MOBILE RADIO

LBI30106D
(DF1100)

DESCRIPTION AND MAINTENANCE

MASTR® II 25—50 MHz RECEIVER (WITH NOISE BLANKER)

TABLE OF CONTENTS

ILLUSTRATIONS

DESCRIPTION

MASTR II, 25 to 50 megahertz receivers are single conversion, superheterodyne FM receivers designed for one-through eight-frequency operation. The solid state receiver utilizes integrated circuits (ICs), monolithic crystal filters and discrete components with each of the crystal filters located between gain stages to provide 100 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)
- IF/Audio and Squelch (IFAS)

Audio, supply voltages and control functions are connected to the system board through P903 on the Osc/Mult board, and p904 on the IFAS 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 IFAS board is provided for use with GE Test set meters the oscillator, multiplier, Noise Blanker, discriminator and IF amplifier stages. Speaker high and low are metered on the system board metering jack.

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

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

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

GENERAL ELECTRIC*
U.S.A.

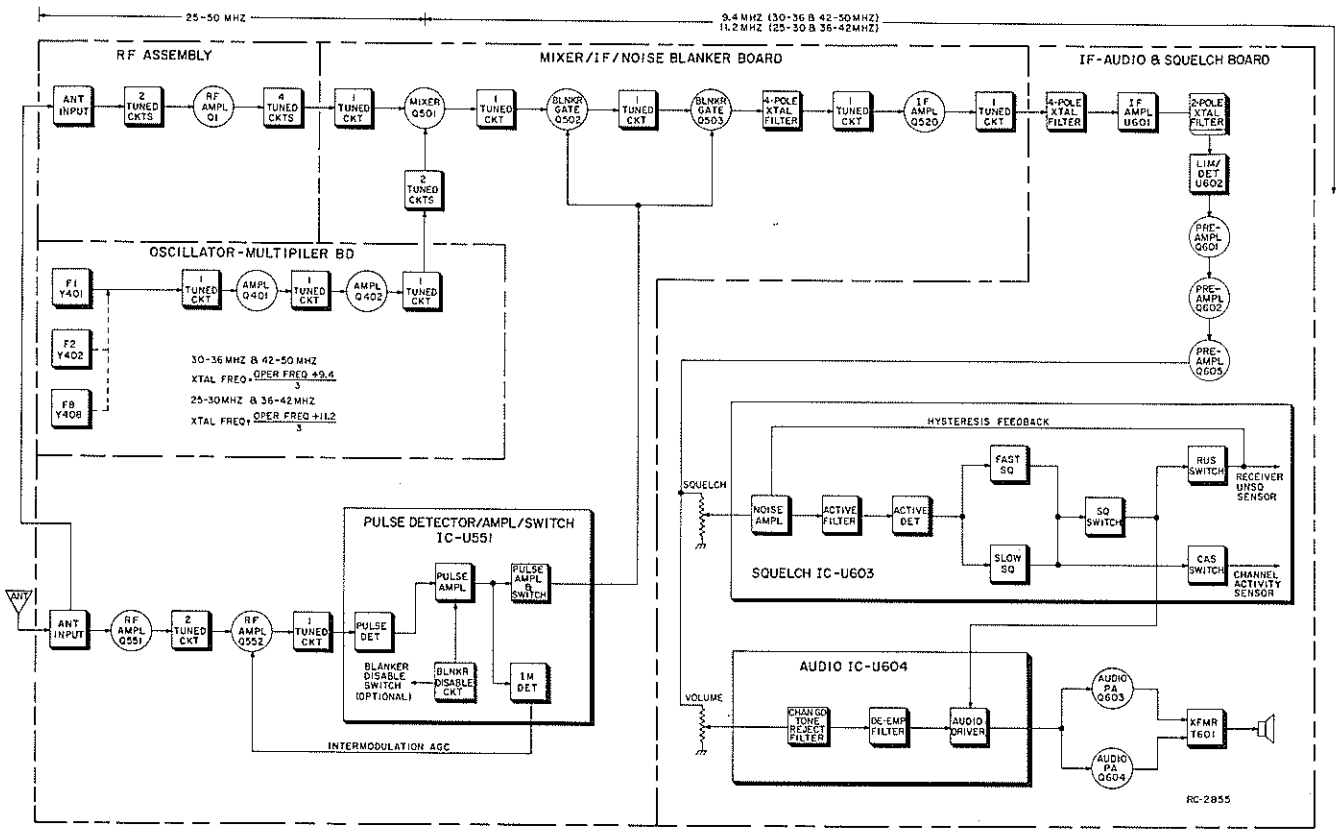


Figure 1 - Receiver Block Diagram

MAINTENANCE

DISASSEMBLY

To service the Receiver from the top (see Mechanical Parts Breakdown):

1. Pull the locking handle down, then pry up the top cover at the front notch and lift off the cover.

To service the Receiver from the bottom:

1. Pull the locking handle down and pull the radio out of the mounting frame.
2. Remove the top cover, then loosen the two bottom cover retaining screws and remove the bottom cover (see Figure 2).
3. To gain access to the bottom of the Osc/Mult and IFAS board, remove the six screws (A) holding the receiver bottom cover (see Figure 3).

NOTE

Refer to Figure 4 for receiver module location.

To remove the OSC/Mult board from the radio:

1. Remove the six screws (A) holding the receiver bottom cover, and the three screws (B) holding the board.
2. Remove the six screws (E) holding the MIF bottom cover.
3. Press straight down on the plug-in Osc/Mult board from the top to avoid bending the pins when unplugging the board from the system board jack.

To remove the IFAS board from the radio:

1. Disconnect Connector (K) from jack J552 on MIF/NB board.
2. Remove the six screws (A) holding the bottom cover, and the one screw (C) holding the board.
3. Remove the two screws (D) holding the audio PA heatsink to the right side rail.
4. Press straight down on the plug-in IFAS board from the top to avoid bending the pins when unplugging the board from the system board jack.

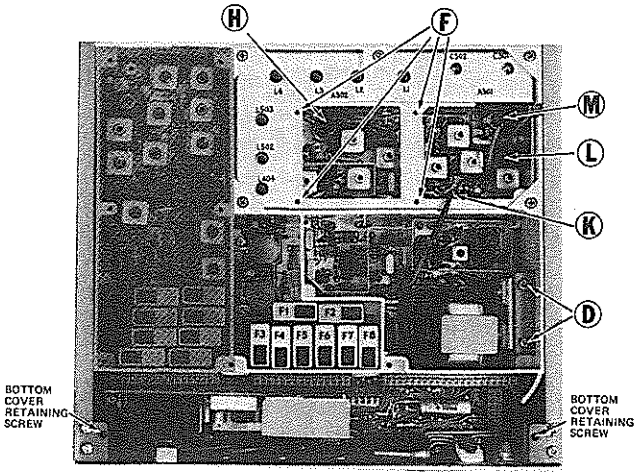


Figure 2 - Disassembly Procedure (Top View)

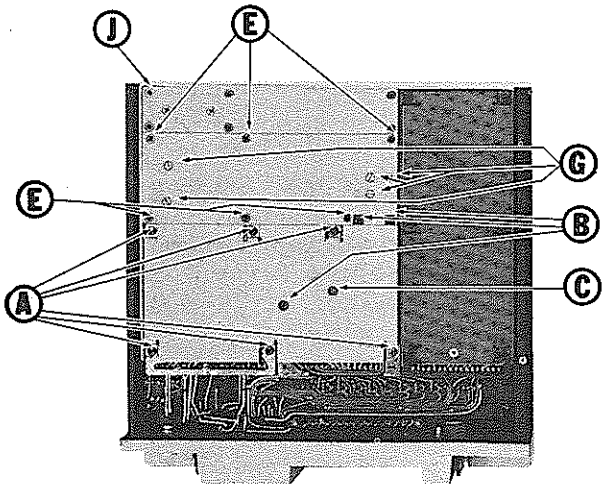


Figure 3 - Disassembly Procedure (Bottom View)

