ERICSSON

LBI-31540A
(REPLACES LBI-31417)

MAINTENANCE MANUAL

403-470 MHz DELTA-SX TWO WAY FM RADIO SERVICE SECTION

TABLE OF CONTENTS

DESCRIPTION

The service section of this manual contains the diagnostic routines, and other maintenance information to service this radio. The service section includes:

- System interconnections.
- Mechanical layout.
- Disassembly procedures.
- Replacement of IC's chip capacitors and resistors.
- Alignment procedures for the transmitter and receiver.
- Troubleshooting flow charts and waveforms.

INITIAL ADJUSTMENT

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

TRANSMITTER ADJUSTMENT

The adjustment for the transmitter includes measuring the forward and reflected power and adjusting the antenna length for optimum ratio, then setting the transmitter to rated power output. Next, measure the frequency and modulation and record these measurements for future reference. For the complete transmitter adjustment, refer to the Alignment Procedure (see Table of Contents).

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.

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. Be sure that all screws are properly torqued.	X	
ANTENNA - The antenna, antenna base and all contacts should be kept clean and free from dirt or corrosion. If the antennas 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 retaining screws at (A) (Figure 1) securing the circuit board to the main frame.
  3. Remove two retaining screws (B) securing systems connector J601 to front casting.
  4. Unsolder the two feed through capacitor terminals (E) at holes H13 and H14 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 regultors U701 and U702 to the side of chassis.
  6. To remove the front end shield, remove the 20 retaining screws securing the shield to the back plate and remove.

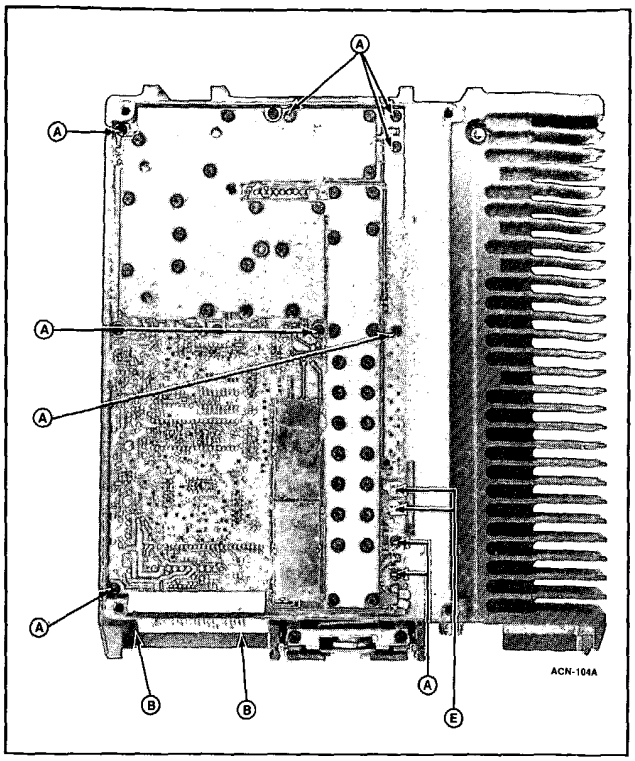

Figure 1 - Disassembly - Bottom View

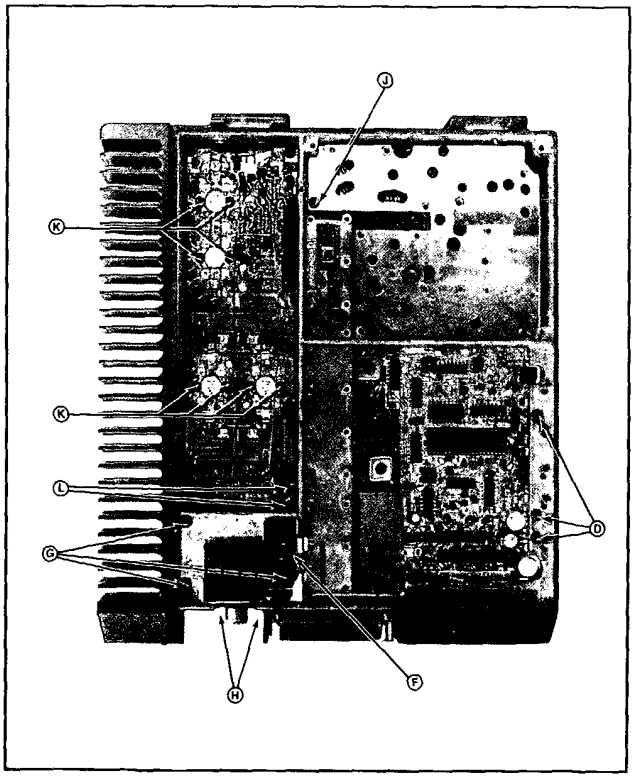

Figure 2 - Disassembly - Top View

NOTE

When replacing front end shield tighten all retaining screws to 1.75 Newton Meters (15.5 inch pounds).

7. To remove the synthesizer shield, remove the retaining screws securing the shield to the backplate.

- To replace TRS board:

1. Perform above procedures in reverse order.

- To remove the PA board:

1. Remove the eight retaining screws (F) from around the edge of the PA board.
2. Remove the three retaining screws (G) securing the PA filter cover to the main frame.
3. Remove the two retaining screws (H) securing the antenna connector to the main frame.
4. Loosen the retaining screw (J) securing the pass transistor to the side of the PA chassis compartment.
5. Remove the retaining screws (K) securing the PA transistors to the main frame.
6. Turn the radio over and remove the nut nd washer from the stud of PA transistor Q1.
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 realign 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 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 with a vacuum desoldering 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 capacitors 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. Grip the component with tweezers or needle nose pliers.
2. Alternately heat each end of the chip in rapid succession until solder flows, and then remove and discard the chip.
3. Remove excess solder with a vacuum solder extractor.
4. 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 using Diagnostics routines and servicing techniques unique to this radio. Typical voltage readings are provided on the Schematic Diagram for reference when troubleshooting.

SERVICE TIPS

When servicing the transmit/receiver/synthesizer board it may be helpful to remove and relocate the Channel Guard board.

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. Again, the Channel Guard may be reconnected using the 19C850936G1 cable.

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 AND ALIGNMENT

The following procedure describes how to change the frequencies in the radio EEPROM (S) for new user frequencies. No alignment is required after changing frequencies unless new frequencies fall outside the factory sweep tune range as shown in the chart below.

PROGRAMMING

The DELTA-SX UHF 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 PC.

When programming the radio, consideration must be given to the individual band split for the T/R/S board. See the Programming tips on the following page and the individual band splits listed below.

Band Splits

T/R/S BOARD (NEG. GRD ONLY)	T/R/S BOARD (FLOATING GRD)	BAND SPLIT	FACTORY SWEEP TUNE RANGE
19D901670G1	19D901323G1	440-470 MHz 25 kHz Ch. Spac.	450-470 MHz
19D901670G2	19D901323G2	440-470 MHz 12.5 kHz Ch. Spac.	450-470 MHz
19D901670G3	19D901323G3	403-440 MHz kHz Ch. Spac.	403-423 MHz
19D901670G4	19D901323G4	403-440 MHz 12.5 kHz Ch. Spac.	403-423 MHz
19D901670G5		440-470 MHz 25 kHz Ch. Spac.	440-460 MHz
19D901670G6		403-440 MHz 25 kHz Ch. Spac.	420-440 MHz
19D901670G7		403-440 MHz 25 kHz Ch. Spac.	410-430 MHz

Programming Tips

When using the TQ-2310 suitcase programmer or a Personal Computer for programming, Jumper 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 reprogrammed with new user frequencies, no alignment is required unless new frequencies fall outside the factory sweep tune range per chart above. The receiver and exciter are sweep tuned at the factory to cover the sweep tune range above, and the TX and RX VCO's are set to cover the entire band split. If alignment is required, use the following procedure:

Under Synthesizer and Transmitter Alignment Procedure

1. Check 9 volt regulator.
2. No alignment required for TX and RX VCO.
3. Tune the exciter.
4. Adjust transmitter power amplifier.
5. Set the reference oscillator frequency (one setting for both TX and RX).

