MOBILE RADIO

DESCRIPTION AND MAINTENANCE

138--174 MHz MONITOR RECEIVER WITH NOISE BLANKER

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MAINTENANCE

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, 10-Volt regulator, and IF amplifier stages. Speaker high and low may be monitored at J1-3 (Hi) and J1-4 (low).

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

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

DISASSEMBLY

To gain access to the receiver for servicing, remove the four pan head screws from the rear of the case assembly (one in each corner) and slide the cover off the receiver.

To remove the RF Assembly and MIF board:

1. Disconnect the two leads connected to J606 and J607 on the IF Detector board.
2. Unplug the receiver input cable P301.
3. Remove the two screws on the rear of the system frame assembly, and one screw at the front of the frame assembly. Then lift out RF Assembly and MIF board.

To remove the Osc/Mult board:

1. Remove the crystal module.
2. Remove the two screws securing the board.
3. Carefully unplug the Osc/Mult board from the adapter board (on the receiver front end).

To remove the IF Det board:

1. Disconnect the two leads connected to J606 and J607 on the IF-Det board.
2. Disconnect the two plugs (P602 and J903) from the IF-Det board.
3. Remove the five screws securing the board and lift the board out.

Access to the Channel Guard board is obtained by removing the four flat head screws from the control panel.

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

ALIGNMENT & TROUBLESHOOTING

Alignment and Troubleshooting procedures are provided as an aid to the technician to maintain the receiver in optimum operating condition. Also provided are symptom checks to aid in quickly isolating a malfunction.