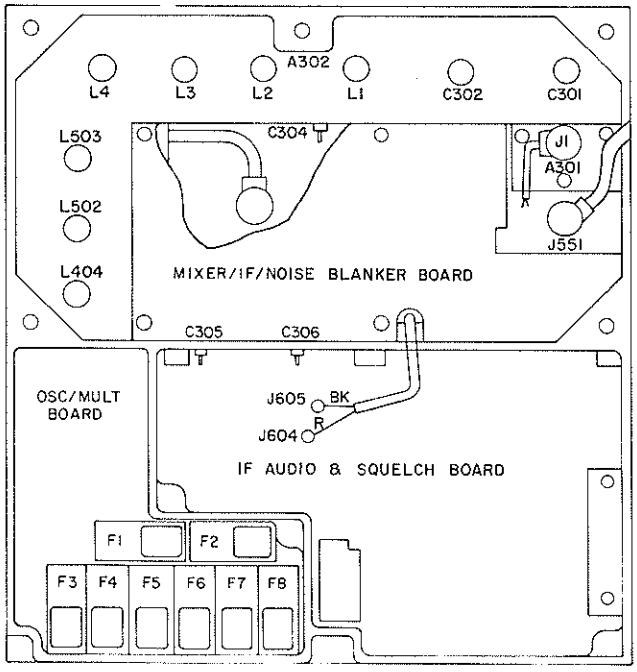


Figure 4 - Receiver Module Location Diagram

To remove the MIF/NB board from the radio:

1. Disconnect Connector (L) from J551 on the MIF/NB board.
2. Disconnect Connector (K) from Jack J552 on the MIF/NB board.
3. Disconnect Connector (M) from Jack A301-J1 on the Antenna input board.
4. Remove the six screws (E) holding the MIF/NB bottom cover.
5. Remove the four screws (F) holding the MIF/NB top cover.
6. Remove the five screws (G) and the Connector (H), and carefully push down on the top of the MIF/NB board to avoid damaging the feedthrough capacitors.

To remove the RF pre-selector board in the RF Assembly:

1. Remove the MIF/NB board as instructed.
2. Remove the eight screws (J) holding the RF assembly bottom cover.
3. Carefully unsolder the lead to the pre-selector board from the helical resonator cavity.
4. Remove the five screws holding the pre-selector board, and lift the board out.

(Page 4 is blank)

ICOM FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency measurement requires equipment with an absolute accuracy which is 5 to 10 times better than the tolerance to be maintained. When performing frequency measurement, the entire radio should be as near as possible to an ambient temperature of 26.5°C (79.8°F).

MASTR II ICOMs should be reset only when the measured frequency error exceeds the following limits.

A. ±0.5 PPM, when the radio is at 26.5°C (79.8°F).

B. ±2 PPM at any other temperature within the range -5°C to +55°C (+23°F to +131°F).

C. The specification limit (±2 PPM or ±5 PPM) at any temperature within the ranges -40°C to -5°C (-40°F to +23°F) or +55°C to +70°C (+131°F to +158°F).

If frequency adjustment is required, lift up the cover on the top of the ICOM to expose the adjustment trimmer. Depending upon the type of frequency measuring equipment that is available, any of the following procedures may be used:

A. DIRECT MEASUREMENT IN THE INJECTION CHAIN

1. WITH A FREQUENCY COUNTER. "Count" the frequency at the junction of C411 and L402 on the Oscillator/Multiplier Board. The frequency measured at this point is 3 times the ICOM frequency. NOTE: The output from the ICOM itself is not sufficiently sinusoidal for reliable operation with most frequency counters.

2. WITH A COMMUNICATION MONITOR (for example: Cushman Model CE-3). "Monitor" frequency at the junction of C411 and L402 on the Oscillator/Multiplier Board. The frequency monitored at this point is 3 times the ICOM 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 top of Z602-B2 on the IFAS 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 error in PPM.

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 either of the following methods:

NOTE

To SET ICOM frequency using "beat frequency" method, the temperature should be at 26.5°C (79.8°F). If the temperature is not 26.5°C, then offset the "on frequency" signal (at the receivers input), as a function of actual temperature, by the frequency error factor (in PPM) shown in Figure 6.

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

b. Observe "beat frequency" at P904-4 with an Oscilloscope.

c. With GE TEST SET (Meter Position B) connected to J601 on the IFAS 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 error in PPM.

NOTE

The FM Detector output (meter position A of the test set) has a dc voltage of +0.35 to 0.5 Volt with an on-frequency signal or under no-signal conditions 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 VTVM at P904-3 or J601-2 on the IFAS board) is inadequate for oscillator frequency setting.

If the radio is at an ambient temperature of 26.5°C (79.8°F), set the oscillator for the correct mixer frequency (ICOM FREQ. X 3).

If the radio is not at an ambient temperature of 26.5°C, setting errors can be minimized as follows:

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

1. Maintain the radio at 26.5°C (±5°C) and set the oscillator to require mixer injection frequency, or

2. Maintain the radio at 26.5°C (±10°C) and offset the oscillator, as a function of actual temperature, by the frequency error factor shown in Figure 6.

B. To hold setting error to ±0.35 PPM (which is considered reasonable for 2 PPM ICOMS): Maintain the unit at 26.5°C (±5°C) and offset the oscillator, as a function of actual temperature, by the frequency error factor shown in Figure 6.

For example: Assume the ambient temperature of the radio is 18.5°C (65.4°F). At that temperature, the curve shows a correction factor of 0.3 PPM. (At 25 MHz, 1 PPM is 25 Hz. At 50 MHz, 1 PPM is 50 Hz).

With a mixer injection frequency of 50 MHz, adjust the oscillator for a corrected mixer injection frequency 15 Hz (0.3 x 50 Hz) higher. If a negative correction factor is obtained (at temperatures above 26.5°C), set the oscillator for the indicated PPM lower than the calculated mixer injection frequency.