Under Receiver Frequency Segment Alignment Procedure

1. Adjust IF and 2nd oscillator.
2. Adjust FM Detector/Audio.
3. Adjust injection chain.
4. Adjust front end.

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Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

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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.

SYMPTOM	PROCEDURE	ANALYSIS
Little or No RF Output	Key transmitter and check J1-10 (Pos A) for +0.5 V (exciter input).	Refer to Schematic Diagram and verify voltage readings.
	Unkey transmitter and check Q104-C for +9.0 Vdc.	Verify +9.0 Volt supply. Check R124 and L112.
	Check DC voltages on Q101-Q104.	If voltages are incorrect, check L102-L104, L107 and L112. Also check all resistors for each stage. Check R108, R113, R119, R123, R124 and R128. Check Q101-Q104. Replace components if defective.
	Key transmitter and monitor voltage at J101-9 (AMPL 3 Volt). Voltage should increase.	If voltage does not increase check Q101, Q102 and associated components.
	Monitor J101-8 (AMPL 3 Voltage) key transmitter. Voltage should increase.	If voltage does not increase, check Q104 and associated components. Check D102 and associated metering circuitry. Finally, check both helical filters.
	Disconnect P101 from PA and measure RF input power from exciter. Should be 0.5 Watt or more.	If exciter output is low, check Q104 and associated circuitry. Also check 2nd helical filter including L109 and L110. Retune exciter if needed.
		If output power is correct be sure P101 is soldered securely and that it mates properly with the contact on the power amplifier.

PA QUICK CHECKS

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

POWER AMPL METERING J1 PA JACK READINGS								METER READINGS	PROBABLE CAUSE
					100W	75W	40W		
RANGE POSITION	TEST POS.	METERING POINT	FUNCTION MEASURED	METER SCALE	TYPICAL READING	TYPICAL READING	TYPICAL READING	HIGH	LOW
TEST 1	A	J1-10	RF DRIVE	0-1V	0.5V	0.5V	0.5V		LOW EXCITER OUTPUT. REALIGN OR REPAIR EXCITER.
TEST 1	B	J1-9	CONTROL VOLTAGE	0-15V	4V	7.5V	4.5V	LOW EXCITER OUTPUT	HIGH EXCITER OUTPUT
TEST 1	C	J1-8	TX A+	0-15V	12.5V	12.5V	12.5V		EXCESSIVE VOLTAGE DROP IN POWER CABLE.
TEST 1	E *	J1-6	PA CURRENT	0-30A	15A	11A	NS	RF OUTPUT EXCESSIVELY HIGH. BE SURE ANTENNA IS PROPERLY MATCHED TO 50 ohms.	RF OUTPUT LOW.
TEST 1	F *	J1-5	DRIVER CURRENT	0-15A	5A	4A	8A	100 WATT PA CHECK A105 AND A106. BE SURE ANTENNA IS PROPERLY MATCHED TO 50 ohms. 40 WATT PA RF OUTPUT POWER IS EXCESSIVE. BE SURE ANTENNA IS PROPERLY MATCHED TO 50 ohms.	100 WATT PA A105 AND A106 HAVE EXCESSIVE GAIN. RF OUTPUT SET TOO LOW. 40 WATT PA LOW RF OUTPUT.

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

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 ±0.05 Vdc	R703	9 Volt Regulator
J202	3.0-8.0 Vdc	C220	VCO Control Voltage (See Synth Align)
TP701	Less than 1.0	L209	Frequency Lock Detector
J353	0.3 VPP		Reference Osc. Output (high impedance)

RADIO CONNECTOR IDENTIFICATION	
Front Connector	J601
Systems Metering	J602
Option Connector	J603
PROM Program Plug	J711
RF Metering	J101
RX In.	P401
RX Inj.	P450
Exciter Input	P102
Exciter Out.	P101, P103

RECEIVER READINGS SYSTEM JACK, J602			
TEST POS	FUNCTION	SCALE	TYPICAL READING
D	IF AMP	1V	0.75
H	RX INJ	1V	0.55

ORM CHECKS

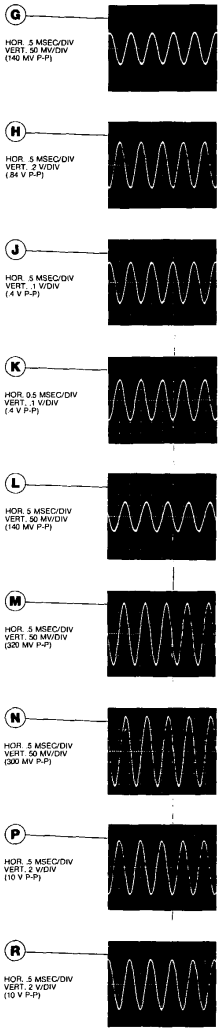
UDIO CIRCUIT

MINARY STEPS

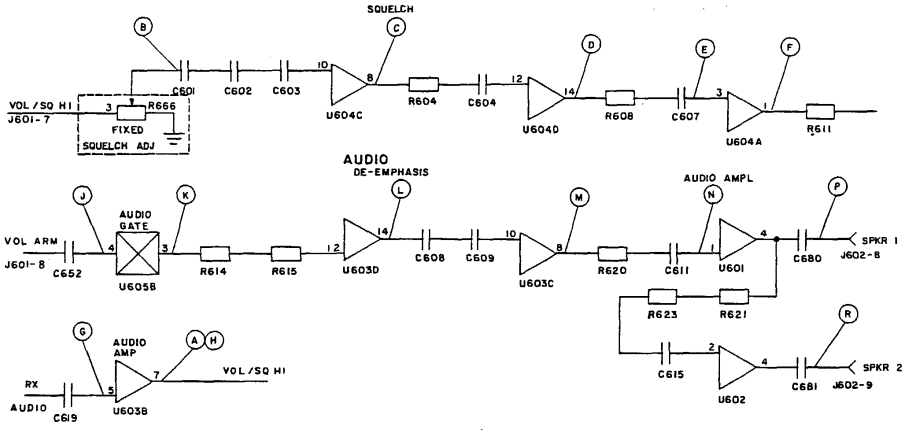
ply 1000 uV on frequency signal with 1000 Hz
odulation and 3 kHz deviation to antenna jack J2.

tput set to 12 Watts (6.93 VRMS) into 4-ohm load.

e 1 megohm probe.



AUDIO AND SQUELCH WAVEFORMS



LEAD IDENTIFICATION
FOR ALL TRANSISTORS
NOT OTHERWISE IDENTIFIED

TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR
FOR LEAD IDENTIFICATION.

