ERICSSON

LBI-31538C
(REPLACES LBI-31372)

MAINTENANCE MANUAL
136-174 MHz SYNTHESIZED DELTA-SX
TWO WAY FM RADIO
SERVICE SECTION

TABLE OF CONTENTS

	Page
DESCRIPTION	1
INITIAL ADJUSTMENT	1
MAINTENANCE	1
Preventative Maintenance	1
Disassembly Procedure	2
PA Transistor Replacement	4
Replacing Chip Components	5
TEST AND TROUBLESHOOTING PROCEDURES	5
PROGRAMMING	6
SYNTHESIZER AND TRANSMITTER ALIGNMENT	7
RECEIVER ALIGNMENT	8
RECEIVER TEST PROCEDURES	9
RECEIVER AUDIO AND SQUELCH WAVEFORM CHECKS	10
TRANSMITTER ALIGNMENT	12
MECHANICAL LAYOUT	13
INTERCONNECTION DIAGRAMS	14

DESCRIPTION

This section contains information required to service the radio. The section includes disassembly procedures, procedures for replacing transistors, Integrated Circuits (IC's) and chip components. The section also includes alignment procedures and troubleshooting information (see Table of Contents).

INITIAL ADJUSTMENT

After the radio has been installed (as described in the Installation Manual), the following adjustments should be made by an authorized electronics technician.

TRANSMITTER ADJUSTMENT

Transmitter adjustment includes measuring the forward and reflected power and adjusting the antenna length for optimum ratio. Next, verify the correct frequency and modulation and record these measurements for future reference. The RF circuits in the exciter and the PA are wideband and require no tuning. The power output of the transmitter has been set to the specified rated power at the factory. For complete transmitter adjustment, refer to the Alignment Procedure (see Table of Contents).

RECEIVER ADJUSTMENT

There are no initial receiver adjustments.

MAINTENANCE

PREVENTIVE MAINTENANCE

To ensure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. This preventive maintenance should include the checks as listed in the table of Maintenance Checks.

CAUTION

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, the serviceman should discharge himself by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering iron should also have a 3-prong power cord connected to an outlet with a known good earth ground. A battery-operated soldering iron may be used in place of the regular soldering iron.

MAINTENANCE CHECKS	INTERVAL	
	6 Months	As Required
CONNECTIONS - Ground connections and connections to the voltage source should be periodically checked for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation. When ground connections are not made directly to the battery, the connection from the battery to vehicle chassis must be checked for low impedance. A high impedance may cause excessive voltage drops and alternator noise problems.	X	
ELECTRICAL SYSTEM - Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. Overvoltage is indicated when the battery loses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation. A weak battery will often cause excessive noise or faulty operation.		X
MECHANICAL INSPECTION - Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws and parts to make sure that nothing is working loose.	X	
ANTENNA - The antenna, antenna base and all contacts should be kept clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss of radiation and a weak signal will result.	X	
ALIGNMENT - The transmitter and receiver meter readings should be checked periodically, and the alignment "touched up" when necessary. Refer to applicable Alignment Procedure and troubleshooting sheet for typical voltage readings.		X
FREQUENCY CHECK - Check transmitter frequency and deviation. Normally, these checks are made when the unit is first put into operation, after the first six months and once a year thereafter.		X

DISASSEMBLY

- To gain access to the unit for servicing:
  1. Unlock the radio.
  2. Pull down the handle.
  3. Pull the radio forward and lift radio out of mounting place -- if desired.
  4. Pry up the front of top cover and lift the cover off.
  5. To gain access to the bottom side, pull the radio all the way out of the mounting frame and remove the four mushroom shaped feet using a 5mm allen wrench.

NOTE

With the top cover removed all components on the PA and TRS board are accessible for tuning. The PA, IF, and synthesizer/exciter covers must be removed to expose components.

- To remove the TRS board:

1. Remove the bottom cover.
2. Remove the eleven #15 TORX retaining screws (A) (Figure 1) securing the circuit board to the main frame.
3. Remove two #9 TORX retaining screws (B) securing systems connector J601 to front casting.
4. Unsolder the two feed through capacitor terminals (E) on printed wire pattern.
5. Turn over the radio and remove the three retaining screws (D) (Figure 2) securing the audio bridge amplifier, U601 and U602, and the 5 and 9 volt regulators U702 and Q705 to the side of chassis.

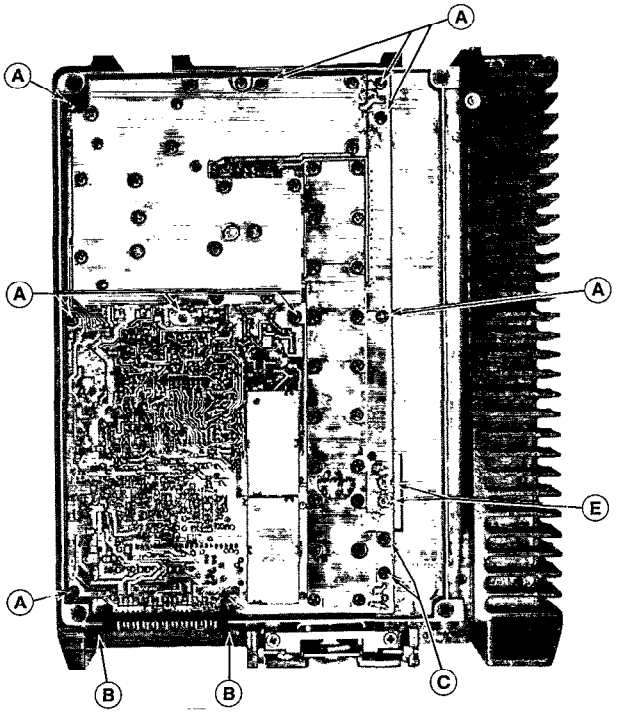

Figure 1 - Disassembly Procedure Bottom View

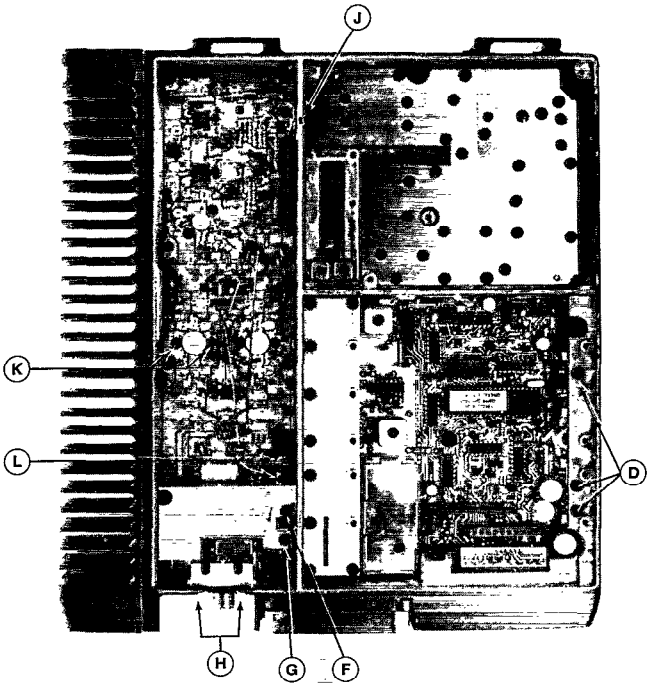

Figure 2 - Disassembly Procedure Top View

6. To remove the front end shield, remove the twenty #15 TORX retaining screws securing the shield to the front end casting and remove.
7. To remove the synthesizer shield, remove the seventeen #15 TORX retaining screws securing the shield to the synthesizer top casting.

- To replace TRS board:

1. Perform above procedures in reverse order.

- To remove the PA board:

1. Remove the three #15 TORX retaining screws (G) securing the PA filter cover to the main frame.
2. Remove the eight #15 TORX retaining screws (F) from around the edge of the PA board.
3. Remove the two #15 TORX retaining screws (H) securing the antenna connector to the main frame.

4. Loosen the #8 TORX retaining screw (J) securing the pass transistor to the side of the PA chassis compartment.
5. Remove the #8 TORX retaining screws (K) securing the PA transistors to the main frame.
6. Turn the radio over and remove the #8 nut and washer from the stud of PA transistor Q1.

NOTE

Torque #8 nut on Q1 to 6 inch lbs. when replacing.

7. Unsolder the two power feed through capacitors at (L).
8. Carefully lift the PA board up off the pins extending upward from the TRS board.

NOTE

Note the position of the copper washer spacer under transistor Q1. Be sure that this spacer is in place when replacing the board.

- To replace the PA board:

1. Perform the above procedures in reverse order, being careful to align all interconnecting pins and sleeves. Be sure the antenna gasket between the antenna jack and front casting is positioned properly.

PA TRANSISTOR REPLACEMENT

WARNING

The RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, the escaping dust may be hazardous if inhaled. Use care in replacing transistors of this type.

