MOBILE RADIO

DESCRIPTION AND MAINTENANCE

406—512 MHz MASTR® EXECUTIVE II RECEIVER

TABLE OF CONTENTS

DESCRIPTION

MASTR®Executive II, 406 to 512 megahertz receivers are single conversion, superheterodyne FM receivers designed for one-through four-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 85 dB selectivity and maximum protection from de-sensitization and intermodulation.

The receiver consists of the following modules:

- RF Assembly
- IF Filter Board
- Oscillator/Multiplier (Osc/Mult)
- Audio and Squelch circuits (part of System-Audio & Squelch (SAS) board)
- IF Detector (IF Det)
- Optional Ultra-High Sensitivity (UHS) Pre-Amplifier

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 Manaal 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.

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

GENERAL ELECTRIC*
U.S.A.

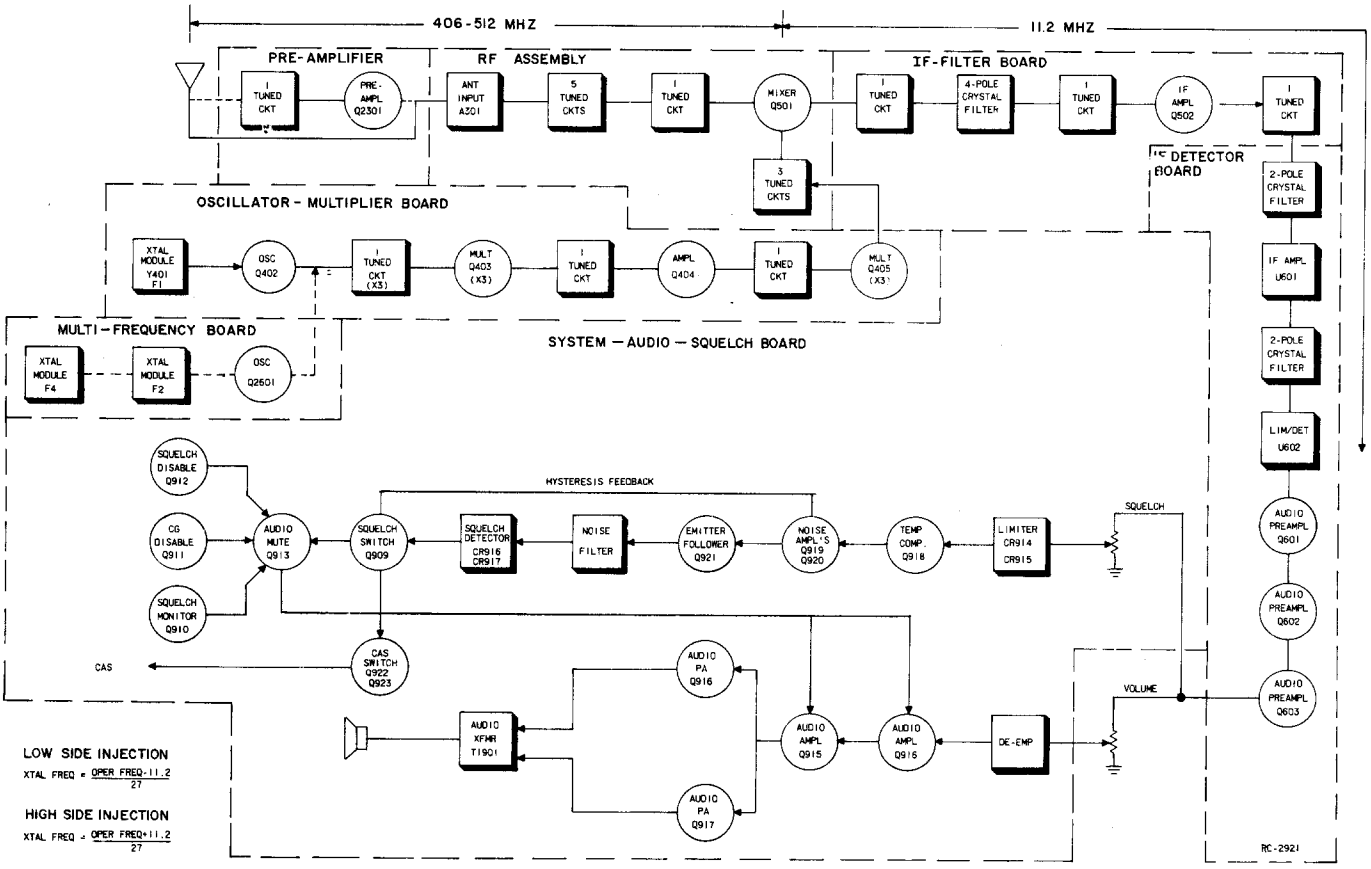


Figure 1 - Receiver Block Diagram

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).

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) at any temperature within the range -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 C416 and L403 on the Oscillator/Multiplier Board. The frequency measured at this point is 9 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 C416 and L403 on the Oscillator/Multiplier Board. The frequency monitored