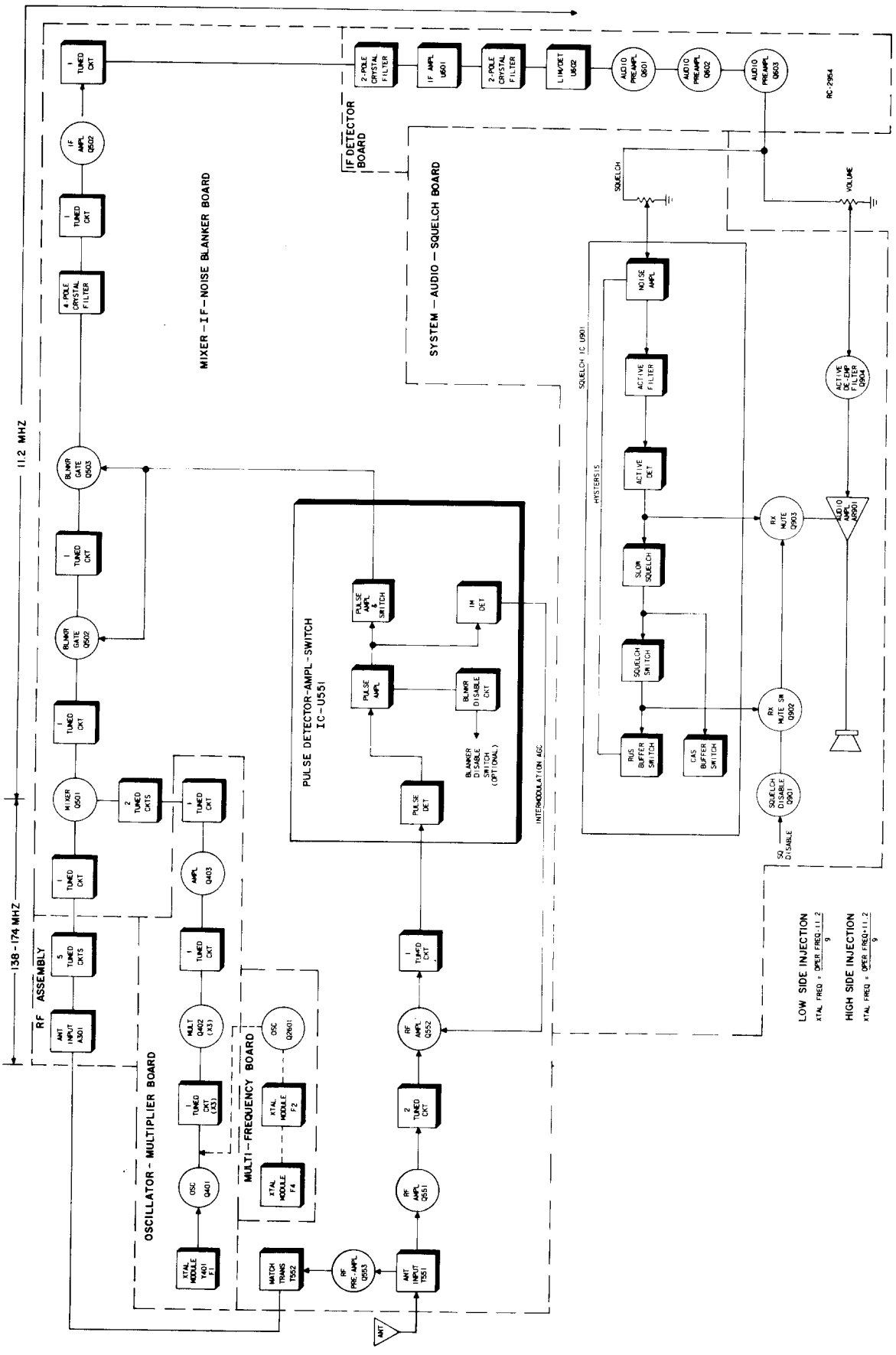


Figure 1 - Monitor Receiver Block Diagram

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.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect black plug from Test Set to Receiver Centralized Metering Jack J601. 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 G, check for regulated +10 Volts. If using multimeter, measure between J601-6 (+) and J601-9 (-).
4. If using multimeter, connect the negative lead to J601-9 (A-).
5. 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. Then repeak C411. Next, return 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 C305 and top slug of T551, C306 and C307	Maximum	Apply an on-frequency signal to the antenna jack (J551) and slightly tune C301 through C305, C502 and T551 (top slug-L555) for best quieting sensitivity. C306 and C307 may also be tuned slightly (not exceeding 1/4 turn).