- To replace the PA RF transistors:

1. Unsolder one lead at a time with a 50 watt soldering iron. Use a scribe or X-acto® knife to hold the lead away from the printed circuit board until the solder cools.
2. Remove retaining screws and lift out the transistor. Remove any old solder from the printed circuit board using a vacuum tool. Special care should be taken to prevent damage to the printed circuit board runs because part of the matching network is included in the base and collector runs.
3. Trim the new transistor leads (if required) to the lead length of the removed transistor. The letter "C" on the top of the transistor also indicates the collector.
4. Apply a coat of silicon grease to the transistor mounting surface. Place the transistor in the mounting hole. Align the leads as shown on the Outline Diagram. Then replace the transistor mounting screws using moderate torque.
5. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board. Use care not to use excessive heat that causes the printed wire board runs to lift up from the board. Check for shorts and solder bridges before applying power.

CAUTION

Failure to solder the transistor leads as directed may result in the generation of RF loops that could damage the transistor or may cause low power output.

REMOVING IC's

Removing IC's (and most other soldered-in components) can be easily accomplished by using a vacuum desoldering tool. To remove an IC, heat each lead separately on the solder side and remove the old solder with the desoldering tool.

CAUTION

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, the serviceman should discharge himself by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering iron should also have a 3-prong power cord connected to an outlet with a known good earth ground. A battery-operated soldering iron may be used in place of the regular soldering iron.

REPLACING CHIP COMPONENTS

Replacement of chip components should always be done with a temperature-controlled soldering iron, using a controlled temperature of 700°F (371°C). However, do NOT touch black metal film of the resistors or the ceramic body of capacitors with the soldering iron.

NOTE

The metalized end terminations of the parts may be touched with the soldering iron without causing damage.

TO REMOVE CHIP COMPONENTS

1. Heat each end of the chip using two soldering irons until solder flows, and then remove.
2. Remove excess solder with a vacuum solder extractor or Solder-wick®.
3. Carefully remove the epoxy adhesive and excess flux to prevent damage to the printed board.

TO REPLACE CHIP COMPONENTS

1. Using as little solder as possible, "tin" one end of the component and one of the pads on the printed wiring board.
2. Place the "tinned" end of the component on the "tinned" pad on the board and simultaneously touch the component and the pad with a well "tinned" soldering iron while pressing the component down on the board.
3. Place the "tinned" soldering iron on the other end of the component and the pad simultaneously. Apply solder to the top of the end of the component until the solder starts to flow. Use as little solder as possible while getting a good joint.
4. After the component has cooled, remove all flux from the component and printed wiring board area with alcohol.

TEST AND TROUBLESHOOTING PROCEDURES

Maintenance of the radio is facilitated by use of the Self Test and Diagnostics routines and servicing techniques unique to this radio. Typical voltage readings are provided on the Schematic Diagram for reference when troubleshooting.

SERVICE TIP

When servicing the TRS board, relocating the Channel Guard board may be helpful.

CHANNEL GUARD BOARD

Both the Channel Guard board and Channel Guard extender may be removed and set aside during servicing. While servicing the radio install P608 to connect VOL/SQ/HI.

Microcomputer

When servicing the microcomputer/synthesizer circuitry it is sometimes desirable to force the microcomputer into specific operating modes. Following are some tips that allow you to initiate these modes.

- To force the microcomputer to continually try to reload the synthesizer. This mode will enable you to check the serial data, clock, channel change pulse and enable signals to the synthesizer. Grounding the lock detect line into the microcomputer at U703-8.

- To stop the microcomputer from running, disable the watchdog timer by shorting the collector and emitter of Q714 and ground the single step line at U705-5.

Microphonics

Synthesized radios tend to be sensitive to shock and vibration, creating microphonics. The construction of the DELTA-SX, radio with its die cast aluminum frame, cast shields, and multiple board mounting screws, provides a high degree of immunity. When removing either printed circuit board or the shields, note the exact location and position of all mounting hardware including rubber padding and bracket (if included).

When servicing the radio be sure that no solder build-up has occured on the chassis or shield.

To assure a high degree of resistance to microphonics be sure to replace exactly, all hardware removed. Be sure that all mounting screws are properly torqued and shields in place. Refer to Mechanical Layout Diagram.

NOTE

Loose or rubbing parts, especially in the VCO area are particularly sensitive and can cause microphonics. Again be certain all hardware is properly installed and torqued.

TEST FREQUENCIES

If the EEPROM is not custom programmed to the customers specified personality, then a standard test program is provided. The EEPROM is programmed on channels 1 through 16 including tone and digital Channel Guard and carrier control timer. Table 1 identifies the programmed test frequencies.

PROGRAMMING

The following procedure describes how to change the frequencies in the radio EEPROM(S) for new user frequencies.

The DELTA-SX VHF Wideband radio may be programmed using the TQ-2310 Suitcase Programmer, the 4EX22A10 Hand Programmer or by a Personal Computer. The procedures for using the programmers are covered in detail in LBI-31263 (TQ-2310) and LBI-31275 (4EX22A10). TQ-3334 provides the software and programming instructions for programming with a Personal Computer.

When programming the radio, consideration must be given to the individual band splits for the T/R/S board used in the radio, and the type of software in the radio microcomputer. The band splits and software group numbers are given below:

Band Split	T/R/S Board (Negative Ground Only)	T/R/S Board (Floating Ground)
150.8-174 MHz	19D901650G1,3	19D901228G1
136-153 MHz	19D901650G2,4	19D901228G2

MICROCOMPUTER SOFTWARE (U705)

The latest software package is a 19A703244P23 or a 19A703868G5; replacing the following packages:

Narrowband	Wideband
19A703244P10	19A703244P21,22
19A703241G3-8	19A703868G2-4

PROGRAMMING TIPS

When using the TQ-2310 suitcase programer or a Personal Computer for programming, Jumber P707 (if present on Neg. Grd. Only system boards) must be removed. If programming the S950/S990 Control Unit for download to the radio, P703 (on the rear of the radio) must be disconnected to isolate the Advance Change Pulse line.

When the 4EX22A10 Hand Programmer, Jumper P706 (Neg. Grd. T/R/S boards) must be removed (disconnects D720) or lift one end of D720 on Floating Grd. T/R/S Boards.

ALIGNMENT

After the radio has been programmed with new user frequencies, NO ALIGNMENT is required. The receiver is sweep tuned at the factory to cover the entire band split, the exciter requires no tuning, and the TX and RX VCO's are set to cover the entire band split.

TABLE 1 - PROGRAM TEST FREQUENCIES

FREQ SPLIT	CHANNEL	TRANSMIT	RECEIVE	CG ENC	CG DEC	CCT
136-153 MHz	1A,1B	144.020	144.060	71.9	71.9	---
	2A,2B	146.770	145.060	023	023	---
	3A	144.020	144.060	---	---	30 SEC
150.8-174 MHz	1A,1B	156.015	156.060	71.9	71.9	---
	2A,2B	158.565	157.060	023	023	---
	3A	156.015	156.060	---	---	30 SEC

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RECEIVER FREQUENCY ADJUSTMENT

(Refer to Transmit Frequency Adjustment, no RF receive frequency adjustment is required)

IF ALIGNMENT

1. Attach an oscilloscope probe to IF AMP. MTR. (J602-10).
2. Using an HP8640B signal generator, set to an on-channel frequency, feed a 20 Hz modulating frequency with ±12 kHz of deviation into the radio at antenna jack J2. (See Figure 6).
3. Connect a coaxial cable between the AM output of the HP8640B and the external 10 trigger signal on the scope. Use NORMAL triggering.
4. DC couple the scope probe and adjust the controls for 0.1V per div. (vertical) and 2 msec per div. (horizontal).
5. Adjust the AM output level to make sure the scope is triggering. Adjust the RF input signal level to keep the IF passband sweep pattern just below saturation (typ. 2 uV). After using the vertical and horizontal positioning controls to center the waveform, check for a scope pattern similar to the one shown in Figure 7.

SERVICE NOTE: L458, L502, L503, L506, L508 and L509 should be tuned to peak the IF passband, no ripple should be present in the passband.

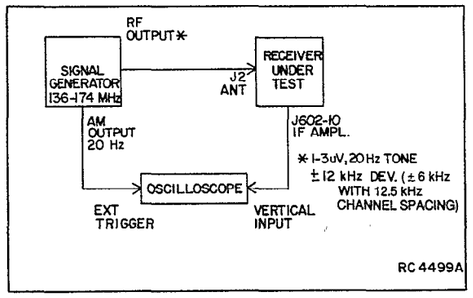


Figure 6 - Test Set-up, Audio Output Measurement

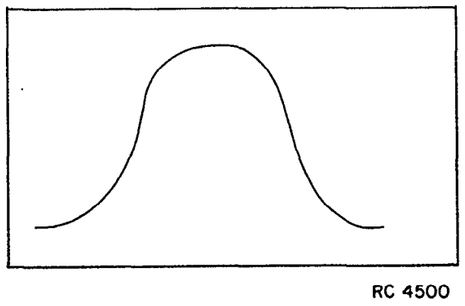


Figure 7 - IF Waveform

RECEIVER ALIGNMENT

The DELTA-SX wideband synthesized radio receiver has been sweep aligned at the factory to demanding specifications using a complex test procedure and test set up. Therefore, no detailed receiver alignment or readjustment is necessary nor recommended.

