LBI-38504

ERICSSON

(Supercedes LBI-30027)

Mobile Communications

MASTR® II
BASE STATION
138-174 MHz RECEIVER

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Maintenance Manual

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ILLUSTRATIONS

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SPECIFICATIONS*

Audio Output (to 8-ohm Speaker)	1 Watt at less than 3% distortion	
Sensitivity	With Pre-Ampl	Without Pre-Ampl
12 dB SINAD (EIA method)	0.175 µV	0.35 µV
20 dB Quieting Method	0.25 µV	0.50 µV
SELECTIVITY		
EIA Two-Signal Method (25 kHz Spacing)	-95 dB	-100 dB
Spurious Response	-95 dB	-100 dB
Intermodulation (EIA)	-80 dB	-85 dB
Squelch Sensitivity		
Critical Squelch	0.25 µV	
Maximum Squelch	Greater than 12 dB SINAD (less than 1.0 µV)	
Frequency Stability		
2C-ICOMs	±0.0002% (-40°C to +70°C)	
Modulation Acceptance	±7 kHz (narrow band)	
Maximum Frequency Separation	Full Specifications	3 dB Degradation
138-155 MHz	.900 MHz	1.6 MHz
150.8-174 MHz	1.0 MHz	1.8 MHz
Frequency Response	Within +2 and -8 dB of a standard 6 dB per octave de-emphasis curve from 300 to 3000 Hz (1000 Hz reference)	
RF Input Impedance	50 ohms	

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

WARNING

Although the highest DC voltage in MASTR II receiver is +12 Volts DC, high current may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits!

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

DESCRIPTION

MASTR II Base Station, 138-174 Megahertz receivers are single conversion, superhetrodyne 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 (MIF)
- 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 4EX3A11 or Test Kit 4EX8K12. The test set meters the oscillator, multiplier, discriminator 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 2.

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

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 1).
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 seven 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.
4. 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. Remove the six screws (A) holding the bottom cover, and the one screw (C) holding the board.
2. Press straight down on the plug-in IFAS board from the top to avoid bending pins when unplugging the board from the system board jack.

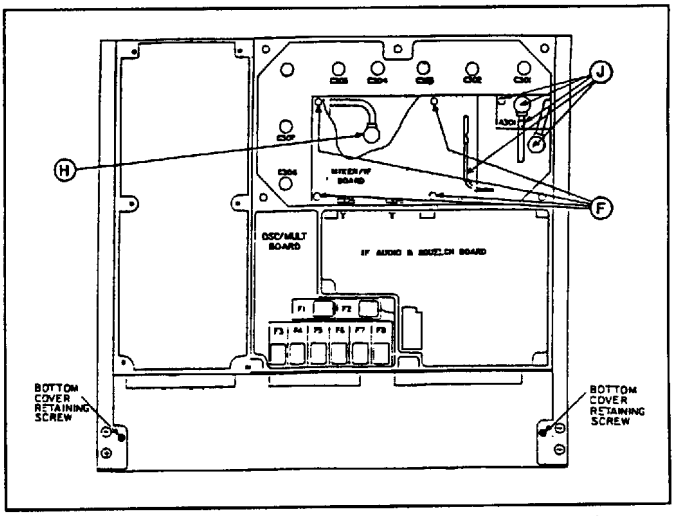

Figure 1 - Disassembly Procedure (Top View)