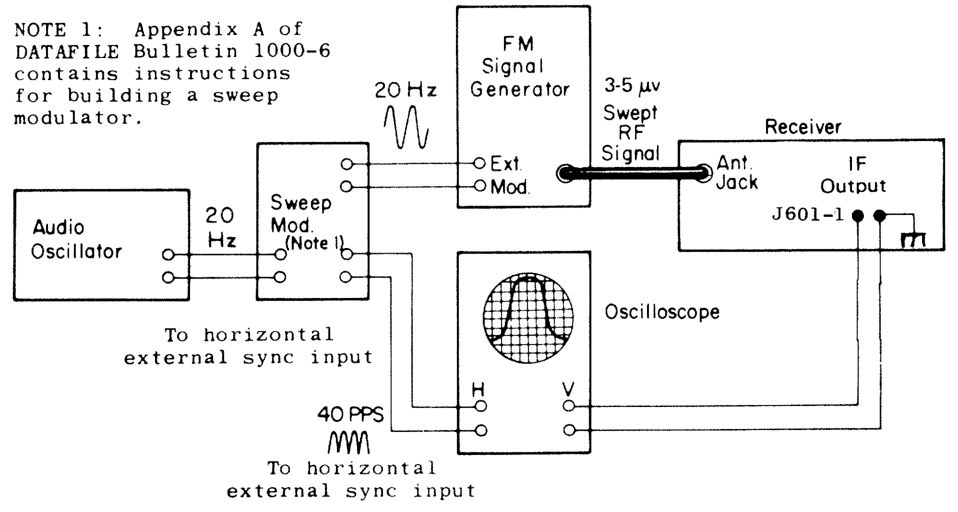
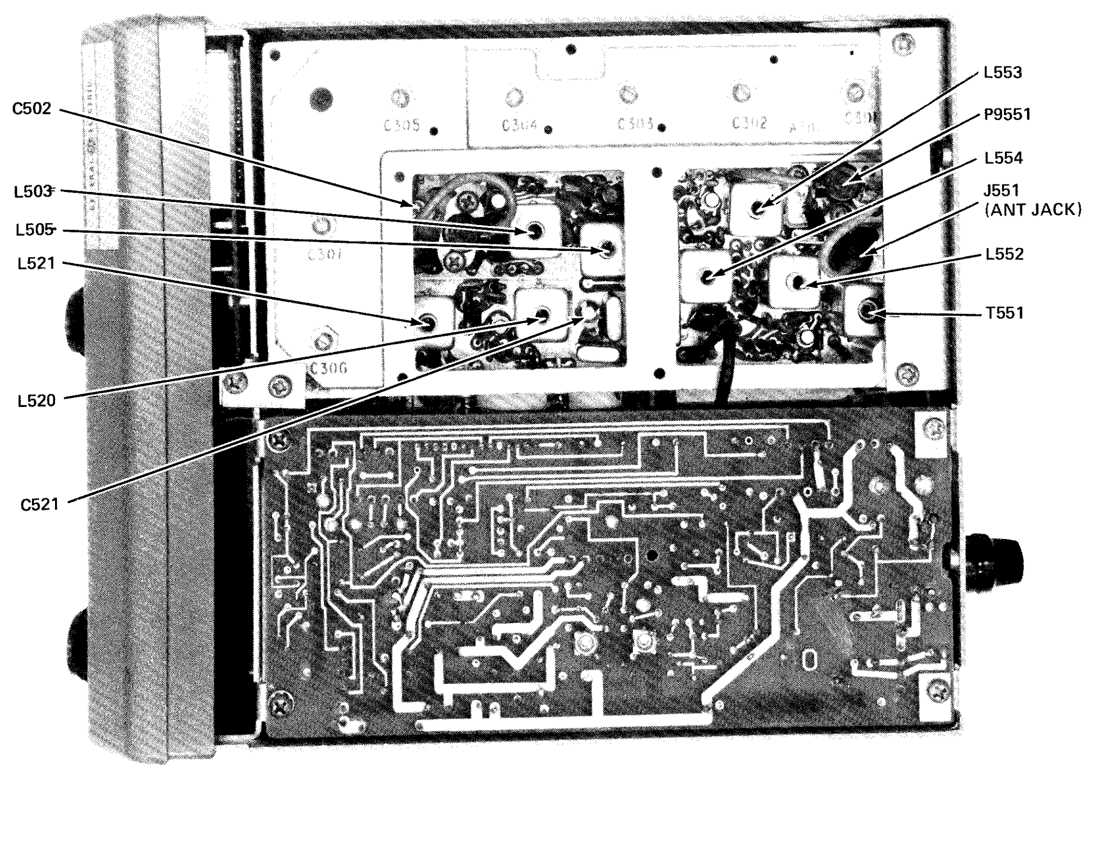