Should it become necessary to replace a tunable coil it is recommended that the core position in the removed coil be noted and that the core in the replacement coil be positioned to a like position. Following this procedure should return the radio to service with little or no compromise in bandwidth. Check radio specifications on all operating channels. If necessary retune replaced coil slightly to obtain required response.

Adjustment Procedures are provided for the receiver 2nd oscillator, Quadrature Detector, Audio Power, and Squelch.

TEST EQUIPMENT REQUIRED

1. GE Test Set 4EX3A11, 4EX8K12, or 20,000 ohms-per-volt milliameter.
2. AC Voltmeter
3. RF Signal Generator (136-174 MHz)
4. Frequency Counter (136-174 MHz)
5. 4-ohm 15 Watt resistor
6. Audio Isolation Transformer (1:1) 19A116736P1 or equivalent.

ADJUSTMENT PROCEDURES

RECEIVER 2ND OSCILLATOR/FM DETECTOR/ AUDIO

1. Select a center frequency channel. Apply an on-frequency signal with no modulation to antenna jack J2.
2. Monitor J501 with a AC coupled frequency counter. Tune L551 for 10.7 MHz (± 50 Hz). Increase level of generator if necessary to obtain a reading. The 13.2 MHz reference oscillator must have already been adjusted per the Transmitter Frequency Adjustment before this step.

> **NOTE**
>
> Do not readjust L551 once it has been set.

3. Apply a 1 kHz tone modulation with ±3 kHz deviation (±1.5 kHz deviation for units with 12.5 kHz channel spacing) to the RF input signal and adjust its level to 1000 uV. Set R629 fully clockwise. Monitor the speaker output (J602-6, 7) with an AC voltmeter and adjust L510 for a peak audio voltage.

> **NOTE**
>
> The audio output is a balanced bridge circuit and requires all test equipment connected across the speaker leads to be both AC and DC isolated from ground. Refer to Figure 8 and connect audio isolation transformer to J602-6 and J602-7.

4. Adjust R629 for 300 mV (±10 mV) RMS at VOL/SQ HI (J603-14).

FIXED SQUELCH ADJUSTMENT (8 dB SINAD)

1. Adjust fixed squelch control R666 fully clockwise (open squelch).
2. Adjust input level of RF Signal Generator to produce a SINAD sensitivity reading of 9 dB.
3. Turn R666 fully counterclockwise (maximum squelch position) to close squelch. Slowly readjust R666 to the position where the squelch just opens. Check that squelch opens at 8 dBs (±1 dBs).

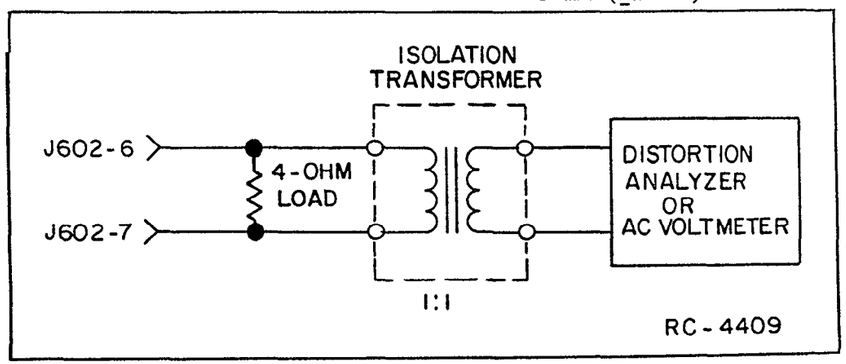


Figure 8 - Audio Isolation Transformer

TEST EQUIPMENT REQUIRED

1. Wattmeter, 50 ohm (capable of measuring 150 Watts & 1 Watt)
2. Digital Voltmeter
3. RF Frequency Counter
4. RF Voltmeter
5. Power Supply, 13.8 VDC regulated
6. GE Test Set, 4EX3A11 with Test Set Adapter 19C850590G1
7. Tuning Tool 19B800716P2

PRELIMINARY CHECKS AND ADJUSTMENTS

NOTE

Refer to Figure 3 for location of tuning and adjustment controls.

Connect black plug of GE Test Set to RF Metering jack J101. Connect red system metering plug to J602, system metering. Set polarity to "+" and voltage range to the 1 volt position (Test 1).

NOTE

Before aligning or making any adjustments to the transmitter, be sure that the output of the 9 volt regulator is set for 9.0 +0.05 VDC. Monitor J602-3 with a digital voltmeter and adjust R703.

ALIGNMENT PROCEDURE

SYNTHESIZER TX AND RX VCO

NOTE

The synthesizer is factory aligned and should not require further adjustment. Should it become necessary to adjust the synthesizer please refer to the Maintenance Manual LBI-31537 and the sections from "Frequency Segment Control" to the "Frequency Synthesizer" section. These will familiarize you with the operation of the VCO's and make the Alignment Procedure more understandable.

STEP	METERING POSITION: GE TEST SET	METERING POSITION: MULTIMETER (- to A-)	TUNING CONTROL	METER READING	PROCEDURE
1.		LED D713	L209	LIGHT OUT	Install a test EEPROM programmed as follows: RADIO FREQ SPLIT — TEST FREQ TX & RX 150-174 MHz — 174.0 MHz 136-153 MHz — 153.0 MHz Select the proper test frequency, key the transmitter, and adjust L209 until lock detect indicator D713 goes out.
2.		J202	L209	7.5 VDC	Monitor J202 with digital voltmeter. Tune L209 for 7.5 VDC ±0.05V.
3.		LED D713	C220	LIGHT OUT	Unkey the transmitter. Adjust C220 until lock detect indicator D713 goes out.
4.		J202	C220	7.5VDC	Monitor J202 with a digital voltmeter. Tune C220 for 7.5 VDC ±0.05V. Remove test PROM when complete.
	Test aid for TX and RX Injection				Monitor TX injection at J102 and RX injection at J430. TX injection +5 to +15 dBm RX injection +5 to +15 dBm

ALIGNMENT PROCEDURE (Continued)

STEP	METERING POSITION: GE TEST SET	METERING POSITION: MULTIMETER (- to A-)	TUNING CONTROL	METER READING	PROCEDURE
	EXCITER/TRANSMITTER POWER AMPLIFIER				
					NOTE The exciter can be isolated from the rest of the radio for test purposes, if desired. To isolate and set up, remove P102 and P103. Connect a (0-1 watt) wattmeter to J103-2,4. Apply a +7 dBm on frequency signal to J102-2,1.
5.					Install a test EEPROM programmed to the low, center, and high end of the frequency split.
6.				250 mw	Key the transmitter on the low, center, and high end frequency. Connect a 0-1 watt wattmeter to J103-2,4 (exciter output). Meter should read 250 mw minimum. No tuning is required. Typical output is 350 mw.
7.	A (PA INPUT)	J1-10		RATED OUTPUT POWER	NOTE Disconnect wattmeter from J103. Reinstall jumper P103 and P102 if removed. Connect wattmeter set for 150 watts to antenna jack J2. Connect meter to PA Board J1. Set the RF Power Adjust Control for maximum power (fully clockwise). Key the transmitter and check to see that rated power is exceeded at the low, center, and high end frequency channel and meter reading is fairly constant.
8.				RATED OUTPUT POWER	On the center frequency channel, set power to rated.
9.		J2	L352	CHANNEL OPERATING FREQUENCY	NOTE This step assumes the frequency is measured when the transmitter is first keyed. If delayed the rapidly rising ambient temperature must be taken into consideration. Figures 4 and 5 below show the temperature versus frequency correction curve for the 5 PPM and optional 2 PPM reference osc. Key the transmitter while monitoring the frequency at the antenna connector J2. Adjust L352 for the assigned channel frequency. If adjusting L352 does not result in setting transmitter on frequency, remove synthesizer top cover, set L352 two turns from top of coil form, then adjust course frequency control L354 on frequency. Replace cover. This procedure would be necessary if repairing/replacing parts in oscillator circuit. ±75 Hz for a 5 PPM (standard) or ±30 Hz for a 2 PPM radio (optional). NOTE: The receiver injection frequency will automatically be correct.