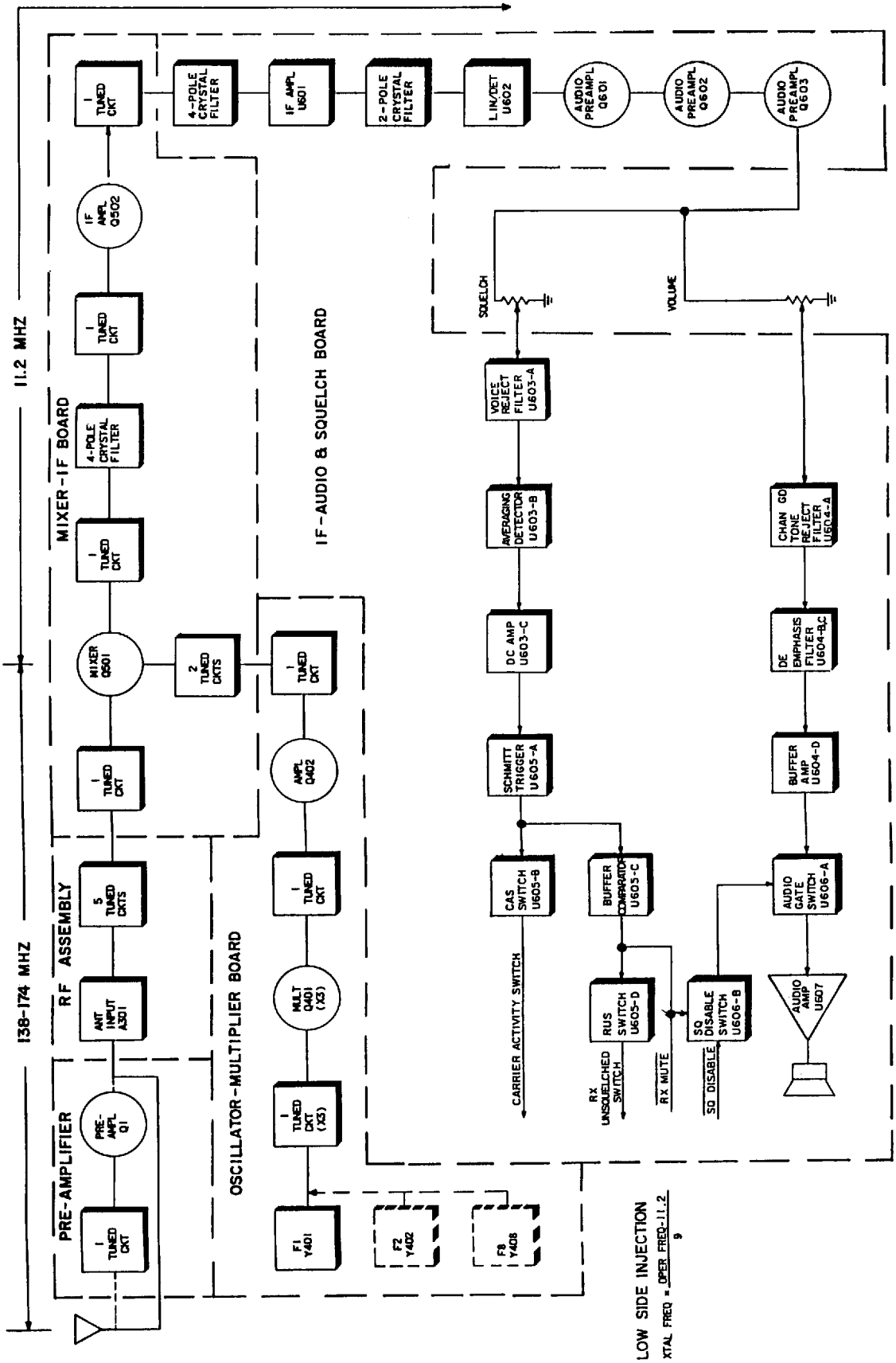

Figure 2 - Receiver Block Diagram

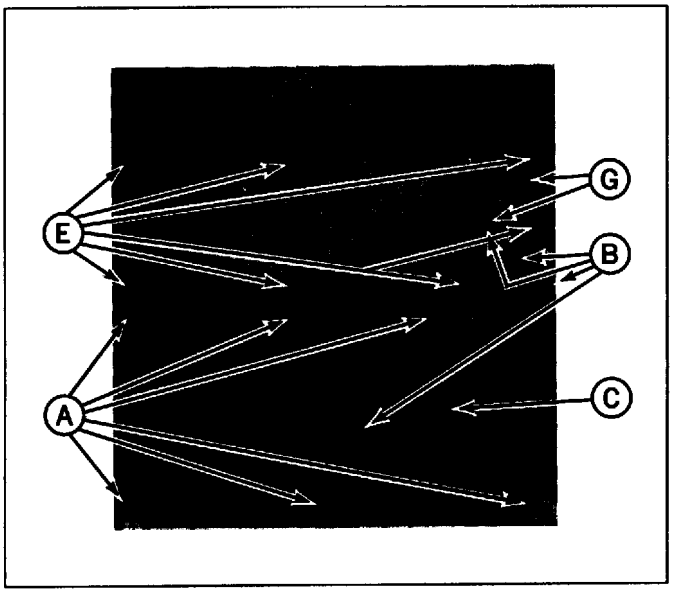

Figure 3 - Disassembly Procedure (Bottom View)

To remove the MIF board from the radio:

1. Remove the seven screws (E) holding the MIF bottom cover.
2. Remove the four screws (F) holding the MIF top cover.
3. Remove the three screws (G) and the Connector (H), and carefully push down on the top of the board to avoid damaging the feedthrough capacitors.

To remove the optional UHS pre-amplifier board:

1. Remove the seven screws (E) holding the MIF bottom cover, and the six screws (F) holding the MIF top cover.
2. Disconnect the two connectors and 10 Volt lead (J).
3. Remove the two screws on the bottom side of the board, and lift out the board.

