply leads, and check fuse. If fuse is blown, check receiver for short circuits.
NO REGULATED 10-VOLTS	• Check the 12-Volt supply. Then check 10-Volt regulator circuit. (See Troubleshooting Procedure for 10-Volt Regulator).
LOW IF READING	• Check supply voltages and then check oscillator readings at P904-1 & -2 as shown in STEP 2. • Make SIMPLIFIED VTVM GAIN CHECKS from Mixer through Limiter Detector stages as shown in STEP 2.
LOW OSCILLATOR/MULTIPLIER READINGS	• Check alignment of Oscillator/Multiplier. (Refer to Front End Alignment Procedure). • Check voltage readings of Oscillator/Multiplier (Q401, Q402).
LOW RECEIVER SENSITIVITY	• Check Front End Alignment. (Refer to Receiver Alignment Procedure). • Check antenna connections, cable and antenna switch. • Check Oscillator injection voltage. • Check voltage readings of Mixer and IF Amp. • Make SIMPLIFIED GAIN CHECKS (STEP 2).
IMPROPER SQUELCH OPERATION	• Check voltages on Schematic Diagram. • Make gain and waveform checks with noise. • Make gain and waveform checks with 6 kHz signal. • Check discrete components in the squelch circuit.
LOW OR DISTORTED AUDIO	• Check voltages on Schematic Diagram. • Make gain and waveform checks. • Check receiver and alignment and FM Detector output. • Check Audio Transistors and other discrete components.

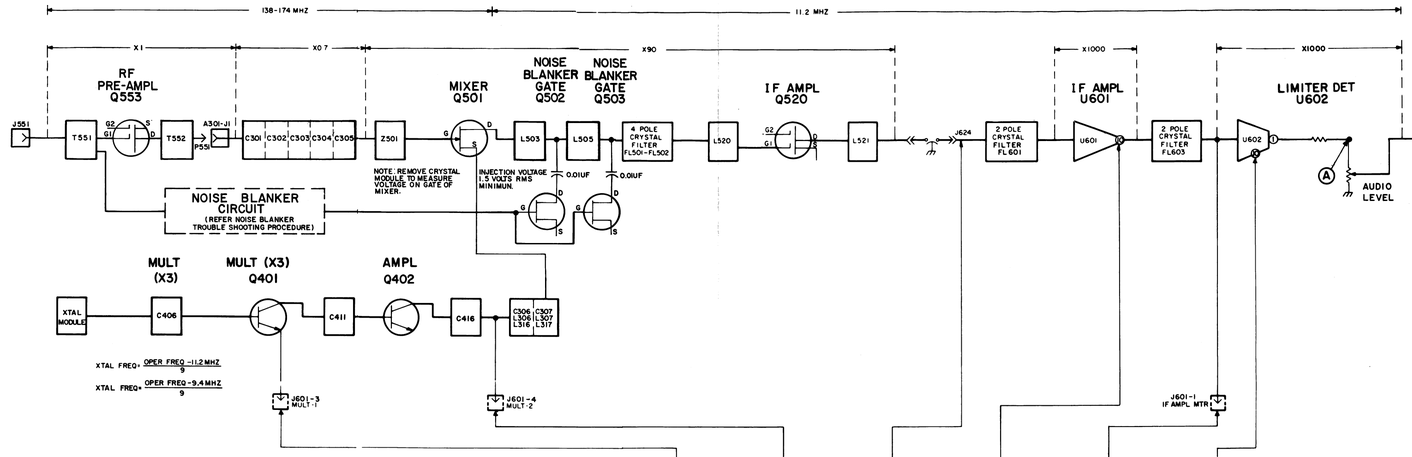
STEP 4-VOLTAGE RATIO READINGS →

EQUIPMENT REQUIRED:
1. RF VOLTMETER (SIMILAR TO BOONTON MODEL 91-CA OR MILLIVAC TYPE MV-18C.
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION). USE 1000 HERTZ SIGNAL WITH 3.0 KHz DEVIATION.

PROCEDURE:
1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE, SOURCE OF RF AMP) PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (E_1).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (MIXER). REPEAK FIRST RESONANT CIRCUIT THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (E_2).
3. CONVERT READINGS BY MEANS OF THE FOLLOWING FORMULA.

   VOLTAGE RATIO = $\frac{E_2}{E_1}$

4. CHECK RESULTS WITH TYPICAL VOLTAGE RATIOS SHOWN ON DIAGRAM



STEP 2-SIMPLIFIED GAIN CHECKS →

EQUIPMENT REQUIRED:
1. VTVM - AC & DC
2. SIGNAL GENERATOR (MEASUREMENTS 803 OR EQUIVALENT).
3. RF VOLTMETER

PRELIMINARY STEPS:
1. SET VOLUME CONTROL FOR 4.0 VOLTS ACROSS 3.2-OHM LOAD. IF THIS CANNOT BE OBTAINED, SET TO APPROX. 70% OF MAX. ROTATION.
2. SET SQUELCH CONTROL FULLY COUNTERCLOCKWISE.
3. RECEIVER SHOULD BE PROPERLY ALIGNED.
4. CONNECT METER BETWEEN A- AND POINTS INDICATED BY ARROW.