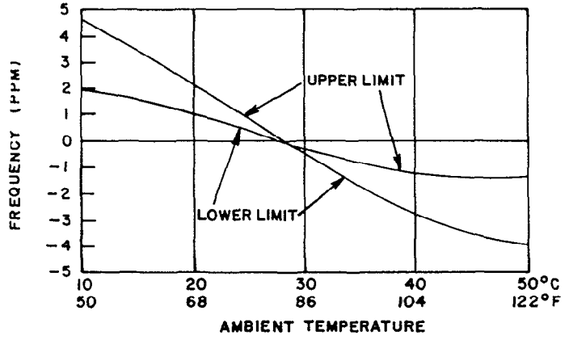


FIGURE 4 CORRECTION FACTOR IN FREQ. SETTING FOR 5 PPM OSCILLATOR

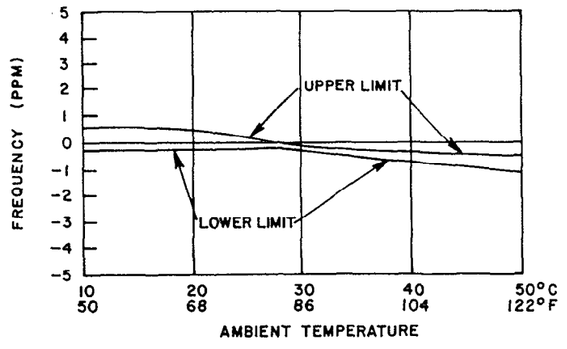


FIGURE 5 CORRECTION FACTOR IN FREQ. SETTING FOR 2 PPM OSCILLATOR

STEP	METERING POSITION: GE TEST SET	METERING POSITION: MULTIMETER (- to A-)	TUNING CONTROL	METER READING	PROCEDURE
					EXCITER/TRANSMITTER POWER AMPLIFIER
					NOTE: The exciter can be isolated from the rest of the radio for test purposes, if desired. To isolate and set up, remove P102 and P103. Connect a (0-1 watt) wattmeter to J103-2,4. Apply a +7 dBm on frequency signal to J102-2,1.
5.					Install a test EEPROM programmed to the low, center, and high end of the frequency split.
6.				250 mw	Key the transmitter on the low, center, and high end frequency. Connect a 0-1 watt wattmeter to J103-2,4 (exciter output). Meter should read 250 mw minimum. No tuning is required. Typical output is 350 mw.
7.	A (PA INPUT)	J1-10		RATED OUTPUT POWER	NOTE: Disconnect wattmeter from J103. Reinstall jumper P103 and P102 if removed. Connect wattmeter set for 150 watts to antenna jack J2. Connect meter to PA Board J1. Set the RF Power Adjust Control for *maximum power (fully clockwise)*. Key the transmitter and check to see that rated power is exceeded at the low, center, and high end frequency channel and meter reading is fairly constant.
8.				RATED OUTPUT POWER	On the center frequency channel, set power to rated.
9.		J2	L352	CHANNEL OPERATING FREQUENCY	NOTE: This step assumes the frequency is measured when the transmitter is first keyed. If delayed the rapidly rising ambient temperature must be taken into consideration. Figures 4 and 5 below show the temperature versus frequency correction curve for the 5 PPM and optional 2 PPM reference osc. Key the transmitter while monitoring the frequency at the antenna connector J2. Adjust L352 for the assigned channel frequency. If adjusting L352 does not result in setting transmitter on frequency, remove synthesizer top cover, set L352 two turns from top of coil form, then adjust course frequency control L354 on frequency. Replace cover. This procedure would be necessary if repairing/replacing parts in oscillator circuit. ±75 Hz for a 5 PPM (standard) or ±30 Hz for a 2 PPM radio (optional). NOTE: The receiver injection frequency will automatically be correct.

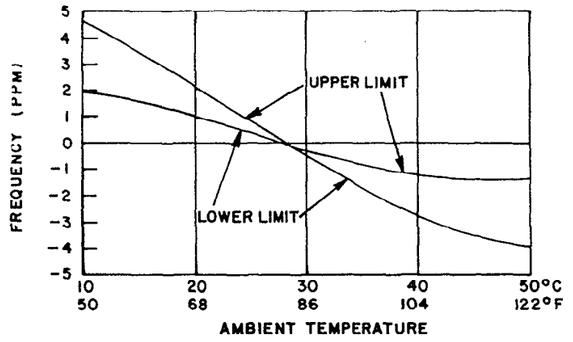


FIGURE 4 CORRECTION FACTOR IN FREQ. SETTING FOR 5 PPM OSCILLATOR

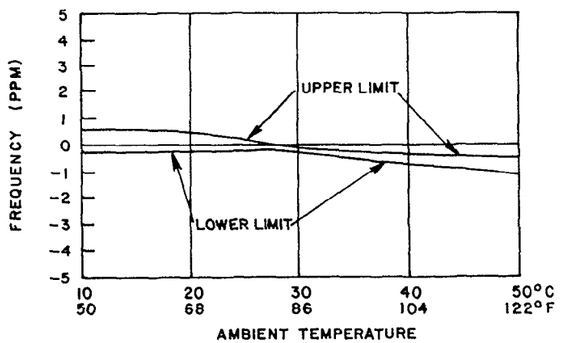


FIGURE 5 CORRECTION FACTOR IN FREQ. SETTING FOR 2 PPM OSCILLATOR

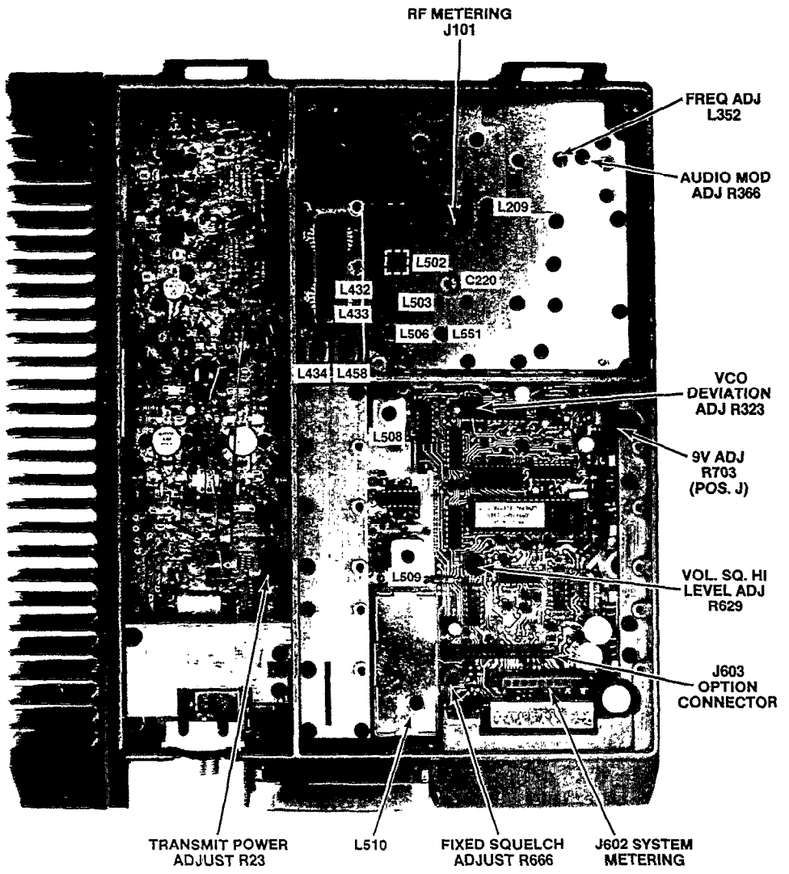


Figure 3 - Transmitter/Receiver Tuning & Adjustment Controls

POWER AMP. METERING J1 PIN	POS	FUNCTION
10	A	RF DRIVE(EX OUT)
9	B	PWR CTL VOLT
8	C	TX A+ METER
7		
6	E	PA CURRENT (REF TX A+)
5	F	DRIVER CURRENT (REF TX A+)
4		
3		
2		TX A+
1		TX A-

RF METERING J101 PIN	POS	FUNCTION
10	A	AMPL 1 VOLT
9	B	AMPL 2 VOLT
8	C	AMPL 3 VOLT
7		
6		
5		
4		
3		
2		A-
1		A-

SYSTEM METERING J602 PIN	POS	FUNCTION
10	D	IF AMPL
9		CG DISABLE
8		P.T.T.
7		SPKR 1
6		SPKR 2
5		MIC HI
4		
3	J	0-10V
2	K	0-15V
1		A-

RC-7780

TEST PROCEDURE

These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer
- Signal Generator
- 6 dB attenuation pad
- Audio Isolation Transformer
- 4 ohm resistor (15 watt minimum)

PRELIMINARY ADJUSTMENTS

NOTE

These procedures are written around the Heathkit Distortion Analyzer. If a Distortion Analyzer other than the Heath IM-12 is used, measure the sensitivity and modulation acceptance bandwidth in accordance with manufacturer's instructions.

1. Unsquelch the receiver.

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 1,000 Hz with ±3.0 kHz deviation to antenna jack J2.

B. With 12 Watt Speaker

Disconnect speaker lead pins from J1A-36 and 37 on rear of control unit. Connect a 4.0 ohm, 15 Watt load resistor across system metering jack J602-6 and 7 on the TRS board.

Connect the isolation transformer input across the resistor. Connect the isolation transformer output to the Distortion Analyzer (See Figure 5).

C. Adjust the VOLUME control for 12 Watts output 6.93 VRMS 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 12 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 J601.