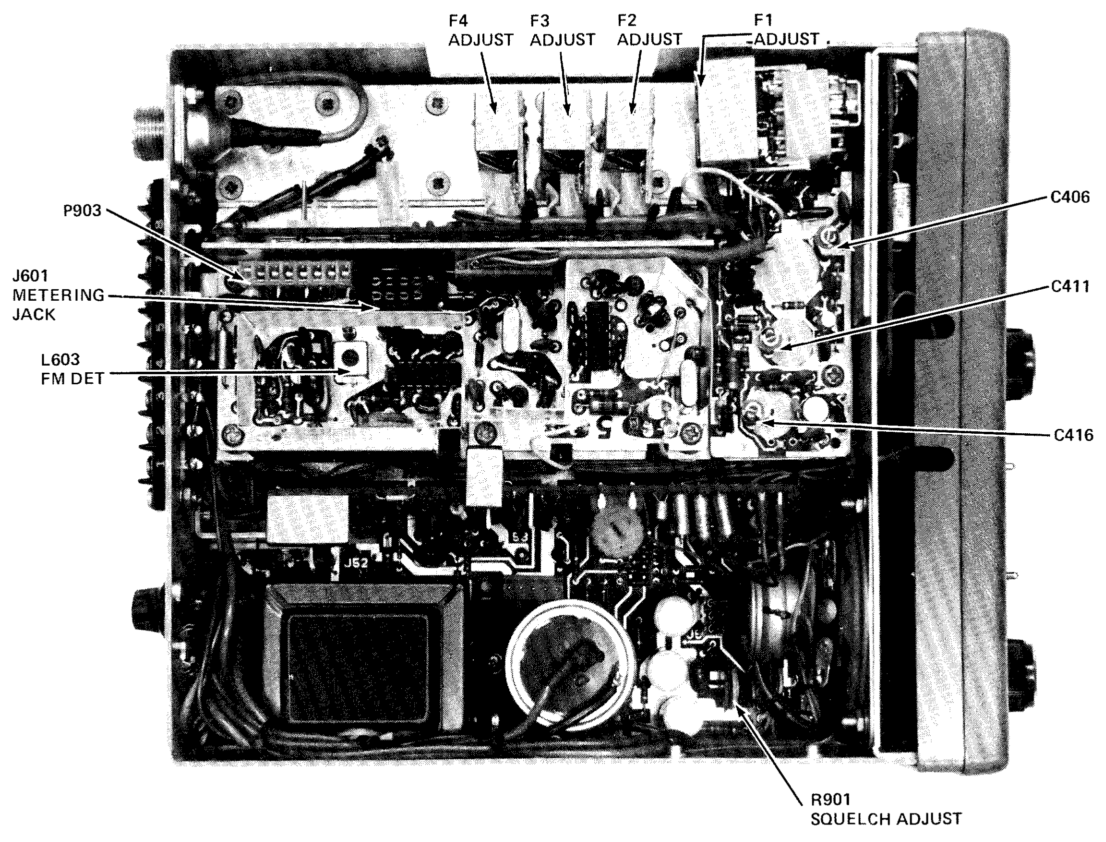