SET SIGNAL GENERATOR TO CORRECT RF FREQUENCY AND APPLY TO A301-J1			UNMODULATED	UNMODULATED	UNMODULATED	NO SIGNAL INPUT
PROCEDURE			SET GENERATOR OUTPUT AT 1000 MICROVOLTS	INCREASE GENERATOR OUTPUT FROM ZERO UNTIL U601 SATURATES AS MEASURED WITH RF VOLTMETER	INCREASE GENERATOR OUTPUT FROM ZERO TO 40 MICROVOLTS (10 MICROVOLTS WITH PREAMP)	SHOULD BE IN SATURATION AT ALL TIMES
READING	VTVM READING SHOULD BE APPROX 0.5 VDC	VTVM READING SHOULD BE APPROX 0.2 VDC	RF VOLTMETER READING SHOULD BE APPROX 200 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 40 MICROVOLTS (10 MICROVOLTS WITH PREAMP)	VTVM READING SHOULD BE APPROX 0.54 VDC	RF VOLTMETER READING SHOULD BE APPROX 0.6 V RMS

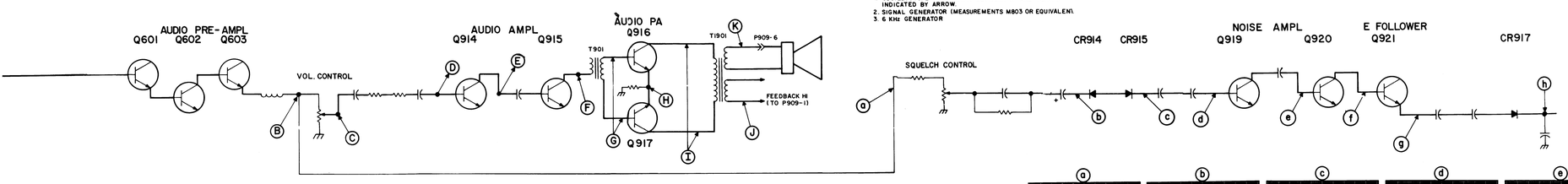
(RC-3932)

TROUBLESHOOTING PROCEDURE

138--174 MHz EXECUTIVE II RECEIVER
WITH NOISE BLANKER

STEP 3-AUDIO & SQUELCH WAVEFORMS

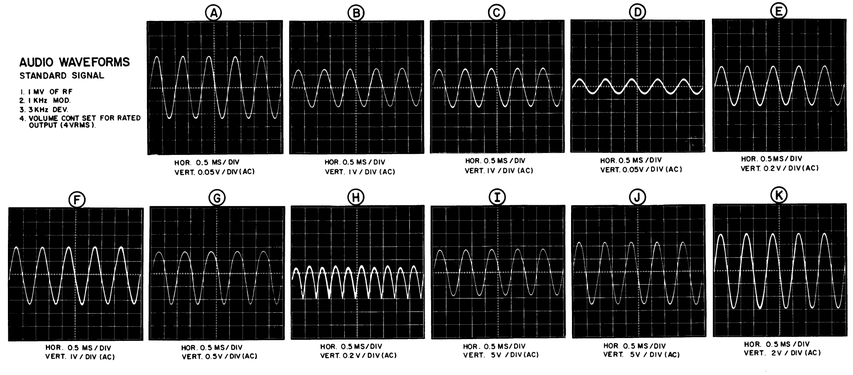
EQUIPMENT REQUIRED:
1. OSCILLOSCOPE CONNECTED BETWEEN A- AND POINTS INDICATED BY ARROW.
2. SIGNAL GENERATOR (MEASUREMENTS MB03 OR EQUIVALENT).
3. 6 KHz GENERATOR



AUDIO WAVEFORMS

STANDARD SIGNAL

1. 1 MV. OF RF.
2. 1 KHz MOD.
3. 3 KHz DEV.
4. VOLUME CONT SET FOR RATED OUTPUT (4 VRMS).