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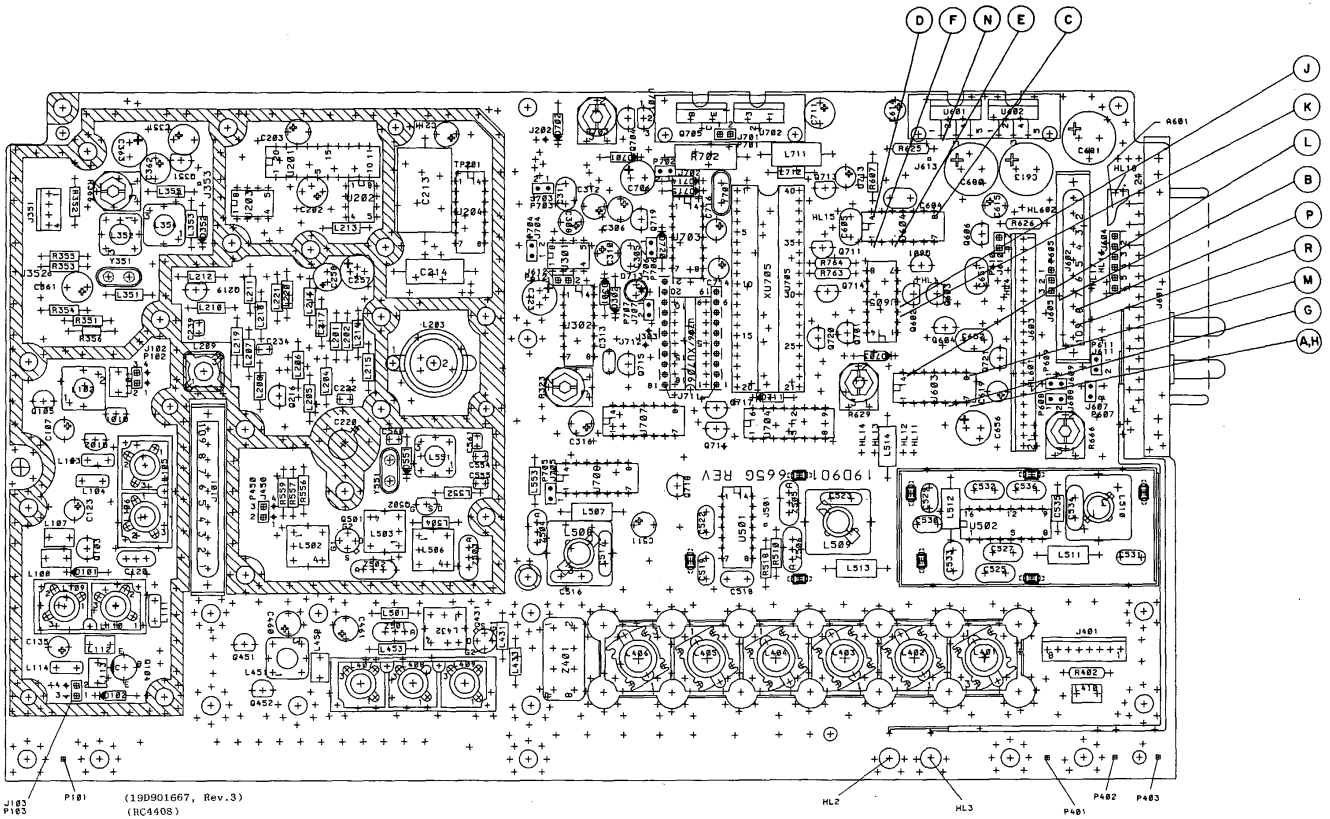


RECEIVER AUDIO AND SQUELCH WAVEFORM CHECKS

SQUELCH CIRCUIT TEST WITH kHz SIGNAL

PRELIMINARY STEPS

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

A

B

C

HOR. 1 MSEC/DIV
VERT .2 V/DIV
(.36 V P-P)

D

HOR. 50 uSEC/DIV
VERT .2 V/DIV
(1.2 V P-P)
BASE LINE = 0 VDC

E

F

SQUELCH CIRCUIT CHECKS WITH NOISE

PRELIMINARY STEPS

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

A

HOR. 5 MSEC/DIV
VERT. 1 V/DIV
(=4 V P-P)

B

HOR. 5 MSEC/DIV
VERT. 1 V/DIV
(=2 V P-P)

C

HOR. 5 MSEC/DIV
VERT. .5 V/DIV
(=1.5 V P-P)

D

HOR. 5 MSEC/DIV
VERT. 1 V/DIV
(=4 V P-P)
BASE LINE = 0 VDC

E

HOR. 5 MSEC/DIV
VERT .2 V/DIV
(.6 VDC)
BASE LINE = 0 VDC

F

HOR. 5 MSEC/DIV
VERT .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 (6.93 VRMS) into 4-ohm load.
3. Use 1 megohm probe.

G

HOR. 5 MSEC/DIV
VERT. 50 MV/DIV
(140 MV P-P)

H

HOR. 5 MSEC/DIV
VERT. .2 V/DIV
(.84 V P-P)

J

HOR. 5 MSEC/DIV
VERT. .1 V/DIV
(.4 V P-P)

K

HOR 0.5 MSEC/DIV
VERT. .1 V/DIV
(.4 V P-P)

L

HOR. 5 MSEC/DIV
VERT. 50 MV/DIV
(140 MV P-P)

M

HOR. 5 MSEC/DIV
VERT. 50 MV/DIV
(329 MV P-P)

N

HOR. 5 MSEC/DIV
VERT. 50 MV/DIV
(300 MV P-P)

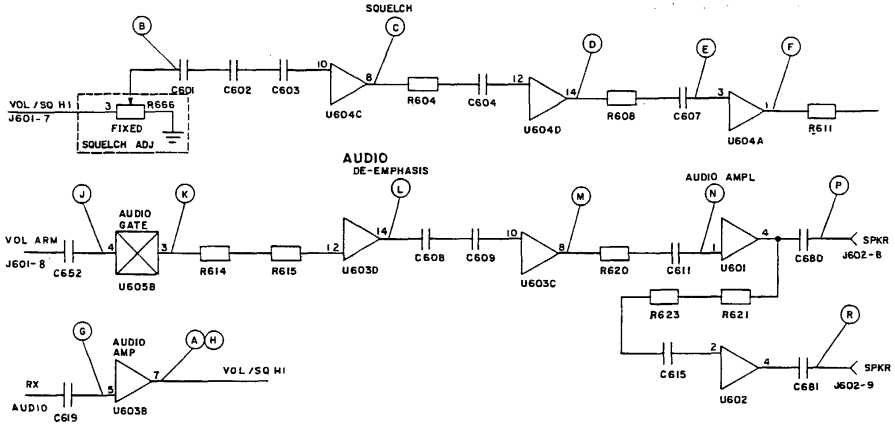
P

HOR. 5 MSEC/DIV
VERT. 2 V/DIV
(10 V P-P)

R

HOR. 5 MSEC/DIV
VERT .2 V/DIV
(10 V P-P)