Figure 2 - Test Setup for 20-Hz Double-Trace Sweep Alignment





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 ER..OR 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 kHz as read on a GE Test Set in meter position A, or 0.1 V per kHz as measured with a voltmeter 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.

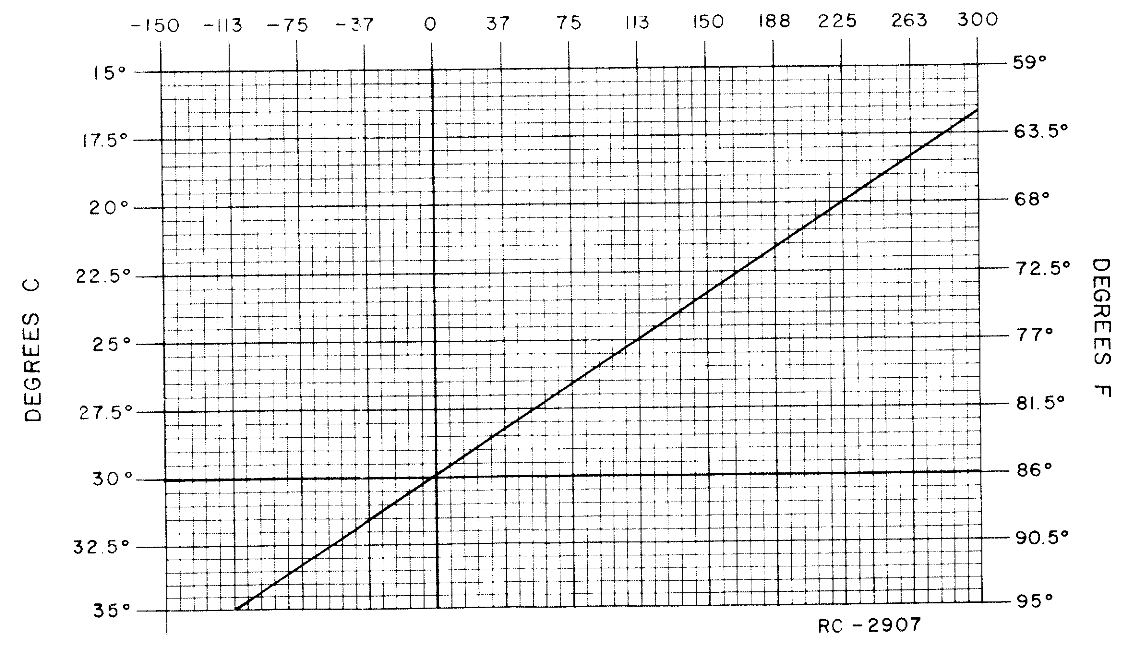


Figure 3 - Frequency Characteristics Vs. Temperature

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set 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 with a one-inch piece of insulated wire no larger than .065 inch diameter connected to generator probe.
3. Voltmeter
4. Distortion Analyzer.

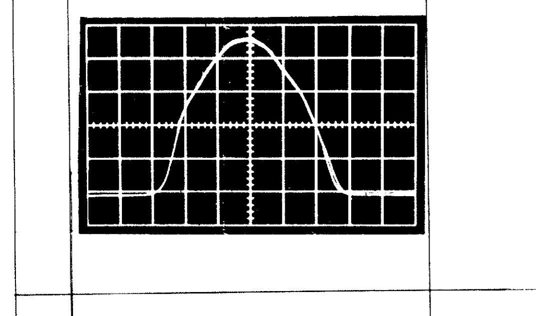
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect the black plug from the Test Set to receiver metering jack J601. 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 G, check for regulated +10 Volts. If using multimeter, measure between J601-6 (+) and J601-9 (-).
4. If using multimeter, connect the negative lead to J601-9 (A-).
5. 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. Then, repeak C411. Next, return 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 C305 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) C306 and C307	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C301 through C305, C502 and T551 (top slug-L555) for best quieting sensitivity. C306 and C307 also may be tuned slightly (not exceeding 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 P903-1 (VOL/SQ HI) and P903-6 (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.			R901	30°	Set SQUELCH ADJUST control R901 to open with a 6 dB SINAD signal (approximately 30° counterclockwise of critical squelch position).

TEST PROCEDURES

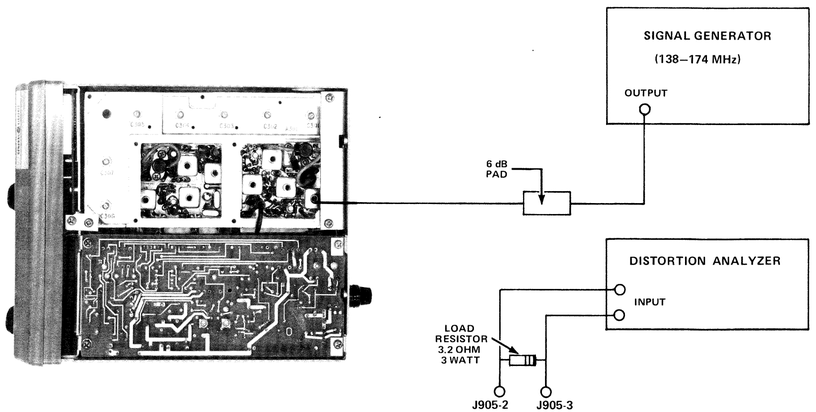
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect 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
- Signal Generator
- 6-dB attenuation pad, and 3.2-ohm, 5-watt resistor

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully counterclockwise for all steps of the Test Procedure.



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 P1-3 (speaker HI) to P1-4 (A-).

Connect the Distortion Analyzer input across the resistor as shown.

C. Adjust the VOLUME control for 3-Watt output using the Distortion Analyzer as a Voltmeter (3.1 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. Power supply 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
12-dB SINAD SENSITIVITY

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

A. Apply 1000 microvolts 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 +2 dB reading on the 30% range.

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. Read the 12 dB SINAD sensitivity from the signal generator output voltage scale ratio. It should be less than rated 12 dB SINAD specifications with an audio output of at least 1.5 Watts (2.2 Volts RMS across the 3.2-ohm receiver load using the Distortion Analyzer as a Voltmeter).

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. Reduce the audio output to 0.3 watts (0.98 VRMS) across the 3.2 ohm receiver load.

