MOBILE RADIO

DESCRIPTION AND MAINTENANCE
454.025-454.650 MHz MASTR® EXECUTIVE II
RCC & IMTS SYNTHESIZED RECEIVER

TABLE OF CONTENTS

DESCRIPTION

MASTR® Executive II 454.025-454.650 MHz Synthesized receiver is a single-conversion superheterodyne FM receiver designed for up to thirty-two channels. The solid-state receiver utilizes integrated circuits and discrete components with 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
- Synthesizer
- Audio Amplifier (Part of System Board)
- IF Detector
- UHF Receiver Adapter

Supply voltages are connected from the System Board through J903 and P903 on the IF Detector board. The +10 Volt regulated supply is used for all receiver stages and the audio PA stage on the System Board operates from the A+ system supply.

Centralized metering jacks are provided for use with the GE Test Set 4EX3A11. The test set meters oscillator, multipliers, FM Detector and IF amplifier stages. Speaker high and low are metered on the System Board metering jack.

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

Refer to the appropriate Maintenance Manual for complete details on each receiver module as listed in the receiver 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 side-rail 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. Unplug the receiver antenna connector.
6. Unplug the lead on the Synthesizer board.
7. Lift the receiver modules out of the radio with a gentle rocking motion.

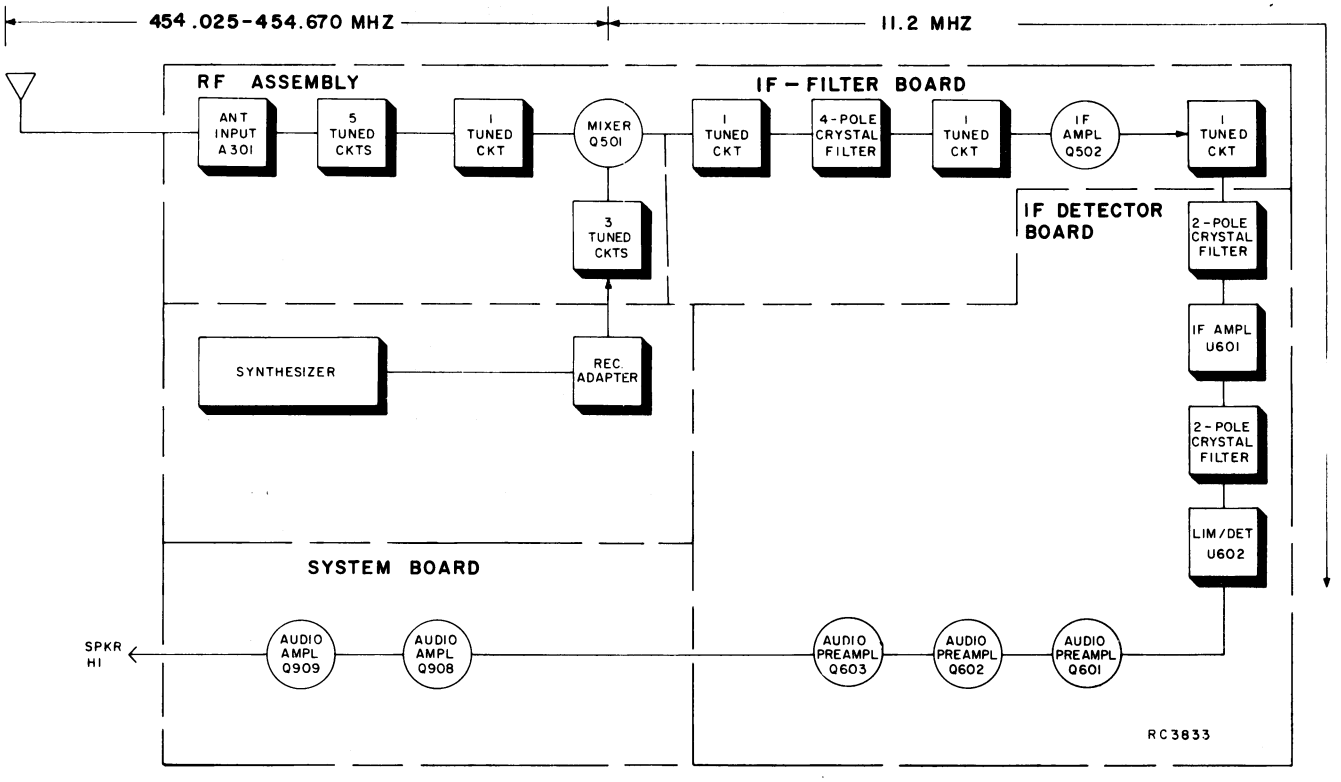

Figure 1 - Synthesized Receiver Block Diagram

ICOM FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set with a frequency meter or counter with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained, and with the entire radio as near as possible to an ambient temperature of 26.5°V (79.8°F).