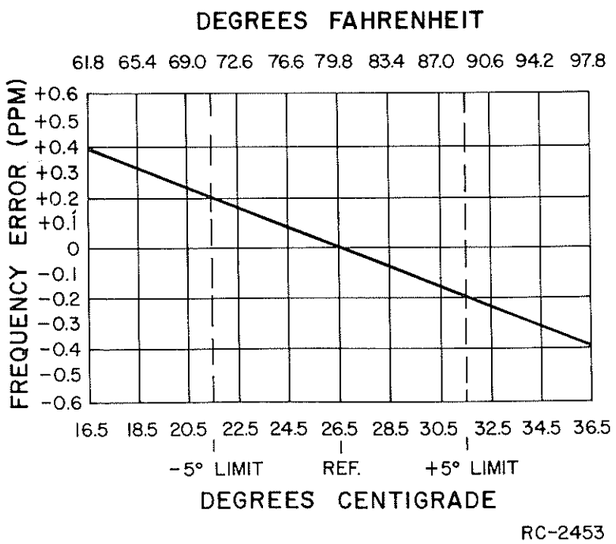


Figure 6 - Frequency Characteristics Vs. Temperature

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A11, 4EX8K12 (or 20,000 ohms-per-Volt multimeter with a 1 Volt and 3 Volt scale.
2. A 9.4 MHz signal source for 30-36 and 42-50 MHz receivers, or 11.2 MHz signal source for 25-30 and 36-42 MHz receiver. Also a 25-50 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, and the red plug to system board metering jack J905. Set the meter sensitivity switch to the Test 1 (or 1 Volt position on the 4EX8K12).
2. For multi-frequency receivers with a frequency spacing up to 0.060 MHz for frequency range of 25-36 MHz, 0.080 MHz for frequency range of 36-42 MHz or 0.180 MHz for frequency range of 42-50 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 0.120 MHz for frequency range of 25-36 MHz, .160 MHz for frequency range of 36-42 MHz, or .360 MHz for frequency range of 42-50 MHz, align the receiver using a center frequency tune-up ICOM. These limits can be extended to .340 MHz, .400 MHz and .640 MHz respectively, with 3 dB degradation in standard receiver specifications.
3. With the Test Set in Position J, check for regulated +10 Volts. With multimeter, measure from J905-3 to J905-9.
4. If using multimeter, connect the negative lead to J601-9 (A-).
5. Disable the Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE TEST SET	METERING POSITION: INTERNAL METERING	METERING POSITION: MULTIMETER - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
				FM DETECTOR		
1.	A (FM DET)	1 (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)	3 (MULT-1)	Pin 3	L404, L502, L503, C402	See Procedure	Set the range selector switch to the Test 3 position on the 3 Volt scale. Adjust the slugs in L404, L502 and L503 to top of coil. Adjust C402 for maximum meter reading.
3.	D (MULT-2)	4 (MULT-2)	Pin 4	C411, C402, L404, L502, and L503	See Procedure	Adjust C411 and C402 for maximum meter reading. Carefully tune L404 for a dip in meter reading. Then adjust L502 for maximum meter reading and L503 for a dip in meter reading. Do NOT readjust L404, L502 and L503.
				RF AMP & SELECTIVITY		
4.	B (IF AMP)	2 (IF AMP)	Pin 1	L4		Apply an on-frequency signal in the hole adjacent to L4. Set the range selector switch to the Test 1 position or the 1 Volt scale and tune L4 for maximum meter reading.
5.	B (IF AMP)	2 (IF AMP)	Pin 1	L4, L3	Maximum	Apply an on-frequency signal adjacent to L2 keeping the signal below saturation. Then tune L4 and L3 for maximum meter reading.
6.	B (IF AMP	2 (IF AMP)	Pin 1	L1,L2,L3,L4, C301, C302 & C502	Maximum	Apply an on-frequency signal to the antenna jack A301-J1, keeping the signal below saturation. Then tune L1, L2, L3, L4, C301 C302 and C502 for maximum meter reading.
7.	B (IF AMP)	2 (IF AMP)	Pin 1	C502, L4, L3 L2, L1, C301 & C302	See Procedure	Apply an on-frequency signal as in Step 6 and slightly tune C502, L4, L3, L2, L1, C301 and C302 for best quieting sensitivity.
8.				L603, 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 kHz and adjust R608 for 1 Volt RMS measured with a VTVM at P904-11 (VOL/SQ HI) and P904-17 (A-).
				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 STEPS 10 and 11. 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.						
9.				L504, L506, L520, L521 and C521		Connect scope, signal generator, and probe as shown in Figure 5. Set signal generator level for 3 to 5 µV and modulate with 20 Hz at 10 kHz deviation. With probe between P904-4 (or J601-1) and A-, tune L504, L506, L520, L521 and C521 for double trace as shown on scope pattern.
10.					See Procedure	Check to see that modulation acceptance bandwidth is greater than ±6.5 kHz.
				NOISE BLANKER		
11.	F (BLANKER)	5	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: Receiver Operating Frequency: 25-30 MHz, 30-36 MHz, 36-42 MHz, 42-50 MHz — Align Noise Blanker to: 33 MHz, 40 MHz, 33 MHz, 38 MHz. Tune L554, L553, L552 and L551 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 2 MHz to the operating frequency of the receiver.
12.	F	5	J601-Pin 7		Greater than 0.1 VDC	Apply a 1000 microvolt signal on blanker frequency to antenna jack J551. The meter reading should be greater than 0.1 VDC.
				SQUELCH ADJUST		
13.				R622		Squelch adjust control R622 (if present) is preset at the factory. If further adjustment is required, adjust R622 on the IFAS board for best squelch operation. NOTE: Maximum squelch decreases with increasing resistance.

FRONT END ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A11, 4EX8K12, or 20,000 ohms-per-Volt multimeter with a 1-Volt and 3-Volt scale.

2. A 25-50 MHz signal source. Connect a one-inch piece of insulated wire no larger than .065-inch diameter to generator output probe.

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 J905. Set range selector switch to the TEST 3 position (or 3-Volt position on 4EX8K12).

2. For multi-frequency receivers with a frequency spacing up to 0.060 MHz for frequency range of 25-36 MHz, 0.080 MHz for frequency range of 36-42 MHz or 0.180 MHz for frequency range of 42-50 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 0.120 MHz for frequency range of 25-36 MHz, .160 MHz for frequency range of 36-42 MHz, or .360 MHz for frequency range of 42-50 MHz, align the receiver using a center frequency tune-up ICOM. These limits can be extended to .340 MHz, .400 MHz and .640 MHz respectively, with 3 dB degradation in standard receiver specifications.

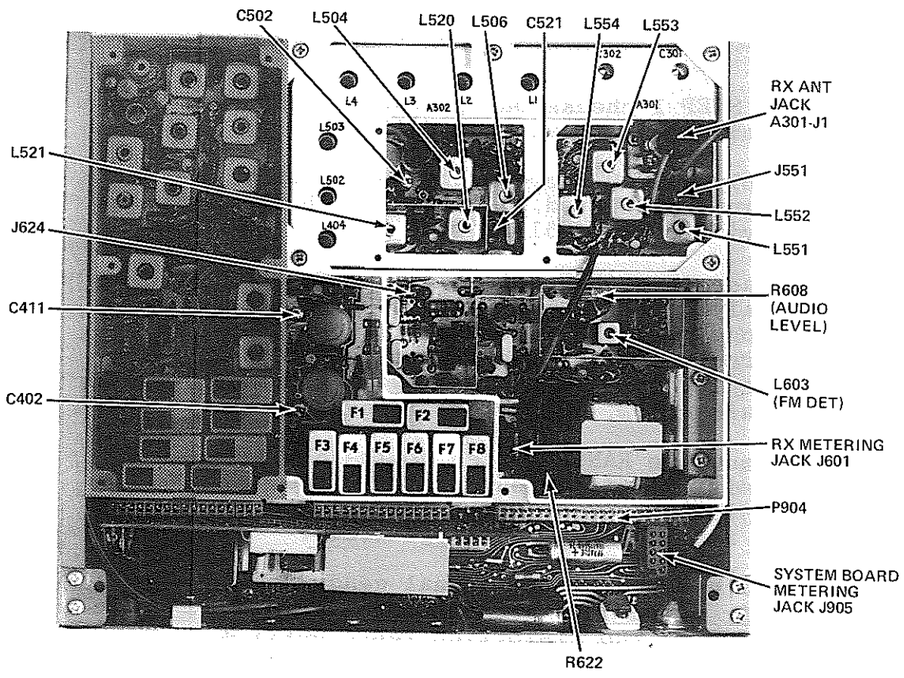
3. With Test Set in Position J, check for regulated +10 Volts. If using multimeter, measure between J905-3 (+) and J905-9 (-).