C. 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.

D. 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).

E. 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 (30 KHz) and level controls (Similar to General Electric Model 4EX4A10).
3. T-Connector.
4. AC Voltmeter 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 Voltmeter 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 Voltmeter. 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.

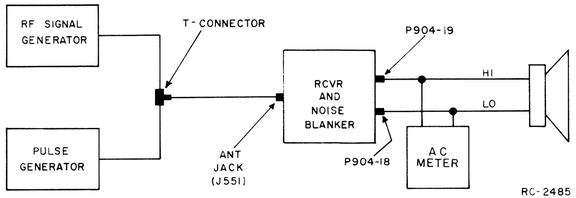


Figure 1 - Equipment Connection Diagram

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 quieting level obtained in Step 2.

STEP 2 - QUICK CHECKS

Equipment Required:

1. RF Voltmeter.
2. RF Signal Generator.
3. AC Voltmeter 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:

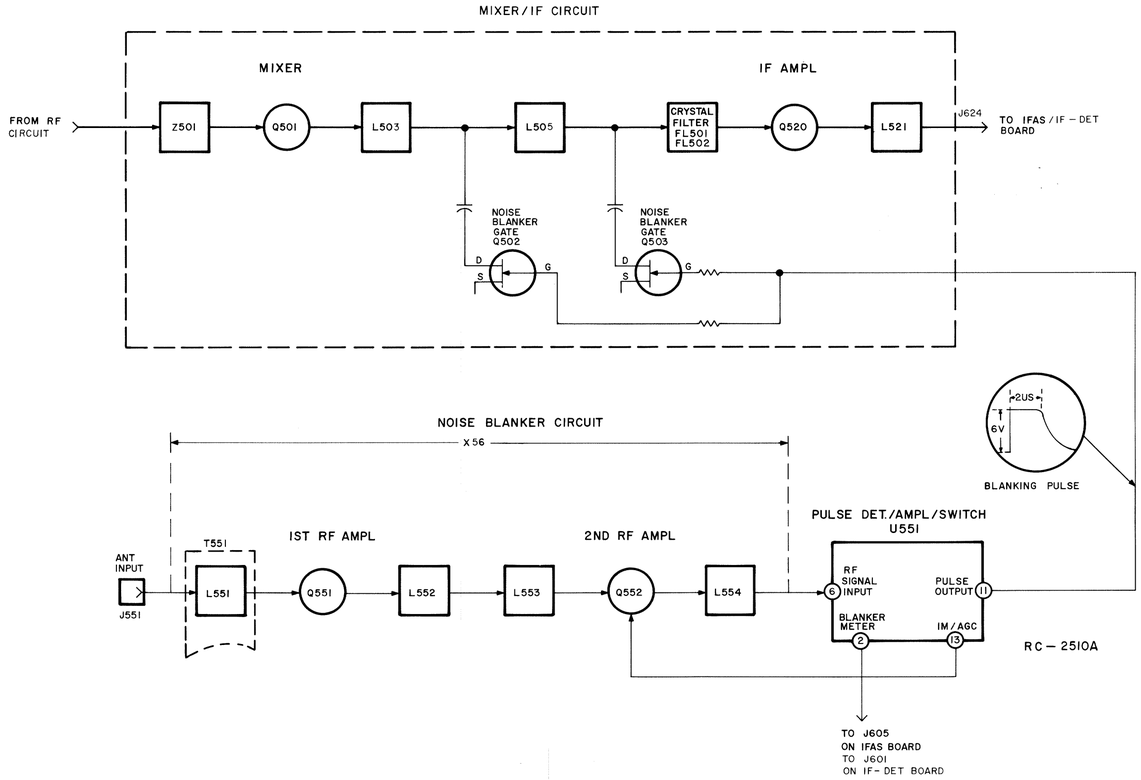
1. RF Voltmeter.
2. Signal generator.

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 CE Test Set Model 4X83A11 in the Test 1 position, or Model 4X83A12 in the 1-Volt position.