AUDIO AND SQUELCH WAVEFORMS



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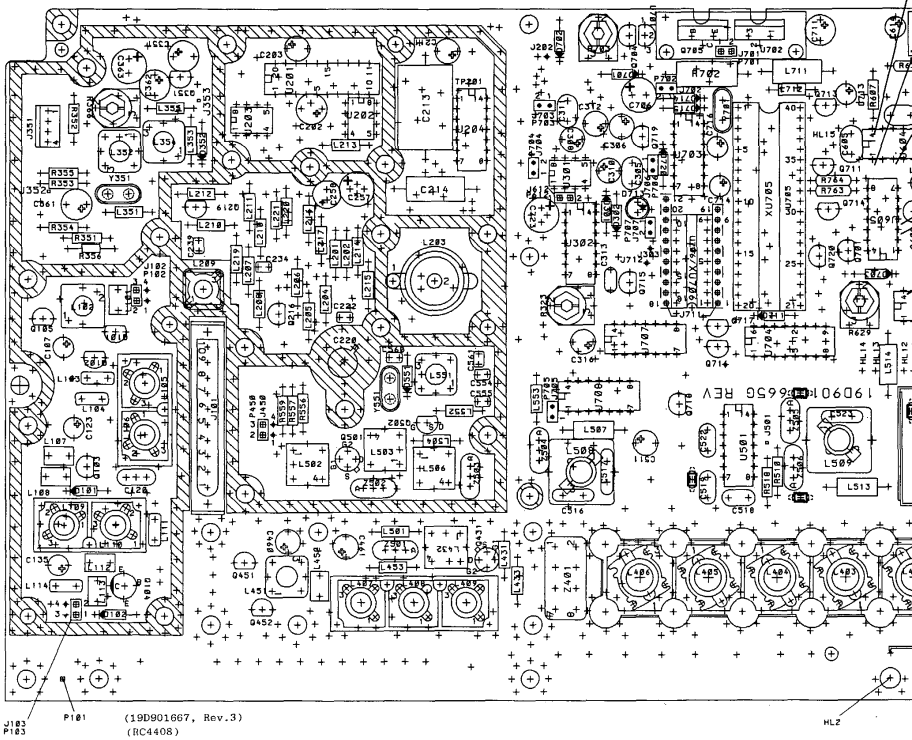


TEST PROCEDURES

These Test Procedures are deisgned 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 to the proper operating frequency.

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 of (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 automotive storage battery.

TEST PROGRAMMING

In DELTA-SX radios, in which the EEPROM is not custom programmed, the EEPROM is programmed with the personality similar to the ones shown in Table 1 below.

CHANNEL	FREQUENCY SPLIT				CHANNEL GUARD ENCODE/DECODE		CCT
	403-470 MHz		440-470 MHz		403-470 MHz	440-470 MHz	
	TX	RX	TX	RX			
1A	403.025	403.075	440.025	440.075	71.9	71.9	---
2A	413.025	413.075	450.025	450.075	023	023	---
3A	422.950	422.975	459.950	459.975	---	---	30 SEC.
4A	420.025	420.075	460.025	460.075	71.9	---	---
5A	430.025	430.075	469.950	469.975	023	71.9	---
6A	439.950	439.975	440.025	440.075	---	---	---
7A	403.025	403.075	445.950	445.975	---	---	---
8A	407.925	407.950	446.025	446.050	---	---	---
9A	408.025	408.050	451.950	451.975	---	---	---
10A	416.925	416.950	452.025	452.050	---	---	---
11A	417.025	417.050	459.950	459.975	---	---	---
12A	425.925	425.950	460.025	460.050	---	---	---
13A	426.025	426.050	469.950	469.975	---	---	---
14A	439.950	439.975					

Table 1 - Program Test Frequencies

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.

NOTE

Refer to Figures 4 and 5 Frequency Correction Factor.

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

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST controls are adjusted to the proper setting before shipment and normally do not require 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 overmodulation 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 Test Cable 19C850590G1

PROCEDURE

SYNTHESIZER TRANSMIT DEVIATION

NOTE

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 LBI-31418 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 (470 MHz for 440 to 470 MHz split, 440 MHz for 403 to 440 MHz split) or use the recommended test PROM given earlier in the Test Procedures.

1. Select the highest possible frequency. Disable the Channel Guard if present.
2. Preset R366 (Audio Mod Adjust) fully counter clockwise 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 a deviation of ± 4.5 kHz (± 2.5 kHz in radios with 12.5 kHz frequency spacing) for units without Channel Guard. For radios equipped with Channel Guard set deviation to ± 3.75 kHz (± 1.90 kHz for radios with 12.5 kHz frequency spacing).
4. Apply a 400 Hz tone through a 100 μF capacitor to J603-15. Set output level to obtain a deviation of ± 2.0 kHz. Note and maintain this voltage level while switching the output frequency to 10 Hz. Adjust Audio Mod Adjust Control R366 starting from the fully clockwise position for ± 2.0 kHz deviation (± 1.0 kHz for 12.5 kHz frequency spacing). Remove modulation.
5. Select a channel with Channel guard nearest the center frequency and adjust R22 on the Channel Guard option board to ± 0.65 kHz (tone or digital Channel Guard) and ± 0.30 kHz in radios with 12.5 kHz spacing.

TRANSMITTER QUICK CHECKS

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

EXCITER

RANGE POSITION	RF METERING J101 EXCITER READINGS					PROBABLE CAUSE METER READINGS	
	TEST POS.	METERING JACK J101	FUNCTION	METER SCALE	TYPICAL READING	HIGH	LOW
TEST 1	A	J101-10	TRIPLER	0-1	-0.65V	Q101 SHORTED R107, R110 OPEN	Q101 OPEN; R110, R109, OPEN; L102 OPEN; OSCILLATOR/ BUFFER DEFECTIVE
TEST 1	B	J101-9	AMPL 2	0-1	0.45V	Q102 DEFECTIVE R112 OPEN	Q102 SHORTED; R113 OPEN; L105, L103, AND ASSOCIATED CIRCUITS, DEFECTIVE OR IMPROPERLY TUNED.
TEST 1	C	J101-8	AMPL 3 EXCITER OUT	0-1	0.8V	HELICAL COIL L109 SHORTED OR C10 MISTUNED	Q103 OR Q104 DEFECTIVE. CHECK RESISTORS, CAPACITORS AROUND Q103 AND Q104. HELICAL COILS L109, L110 MIS-TUNED OR DEFECTIVE. D101 AND ASSOCIATED METERING CIRCUITS DEFECTIVE.

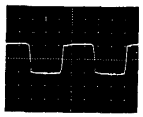
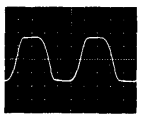
AUDIO CHECK

TEST EQUIPMENT REQUIRED

- Audio Oscillator
- Oscilloscope
- AC Voltmeter
- 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 μ SEC/DIV	200 μ SEC/DIV
	VERTICAL	2 VOLTS/DIV	2 VOLTS/DIV
SET AUDIO OSCILLLATOR 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 Channel Guard or to 2.25 kHz for radios with Channel Guard. Voltage should be less than 120 millivolts.