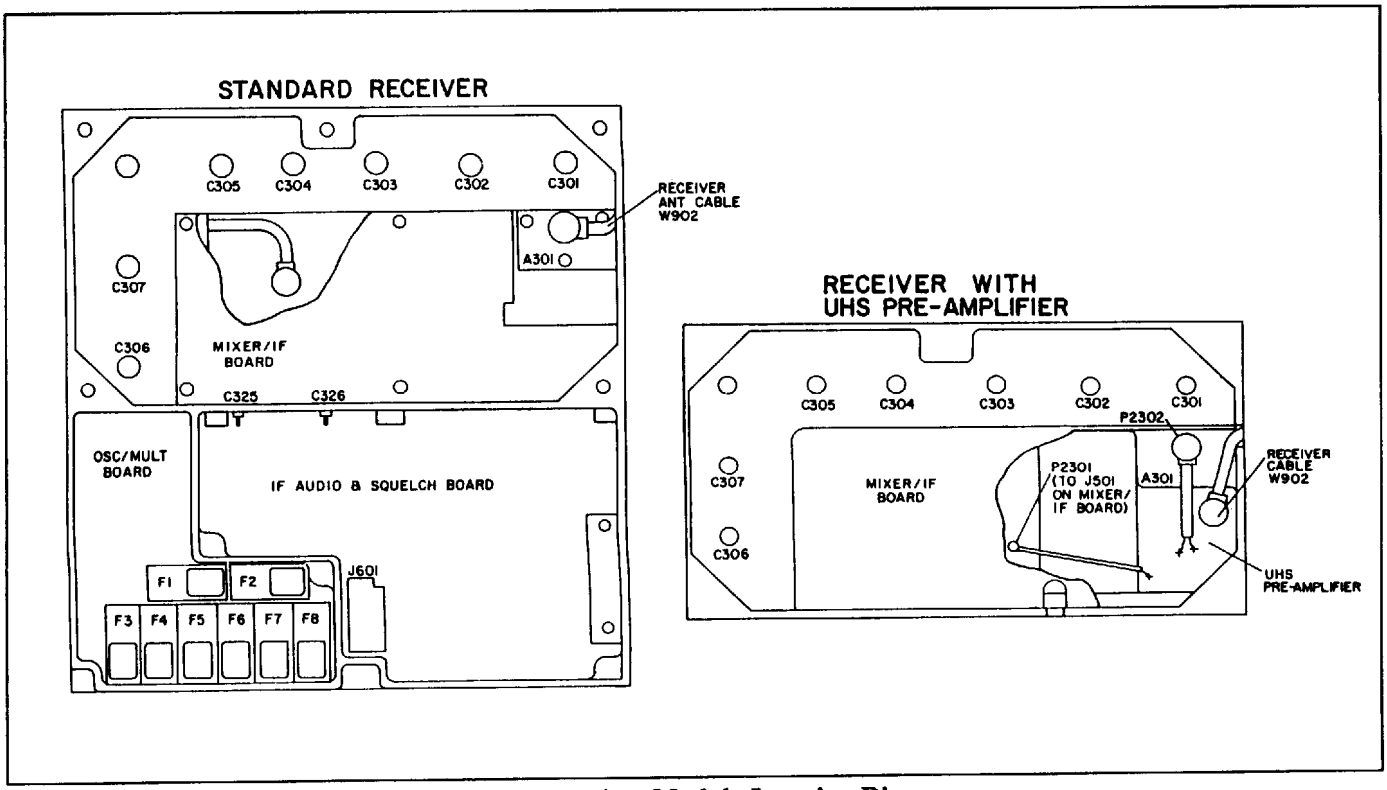

Figure 4 - Receiver Module Location Diagram

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FRONT END ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A11, 4EX9K12, 4EX8K12, or 20,000 ohms-per-Volt multimeter with a 1 Volt and 3 Volt scale.
2. A 138-174 MHz signal source.

PRELIMINARY CHECKS AND ADJUSTMENT

1. Connect black plug from Test Set to Receiver Centralized Jack J601, and red plug to system board metering jack J905. 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 150-174 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 ICOM. These limits can be extended to 1.60 MHz, and 1.80 MHz respectively, with 3 dB degradation in standard receiver specifications.
3. With Test Set in Position J, check for regulated +10 Volts. If 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			TUNING CONTROL	METER READING	PROCEDURE
	GE TEST SET	INTERNAL METERING	MULTIMETER AT J601-9			
OSCILLATOR/MULTIPLIER						
1.	C (MULT-1)	3 (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 (IF AMP)	2 (IF AMP)	Pin 4	C411,C416, C406	See Procedure	Tune C411 and C416 for maximum meter reading. Next, retune C406, C411 and C416 for maximum meter reading, then, carefully dip C306 and tune C307 for maximum meter reading. Do NOT readjust C306 and C307.
RF SELECTIVITY NOTE: IF AMP meter range is 0-700 mVdc with a high impedance DC voltmeter.						
4.	B (IF AMP)	2 (IF AMP)	Pin 1	C502, C301 thru C305 (and T2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C502 and C301 through C305 for maximum meter reading. In receivers with the UHS preamplifier, also tune T2301 for maximum meter reading.
5.	B (IF AMP)	2 (IF AMP)	Pin 1	C502, C301 thru C307 (and T2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C502, C301 through C305 (and T2301 if present) for best quieting sensitivity. C306 and C307 also may be tuned slightly (not to exceed 1/4 turn).