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. Set signal generator output to 0.3 uV. Switch the RANGE control from SET LEVEL to the distortion range. Readjust Distortion Analyzer SET LEVEL as required 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 6 Watts (49 Volts RMS across the 4.0 ohm receiver load using the Distortion Analyzer as a Voltmeter).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWITH (IF BANDWITH)

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Reduce audio output level to 10% of rated output.

B. Set the Signal Generator output for twice the microvolt reading obtained in the 12 dB SINAD measurement.

C. Set the Range control on the Distortion Analyzer in the SET LEVEL position (1000 Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

D. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12 dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

E. The deviation control reading for the 12 dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7.0 kHz.

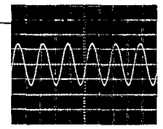
SERVICE CHECK

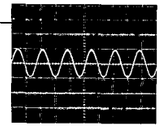
If the Modulation Acceptance Bandwidth test does not indicate the proper width, check the synthesizer frequency and then refer to the Alternate IF Sweep Alignment Section of the Receiver Alignment Procedure.

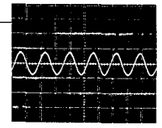
SQUELCH CIRCUIT TEST WITH 7 kHz SIGNAL

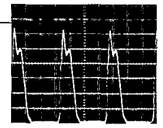
PRELIMINARY STEPS

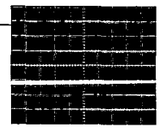
1. Quiet receiver with 1000 uv modulated signal applied to antenna jack J2.
2. Squelch Adjust R666 to 8 dB SINAD.
3. Set modulation to 6 kHz.
4. Set deviation to 3 kHz.
5. Use 10 megohm probe.

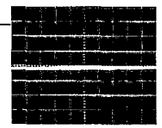
A

HORIZONTAL
0.2 MSEC DIV
VERTICAL
0.2 V/DIV
(0.5 V P-P)

B

HORIZONTAL
0.1 MSEC/DIV
VERTICAL
0.2 V/DIV
(0.4 V P-P)

C

HORIZONTAL
0.1 MSEC/DIV
VERTICAL
0.2 V/DIV
(0.36 V P-P)

D

HORIZONTAL
μSEC/DIV
VERTICAL
0.2 V/DIV
(1.2 V P-P)
BASE LINE = 0 VDC

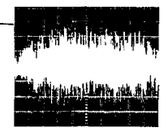
E

HORIZONTAL
1 MSEC/DIV
VERTICAL
0.3 V/DIV
(0.3 VDC)
BASE LINE = 0 VDC

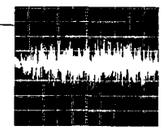
F

HORIZONTAL
1 MSEC/DIV
VERTICAL
1 V/DIV
(5 VDC)
BASE LINE = 0 VDC

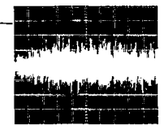
SQUELCH CIRCUIT CHECKS WITH NOISE

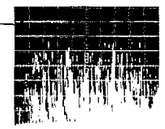
PRELIMINARY STEPS

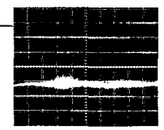
1. No input signal applied.
2. Squelch Adjust R666 set for 8 dB SINAD.
3. Use 10 megohm probe.

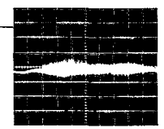
A

HORIZONTAL
5 MSEC/DIV
VERTICAL
1 V/DIV
(≈ 4 V P-P)

B

HORIZONTAL
5 MSEC/DIV
VERTICAL
1 V/DIV
(≈ 2 V P-P)

C

HORIZONTAL
5 MSEC/DIV
VERTICAL
0.5 V/DIV
(≈ 1.5 V P-P)

D

HORIZONTAL
5 MSEC/DIV
VERTICAL
1 V/DIV
(≈ 4 V P-P)
BASE LINE = 0 VDC

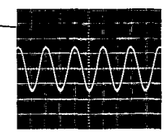
E

HORIZONTAL
5 MSEC/DIV
VERTICAL
0.2 V/DIV
(0.6 VDC)
BASE LINE = 0 VDC

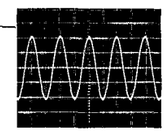
F

HORIZONTAL
5 MSEC/DIV
VERTICAL
2 V/DIV
(7.5 VDC)

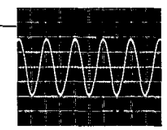
AUDIO CIRCUIT

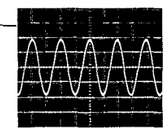
PRELIMINARY STEPS

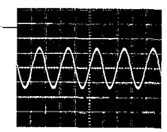
1. Apply 1000 uV on frequency signal with 1000 Hz modulation and 3 kHz deviation to antenna jack J2.
2. Output set to 12 Watts (9.8 VRMS) into 4-ohm load.
3. Use 1 megohm probe.

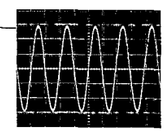
G

HORIZONTAL
0.5 MSEC/DIV
VERTICAL
50 MV/DIV
(140 MV P-P)

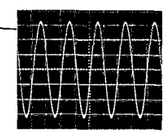
H

HORIZONTAL
0.5 MSEC/DIV
VERTICAL
0.2 V/DIV
(0.84 V P-P)

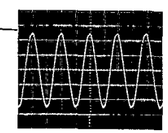
J

HORIZONTAL
0.5 MSEC/DIV
VERTICAL
0.1 V/DIV
(0.4 V P-P)

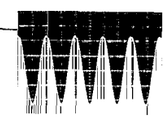
K

HORIZONTAL
0.5 MSEC/DIV
VERTICAL
0.1 V/DIV
(0.4 V P-P)

L

HORIZONTAL
5 MSEC/DIV
VERTICAL
50 MV/DIV
(140 MV P-P)

M

HORIZONTAL
0.5 MSEC/DIV
VERTICAL
50 MV/DIV
(320 MV P-P)

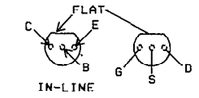
N

HORIZONTAL
0.5 MSEC/DIV
VERTICAL
50 MV/DIV
(300 MV P-P)

P

HORIZONTAL
0.5 MSEC/DIV
VERTICAL
2 V/DIV
(10 V P-P)

R

HORIZONTAL
0.5 MSEC/DIV
VERTICAL
2 V/DIV
(10 V P-P)

RECEIVER AUDIO AND SQUELCH WAVEFORM CHECKS

LEAD IDENTIFICATION
FOR ALL TRANSISTORS
NOT OTHERWISE IDENTIFIED

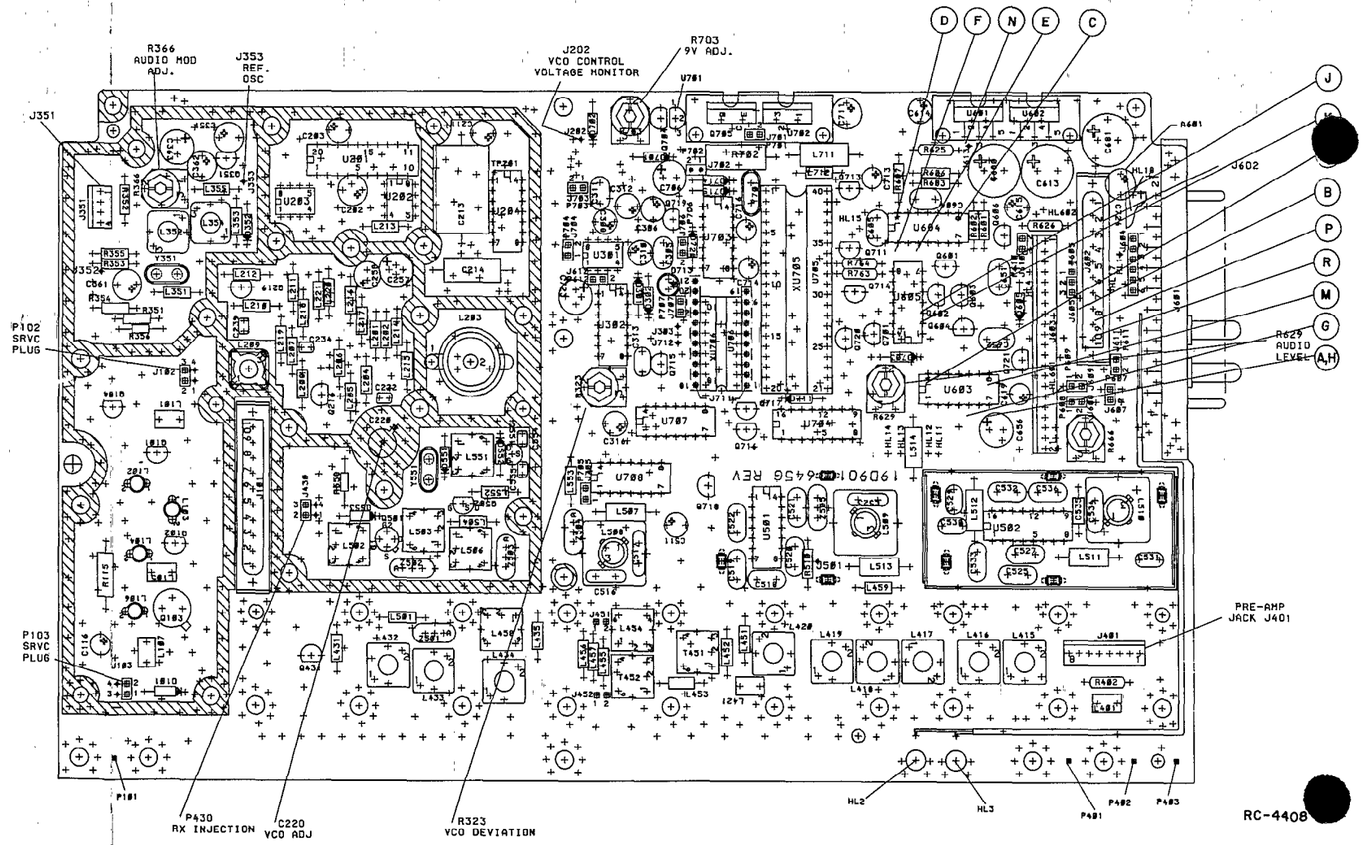


TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

AUDIO AND SQUELCH WAVEFORMS

RC-4202A



RC-4408

(19D901647, Rev. 1)