MASTR II ICOMs should be reset only when the frequency shows deviation in excess of the following limits:

1. ±0.5 PPM, when the radio is at 26.5°C (79.8°F).
2. ±2 PPM at any other temperature within the range of -5°C to +55°C (+23°F to +131°F).
3. The specification limit (±2 PPM) or ±5 PPM at any temperature within the ranges of -40°C to -5°C (-40°F to +23°F) or +55°C to +70°C (+131°F to +158°F).

If the radio is at an ambient temperature of 26.5°C (79.8°F), set the oscillator for the correct operating frequency.

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

1. To hold the setting error to ±0.6 PPM (which is considered reasonable for 5 PPM ICOMS):
   a) Maintain the radio at 26.5°C (±5°C) and set the oscillator to desired frequency, or -
   b) Maintain the radio at 26.5°C (±10°C) and offset the oscillator, as a function of acual temperature, by the amount shown in Figure 2.

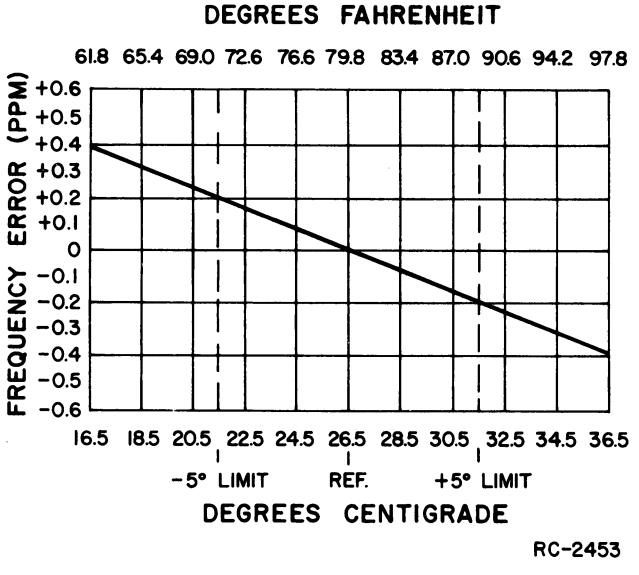

Figure 2 - ICOM Frequency Offset Chart

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

RECEIVER ALIGNMENT

EQUIPMENT NEEDED

1. GE Test Set Models 4EX3A11 or Test Kit 4EX8K12.
2. A 420-470 MHz signal source.
3. Ammeter (capable of measuring 20 milliamperes).
4. Distortion Analyzer.

ALIGNMENT PROCEDURE

1. Connect the black plug from the Test Set to centralized metering jack J17 on the Synthesizer mother board A901. Connect the red plug to System Board metering jack J902. Set range selector switch to the TEST 1 position (or 1 Volt position on 4EX8K12).
2. With test set in position "J", check for regulated +10 Volts. If necessary, adjust R911 on the System Board for 10 Volts.
3. Connect the transmitter VCO output A904-J1 to a 50 ohm load. Connect a 500 MHz frequency counter through a 10 dB pad to P3.