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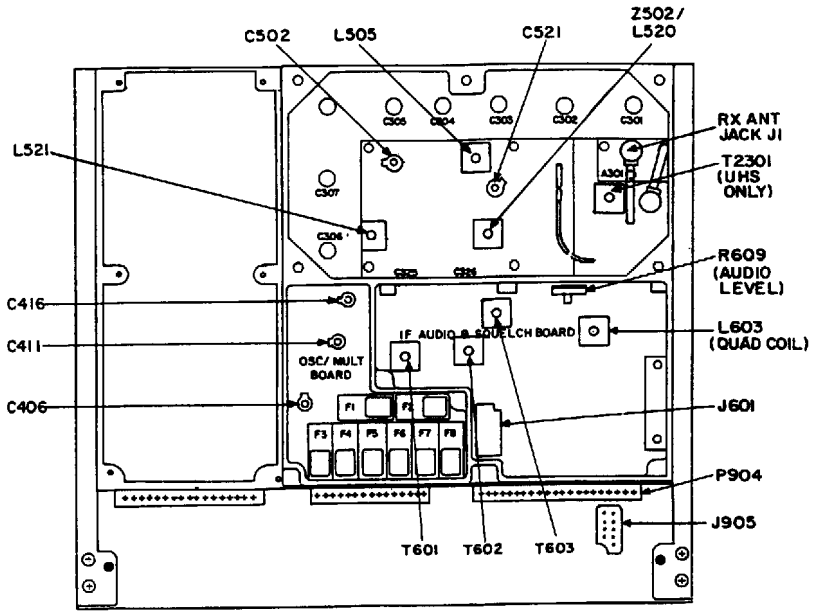

Figure 5 - Test Points And Alignment Controls

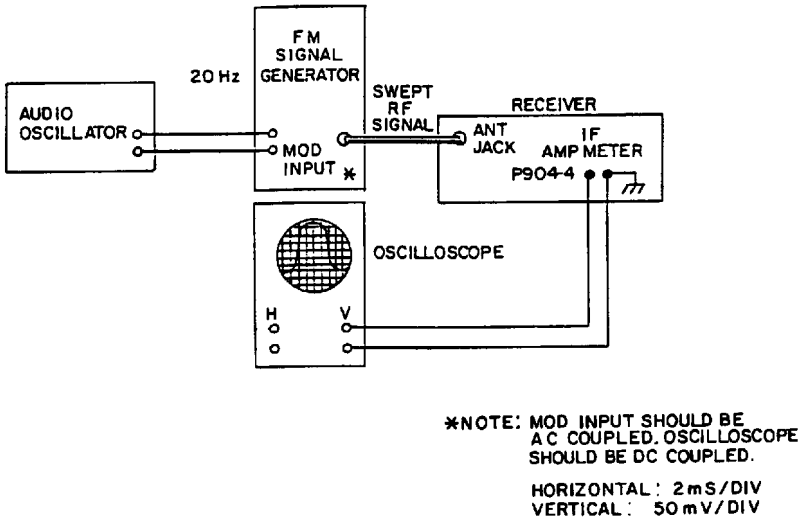

Figure 6 - Test Setup For 20 Hz Double-Trace Sweep Alignment

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 26.5°C (79.8°F).

B. ±2 PPM at any other temperature within the range -5°C to +55°C (+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° to +70°C (+131°F to +158°F).

If frequency adjustment is required, lift up the cover on the top of the ICOM (where present) 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 tap of Z602-R2 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 7.

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.

(Contd.)

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-Volts 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 an ambient temperature of 26.5°C, setting errors can be minimized as follows:

A. To hold setting error ±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 7.

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 7.

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 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.