PA TROUBLESHOOTING PROCEDURE

When troubleshooting the transmitter check for typical meter readings for the exciter, J101, and the power amplifier JACK, J1. Typical readings for the various test positions and test points are given in the charts below.

Power Amplifier Quick Checks

- Connect red system metering plug to J602, system metering.
- Connect black plug of GE Test Set to RF Metering jack J1 of PA. Set polarity to "+" and voltage range to the 1 volt position (Test 1).

PA Jack Reading at J1 with Transmitter Keyed

RANGE POSITION	TEST POSITION	FUNCTION MEASURED	METER SCALE	TYPICAL READINGS		
				110W	60W	40W
TEST 1	A	RF DRIVE	0-1V	0.7V	0.8V	0.7V
TEST 1	B	CONTROL VOLTAGE	0-15V	4V	7.5V	8V
TEST 1	C	TX A+	0-15V	12.5V	13V	13V
TEST 1	E *	PA CURRENT	0-30A	15A	9A	---
TEST 1	F *	DRIVER CURRENT	0-15A	5A	2.5A	8.5A

* NOTE: With High Sensitivity button depressed, polarity to "-".

Exciter Quick checks with Transmitter Keyed

- Connect black plug of GE Test Set to RF Set to RF Metering jack J101, polarity to "+", and voltage range to the 1 volt position (Test 1).

RANGE POSITION	TEST POSITION	FUNCTION	METER SCALE	TYPICAL READINGS
TEST 1	A	AMPL 1	0-1 VOLT	0.65
TEST 1	B	AMPL 2	0-1 VOLT	0.45
TEST 1	C	EXCITER OUTPUT	0-1 VOLT	0.65

SYMPTOM	PROCEDURE	ANALYSIS
Little or No RF Output	Key transmitter and check PA Jack J1-10 Pos A for +0.7 V exciter input (0.8V for 60 W transmitters).	If the specified voltage is present at J1-10 (Position A) then refer to PA Jack Readings Table above. If there is no control voltage J1-9 (Position B) check DC pass transistor Q4, DC amplifiers Q1,Q2,Q3,Q4 and Q5. Check the bases of all RF Transistors for short or open circuit. Check for short or open circuits in Low Pass Filter and RF relay. Make sure the relay is operating when Tx is keyed. If the specified voltage is not present at J1-10 (Position A) make sure that VCO is locking and P102 and P103 are properly installed. Check +9.0 Volt Supply Voltage and keyed +9.0 Volt. If keyed +9.0 Volt is not present check Q104 and associated circuitry. Disconnect P103 and connect a cable to a 1 watt full scale wattmeter, J103 pins 2-4. The power output should be more than 250 mW. If not check Q103 and associated circuitry.

TYPICAL PERFORMANCE INFORMATION

SIGNAL LEVELS

SIGNAL	INDICATION	VOLTAGE LEVEL
CAS	High Level	9.0 VDC
	Low Level	0.15 VDC
RUS	High Level (Rx Un-sq)	9.0 VDC
	Low Level (Rx Squelched)	0.15 VDC
	Low Level (Rx Mute/PTT pulled low, Rx unsquelched)	0.6 VDC
Sq Dis, Input	Logic Low (Sq. Dis)	0 VDC
	Logic High(Sq)	2.4 VDC
	Rx Un-Sq	0.14 VDC
CCT Sq Dis, Input	Logic Low	0.35 VDC
	Logic High	5.5 VDC
Tx Enable	Logic Low	2.0 VDC
	Logic High	9.0 VDC
PTT, Input	Logic Low	0 VDC
	Logic High	13 VDC

CURRENT REFERENCE CHART

SERVICE PLUG	FUNCTION	TYPICAL CURRENT/mA
P701	5V	175
P702	9V	70
P703	9V	Tx 225, Rx 90
P704	9V	Tx 20, Rx 38
P705	9V	Tx 8, Rx 19

TEST POINT DATA

TEST POINT	VOLTAGE	CONTROL	DESCRIPTION
J602-3	9±0.05 VDC	R703	9 Volt Regulator
J202	2.5-8.5 VDC	C220	VCO Control Voltage (See Synth Align)
TP701	Less than 1.0	L209	Frequency Lock Detector
J353	0.3 VPP Tx 0.5 VPP Rx		Reference Osc. Output (high impedance)
J352	5.55 VDC		Ref Osc. Compensation Voltage at 25° C. ±5 PPM
J352	5.23 VDC		2 PPM Osc. Resistor Network marked "090B"
J352	5.56 VDC		2 PPM Osc. - All others

RADIO CONNECTOR IDENTIFICATION	
Front Connector	J601
Systems Metering	J602
Option Connector	J603
PROM Program Plug	J711
RF Metering	J101
RX In.	P401
IF Input	P404
RX Inj.	P451
Exciter Input	P102
Exciter Out.	P101, P103

RECEIVER READINGS SYSTEM JACK, J602			
TEST POS	FUNCTION	SCALE	TYPICAL READING
0	IF AMP	1V	.75 +
1	FM DET	1V	.35

+ VARIES WITH REFERENCE SIGNAL LEVEL

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating -- but *not* properly. *Once a defect is pin-pointed, refer* to the Transmitter Troubleshooting Procedure. Before starting, be sure that transmitter is tuned and aligned properly.

CAUTION

Before bench testing the radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed:	**20 Volts**
Transmitter keyed (50 ohms resistive load):	**18 Volts**
Transmitter keyed (no load or non-resistive load):	**14 Volts**

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limits shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.6 VDC for loads of 6 to 16 amperes; 13.4 VDC for loads of 16 to 36 amperes). Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12 Volt automative storage battery.

TEST PROGRAMMING

In DELTA-SX radios, in which the EE PROM is not custom programmed, the EE PROM is programmed with the personality shown in Table 1 below.

136-153 MHz

CHANNEL	TRANSMIT	RECEIVE	CHANNEL GUARD ENC	CHANNEL GUARD DEC	CCT
1A	136.125	136.075	71.9	71.9	---
2A	140.200	140.175	023	023	---
3A	148.500	148.475	---	---	30 SEC
4A	152.925	152.950	71.9	---	---
5A	136.025	136.050	---	---	---
6A	138.925	138.950	---	---	---
7A	139.025	139.050	---	---	---
8A	141.925	141.950	---	---	---
9A	142.025	142.050	---	---	---
10A	146.925	146.950	---	---	---
11A	147.025	147.050	---	---	---
12A	152.925	152.950	---	---	---

150-174 MHz

CHANNEL	TRANSMIT	RECEIVE	CHANNEL GUARD ENC	CHANNEL GUARD DEC	CCT
1A	150.020	150.040	71.9	71.9	---
2A	156.075	156.025	023	023	---
3A	162.125	162.175	---	---	30 SEC
4A	173.850	173.950	71.9	---	---
5A	150.040	150.075	---	---	---
6A	154.940	154.975	---	---	---
7A	155.025	155.050	---	---	---
8A	158.940	158.975	---	---	---
9A	159.025	159.050	---	---	---
10A	165.940	165.975	---	---	---
11A	166.025	166.050	---	---	---
12A	173.940	173.975	---	---	---

TABLE 1 - PROGRAM TEST FREQUENCIES

TRANSMITTER ALIGNMENT

TRANSMITTER 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 25°C (77°F).

The oscillator frequency should be set at 25°C ambient temperature. In the range of 15°C to 40°C, if the frequency deviates more than ±1 PPM, it may be reset to ±1 PPM, respectively.

Adjust L352 to set the transmit frequency while monitoring RF output jack J2 through a 30 dB decoupler.

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST controls are adjusted to the proper setting before shipment and normally do not required readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause overmodulation are clipped by the modulation limiter. The limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing over-modulation while preserving intelligibility.

TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. Deviation Monitor
3. An output meter or a VTVM
4. GE Test Set Model 4EX3A11 with Test Set Adapter Cable 19C850590G1

PROCEDURE

SYNTHESIZER TRANSMIT DEVIATION

The transmit deviation has been properly set by the factory and should require no readjustment. Deviation is set at the high end of each split and will drop slightly across the band. (Refer to the Maintenance Manual LBI31367 and the sections from "Frequency Segment Control" to the "Frequency Synthesizer" section for more information.) Should alignment be necessary, program a PROM to the highest frequency of the split (153 MHz for G2 board or 174 MHz for G1 board) or use the recommended Test PROM given earlier in the Test Procedure.

1. *Select the highest frequency transmit channel* for the split, (174 MHz for G1, 153 MHz for G2). Disable Channel Guard, if present.
2. Preset R366 fully counterclockwise and R22 on Channel Guard board (if present) to the center of its range.
3. Apply a 1 kHz tone at 1.0 VRMS to mic input jack J603-17. Connect deviation monitor to RF output jack J2 through a 30 dB decoupler. Set VCO DEVIATION ADJUST R323 for rated deviation (±3.75 kHz with Tone or Digital Channel Guard or ±4.5 kHz without Channel Guard).
4. Apply a 400 Hz tone through a 100 uF capacitor to J603-15. Set output level to obtain a deviation of ±2.0 kHz. Note and maintain this voltage level while switching the generator frequency to 10 Hz. Adjust Audio MOD ADJ UST Control R366 starting from the fully clockwise position for ±2.0 kHz deviation. Remove modulation.
5. Tone or Digital Channel Guard

   Select a channel with Channel Guard and set R22 on the Channel Guard board to ±0.65 kHz.

AUDIO CHECKS

TEST EQUIPMENT REQUIRED

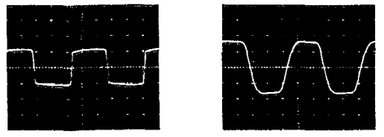
- Audio Oscillator
- AC Voltmeter
- Oscilloscope
- Deviation Monitor

AUDIO AC VOLTAGES

1. Connect audio oscillator output across J603-10 (MIC HI) and J603-16 (MIC LO).

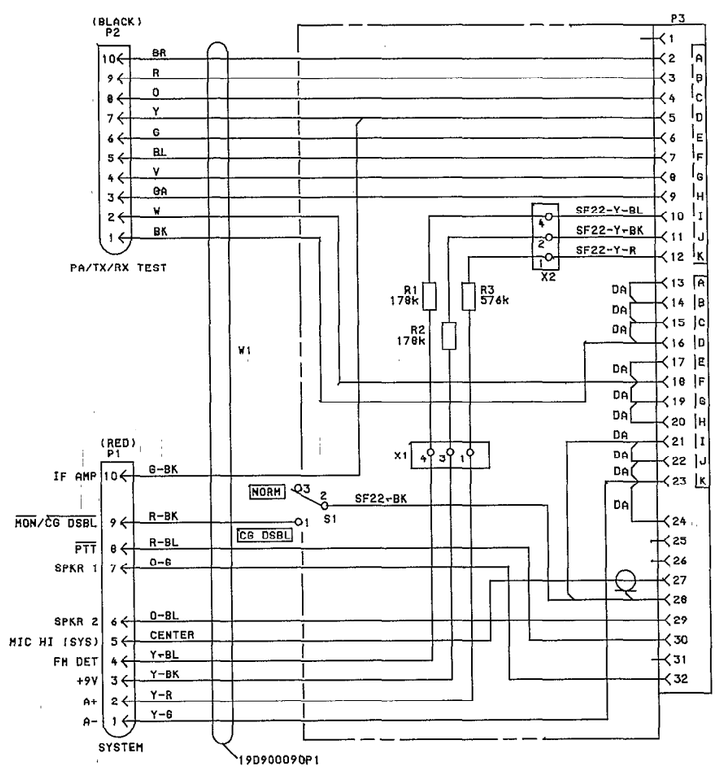
		U301-7	C301-1
SCOPE SETTING	HORIZONTAL	200 U SEC/DIV	200 U SEC/DIV
	VERTICAL	2 VOLTS/DIV	2 VOLTS/DIV

SET AUDIO OSCILLATOR AT 1000 Hz WITH OUTPUT OF 1.0 VRMS. MODULATION ADJUSTED FOR 4.5 kHz DEVIATION. NOTE: AN RMS OR PEAK READING VOLTMETER WILL READ 1/2 TO 1/3 OF PEAK-TO-PEAK READINGS.



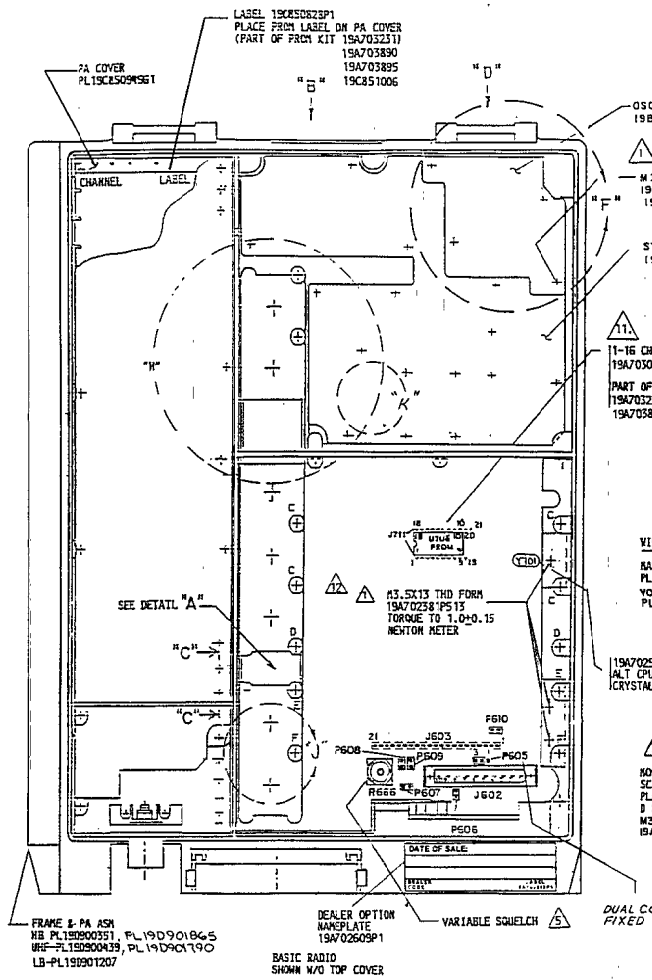
AUDIO SENSITIVITY

1. Connect audio oscillator output across J603-10 (MIC HI) and J603-16 (MIC LO). Adjust output for 1000 Hz at 1.0 VRMS.
2. Reduce generator output until deviation falls to 3.0 kHz for radios without



ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER k OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER µ,n OR p.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR µ.

(19C850593, Rev. 4)



NOTES:

1. PART OF HARDWARE KIT PL19A702024.
2. TORQUE M3.5 SCREWS TO 1.75 ± 0.15 NEWTON METER.
3. FOR VARIABLE SQUELCH, REMOVE POT R666 AND MOVE P605 TO J605-2 & 3.
4. PART OF UHF PRE-AMPL 19C850692.
5. P607 THRU P609 PLUGS ON SYSTEM BD. SHALL BE REMOVED WHERE "X" IS SHOWN BELOW.