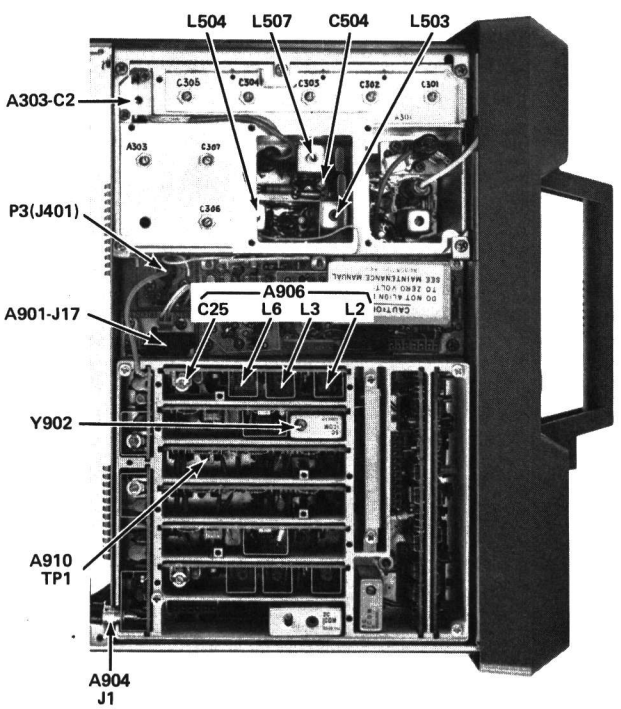

Figure 3 - Alignment Adjustment Locations

4. Select Channel 1 on the Control unit and make the following adjustments on Oscillator/Multiplier board A906:

Test Meter Position	Adjust Component on A906
A	Peak L2
B	Peak L3
C	Peak L6
D	Peak C5

5. Connect a 10 Volt, 10 Megohm DC Voltmeter to TP1 on the A910 Phase Detector and adjust C5 on the A904 Receiver VCO to produce 6.0 Volts as read at TP1.
6. Adjust the frequency of the receiver ICOM (Y902) to produce a local oscillator frequency of 442.825 MHz (RCC) or 443.175 MHz (IMTS) ±0.4 PPM (177 Hz) for a 5 PPM ICOM or ±0.2 PPM (88 Hz) for a 2 PPM ICOM.
7. Disconnect the 10 dB pad and frequency counter from P3. Measure power output. This should be +10 dBm or greater.
8. Plug P3 into J401 on the Receiver Adapter Board.
9. Pre-adjust C306, C307 and C308 on the RF Assembly to the minimum capacity (full out) position.
10. With the Test Set in the "F" position, carefully dip C306.
11. With the Test Set in the "G" position, peak C307. Alternately peak C306 and C307 for maximum "G" reading.
12. With the Test Set in the "G" position, carefully dip C308. Carefully re-pack C306. DO NOT RE-ADJUST C307 or C308.
13. Adjust the signal generator to the desired receiver frequency. Preset C2 on the RF Assembly.
14. With the signal generator probe inserted in the hole next to C304, adjust C305, C304 and C2 for maximum IF current reading.
15. With the signal generator probe inserted in the hole next to C303, adjust C304 and C303 for maximum.
16. With the signal generator probe inserted in the hole next to C302, adjust C303 and C302 for maximum.
17. Insert signal generator cable terminated with phono jack into J1 of antenna input board A301. Adjust C301, C302, C303, C304, C305 and C2 on the RF Assembly for maximum IF current, reducing the signal generator output level as necessary to keep the reading below saturation.
18. The mixer and IF circuits have been aligned at the factory and will normally require no further adjustment. If

adjustment is necessary, connect the signal generator, scope and probe as shown in Figure 4. Set signal generator level for 3 to 5 μV and modulate With 10 kHz at 20 Hz. With probe between J601-1 and A- on the IF Detector board, adjust L507, L503, L504 and C504 on the IF Filter board for a double trace as shown on the scope pattern.

TEST PROCEDURES

These Test Procedures are provided for servicing a receiver that is not operating properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly and low gain. By following the test steps, the defect can be quickly located and connected. Additional corrective measures are provided in the Troubleshooting Procedures. Before beginning the test procedure, be sure the receiver is properly aligned to the operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer (similar to Heath IM-12).
- Signal Generator (similar to Measurements 803).
- 6 dB Attenuation Pad and 600 ohm, 1 Watt Resistor.