at this point is 9 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 tap of Z602-R2 on the IF-Detector 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 heterodyne with the developed IF frequency. The resultant "beat frequency" can be moniotred 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 2.

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-Detector 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.

Continued on page 4

ICOM FREQUENCY ADJUSTMENT

Continued from page 3

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 is approximately .025 Volts 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 J601-2 on the IF-Detector 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 9).

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

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 2.

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 138 MHz, 1 PPM is 138 Hz. At 174 MHz, 1 PPM is 174 Hz).

With a mixer injection frequency of 150 MHz, adjust the oscillator for a corrected mixer injection frequency 45 Hz (0.3 X 150 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.

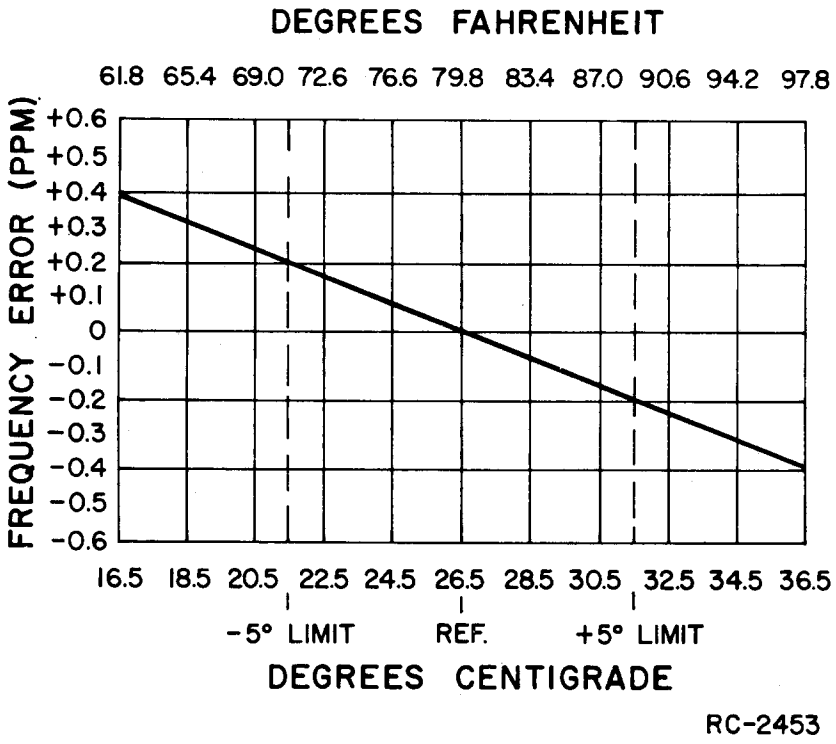


Figure 2 - Frequency Characteristics Vs. Temperature

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 406-512 MHz signal source.
3. Ammeter (capable of measuring 20 milliamperes).