4. If using Multimeter, connect the negative lead to J601-9 (A-1).

5. Disable Channel Guard.

ALIGNMENT PROCEDURE

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	L404, L502, L503, C402	See Procedure	Set the range selector switch to the Test 3 position on the 3-Volt scale. Adjust the slugs in L404, L502 and L503 to top of coil. Adjust C402 for maximum meter reading.
2.	D (MULT-2)	Pin 4	C411, C402, L404, L502, and L503	See Procedure	Adjust C411 and C402 for maximum meter reading. Carefully tune L404 for a dip in meter reading. Then adjust L502 for maximum meter reading and L503 for a dip in meter reading. Do NOT readjust L404, L502 and L503.
		RF AMPLIFIER & SELECTIVITY			
3.	B (IF AMP)	Pin 1	L4		Apply an on frequency signal in the hole adjacent to L4. Set the range selector switch to the Test 1 position or the 1 volt scale and tune L4 for maximum meter reading.
4.	B (IF AMP)	Pin 1	L4, L3	Maximum	Apply an on-frequency signal adjacent to L2 keeping the signal below saturation. Then tune L4 and L3 for maximum meter reading.
5.	B (IF AMP)	Pin 1	L1, L2, L3, L4, C301, C302 and C502	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune L1, L2, L3, L4, C301, C302 and C502 for maximum meter reading.
6.	B (IF AMP)	Pin 1	C502, L4, L3, L2, L1, C301 and C302	See Procedure	Apply an on-frequency signal as in Step 5 and slightly tune C502, L4, L3, L2, L1, C301 and C302 for best quieting sensitivity.



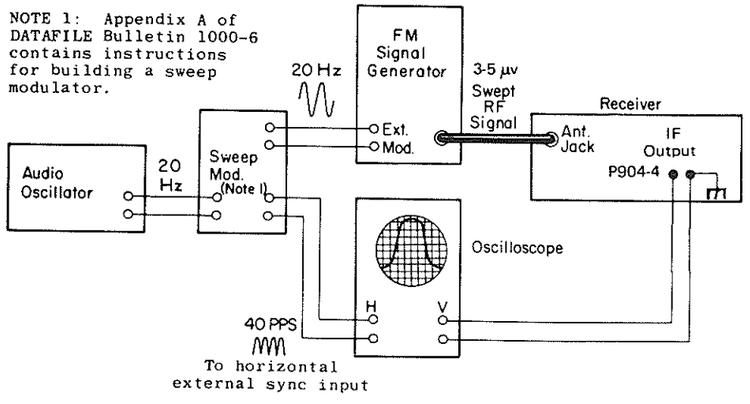


Figure 5 - Test Setup for 20-Hz Double-Trace Sweep Alignment

ICOM FREQUENCY ADJUST

First, check the frequency to determine if any adjustment is required. The frequer accuracy which is 5 to 10 times better than the tolerance to be maintained. When perfor be as near as possible to an ambient temperature of 26.5°C (79.8°F).

MASTR II ICOMs should be reset only when the measured frequency error exceeds the f

A. ±0.5 PPM, when the radio is at 26.5°C (79.8°F).

B. ±2 PPM at any other temperature within the range -5°C to +55°C (+23°F to +131°F

C. The specification limit (±2 PPM or ±5 PPM) at any temperature within the ranges (+131°F to +158°F).

If frequency adjustment is required, lift up the cover on the top of the ICOM to ex type of frequency measuring equipment that is available, any of the following procedures

A. DIRECT MEASUREMENT IN THE INJECTION CHAIN

1. WITH A FREQUENCY COUNTER. "Count" the frequency at the junction of C411 an The frequency measured at this point is 3 times the ICOM frequency. NOTE: sufficiently sinusoidal for reliable operation with most frequency counters

2. WITH A COMMUNICATION MONITOR (for example: Cushman Model CE-3). "Monitor" on the Oscillator/Multiplier Board. The frequency monitored at this point frequency will not always fall within an available measuring range of all m

B. STANDARD "ON FREQUENCY" SIGNAL AT THE RECEIVER INPUT (Generated from a COMMUNIC

1. WITH A FREQUENCY COUNTER. "Count" the developed IF frequency at the top of from the nominal IF frequency (11.2 MHz) in Hz is compared to the receiver error in PPM.

2. WITH AN 11.2 MHz IF FREQUENCY STANDARD (for example: General Electric Mode standard to the IF signal path to create a heterodyne with the developed IF can be monitored by either of the following methods:

NOTE

To SET ICOM frequency using "beat frequency" method, the temperature should ture is not 26.5°C, then offset the "on frequency" signal (at the receivers ture, by the frequency error factor (in PPM) shown in Figure 6.

a. Audible "beat frequency" from the receiver speaker (this requires caref

b. Observe "beat frequency" at P904-4 with an Oscilloscope.

c. With GE TEST SET (Meter Position B) connected to J601 on the IFAS Board by meter movement.

The frequency of the "beat" is the frequency error, related to the IF frequency. T operating frequency, also in Hz, to calculate the error in PPM.

NOTE

The FM Detector output (meter position A of the test set) has a dc voltage signal or under no-signal conditions and is provided for routine test and m reading (approximately .025 V per kHz as read on a GE Test Set in meter p a VTVM at P904-3 or J601-2 on the IFAS board) is inadequate for oscillator

If the radio is at an ambient temperature of 26.5°C (79.8°F), set the oscillator fo

If the radio is not at an ambient temperature of 26.5°C, setting errors can be mini

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

1. Maintain the radio at 26.5°C (±5°C) and set the oscillator to require mixer

2. Maintain the radio at 26.5°C (±10°C) and offset the oscillator, as a functi factor shown in Figure 6.

B. To hold setting error to ±0.35 PPM (which is considered reasonable for 2 PPM IC offset the oscillator, as a function of actual temperature, by the frequency er

For example: Assume the ambient temperature of the radio is 18.5°C (65.4°F). At t of 0.3 PPM. (At 25 MHz, 1 PPM is 25 Hz. At 50 MHz, 1 PPM is 50 Hz).

With a mixer injection frequency of 50 MHz, adjust the oscillator for a corrected m If a negative correction factor is obtained (at temperatures above 26.5°C), set the osci mixer injection frequency.