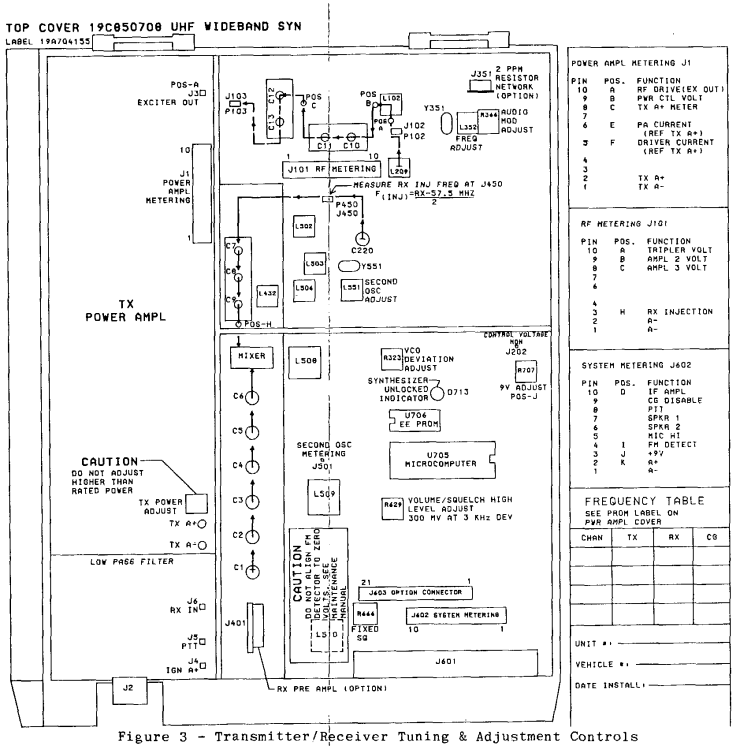
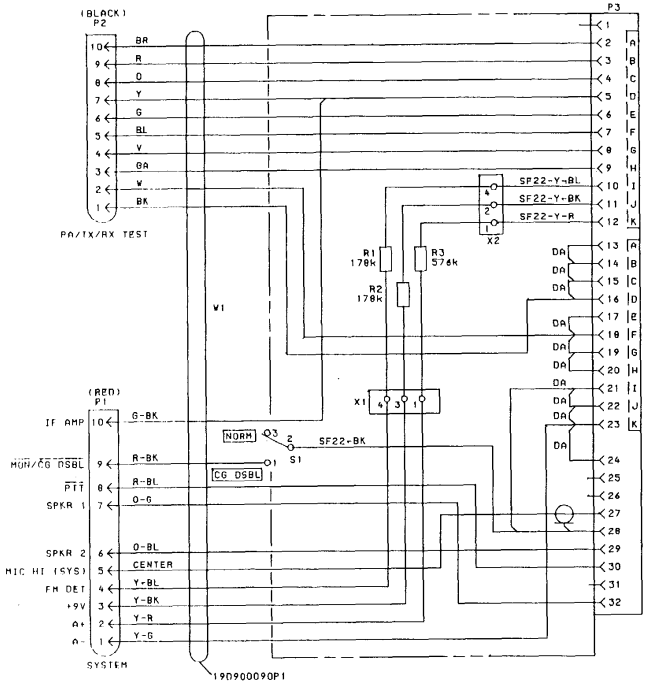


Figure 3 - Transmitter/Receiver Tuning & Adjustment Controls

Figure 3 - Transmitter/Receiver Tuning & Adjustment Controls



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)

SYNTHESIZER AND TRANSMITTER ALIGNMENT

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-31539 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		TUNING CONTROL	METER READING	PROCEDURE
	GE TEST SET	MULTIMETER (- TO A-)			
1.		LED D713	L209	LIGHT OUT	Install a test EEPROM programmed as follows: RADIO FREQ SPLIT — TEST FREQ TX & RX 440-470 MHz — 470.0 MHz 403-440 MHz — 440.0 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	7.5 Vdc	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 J450. TX injection +5 to +15 dBm RX injection +5 to +15 dBm

EXCITER/TRANSMITTER POWER AMPLIFIER

NOTE

Preset cores per below only when performing a complete transmitter alignment.

Preset the core of L352 and L354 to top of coil form and then turn clockwise two full turns.

Set the cores of L105, L106, L109 and L110 flush with the top of the casting then preset as follows, according to the frequency split.

403-423 MHz, 440-460 MHz: Turn 1 1/2 turns clockwise.

420-440 MHz, 450-470 MHz: Turn 1 turn clockwise.

410-430 MHz: Turn 1 1/4 turns clockwise.

STEP	METERING POSITION		TUNING CONTROL	METER READING	PROCEDURE
	GE TEST SET	MULTIMETER (- TO A-)			
					NOTE The exciter can be isolated from the rest of the radio for tuning 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 at 1/3 carrier frequency signal to J102-2, 1.
5.					Install a test EEPROM programmed for the low center, and high end of the allowable bandwidth not to exceed 20 MHz. Select center frequency.
6.	A	J101-10	L102	(Negative)	Tune for maximum meter reading. NOTE: This will be a negative reading.
7.	B	J101-9	C8		Tune for peak meter reading.
8.	B	J101-9	C9		Tune for peak meter reading.
9.	B	J101-9	C10		Tune for a dip in the meter reading.
10.	C	J101-8	C11	500 mw	Tune for maximum power indicated on wattmeter. Wattmeter should indicate 500 milliwatts.
11.	C	J101-8	C9		Select lowest frequency channel. Tune for maximum power indicated on wattmeter. If power does not exceed 450 milliwatts proceed to Step 12, otherwise, proceed to Step 13.
12.	C	J101-8	C11	450 mw+	Tune C11 until output power is slightly more than 450 milliwatts.
13.	C	J101-8	C8		Select the highest frequency channel. If output is less than 450 milliwatts tune C8 for maximum power indicated on wattmeter. If output power does not exceed 450 milliwatts, proceed to Step 14, otherwise, proceed to Step 15.
14.	C	J101-8	C10		Tune C10 until output power is slightly above 450 milliwatts.
15.					Check output power on low, center and high end operating channels. It should be greater than 450 milliwatts.
16.	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 lockwise). 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.
17.				Rated Output Power	On the center frequency channel, set power to rated.

* Fo is the transmit output frequency at the antenna. The injection frequency is Fo/3 at J102.

REFERENCE OSCILLATOR FREQUENCY

STEP	METERING POSITION		TUNING CONTROL	METER READING	PROCEDURE
	GE TEST SET	MULTIMETER (- TO A-)			
18.		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 freq. ± 225 Hz for a 5 PPM radio (standard) or ± 90 Hz for a 2 PPM radio (optional). Note: The receiver injection frequency will automatically be correct.

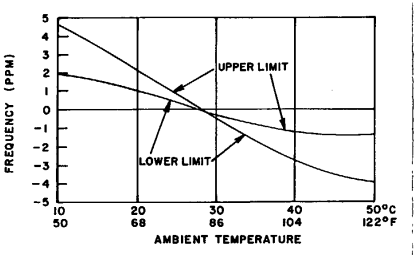


FIGURE 4 CORRECTION FACTOR IN FREQ. SETTING FOR 5 PPM OSCILLATOR

Figure 4 - Correction Factor In Freq. Setting For 5 PPM Oscillator

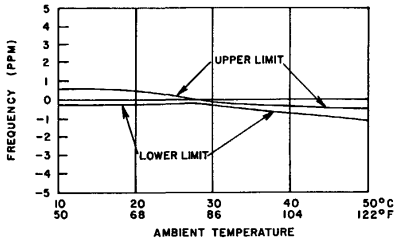


FIGURE 5 CORRECTION FACTOR IN FREQ. SETTING FOR 2 PPM OSCILLATOR

RC 4498

Figure 5 - Correction Factor In Freq. Setting For 2 PPM Oscillator

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.

An Alternate IF Alignment Procedure is included for troubleshooting purposes only.

There are no adjustments to set the receive frequency, you need only set the transmit frequency.

Should it become necessary to realign a working receiver to a different 20 MHz segment of the frequency band, refer to the Receiver Frequency Segment Realignment procedure and realign the front end. Complete the alignment procedure only if necessary.

ALTERNATE IF ALIGNMENT (For Troubleshooting Only)

TEST EQUIPMENT REQUIRED

1. Oscilloscope
2. RF Signal Generator (403-470 MHz)

PROCEDURE

1. Verify that the synthesizer and 2nd oscillator frequency are correct. See Transmitter Frequency Adjustment and 2nd Oscillator/FM Detector/Audio. 2nd IF = 10.7 MHz.
2. Attach an oscilloscope probe to IF AMP.MTR. (J602-10).
3. Using an HP8640B signal generator, set to an on-channel frequency, feed a 20 Hz modulating frequency with ± 12 kHz of deviation (± 6 kHz for 12.5 kHz channel spacing) into the radio at antenna jack J2. (See Figure 6).
4. Connect a coaxial cable between the AM output of the HP8640B and the external 10 trigger input signal on the scope. Use NORMAL triggering.
5. DC couple the scope probe and adjust the controls for 0.1V per div. (vertical) and 2 msec per div. (horizontal).
6. 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 μV). 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: L432, L502, L503, L506, L508 and L509 should be tuned to peak the IF passband, no ripple should be present in the passband.