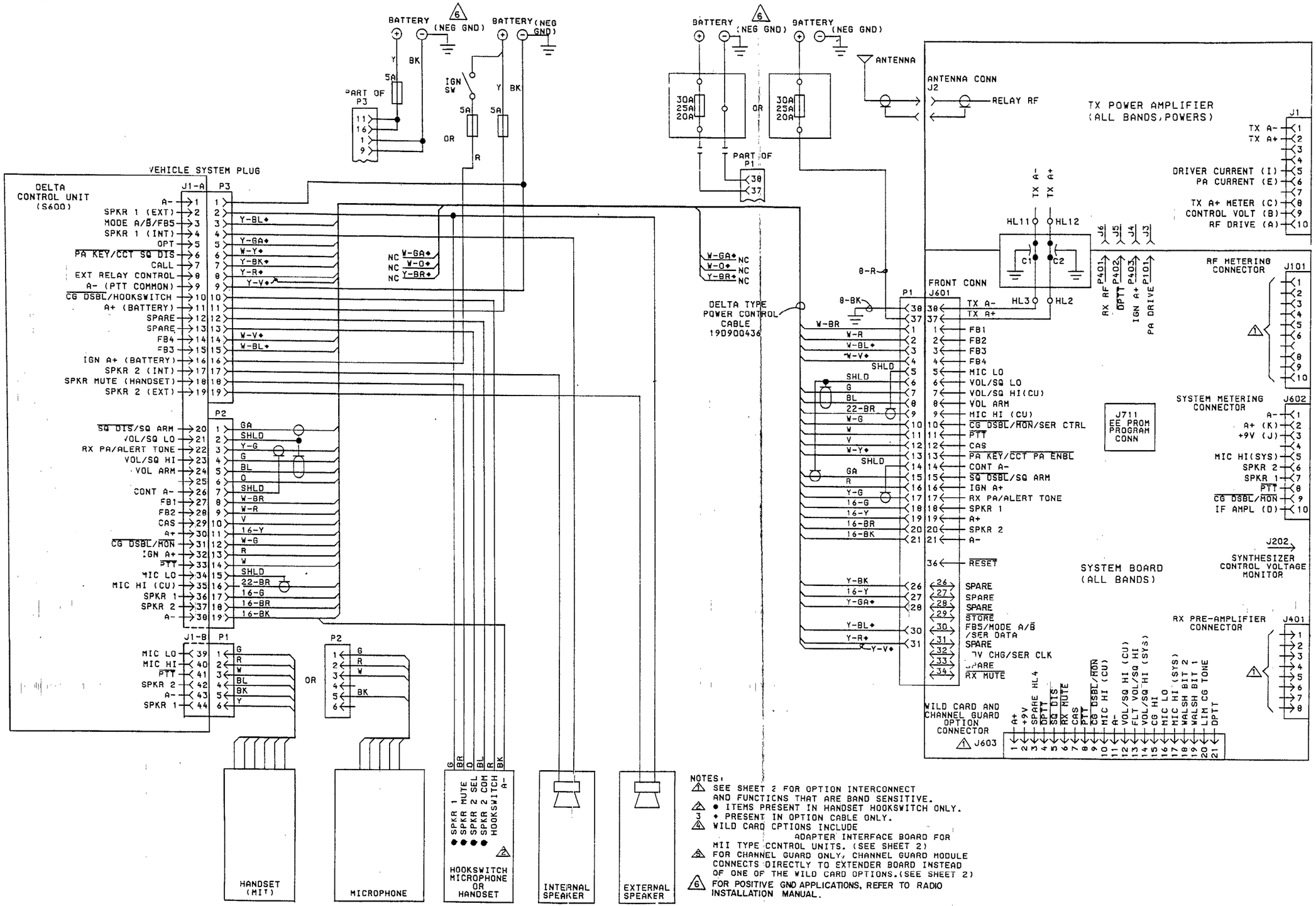
PART NO.	DESCRIPTION	P607	P608	P609
23	CHANNEL GUARD		X	

6. WHEN USING THE MASTR II INTERFACE BD. REMOVE P608 ON THE SYSTEM BD. THE MASTR II INTERFACE BOARD IS ASSEMBLED WITH ALL JUMPERS PRESENT. "X" INDICATES THAT THE JUMPER OR PART IS REMOVED. P3 IS LOCATED ON THE CHANNEL GUARD BOARD. P609 IS LOCATED ON THE SYSTEM BD.

PART NO.	APPLICATION	W1	W2	W3	W4	W5	W6	P3	P605
26	STANDARD (NO OPTION PRESENT)		X	X		X			
27	DELTA CG			X		X			X
28	MASTR II CG ENCODER		X			X			
29	DELTA CG DECODER MASTR II CG ENCODER	X				X		X	X
30	VOICE OVER-RITE	X	X	X	X				X

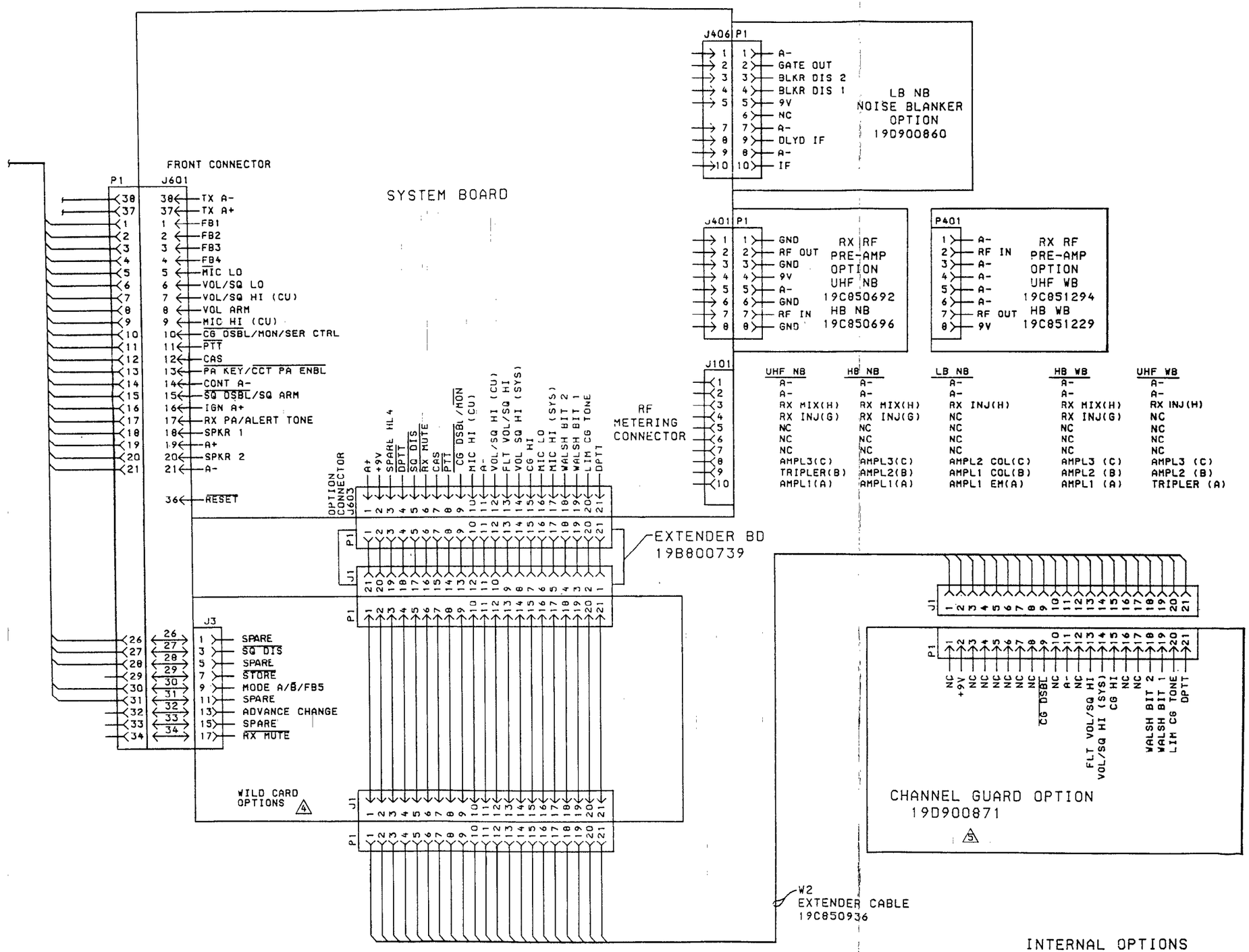
7. ADD P610 WHEN PUBLIC ADDRESS OR DTMF ENC OPTIONS ARE PRESENT IN CONTROL UNIT OR WITH S950 CONTROL UNIT. P610 IS PART OF HARDWARE KIT PL19A702024.
8. THE FOLLOWING ARE ELECTROSTATIC SENSITIVE DEVICES REQUIRING SPECIAL CARE PER 19A701294: U706 (1-16 CHANNEL PROM) AND U1 (17-32 CHANNEL PROM).
9. REMOVE 5PPM CRYSTAL Y351 REMOVE R352, R353, R355, PLUG-IN RESISTOR NETWORK AND CRYSTAL SUPPLIED IN KIT 19C851230.
10. FOR APPLICATIONS THAT REQUIRE VOL/SQ HI GAIN REMOVE W7 ON M11 INTERFACE BOARD.
11. FOR APPLICATIONS OF DUAL CONTROL WITH FIXED SQUELCH (NOT P7 VARIABLE SQUELCH) REMOVE P605.

MECHANICAL LAYOUT DIAGRAM



NOTES:
1. SEE SHEET 2 FOR OPTION INTERCONNECT AND FUNCTIONS THAT ARE BAND SENSITIVE.
2. ● ITEMS PRESENT IN HANDSET HOOKSWITCH ONLY.
3. ♦ PRESENT IN OPTION CABLE ONLY.
4. WILD CARD OPTIONS INCLUDE ADAPTER INTERFACE BOARD FOR MII TYPE CONTROL UNITS. (SEE SHEET 2)
5. FOR CHANNEL GUARD ONLY, CHANNEL GUARD MODULE CONNECTS DIRECTLY TO EXTENDER BOARD INSTEAD OF ONE OF THE WILD CARD OPTIONS.(SEE SHEET 2)
6. FOR POSITIVE GND APPLICATIONS, REFER TO RADIO INSTALLATION MANUAL.

RADIO INTERCONNECTION DIAGRAM



INTERNAL OPTIONS

OPTION INTERCONNECTION DIAGRAM