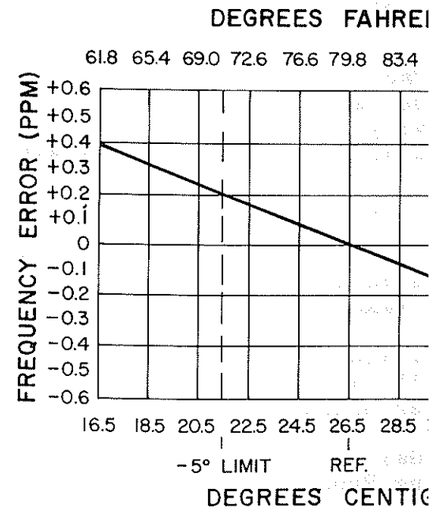


Figure 6 - Frequency Characteristics

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

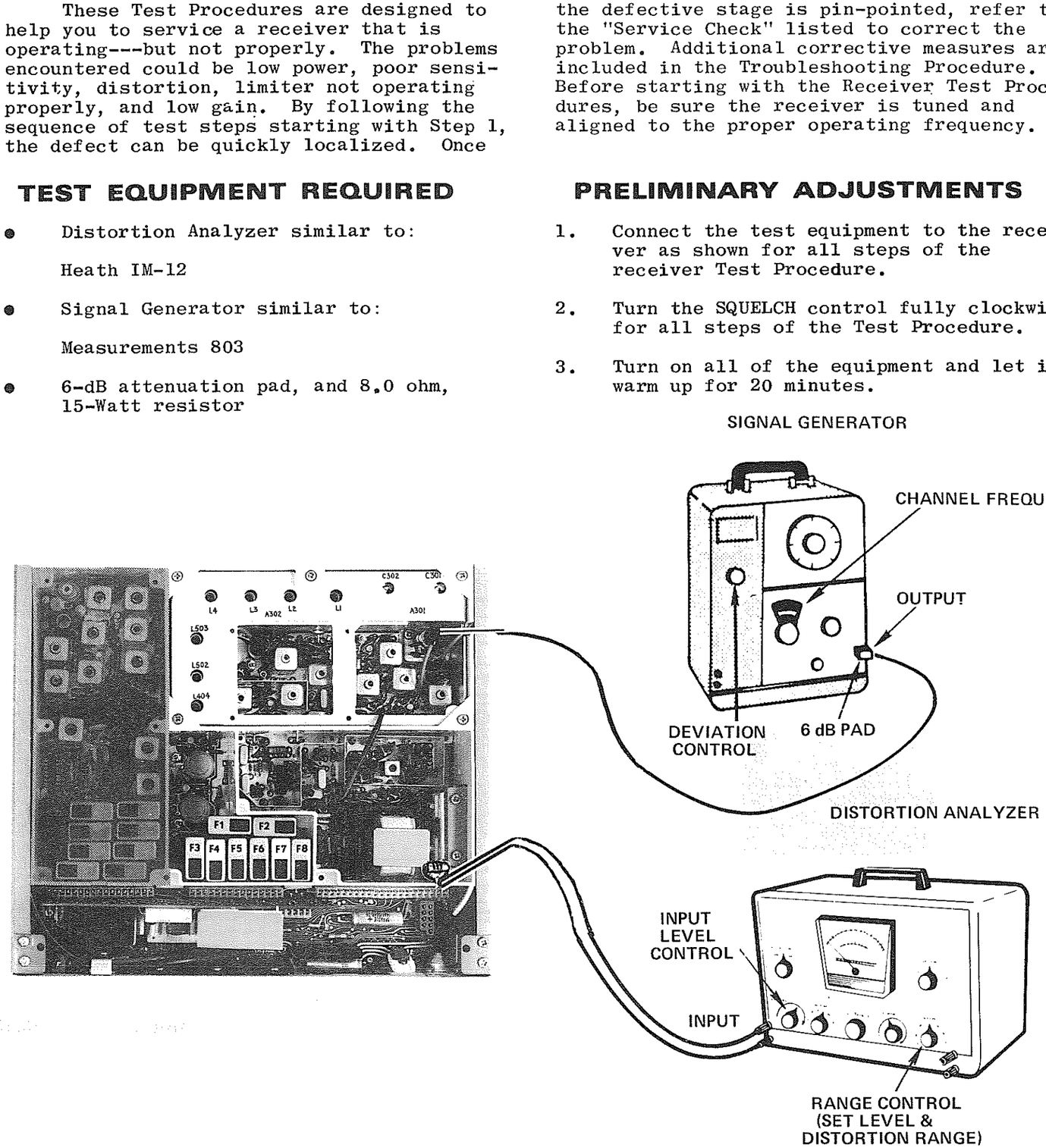
- 6-dB attenuation pad, and 8.0 ohm, 15-Watt resistor

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 1000-microvolt, on-frequency test signal modulated by 1000 hertz with ±3.0 kHz deviation to antenna jack J551.

B. With 15-Watt Speaker (Mobile)

5-Watt (Station):

Disconnect speaker lead pin from Systems Plug P701-11 (on rear of Control Unit).

Connect an 8.0-ohm, 15-Watt load resistor from P904-19 to P904-18 or from P701-4 to P701-17 (SPEAKER Hi) on the System Plug. 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 P904-19 to P904-18.

C. Adjust the VOLUME control for 12-Watt (5-Watt Station) output 9.8 VRMS (Mobile) or 6.3 VRMS (Station) using the Distortion Analyzer as a VTVM.

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 3%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 3%, or maximum audio output is less than 12.0 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 Trouble-shooting Procedure).

G. FM Detector Alignment (refer to Receiver Alignment).

U

If STE
the receive

A. Apply
signal
deviat

B. Place
Analyz
range
circui
readin
scale

C. Place
positi
adjust
dB rea

OR

D. While
put, s
LEVEL
12-dB
obtain
distor
and fi

E. The 12
and Di
ratio)
The se
microv
least
8.0-oh
Analyz

F. Leave
equipm
Accept
formed

If the
0.25 microv
RF stages a
dure, and m
on the Trou

STEP 1
AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1000-microvolt, on-frequency test signal modulated by 1000 hertz with ±3.0 kHz deviation to antenna jack J551.

B. With 15-Watt Speaker (Mobile)

5-Watt (Station):

Disconnect speaker lead pin from Systems Plug P701-11 (on rear of Control Unit).

Connect an 8.0-ohm, 15-Watt load resistor from P904-19 to P904-18 or from P701-4 to P701-17 (SPEAKER Hi) on the System Plug. 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 P904-19 to P904-18.

C. Adjust the VOLUME control for 12-Watt (5-Watt Station) output 9.8 VRMS (Mobile) or 6.3 VRMS (Station) using the Distortion Analyzer as a VTVM.

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 3%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 3%, or maximum audio output is less than 12.0 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 Alignment (refer to Receiver Alignment).

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 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 plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than 0.25 microvolts with an audio output of at least 6.0 Watts (6.9 Volts RMS across the 8.0-ohm receiver load using the Distirtion 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 0.25 microvolts, 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 ±6.5 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.

STEP 2—QUICK CHECKS

tortion Analyzer

PROCEDURE
Check voltage ratios (STEP 3)
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.
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 100 microvolts (see Alignment Procedure, Step 12 for frequencies). Measure RF signal level at pin 6 of U551. This level should be 31 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 millivolt (Corresponds to approx. 30 dB decrease of gain in RF amplifier Q552).

:P 3—VOLTAGE RATIO READINGS

pment Required:

RF Voltmeter.

Signal Generator.

:edure:

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 12). Adjust the RF level for 100 microvolts output.

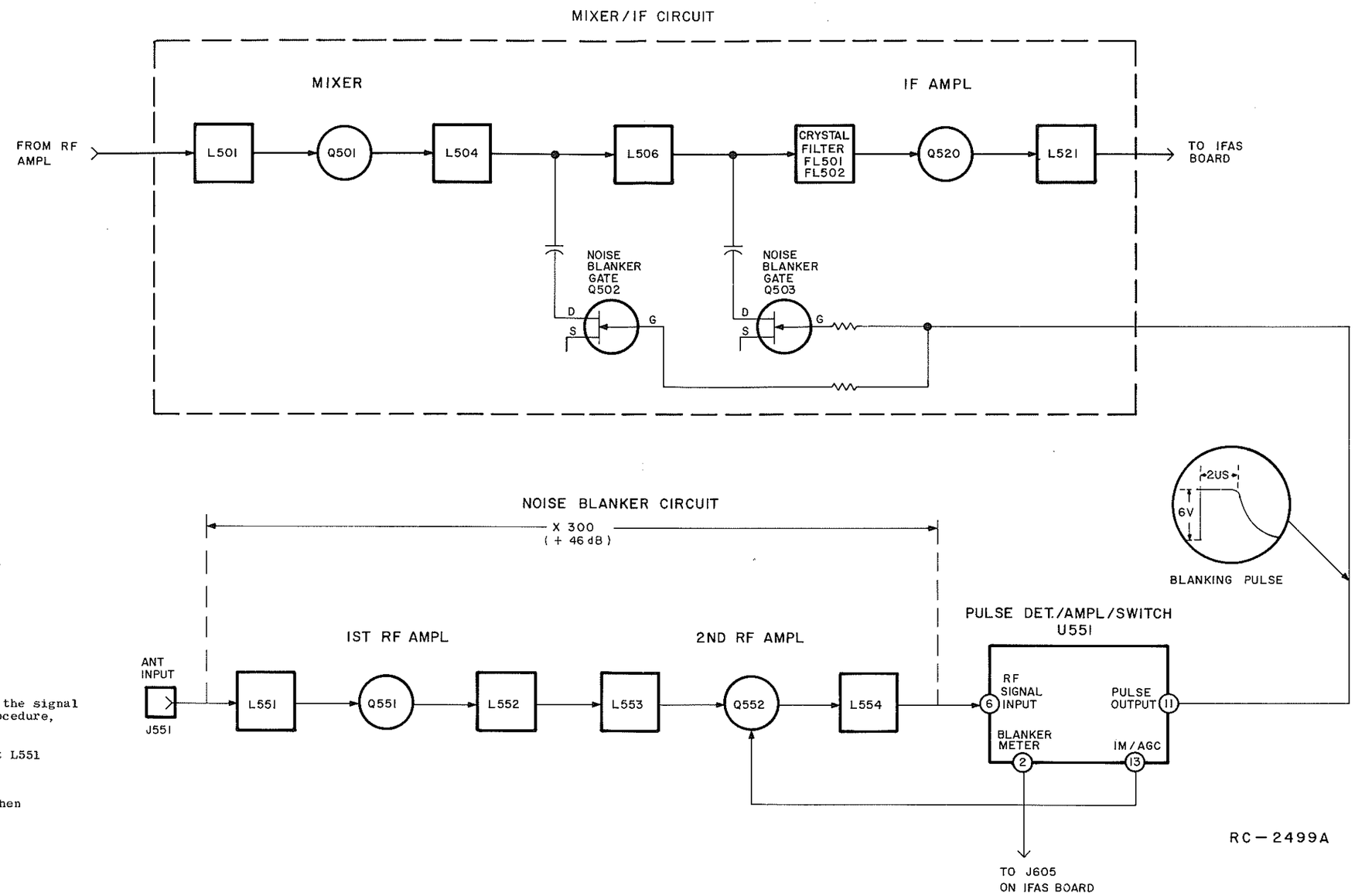
Apply probe of RF Voltmeter to Antenna Jack (J551). Peak resonant circuit L551 and take voltage reading (E_1).