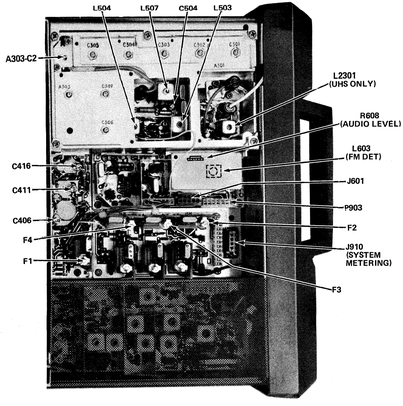
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect black plug from Test Set to Receiver Centralized Metering Jack J601, and red plug to system metering jack J910. Set meter sensitivity switch to the TEST 1 position (or 1-Volt position on 4EX8K12).
2. For multi-frequency receivers with a frequency spacing up to 0.800 MHz for frequency range of 406-470 MHz, 0.900 MHz for frequency range of 470-494 MHz or 0.750 MHz for frequency range of 494-512 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 1.60 MHz for frequency range of 406-470 MHz, 1.80 MHz for frequency range of 470-494 MHz, or 1.50 MHz for frequency range of 494-512 MHz, align the receiver using a center frequency tune-up crystal for frequency range of 494-512 MHz. These limits can be extended to 2.00 MHz, 2.30 MHz and 2.00 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 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
			OSCILLATOR/MULTIPLIER		
1.	C (MULT-1)	Pin 3	C406	Maximum	Tune C406 for maximum meter reading.
2.			C411, C416, C306 C307 and C308	See Procedure	Preset C411 and C416 to a position similar to C406. Next, preset C306, C307 and C308 fully counterclockwise. (Minimum capacity).
3.	D (MULT-2)	Pin 4	C411, C416, C406 and C308	See Procedure	Tune C411 and C416 for maximum meter reading. Next, retune C406, C411 and C416 for maximum meter reading. Then carefully tune C308 for a change in meter reading (peak or dip).
4.	F (MULT-3)	Pin 1	C306, C307 & C308	See Procedure	Carefully tune C307 and C306 for maximum meter reading. Repeak C307 and C306. Next, carefully tune C308 for minimum meter reading, and retune C306 for maximum meter reading. Do NOT readjust C307 or C308.
			RF SELECTIVITY		
5.	B	Pin 1	C301 thru C305, A303-C2, (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C301 through C305 and A303-C2 for maximum meter reading. In receivers with the UHS preamplifier, also tune L2301 for maximum meter reading.
6.	B	Pin 1	C301 thru C308, A303-C2, (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C301 through C305, A303-C2, (and L2301 if present) for best quieting sensitivity. C306, C307, C308 may also be tuned slightly (not exceeding 1/4 turn).



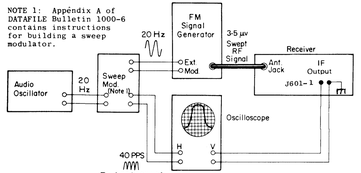


Figure 3 - Test Setup for 20-Hz Double-Trace Sweep Alignment

CRYSTAL MODULE 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 3 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. ±3 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 N THE INJECTION CHAIN

1. WITH A FREQUENCY COUNTER. "Count" the frequency at the junction of C416 and L403 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 J602-S2 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 MH IF FREQUENCY STANDARD (for example: General Electric Model 4EX8A10). 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 crystalfrequency 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 sown in Figure 4.

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

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

c. With GE TEZ 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, 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 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 4.

For example: Assume the ambient temperature of the radio is 20°C (68°F). At that temperature, the curve shows a correction factor of 675 Hz.

Adjust the oscillator for a corrected mixer injection frequency 675 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.