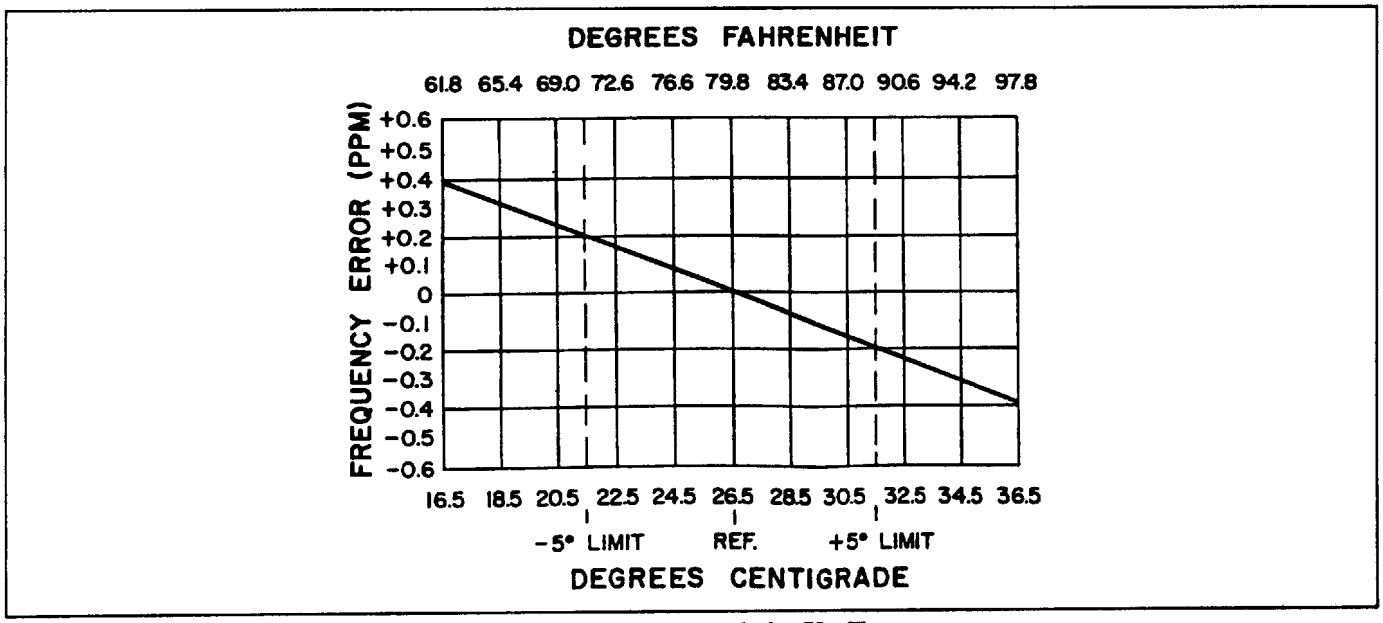

Figure 7 - Frequency Characteristics Vs. Temperature

138-174 MHz MASTR II RECEIVER

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TABLE 2-2. MODULE CONTROLS, INDICATORS, AND DISPLAYS

NAME	TYPE	COLOR	FIGURE 2-2 REFERENCE	DESCRIPTION
Display	Alphanumeric		3	An eight-character alphanumeric display at the top of the module which shows the name of the group (trunked systems) or channel (conventional systems). When the module is selected (SELECT key pressed) and a call is received, the display will change to the NAME of the radio whose call you are receiving.
Label	Fixed		15	A channel label at the top of module. This label shows the name of the channel (conventional systems). The label **is not** changeable without replacement.
PATCH	LED Indicator	Green	1	Lights when the Group or Channel is involved in a patch.
PATCH BUSY	LED Indicator	Yellow	2	Lights when a dispatcher at another console (multiple-console site) has involved the Group or Channel in a patch.
MUTE	LED Indicator	Green	4	Lights when the MUTE key has been pressed.
MUTE	Pushbutton Key	Yellow	7	An alternate-action key on Radio Control modules used to mute audio coming from any Group or Channel.
EMER	LED Indicator	Red	5	Lights when the Group is involved in an emergency activated by a trunked mobile or portable radio.
SELECT	LED Indicator	Green	14	Lights when the module is selected (SELECT key pressed). Received audio associated with the Group or Channel will be heard through the Select speaker.
CALL	LED Indicator	Red	13	Flashes or remains steady to signal an incoming call. When flashing, it signals a call from a selected Group or Channel (SELECT key pressed) on your console. When continually on, it indicates the call is from a Group which is selected by another console within a multiple-console site.
SELECT	Pushbutton Key	Green	6	An alternate-action key used to select the Radio Control module. Use SELECT to monitor and transmit to a Group or Channel. When a module is selected, you will hear received audio associated with the module through the Select speaker. When a module is not selected, you will hear received audio associated with the module through the Unselect speaker.
VOL	Control Knob	Black	12	Used to adjust the received volume associated with a specific Group or Channel.
BUSY	LED Indicator	Yellow	11	Lights when a dispatcher at another console is transmitting to the Group or Channel.
TRANSMIT (Instant)	Pushbutton Key	Red	9	Press to transmit to the Group or Channel. The Group or Channel does not have to be selected.
XMIT	LED Indicator	Red	10	Lights when a transmission is being made to the Group or Channel.

ALIGNMENT PROCEDURE (Cont'd.)