Move probe to input of IC-U551 (Pin 6). Repeak resonant circuit L551. Then peak resonant L554 and take reading (E_2).

Convert reading by means of the following formula:

$$\text{Voltage Ratio} = \frac{E_2}{E_1}$$

Check results with the typical voltage ratio shown on diagram.



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.
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 HI, 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 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 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.

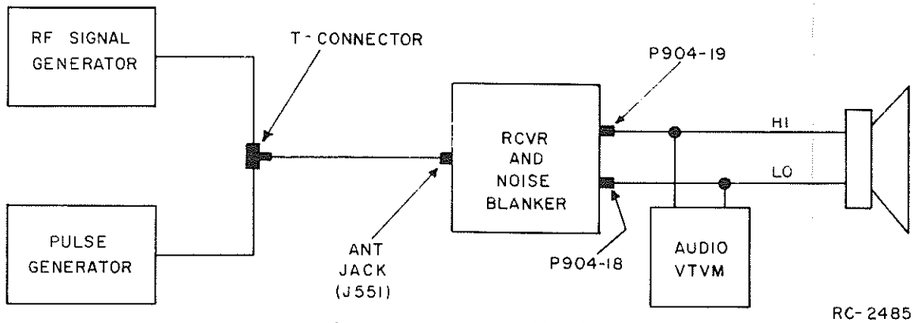


Figure 1 - Equipment Connection Diagram

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 50 dB greater RF level than that established for 20 dB quieting sensitivity.
4. Adjust the pulse generator for a repetition rate up to 40 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
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 100 microvolts (see Alignment Procedure, Step 12 for frequencies). Measure RF signal level at pin 6 of U551. This level should be 31 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 millivolt (Corresponds to approx. 30 dB decrease of gain in RF amplifier Q552).

STEP 3—VOLTAGE RATIO READINGS

Equipment Required:

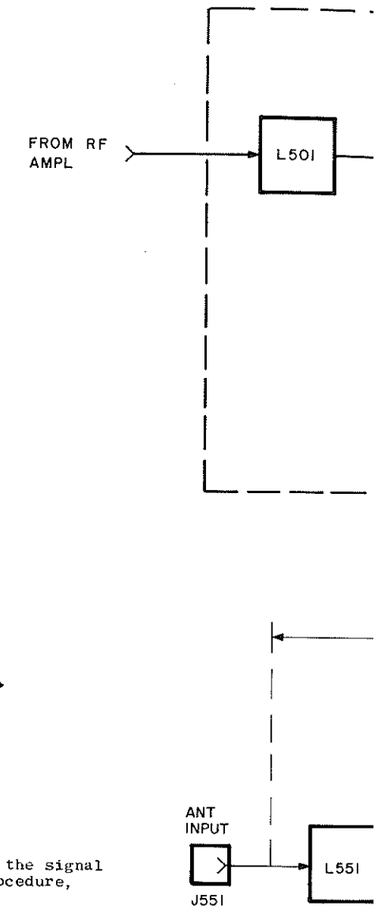
1. RF Voltmeter.
2. Signal Generator.

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 12). Adjust the RF level for 100 microvolts output.
2. Apply probe of RF Voltmeter to Antenna Jack (J551). Peak resonant circuit L551 and take voltage reading (E_1).
3. Move probe to input of IC-U551 (Pin 6). Repeak resonant circuit L551. Then peak resonant L554 and take reading (E_2).
4. Convert reading by means of the following formula:

$$\text{Voltage Ratio} = \frac{E_2}{E_1}$$

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 or Test Kit Model 4EX8K12 in the position shown below.

Metering Position	Reading With No Signal In	Reading With 2 Microvolts Unmodulated	Test Position
A (FM DET)	0.38 VDC		Test 1 (or 1-Volt)
B (IF AMP)		0.1 VDC	Test 1 (or 1-Volt)
C (MULT-1)	0.8 VDC		Test 3 (or 3-Volt)
D (MULT-2)	0.5 VDC		Test 1 (or 1-Volt)
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 GAIN CHECKS from Mixer through 1st 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. • Replace IC circuit U603.
LOW OR DISTORTED AUDIO	• Check voltages on Schematic Diagram. • Make gain and waveform checks. • Check receiver and alignment and FM DET output. • Check Q603, Q604 and other discrete components. • Replace IC circuit U604.

STEP 4-VOLTAGE RATIO READINGS →

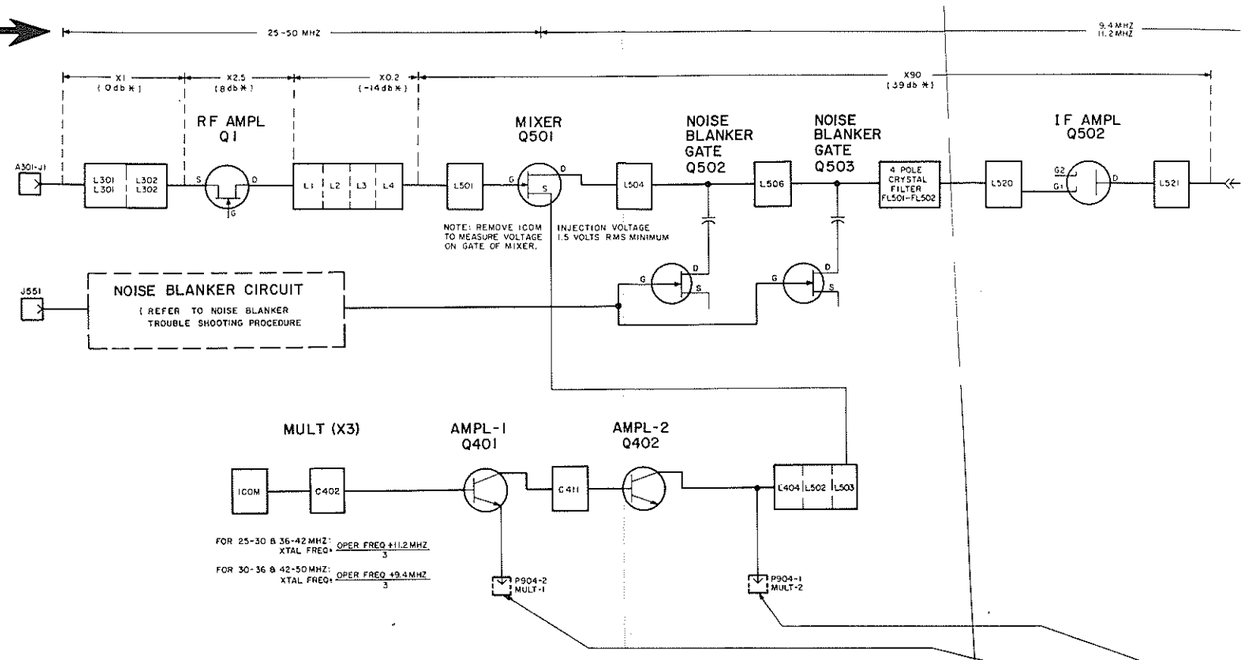
EQUIPMENT REQUIRED:
1. RF VOLTMETER
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION). CORRECT USE 1,000 HERTZ SIGNAL WITH 3.0 KHz DEVIATION.