PRELIMINARY CHECKS

1. Connect the test equipment to the receiver as shown in Figure 5.
2. Turn on all equipment and allow a warm-up period of 20 minutes.

AUDIO POWER OUTPUT AND DISTORTION

Measure audio power output as follows:

1. Apply a 1,000 microvolt, on-frequency test signal modulated by 1000 Hertz with ±3.0 kHz deviation to the antenna jack A301-J1.
2. Lift the handset on the control unit off-hook. Connect the distortion analyzer input across the earpiece leads with the earpiece disconnected. Connect a 600 ohm, 1 Watt resistor across the leads.
3. Read 0.3 milliwatts output using the distortion analyzer as a VTVM (.42 Vrms).
4. Make distortion measurements according to the distortion analyzer manufacturer's instructions. Reading should be less than 5%.
5. If the distortion is more than 5%, or maximum audio output is less than 4 milliwatts, make the following checks:
   a) Battery and regulator voltage. Low voltage will cause distortion.

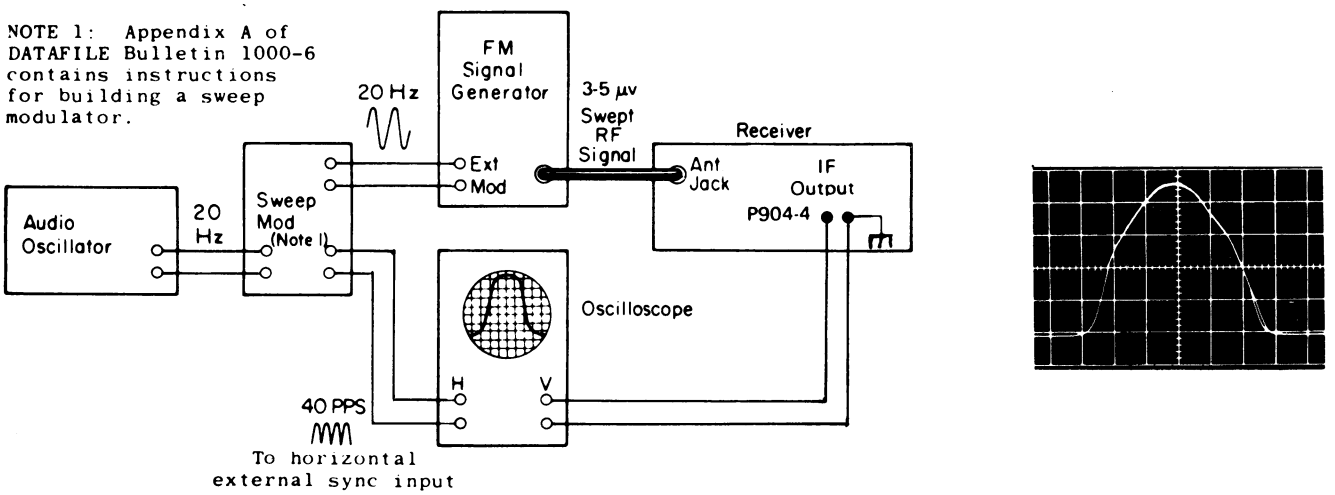

Figure 4 - Test Setup for 20 Hz Double-Trace Sweep Alignment

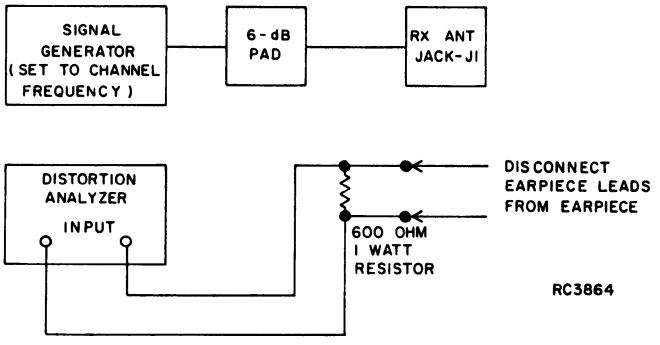

Figure 5 - Test Equipment Set-up

b) Audio gain.

c) FM Detector board adjustment (refer to receiver alignment instructions).