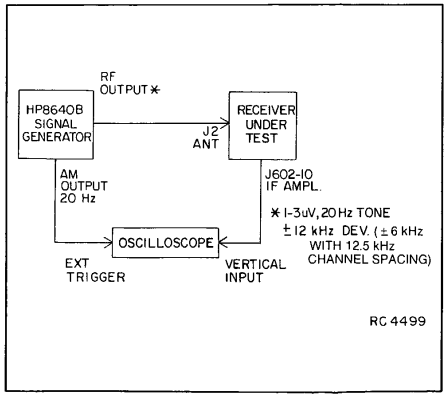


Figure 6 - Test Set-up, Audio Output Measurement

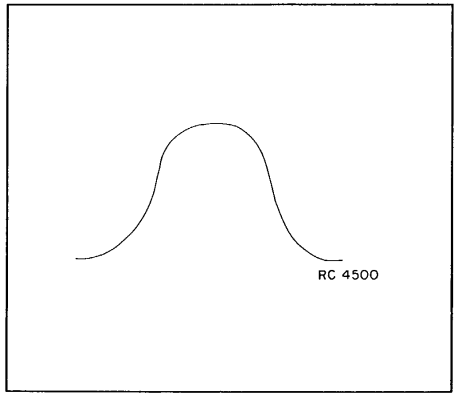


Figure 7 - Idealized IF Waveform

RECEIVER FREQUENCY SEGMENT REALIGNMENT PROCEDURE

TEST EQUIPMENT REQUIRED

1. GE Test Set 4EX3A11, 4EX8K12, or 20,000 ohms-per-volt milliameter.

NOTE

Some performance degradation may occur if the receiver is aligned manually rather than sweep aligned.

2. AC Voltmeter.
3. RF Signal Generator (403-470 MHz).
4. Frequency Counter (403-470 MHz).
5. 4-ohm 15 Watt resistor.
6. Audio Isolation Transformer (1:1) 19A116736P1 or equivalent.

PRELIMINARY ADJUSTMENTS/REQUIREMENTS

1. Program the RF frequency PROM with the two band end frequencies and the center frequency. For example: if the 20 MHz segment 412-432 MHz is used program the three PROM test frequencies for 412 MHz, 422 MHz and 432 MHz.
2. Set up test equipment as shown in Figure 8.
3. Set RF Generator to center channel frequency ± 100 Hz. Set modulation to 1 kHz and deviation to ± 3 kHz (± 1.5 kHz in radios using 12.5 kHz channel spacing). Reduce signal level to approximately 75% of saturated level shown on Test Set.

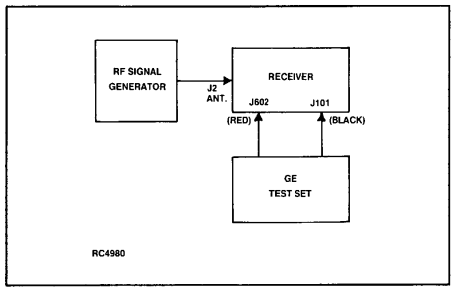


Figure 8 - Receiver Alignment Test Set Up

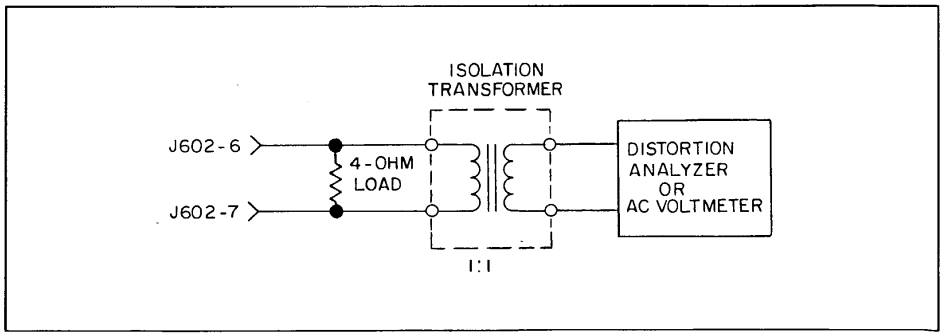


Figure 9 - Audio Isolation Transformer

RECEIVER FREQUENCY SEGMENT REALIGNMENT PROCEDURE

STEP	METERING POSITION: GE TEST SET	METERING POSITION: MULTIMETER	TUNING CONTROL	METER READING	PROCEDURE
IF ALIGNMENT & 2ND OSCILLATOR FREQUENCY					
1.	D	J602-10	L432, L502 L503, L551, L506, L508, & L509	Peak	Sequentially peak L432, L502, L503, L551, L506, L508 and L509.
2.			J501		Monitor J501 with an AC coupled frequency counter. Remove modulation from signal generator. Tune L551 for 10.7 MHz ± 50 Hz. Increase level of signal generator is necessary. (13.2 MHz reference oscillator must already have properly adjusted). **NOTE** Do Not readjust L551 once it has been set.
3.	D	J602-10	L509, L508 L506, L503 L502 & L432	Peak	Set signal generator for ± 1 kHz modulation and sequentially peak L509, L508, L506, L503, L502 and L432 in order.
FM DETECTOR/AUDIO					
4.	-	J602-6, 7	R629	0.35-0.5 VRMS	**NOTE** The audio output is a balanced bridge circuit and required all test equipment connected across the speaker leads to be both AC and DC isolated from ground. Refer to Figure 9 and connect audio isolation transformer to J602-6 and J602-7. Set R629 fully clockwise. Monitor the speaker outputs (J602-6, 7) with an AC voltmeter. Meter reading should be 0.35-0.5 VRMS.
5.	-	J602-6, 7	L510	Peak	Peak quadrature coil L510.
6.		J603-14	R629	300m VRMS	Adj. R629m audio preamplifier level, for a nominal 300 ± 10m VRMS.
FIXED SQUELCH ADJUSTMENT (OPTIONAL)					
7.				R666	Set R666, fixed squelch control, fully clockwise.
8.			R666		**NOTE** Adjust input level of RF Signal Generator to produce a SINAD sensitivity reading of 9 dB. 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).
9.	H	J601-3	C8	< 0.1 VDC	Verify that center channel test frequency is selected. Set Test Set to 1 volt scale. Detune C8 by turning it clockwise into the casting until the voltage is less than 0.1 Vdc.
10.	H	J601-3	C7, C9, C8	Peak	Peak C7 and C9, then peak C8.
11.			C8	Balance	Select the two band edge frequencies and note the voltage readings on the Test Set. Adjust C8 to produce a voltage between the two values noted.
12.			C8	Balance	Alternately select the band edge frequencies and tune C8 until both voltages are equal.

RECEIVER FREQUENCY SEGMENT REALIGNMENT PROCEDURE (Continued)

STEP	METERING POSITION: GE TEST SET	METERING POSITION: MULTIMETER	TUNING CONTROL	METER READING	PROCEDURE
FRONT END ALIGNMENT					
13.	D	J602-10	C1-C6		**NOTE** Adjust the output level of the signal generator to produce 0.6 VDC (below saturation level). Peak C1 through C6.
14.	D	J602-10	C2		Tune C2 clockwise until the core is flush with the casting.
15.				C1	Peak PeakC1.
16.				C3, C2	Dip Detune C3 and peak C2.
17.				C4, C3	Detune C4 and peak C3.
18.				C5, C4	Detune C5 and peak C4.
19.				C6, C5	Detune C6 and peak C5.
20.				C6	Peak C6.

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. (± 1.5 kHz deviation for units with 12.5 kHz channel spacing.)

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 9).

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 J2. (1.5 kHz deviation for units with 12.5 kHz channel spacing.)

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 on 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 μV. Switch the RANGE control from SET LEVEL to the distortion range. Readjust the signal generator and 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.

STEP 3 MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

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.

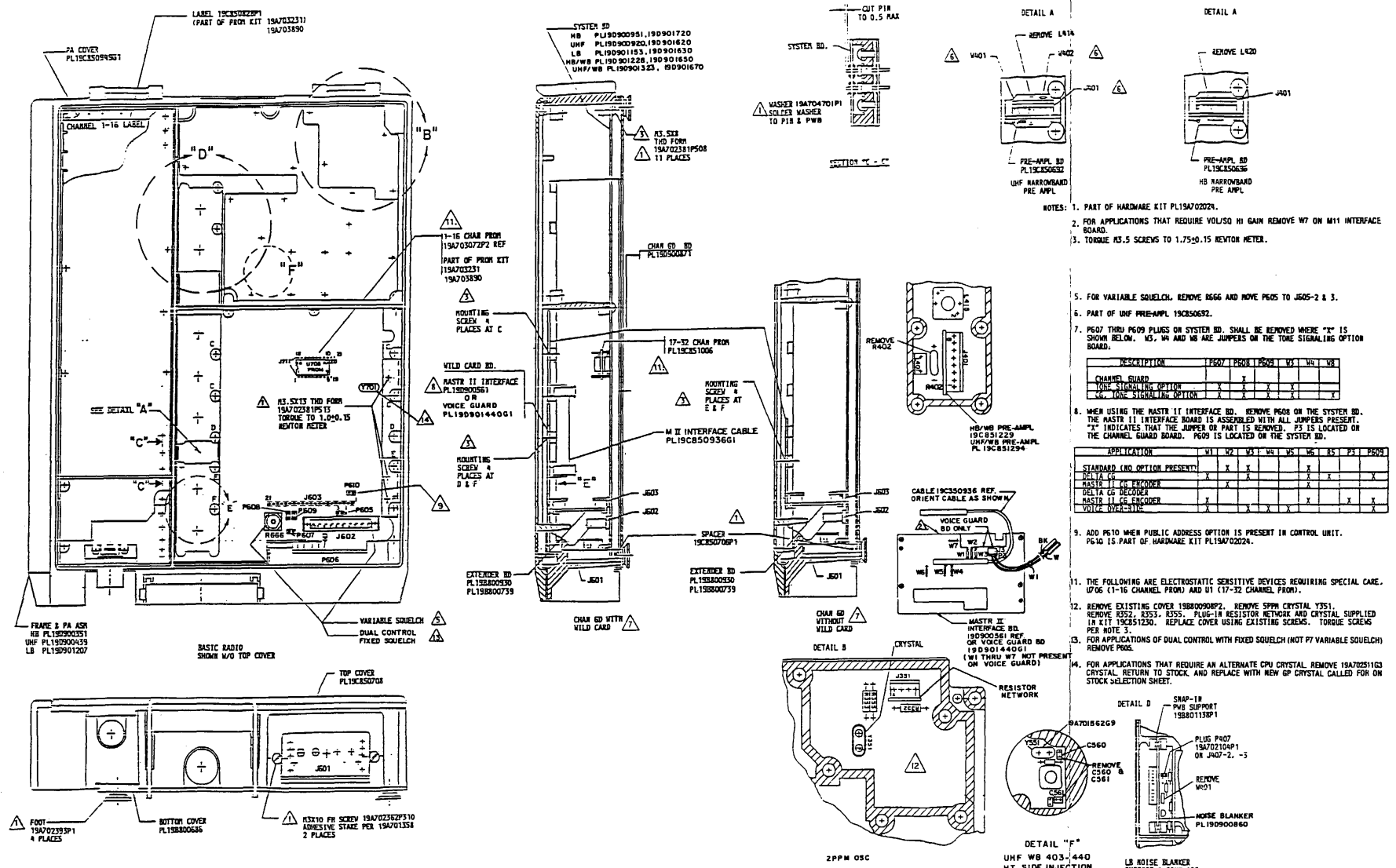
C. Set the Range control on the Distortion Analyzer in the SET LEVEL position (1000 Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

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. (± 3.5 kHz for 12.5 kHz channel spacing units.)

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.



NOTES:

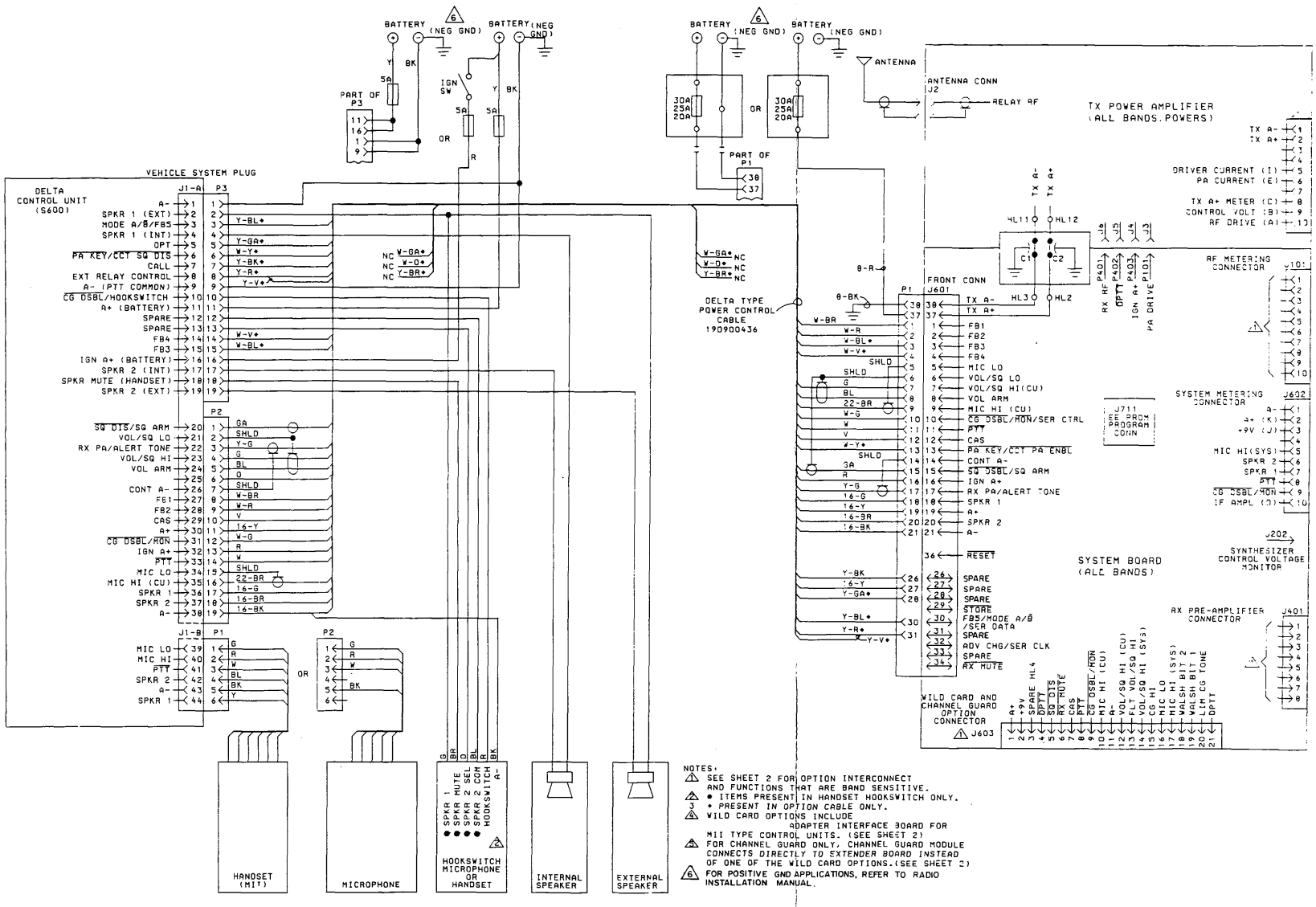
1. PART OF HARDWARE KIT PL19A702024.
2. FOR APPLICATIONS THAT REQUIRE VOL/SQ HI GAIN REMOVE W7 ON M11 INTERFACE BOARD.
3. TORQUE M3.5 SCREWS TO 1.75±0.15 NEWTON METER.
5. FOR VARIABLE SQUELCH, REMOVE R666 AND MOVE P605 TO J605-2 & 3.
6. PART OF UNF PRE-AMPL 19C850692.
7. P607 THRU P609 PLUGS ON SYSTEM BD. SHALL BE REMOVED WHERE "X" IS SHOWN BELOW. W3, W4 AND W8 ARE JUMPERS ON THE TONE SIGNALING OPTION BOARD.

DESCRIPTION	P607	P608	P609	W3	W4	W8
CHANNEL GUARD		X				
TONE SIGNALING OPTION	X	X	X	X		
CG, TONE SIGNALING OPTION	X	X	X	X		X

8. 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.

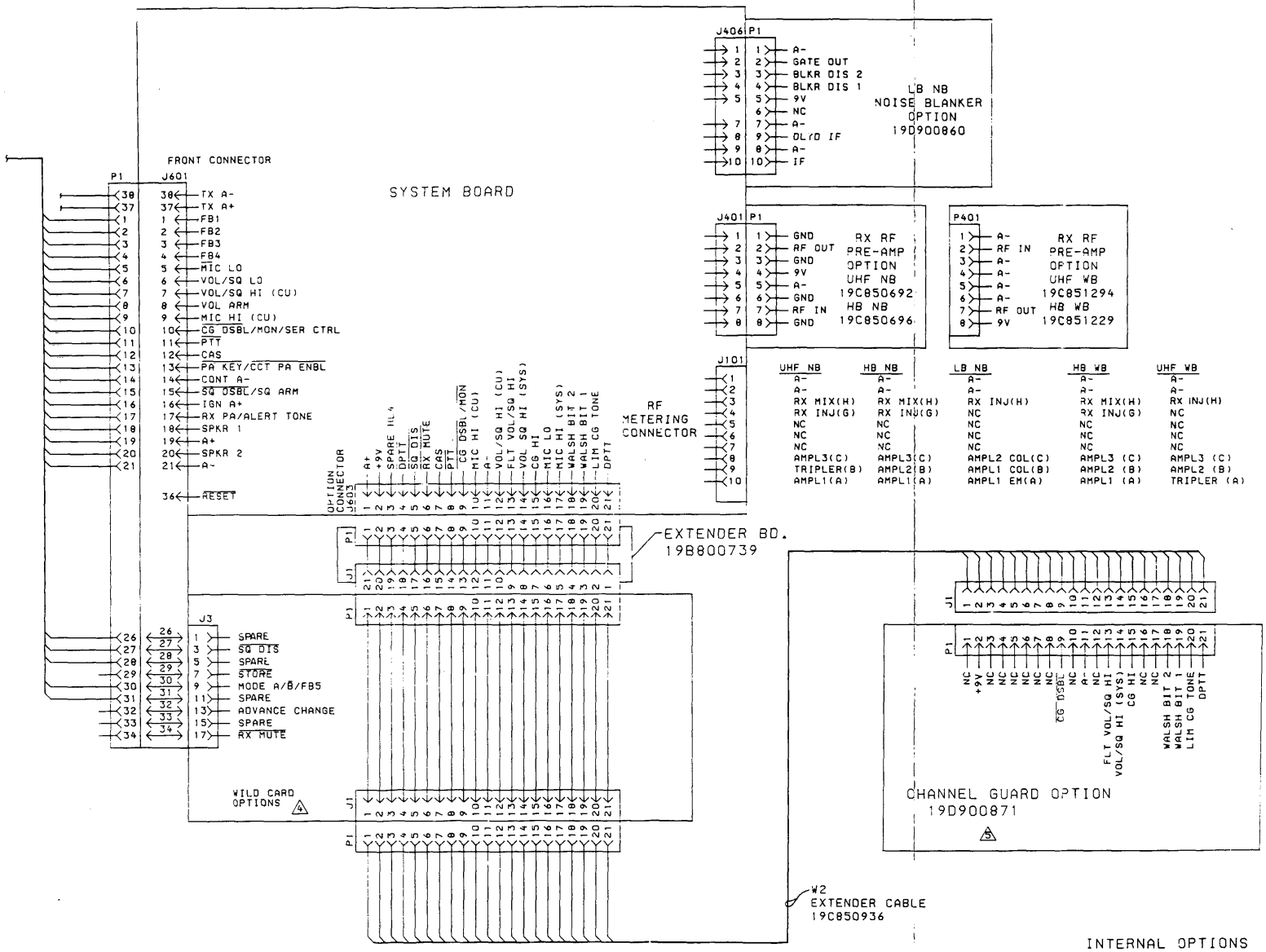
APPLICATION	W1	W2	W3	W4	W5	W6	R5	P3	P609
STANDARD (NO OPTION PRESENT)		X	X			X			
DELTA CG	X		X			X	X		X
MASTR II CG ENCODER		X				X			
DELTA CG DECODER	X					X			
MASTR II CG ENCODER	X					X		X	X
VOICE OVER-RIDE	X		X	X	X				X

9. ADD P610 WHEN PUBLIC ADDRESS OPTION IS PRESENT IN CONTROL UNIT. P610 IS PART OF HARDWARE KIT PL19A702024.
11. THE FOLLOWING ARE ELECTROSTATIC SENSITIVE DEVICES REQUIRING SPECIAL CARE. U706 (1-16 CHANNEL PROM) AND U1 (17-32 CHANNEL PROM).
12. REMOVE EXISTING COVER 19B800908P2. REMOVE SPRM CRYSTAL Y351. REMOVE R352, R353, R355. PLUG-IN RESISTOR NETWORK AND CRYSTAL SUPPLIED IN KIT 19C851230. REPLACE COVER USING EXISTING SCREWS. TORQUE SCREWS PER NOTE 3.
13. FOR APPLICATIONS OF DUAL CONTROL WITH FIXED SQUELCH (NOT P7 VARIABLE SQUELCH) REMOVE P605.
14. FOR APPLICATIONS THAT REQUIRE AN ALTERNATE CPU CRYSTAL REMOVE 19A702511G3 CRYSTAL. RETURN TO STOCK, AND REPLACE WITH NEW GP CRYSTAL CALLED FOR ON STOCK SELECTION SHEET.



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

(19D900980, Sh. 1, Rev. 4)



(19D900980, Sh. 2, Rev. 3)