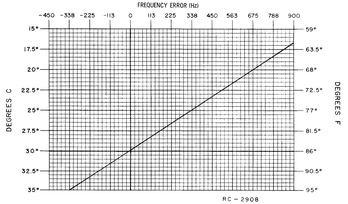


Figure 4 - Crystal Module Frequency Offset Chart

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 406-512 MHz signal source (Measurements 803) with a one-inch piece of insulated wire no larger than .065 inch diameter connected to generator probe.
3. A VTVM.
4. Ammeter (capable of measuring 20 milliamperes).
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 SAS board metering jack J910. 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 0.800 MHz for frequency range of 406-470 MHz, 0.900 MHz for frequency range of 470-494 MHz or 0.750 MHz for frequency range of 494-512 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 1.60 MHz for frequency range of 406-470 MHz, 1.80 MHz for frequency range of 470-494 MHz, or 1.50 MHz for frequency range of 494-512 MHz, align the receiver using a center frequency tune-up (COM or crystal module. These limits can be extended to 2.00 MHz, 2.30 MHz and 2.00 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 J910-3 (+) to 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 the 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	Tune C406 for maximum meter reading.
3.			C411, C416, C306, C307 and C308	See Procedure	Preset C411 and C416 to a position similar to C406. Next, preset C306, C307 and C308 fully counterclockwise (minimum capacity).
4.	D (MULT-2)	Pin 4	C411, C416, C406 and C306	See Procedure	Tune C411 and C416 for maximum meter reading. Next, retune C406, C411 and C416 for maximum meter reading. Then carefully tune C306 for a change in meter reading (peak or dip).
5.	F (MULT-3)	Pin 7	C306, C307 & C308	See Procedure	Carefully tune C307 and C306 for maximum meter reading. Repeak C307 and C306. Next, carefully tune C308 for minimum meter reading, and retune C306 for maximum meter reading. Do NOT readjust C307 and C308.
			RF SELECTIVITY		
6.	B (IF AMP)	Pin 1	C305, C304 and A303-C2	Maximum	Preset A303-C2 to mid position. Apply an on-frequency signal in the hole adjacent to C304, keeping the signal below saturation. Then tune C305, C304 and then A303-C2 for maximum meter reading.
7.	B (IF AMP)	Pin 1	C304 and C303	Maximum	Apply an on-frequency signal in the hole adjacent to C303, keeping the signal below saturation. Then tune C304 and C303 for maximum meter reading.
8.	B (IF AMP)	Pin 1	C303 and C302	Maximum	Apply an on-frequency signal in the hole adjacent to C302, keeping the signal below saturation. Then tune C303 and then C302 for maximum meter reading.
9.	B (IF AMP)	Pin 1	C301 thru C305, A303-C2 (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C301 through C305 and A303-C2 for maximum meter reading. In receivers with the UHS preamplifier, also tune L2301 for maximum meter reading.
10.	B (IF AMP)	Pin 1	C301 thru C308, A303-C2 (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C301 through C305, A303-C2 (and L2301 if present) for best quieting sensitivity. C306, C307, C308 may also be tuned slightly (not exceeding 1/4 turn).
11.			L603, R608	See Procedure	Remove the Test set metering plug from J601. Apply a 100 microvolt signal with 1 kHz modulation and 3 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 H1) and P903-6 (A-).
12.			L507, L500, L504 and C504		Connect scope, signal generator and probe as shown in Figure 3. Set generator output level for 300 µV and modulate with 10 kHz at 20 Hz. With probe between J603-1 and A-, tune L507, L500, L504 and C504 for double trace as shown on scope pattern.
13.				See Procedure	Check to see that modulation acceptance bandwidth is greater than ±7 kHz.
			SQUELCH ADJUST		
14.			R953		Set SQUELCH ADJUST control (R953) to open with a 4 dB SINAD signal. (Approximately 30° counterclockwise of critical squelch position).

TEST PROCEDURES

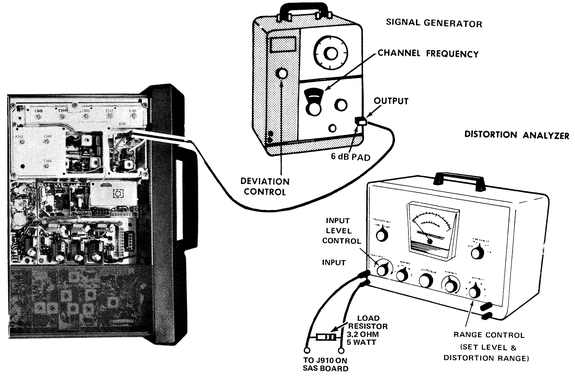
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect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



(Page 7 is blank)

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 A301-J1.