USABLE SENSITIVITY (12 dB SINAD)

Measure the receiver sensitivity as follows:

1. Apply a 1000 microvolt, on-frequency signal modulated by 1000 Hertz with 3.0 kHz deviation to antenna jack A301-J1.
2. 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.).
3. Place the RANGE switch to the SET LEVEL position (filter out of circuit) and adjust input LEVEL control for a +2 dB reading on a mid-range (30%).
4. While reducing the signal generator output, switch the RANGE switch 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).
5. 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.
6. If necessary, slightly adjust C301, C302, C303, C304 and C305 on the RF Assembly and C502 on the IF Filter Board for best SINAD or sensitivity. C306, C307 and C308 may also be tuned slightly, not exceeding 1/4 turn.

MODULATION ACCEPTANCE BANDWIDTH

Measure the bandwidth as follows:

1. Set the signal generator output for twice the microvolt reading obtained in the 12 dB SINAD measurement.
2. Set the RANGE control on the distortion analyzer to 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.
3. 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).
4. The deviation control reading for the 12 dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than 7.0 kHz.
5. If the Modulation Acceptance Bandwidth test does not indicate the proper bandwidth, check the Troubleshooting Procedure.

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WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

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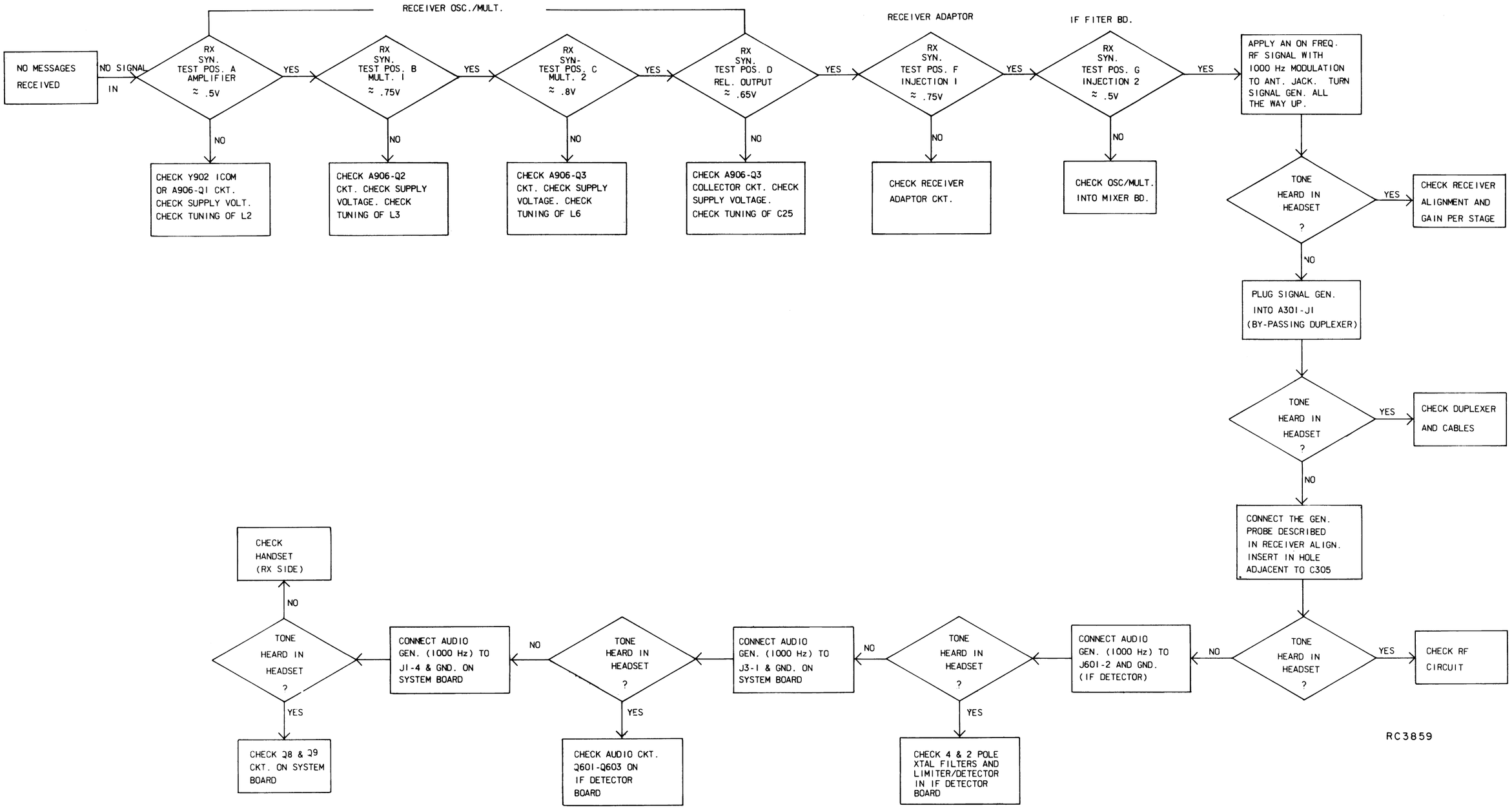