Metering Position	Readings With No Signal In	Reading With 1 Microvolt Unmodulated
A (PW DET)	0.35 to 0.50 VDC	
B (IF AMP)		0.2 VDC
C (MULT-1)	0.45 VDC	
D (MULT-2)	0.1 VDC	
G (Neg. -10 Volts at J601	-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 LIM READING	• Check supply voltages and then check oscillator readings at J601-3 & 4 as shown in STEP 2. • Make SIMPLIFIED GAIN CHECKS from Mixer through 1st Limiter 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 (Q402, Q403, Q404).
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).
INOPERATIVE 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 Q601, Q660 and Q665 and other discrete components. • Check A8601 on SAS board.

STEP 4-VOLTAGE RATIO READINGS

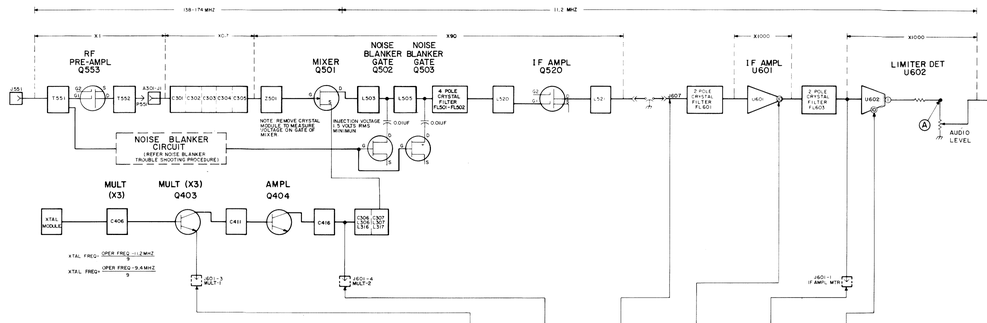
EQUIPMENT REQUIRED:
1. RF VOLTMETER
2. SIGNAL GENERATOR
3. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION) USE 1000 HERTZ SIGNAL WITH 3.0 KHz DEVIATION

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 (E1)
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (MIXER). REPEAT PEAKING PROCEDURE AND TAKE THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (E2)
3. CONVERT READINGS BY MEANS OF THE FOLLOWING FORMULA

VOLTAGE RATIO = $\frac{E2}{E1}$

4. CHECK RESULTS WITH TYPICAL VOLTAGE RATIOS SHOWN ON DIAGRAM



STEP 2-SIMPLIFIED GAIN CHECKS

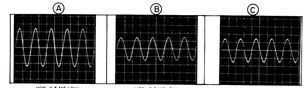
EQUIPMENT REQUIRED:
1. VOLTMETER AC & DC
2. SIGNAL GENERATOR
3. R F VOLTMETER

PRELIMINARY STEPS
1. SET VOLUME CONTROL FOR 3.1 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 ASSY-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	VOLTMETER READING SHOULD BE APPROX 0.5 VDC	VOLTMETER READING SHOULD BE APPROX 0.2 VDC	RF VOLTMETER READING SHOULD BE APPROX 200 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 1.0 MICROVOLTS (10 MICROVOLTS WITH PREAMP)	VOLTMETER READING SHOULD BE APPROX 0.84 VDC	RF VOLTMETER READING SHOULD BE APPROX 0.6 V RMS

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)



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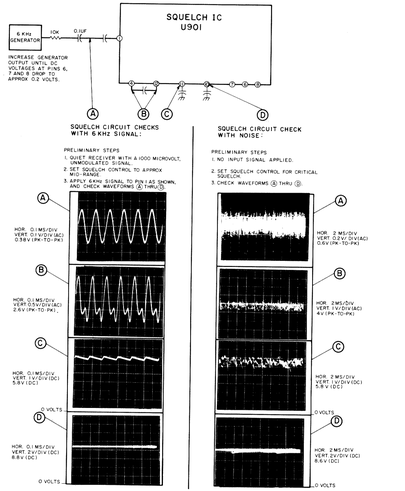
STEP 3-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:
1. OSCILLOSCOPE CONNECTED BETWEEN A- AND POINTS INDICATED BY ARROW.
2. SIGNAL GENERATOR
3. 6 KHz GENERATOR



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