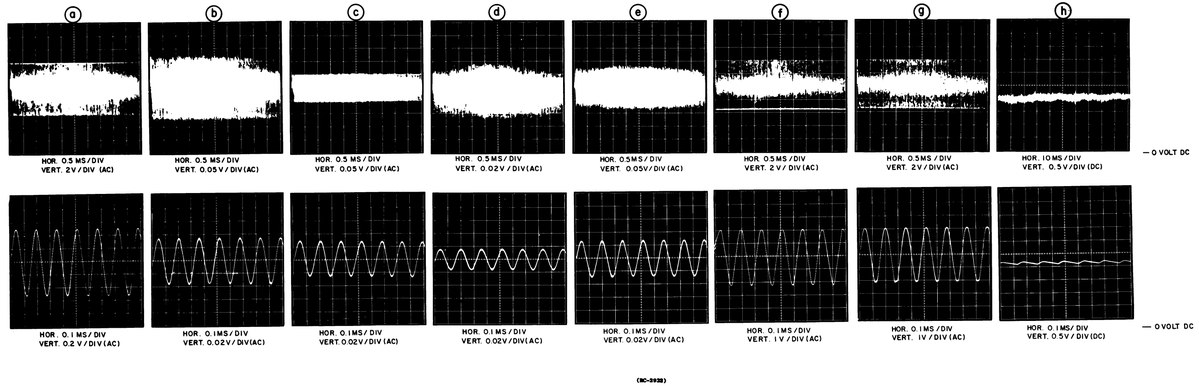
SQUELCH WAVEFORMS

(WITH NOISE)

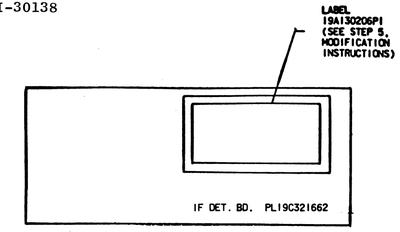
1. NO RF
2. SET SQUELCH CONTROL TO CRITICAL.

(WITH 6KHz SIGNAL)

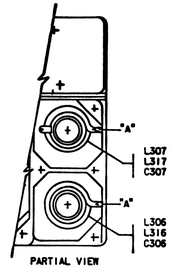
1. 1 MV RF.
2. 6KHz MOD.
3. 3 KHz DEV.
4. SET SQUELCH CONTROL FOR CRITICAL. (TP901 JUST FALLS TO 0VDC.)

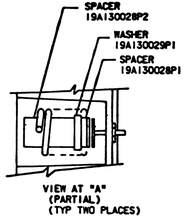


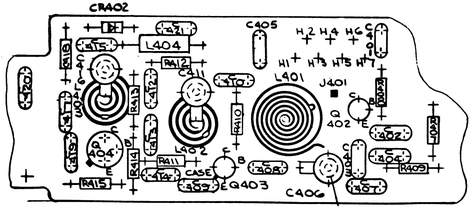
(RC-3928)



HIGH BAND HIGH SIDE INJECTION WITH OSC/MULT BOARD 19C321740







(3) MODIFICATION INSTRUCTIONS FOR HIGH BAND HIGH SIDE INJECTION APPLYING 19A130045G1 OR G2 KIT

1. ON OSC/MULT. BD. 19C321740G1 (LOW SPLIT) REMOVE C412 & C417. REPLACE C407 WITH C2311 (12pf, NPO), REPLACE C419 WITH C2312 (3pf, NPO). REPLACE C420 WITH C2313 (5pf, NPO). DISCARD C2314.
   ON OSC/MULT. BD. 19C321740G2 (HIGH SPLIT), REMOVE C407 AND C412. REPLACE C419 WITH C2312 (3pf, NPO), REPLACE C420 WITH C2314 (4pf, NPO). DISCARD C2311, and C2313.
   SOLDER ALL ELECTRICAL CONNECTIONS. C2301 THRU C2314 ARE PART OF MOD KIT 19A130045G1, C2311 THRU C2314 ONLY—G2.
2. MODIFY RF. CKT ASM PL19D416693 BY ADDING 19A130028P1 SPACER, 19A130029P1 WASHER, AND 19A130028P2 SPACER AS SHOWN TO L306 & L307 (LOW SPLIT) OR L316, & L317 (HIGH SPLIT). SLIDE SPACERS, & WASHER ON CERAMIC POST FROM TOP IN ORDER SHOWN. THESE ITEMS ARE PART OF MOD KIT PL19A130045G1 AND G2.
3. IN APPLICATION OF THIS KIT THE CRYSTAL OSCILLATOR FREQUENCY MUST BE CHANGED PER THE FOLLOWING FORMULA: $Fx = \frac{Fo + 11.2}{9}$
4. MARK ALL OSC/MULT. BD'S 19C321740 WITH A BLUE COLOR DOT IN THE AREA OF THE PL DRAWING NO. PER 19A115740P1.
   MARK ALL RECEIVER CASTINGS WITH A BLUE COLOR DOT IN THE AREA OF THE PL DRAWING NO. PER 19A115740P1.
5. APPLY LABEL (19A130206P1) TO DETECTOR COVER ON IF DET. BD.
6. TEST AND ALIGN PER NORMAL PROCEDURE WITH THE FOLLOWING EXCEPTION: PRE-ADJUST C411 AND C416 TO MINIMUM CAPACITY, THEN TUNE IN SLOWLY.

(19C320883, Sh. 3, Rev. 2)

MODIFICATION INSTRUCTIONS

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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