FIGURE 6 - TROUBLESHOOTING FLOW CHART (SHEET 1)

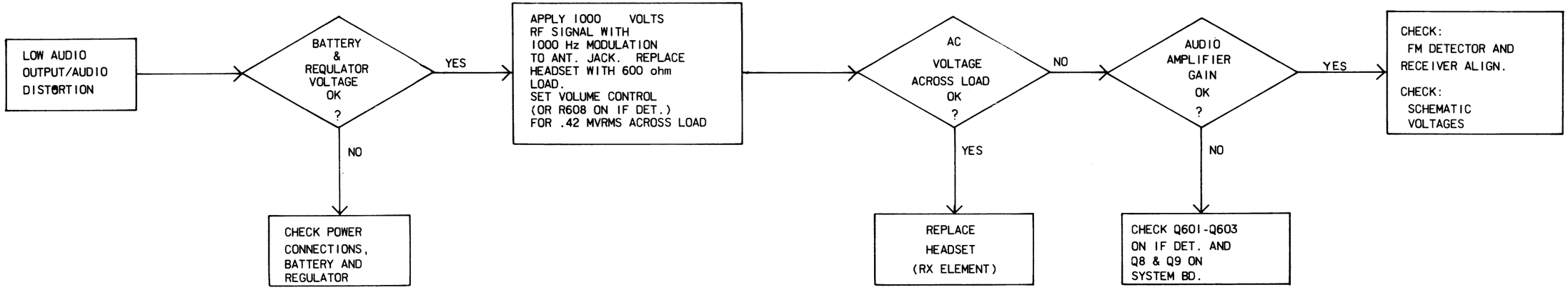