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.

* DIFFERENCE BETWEEN INPUT AND OUTPUT READINGS ON db SCALE OF RF VOLTMETER. NOT ACTUAL POWER GAIN.



STEP 2-SIMPLIFIED GAIN CHECKS →

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

PRELIMINARY STEPS:
1. SET VOLUME CONTROL FOR 9.8 VOLTS ACROSS 8.0-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.

SIGNAL APPLIED TO A301-J1	NONE	NONE	
PROCEDURE			SET TO R AT 1
READING	VOLTMETER READING SHOULD BE APPROX 1.7 VDC	VOLTMETER READING SHOULD BE APPROX 0.9 VDC	RF V SHOU 200

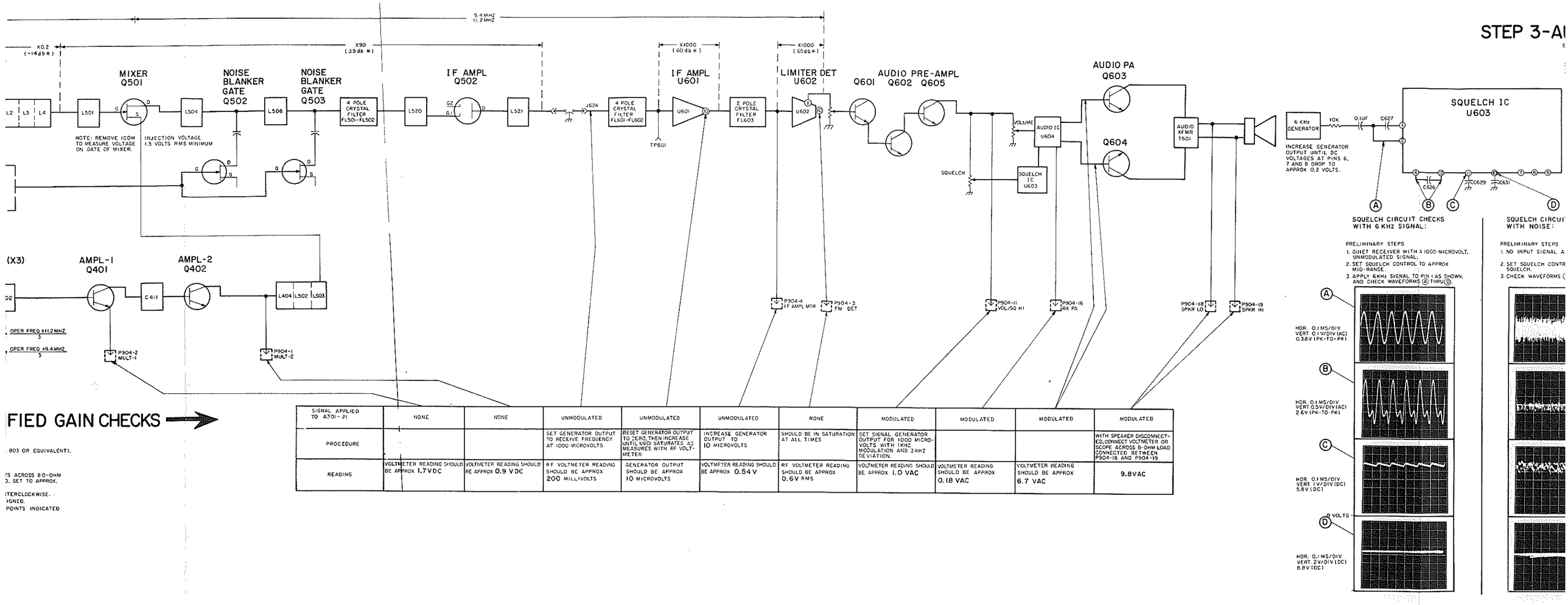
NOTE:

1. DC Voltage readings shown are typical and were taken using a GE Test Set. Voltage readings may vary when using different Voltmeter.

TROUBLESHOOTING PROCEDURE

25—50 MHz RECEIVER

STEP 3-A



FIED GAIN CHECKS

SIGNAL APPLIED TO A301-J1	NONE	NONE	UNMODULATED	UNMODULATED	UNMODULATED	NONE	MODULATED	MODULATED	MODULATED	MODULATED
PROCEDURE			SET GENERATOR OUTPUT TO RECEIVE FREQUENCY AT 1000 MICROVOLTS	RESET GENERATOR OUTPUT TO ZERO, THEN INCREASE UNTIL U601 SATURATES AS MEASURES WITH RF VOLTMETER	INCREASE GENERATOR OUTPUT TO 10 MICROVOLTS	SHOULD BE IN SATURATION AT ALL TIMES	SET SIGNAL GENERATOR OUTPUT FOR 1000 MICROVOLTS WITH 1KHZ MODULATION AND 3 KHZ DEVIATION.			WITH SPEAKER DISCONNECTED, CONNECT VOLTMETER OR SCOPE ACROSS 8-OHM LOAD CONNECTED BETWEEN P904-18 AND P904-19
READING	VOLTMETER READING SHOULD BE APPROX 1.7VDC	VOLTMETER READING SHOULD BE APPROX 0.9 VDC	RF VOLTMETER READING SHOULD BE APPROX 200 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 10 MICROVOLTS	VOLTMETER READING SHOULD BE APPROX 0.54V	RF VOLTMETER READING SHOULD BE APPROX 0.6V RMS	VOLTMETER READING SHOULD BE APPROX 1.0 VAC	VOLTMETER READING SHOULD BE APPROX 0.18 VAC	VOLTMETER READING SHOULD BE APPROX 6.7 VAC	9.8VAC