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 A301-J1.

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 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 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 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 4-Microvolts Unmodulated
A (FM DET)	0.35-0.50 VDC	
B (IF AMP)		0.2 VDC
C (MULT-1)	0.4 VDC	
D (MULT-2)	0.4 VDC	
F (MULT-3)	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 in power supply. 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 J601 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 chain. (Refer to Front End Alignment Procedure). • Check voltage readings of Oscillator/Multiplier chain (Q402, Q403, Q404, Q405).
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 IF Amplifiers. • 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 on SAS board.
LOW OR DISTORTED AUDIO	• Check voltages on Schematic Diagram. • Make gain and waveform checks. • Check receiver and alignment and FM-DET output. • Check Q601, Q602, Q603 and other discrete components. • Check audio circuit on SAS board.

STEP 4-VOLTAGE RATIO READING →

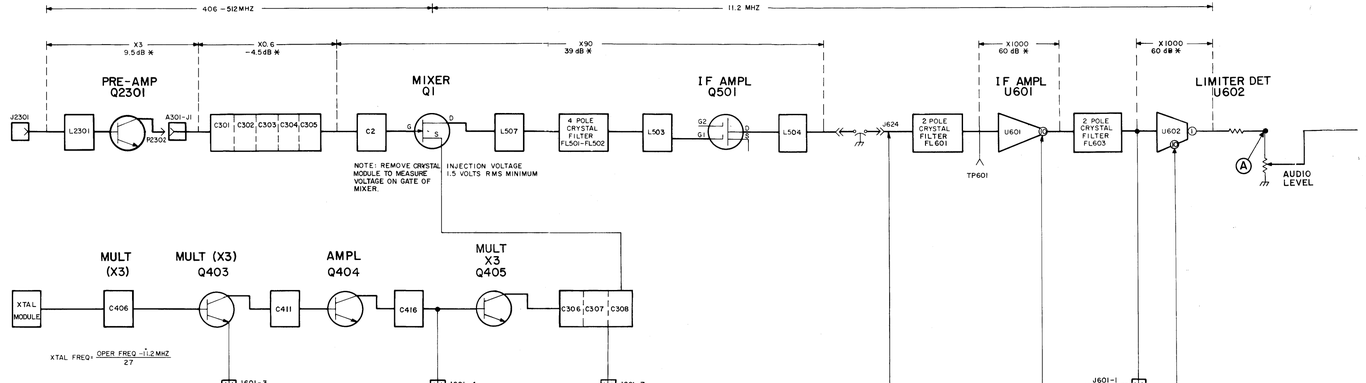
EQUIPMENT REQUIRED:
1. RF VOLTMETER
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION). USE 1000 HERTZ SIGNAL WITH 3.0 KHz DEVIATION.

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.

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

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. R F 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.

SIGNAL APPLIED TO A301-J1.	NONE	NONE		UNMODULATED	UNMODULATED	UNMODULATED	NO SIGNAL INPUT
PROCEDURE				SET GENERATOR OUTPUT AT 1000 MICROVOLTS TO RECEIVE FREQUENCY	RESET GENERATOR TO ZERO, THEN INCREASE GENERATOR OUTPUT UNTIL J601 SATUATES AS MEASURED WITH RF VOLTMETER	SET GENERATOR OUTPUT 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	VOLTMETER READING SHOULD BE APPROX 0.5 VDC	RF VOLTMETER READING SHOULD BE APPROX 200 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 40 MICROVOLTS (10 MICROVOLTS WITH PREAMP)	VOLTMETER READING SHOULD BE APPROX 0.54 VDC	RF VOLTMETER READING SHOULD BE APPROX 0.6 V RMS

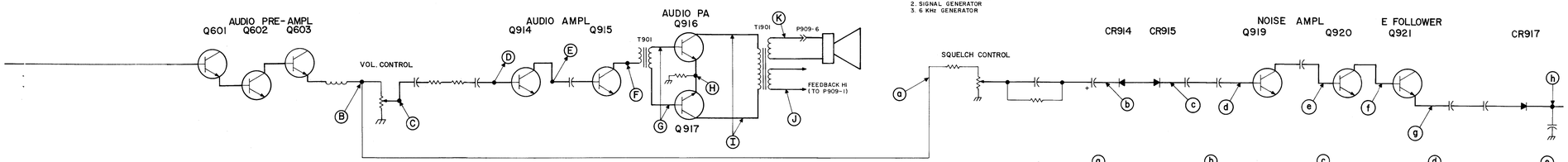
RC-2928A

TROUBLESHOOTING PROCEDURE

406—512 MHz MASTR EXECUTIVE II RECEIVER

STEP 3-AUDIO & SQUELCH WAVEFORMS

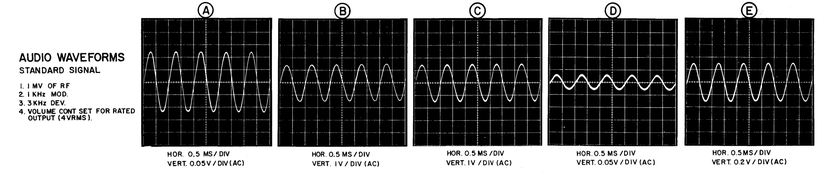
EQUIPMENT REQUIRED
1. OSCILLOSCOPE CONNECTED BETWEEN A- AND POINTS INDICATED BY ARROW.
2. SIGNAL GENERATOR.
3. 6 KHz GENERATOR.

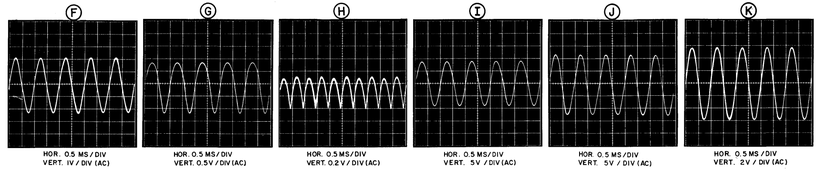


AUDIO WAVEFORMS

STANDARD SIGNAL

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

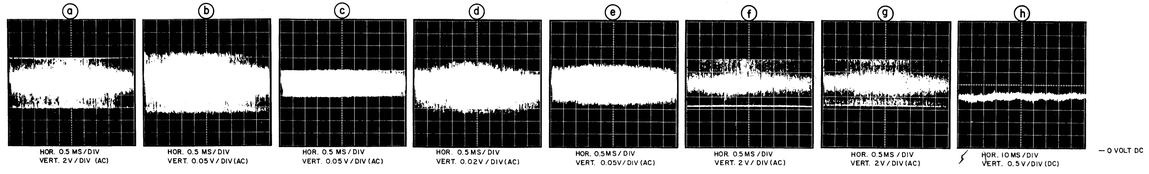




SQUELCH WAVEFORMS

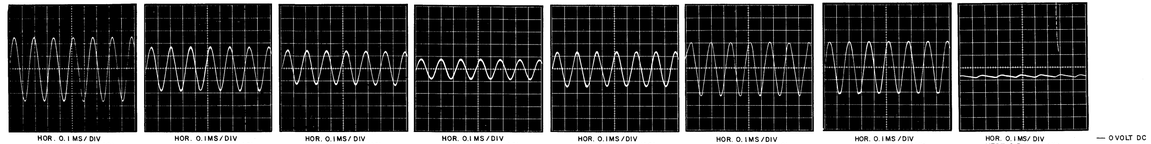
(WITH NOISE)

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.)



RC2928A

(RC-2928)