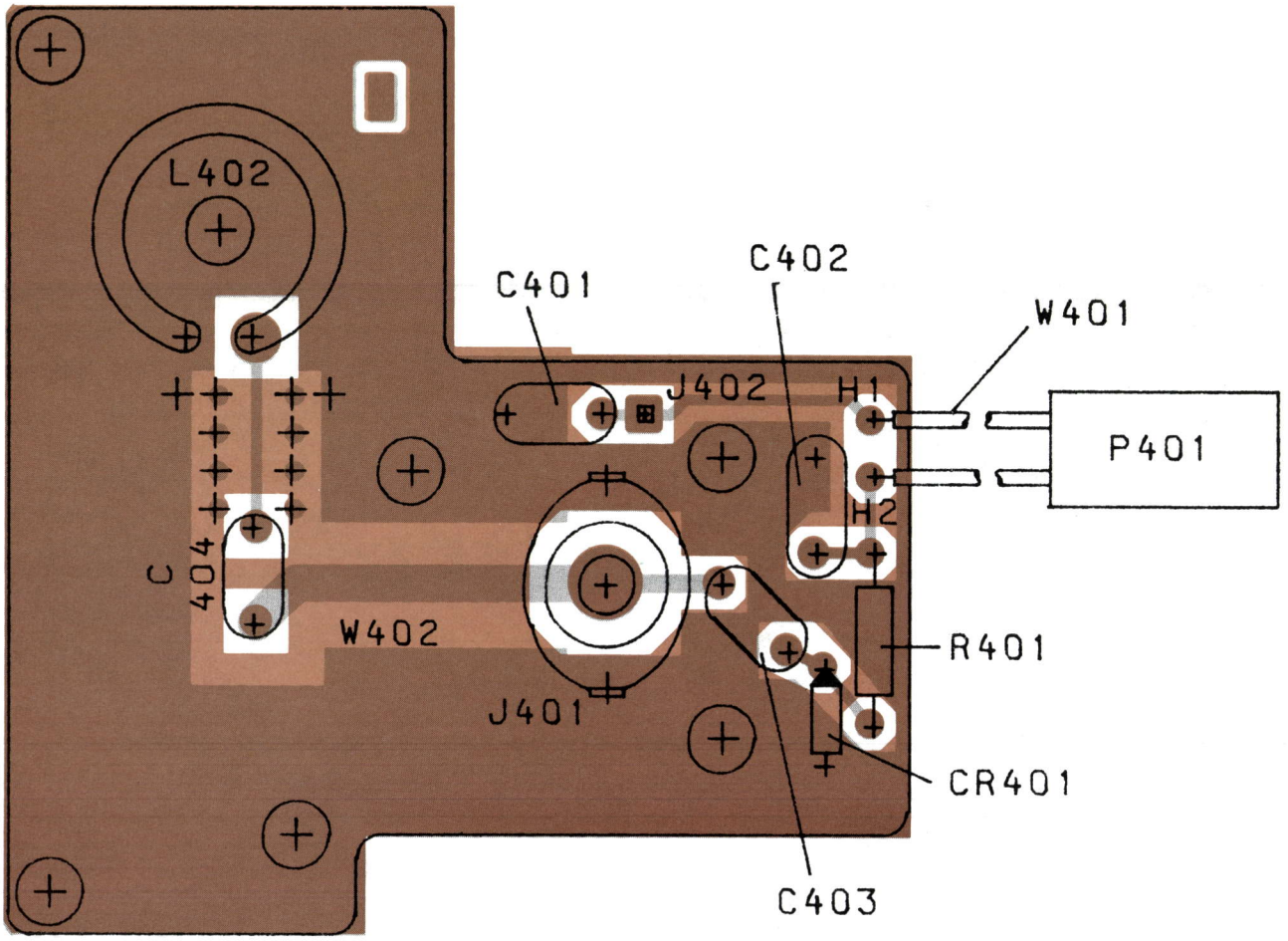


FIGURE 6 - TROUBLESHOOTING FLOW CHART (SHEET 2)