803 OR EQUIVALENT).

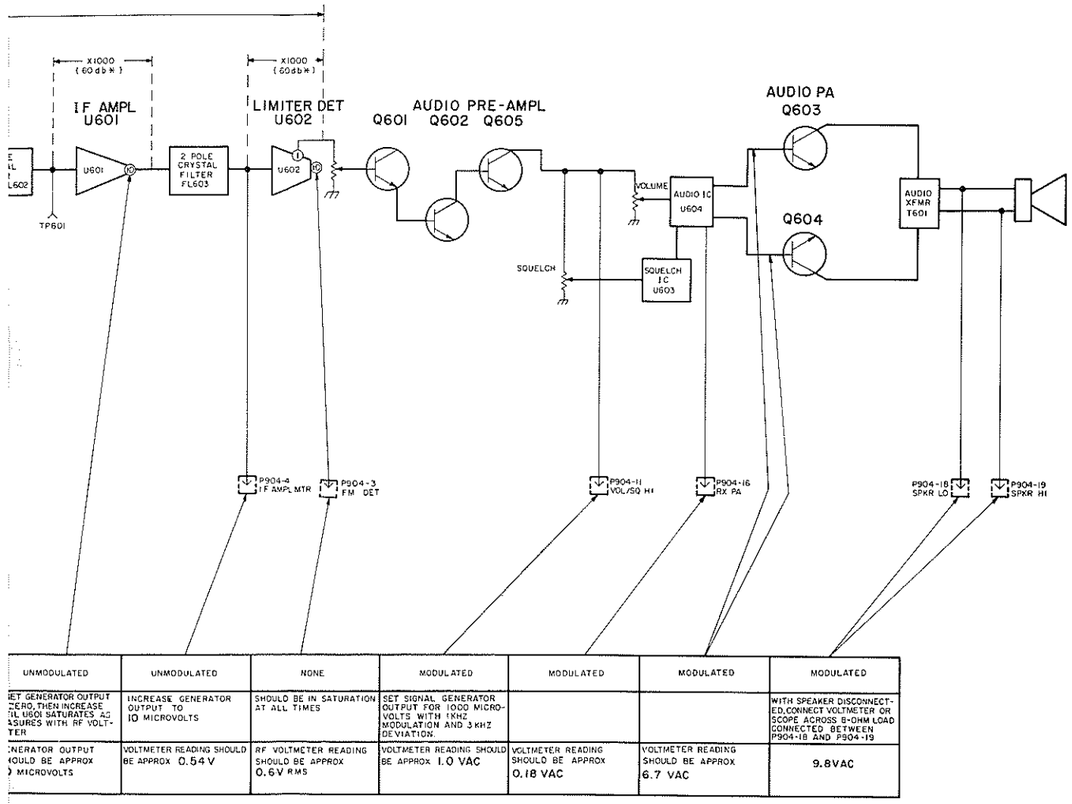
TS ACROSS 8.0-OHM
D. SET TO APPROX.

ITERCLOCKWISE.
IGNED.
POINTS INDICATED

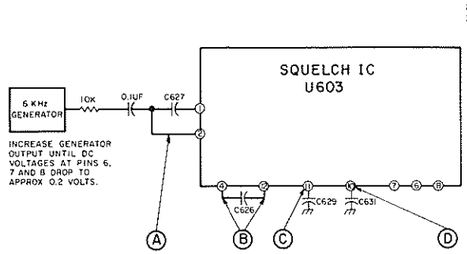
igs shown are typical and were taken using a
.tage readings may vary when using different

STEP 3-AUDIO & SQUELCH WAVEFORMS

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



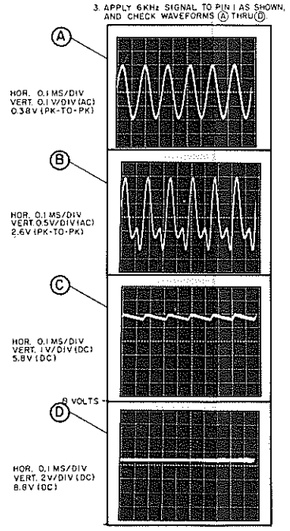
UNMODULATED	UNMODULATED	NONE	MODULATED	MODULATED	MODULATED	MODULATED
ET GENERATOR OUTPUT ERO, THEN INCREASE TIL U601 SATURATES AG ASURES WITH RF VOLT- TER	INCREASE GENERATOR OUTPUT TO 10 MICROVOLTS	SHOULD BE IN SATURATION AT ALL TIMES	SET SIGNAL GENERATOR OUTPUT FOR 1000 MICRO-VOLTS WITH 1KHZ MODULATION AND 3 KHZ DEVIATION.			WITH SPEAKER DISCONNECT-ED, CONNECT VOLTMETER OR SCOPE ACROSS 8-OHM LOAD CONNECTED BETWEEN P904-18 AND P904-19
NERATOR OUTPUT HOULD BE APPROX) MICROVOLTS	VOLTMETER READING SHOULD BE APPROX 0.54 V	RF VOLTMETER READING SHOULD BE APPROX 0.6V RMS	VOLTMETER READING SHOULD BE APPROX 1.0 VAC	VOLTMETER READING SHOULD BE APPROX 0.18 VAC	VOLTMETER READING SHOULD BE APPROX 6.7 VAC	9.8VAC



INCREASE GENERATOR OUTPUT UNTIL DC VOLTAGES AT PINS 6, 7 AND 8 DROP TO APPROX 0.2 VOLTS.

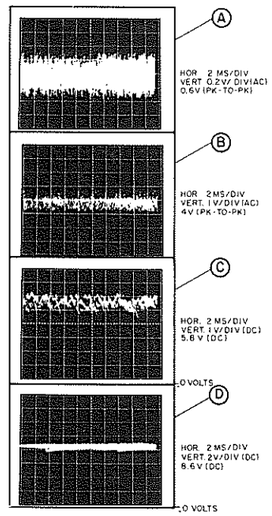
SQUELCH CIRCUIT CHECKS WITH 6 KHZ SIGNAL:

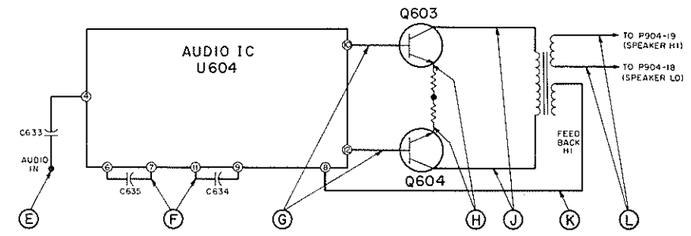
PRELIMINARY STEPS
1. QUIET RECEIVER WITH A 1000 MICROVOLT, UNMODULATED SIGNAL.
2. SET SQUELCH CONTROL TO APPROX MID-RANGE.
3. APPLY 6KHz SIGNAL TO PIN 1 AS SHOWN, AND CHECK WAVEFORMS (A) THRU (D).



SQUELCH CIRCUIT CHECK WITH NOISE:

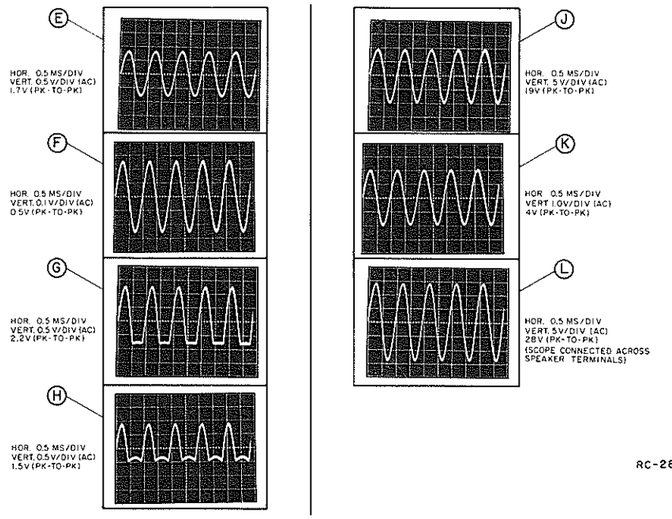
PRELIMINARY STEPS
1. NO INPUT SIGNAL APPLIED.
2. SET SQUELCH CONTROL FOR CRITICAL SQUELCH.
3. CHECK WAVEFORMS (A) THRU (D).





AUDIO CIRCUIT CHECK WITH STANDARD SIGNAL (1000 MICROVOLTS AT RECEIVER FREQ: MODULATED BY 1KHZ WITH 3.0 KHZ DEVIATION)

PRELIMINARY STEPS
1. SET VOLUME CONTROL FOR 9.8 VOLTS ACROSS 8-OHM, 12 WATT LOAD
2. SET SQUELCH CONTROL FULLY COUNTERCLOCKWISE.
3. CHECK WAVEFORMS (E) THRU (L).



RC-2829B