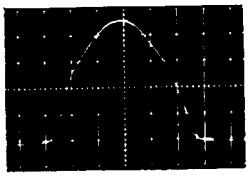
STEP	METERING POSITION			TUNING CONTROL	METER READING	PROCEDURE
	GE TEST SET	INTERNAL METERING	MULTIMETER AT J601-9			
7.	B (IF AMP)	2 (IF AMP)	Pin 1	C304	Maximum	Apply an on frequency signal in the hole adjacent to C308, keeping the signal below saturation. Then tune C304 for maximum meter reading.
8.	B (IF AMP)	2 (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)	2 (IF AMP)	Pin 1	C302 and C301	Maximum	Apply an on frequency signal to the antenna jack, keeping the signal below saturation. Then tune C302 and C301 for maximum meter reading.
10.	B (IF AMP)	2 (IF AMP)	Pin 1	C502, C301, thru C305 (and T2301 if present)	Maximum	Apply an on frequency signal to the antenna jack, keeping the signal below saturation. Then tune C502 and C301 through C305 for maximum meter reading. In receivers with the UHS preamplifier, also tune T2301 for maximum meter reading.
11.	B (IF AMP)	2 (IF AMP)	Pin 1	C502, C301, thru C307 (and T2301 if present)	Maximum	Apply an on frequency signal to the antenna jack and slightly tune C301 through C305 (and T2301 if present) and C502 for best quieting sensitivity. C306 and C307 may also be tuned slightly (not to exceed 1/4 turn).
12.				L603, R609	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 R609 for 1 Volt RMS measured with a DVM 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 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.		L505, L520, L521, C521, T601, T602, and T603 			Connect scope, signal generator, and probe as shown in Figure 6. Set signal generator level for 3 to 5 μV and modulate with 20 Hz at 12 kHz deviation. With probe between P904-4 (or J601-1) and A-, tune L505, L520, L521, C521, T601, T602 and T603 for double trace as shown on scope pattern. Preset T601-T603 to top of coil form before tuning.	
14.					See Procedure	Check to see that modulation acceptance bandwidth is greater than ±7.0 kHz.

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.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to:

  HP331A, or an equivalent average response meter

- Signal Generator similar to:

  HP8640B

- 6 dB attenuation pad, and 8.0 ohm, 2 Watt resistor

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.

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.

(Contd.)

(Contd.)

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

Connect an 8.0 ohm, 2 Watt load resistor from P904-19 (SPKR HI) to P904-18 (SPKR LO). Connect the Distortion Analyzer input across the resistor as shown.

C. Adjust the VOLUME control for one Watt output using the Distortion analyzer as a Voltmeter.

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.

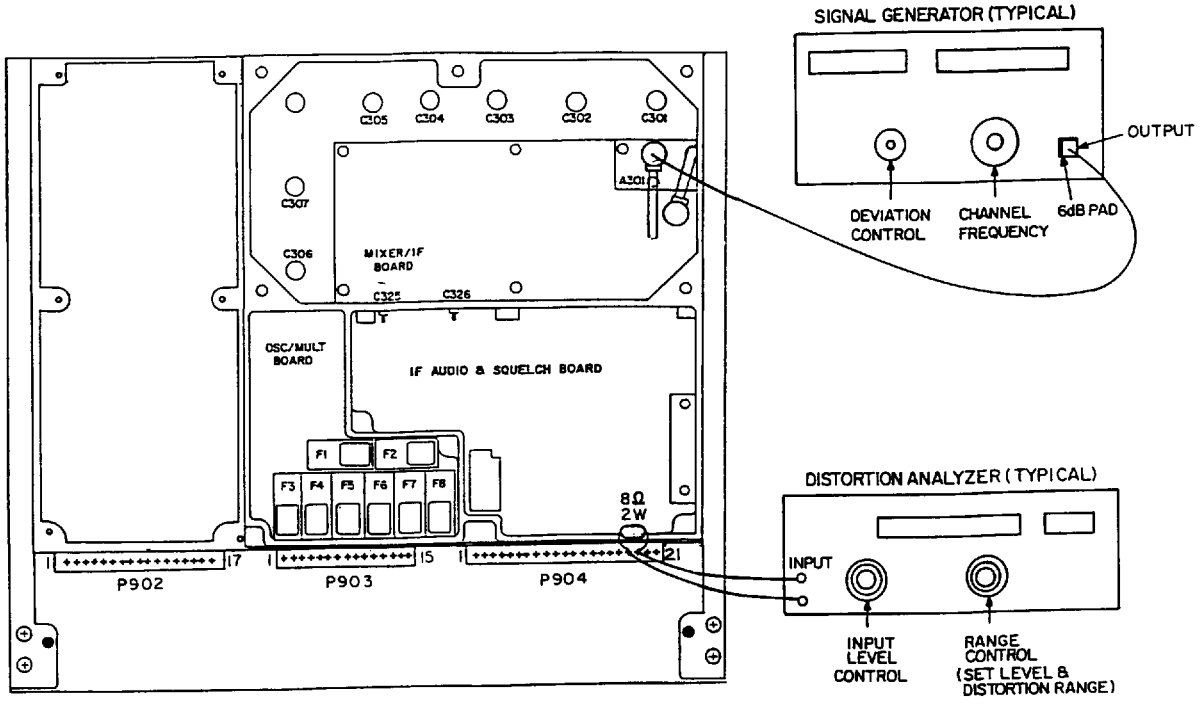
SERVICE CHECK

If the distortion is more than 3%, or maximum audio output is less than 1 Watt, 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 Alignment (Refer to Complete Receiver Alignment).



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STEP 2

USABLE SENSITIVITY

(12 dB SINAD)

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

A. Apply a 1,000 microvolt, on frequency signal modulated by 1,000 Hz with 3.0 kHz deviation to A301-J1.

B. With Function Switch on Distortion Analyzer set to VOLTMETER position, adjust volume control for 1.0 Watt (2.83 VRMS across 8 ohm load). Again, verify that audio output is nulled when Function Switch is set to DISTORTION position.

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

D. While reducing the signal generator output, switch the FUNCTION control from SET LEVEL to DISTORTION until a 12 dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and DISTORTION 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 the rated 12 dB SINAD specification with an audio output of 1.0 Watt across the 8.0 ohm load.

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 the rated 12 dB SINAD specification, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

(Contd.)

KEYPAD MODULE continued

SCROLL▲ key Used with PROGRAM key to change a group on a Display Radio Control module.

SCROLL▼ key Used with PROGRAM key to change a group on a Display Radio Control module.

CLEAR key Used to clear keypad entries and simul-select and patch memories.

TEST key Allows entering the test mode.

PROGRAM key Initiates a group change on a Display Radio Control module.

ENTER key Enters the numbers typed through the keypad and confirms programming entries.

TRANSMIT bar A common Push-To-Talk (PTT) bar which functions the same as a transmit foot switch. When pressed transmissions can be made to all selected groups and channels.

SPEAKER MODULES

Two or more speakers *(Figure 2-5)* are located on each console. In the figure, the Select speaker has the DISPATCHER BUSY indicator and the Unselect speaker has no indicators. Your console may be arranged differently.

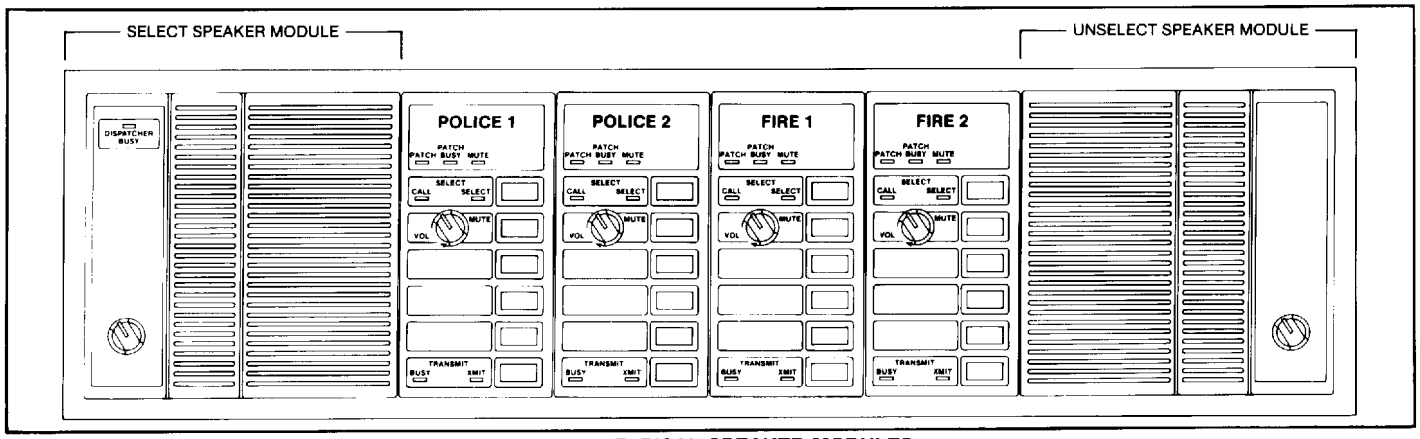

FIGURE 2-5. TYPICAL SPEAKER MODULES

VOL (Volume) control Sets the volume coming from the speaker.

Unselect Speaker Reproduces receive audio from Radio Control modules that are not selected.

Select Speaker Reproduces received audio from the group or channel that is selected (SELECT key pressed).

DISPATCHER BUSY Indicates the dispatcher is busy with a console operation. Lights when a call is being received through the select speaker, when the console is transmitting, or during a telephone or intercom call.

HEADSET

Headset connectors (adapter box under console tabletop) are provided for each dispatch position. When the headset is used, the receive audio on the Select speaker is muted, the console microphone is disabled, and the headset microphone is enabled. Intercom and telephone operation does not require the use of the TX keys when a headset is used. Intercom and telephone headset operation is full-duplex, that is, you can transmit and receive at the same time.

FOOT SWITCH

An optional dual-pedal foot switch is available for the console. The right pedal is for transmit and the left pedal performs the Channel Monitor function on Radio Control modules.

STEP 1 - QUICK CHECKS

TEST SET CHECKS

These checks are typical 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 8 MICROVOLTS (UNMODULATED)	TEST POSITION
A (FM DET)	Approximately 0.38 VDC		Test 1 (or 1 Volt)
B (IF AMP)		0.1 VDC	Test 1 (or 1 Volt)
C (MULT-1)	0.45 VDC		Test 3 (or 3 Volt)
D (MULT-2)	0.1 VDC		Test 3 (or 3 Volt)
J (Reg. +10 Volts at System Metering jack)	+10 VDC		

SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	• Check power connections, continuity of supply leads, and 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 DET READING	• Check supply voltages and then check oscillator readings at P904-1 & -2 as shown in STEP 2. • Make SIMPLIFIED DVM GAIN CHECKS from Mixer through 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 antenna connections, cable and antenna switch. • Check Front End Alignment. (Refer to Receiver Alignment Procedure). • Check Oscillator injection voltage. • Check voltage readings of Mixer and IF Amp. • Make SIMPLIFIED GAIN CHECKS (STEP 2).

Cont'd.

(Contd.)

SYMPTOM CHECKS Con't.

SYMPTOM	PROCEDURE
IMPROPER SQUELCH OPERATION	• Check voltages on Schematic Diagram. • Check voltages as shown in the table below. • Make gain and waveform checks with 6 kHz signal as shown in Step 4. • Check discrete components in the squelch circuit.
LOW OR DISTORTED AUDIO	• Check voltages on Schematic Diagram. • Make gain and waveform checks. • Check receiver alignment and FM DET output. • Check Q601 thru Q603 and other discrete components.

SQUELCH CHECKS

		SQUELCHED	UNSQUELCHED
NOISE SQ OUTPUT	U605-2	0.2 Vdc	9.9V
CAS	U605-1	0.1 Vdc	9.9V
$\overline{\text{RX MUTE}}$	U605-14	0.2 Vdc	9.9V
RUS	U605-13	0.2 Vdc	4.9V
SQ DISABLE SW. INPUT	U606-1	0.2 Vdc	9.9V
AUDIO GATE SW. CONTROL	U606-11	0.2 Vdc	9.9V

If External Decoder is used (CG, DCG, Type 99, etc.), $\overline{\text{RX Mute}}$ will remain low (regardless of noise squelch output), until proper response is decoded. $\overline{\text{RX Mute}}$ = Noise Sq Output • Decoder Output.

In above cases, $\overline{\text{Sq Disable}}$ is assumed high (9.9V). If $\overline{\text{Sq Disable}}$ is grounded, U606-10 = 0.2 Vdc, U606-1 = 9.9 Vdc and Unit is unsquelched for all conditions.

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STEP 3-VOLTAGE RATIO READINGS →

EQUIPMENT REQUIRED:

1. RF VOLTMETER
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION). USED 1000 HERTZ SIGNAL WITH 3.0 KHz DEVIATON.

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 READING ON dB SCALE OF RF VOLTMETER. NOT ACTUAL POWER GAIN.

STEP 4- SQUELCH WAVEFORMS

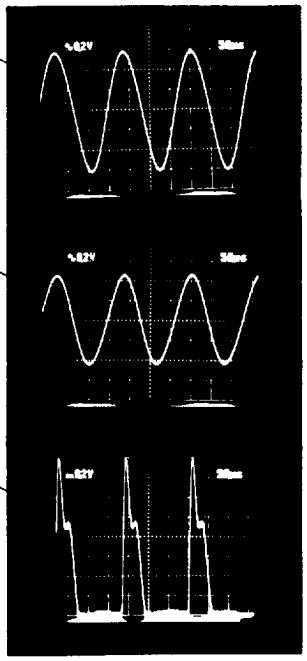
PRELIMINARY STEPS

1. QUIET RECEIVER WITH 1000 μV MODULATED SIGNAL
2. SET MODULATION FREQUENCY TO 6 KHz
3. SET DEVIATION TO 3 KHz
4. ADJUST SQUELCH POT (R901 IN SYSTEMS AREA) FOR 120 mVpp AT SQ ARM (P904-10)
5. USE 10 M ohm PROBE

Ⓐ HORIZONTAL 50 μ SEC/DIV
VERTICAL 200 mV/DIV

Ⓑ HORIZONTAL 50 μ SEC/DIV
VERTICAL 200 mV/DIV

Ⓒ HORIZONTAL 50 μ SEC/DIV
VERTICAL 200 mV/DIV
BASELINE = 0 VDC



Ⓓ APPROX 3.2 VDC

Ⓔ APPROX 10.0 VDC