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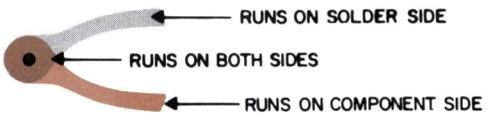
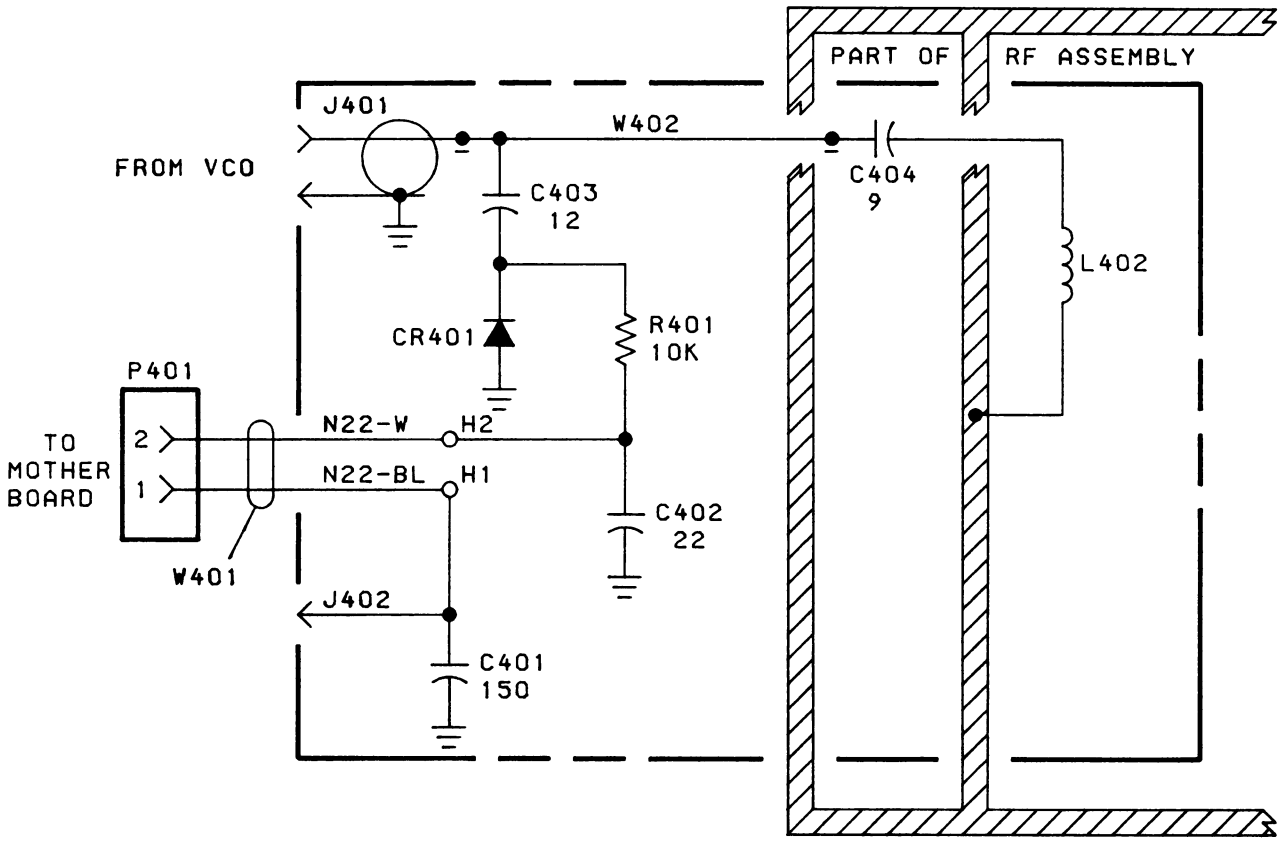


OUTLINE DIAGRAM

UHF RECEIVER ADAPTER
19B232537G1



ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

MODEL NO	REV LETTER
PL19B232537G1	

(19B232924, Rev. 1)

SCHEMATIC DIAGRAM

UHF RECEIVER ADAPTER
19B232537G1

PARTS LIST

UHF RECEIVER ADAPTER
19B232537G1
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C401	19A116655P7	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C402	19A116656P22J0	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef 0 PPM.
C403	19A116656P12J0	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C404	19A116656P9J0	Ceramic disc: 9 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR401	19A116052P1	Silicon, hot carrier: Fwd. drop .350 volts max.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J401	19A116832P1	Receptacle, coaxial: jack type; sim to Cinch 14H11613.
J402	19A116779P1	Contact, electrical: sim to Molex 08-50-0404.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L402	19A129710P1	Coil.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P401		Connector. Includes:
	19A116659P138	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108. (Quantity 2).
		- - - - - - - - - - RESISTORS - - - - - - - - -
R401	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W401	19B232537G2	Cable assembly. (Includes P401).
W402		(Part of printed wire board 19C328260P1).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES