SERVICE SECTION

450-470 MHz PHOENIX-S TWO-WAY RADIO (NARROWBAND)

TABLE OF CONTENTS

DESCRIPTION

The Service Section contains disassembly procedures, procedures for replacing PA transistors, Integrated Circuits (IC's) and chip components and related drawings. Also included are alignment procedures and option modifications 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 electronics technician who holds an appropriate FCC license (where required).

TRANSMITTER ADJUSTMENT

The transmitter is factory preset and requires no adjustment. However, the antenna length should be adjusted for optimum VSWR. Next, measure the frequency and modulation and enter these measurements on the FCC required station records. For the complete tranmitter adjustment, refer to the Alignment Procedure (See Table of Contents).

RECEIVER ADJUSTMENT

No initial adjustments to the receiver are required.

CHANNEL GUARD DISABLE/CODE POLARITY REVERSAL

All radios are equipped with Channel Guard. In applications where Channel

Guard is not desired, disable the Channel Guard circuit by connecting a jumper from J910-8 to J910-9.

Where Digital Channel Guard is used and polarity reversal is required, make modifications as directed by Installation Diagram on Schematic Diagram.

RE-INSTALLATION

If the mobile combination is ever moved to a different vehicle, always check the battery polarity of the new system.

OPTION MODIFICATIONS

Modifications to the synthesizer/ interconnect board are required to maintain compatability with tone, public address, and other options. These modification involve the addition or deletion DA jumpers. Refer to the Installation and Schematic Diagrams for modification data, especially if the option is installed in the field.

MAINTENANCE

PREVENTIVE MAINTENANCE

To insure 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.	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, as required by FCC. 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 service the transmitter/ receiver (Tx-Rx) board, loosen the two screws securing the bottom cover at the rear of the radio. Then slide the cover out from under the edge of the front control panel and lift off.
- To service the synthesizer/ interconnect board, loosen the two screws securing the top cover at the rear of the radio and slide the cover out from the edge of the front control panel and lift off.
- To remove the Tx-Rx board:
  1. Remove the top and bottom covers.
  2. Remove the four screws securing the front panel to the "H" frame and remove the front panel, after removing the two screws securing the display board.
  3. Remove the eight screws securing the RF shield. See Figure 1.
  4. Remove the antenna connector by removing two retaining screws and unsoldering the center connector.
  5. Remove the two screws securing PA transistor Q203.
  6. Turn the radio over and remove the hex nut and washer from the stud of driver transistor Q202. (Note the location of the copper spacer when replacing the hardware.)
  7. Remove the 9 screws securing the Tx-Rx board and carefully lift up the board off of the interconnections pins. (Note the location of the copper spacer under Q202 when replacing the hardware.
- To remove the synthesizer/ interconnect board:
  1. Remove the top cover.
  2. Remove the four screws in the front cover and remove cover, after removing the two screws securing the diaplay board (See Figure 2).
  3. Remove the 16 screws securing the board and carefully lift the board up to disconnect the interconnection pins.

DRIVER AND 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, exercise caution since the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

To replace PA RF transistors Q202 and Q203:

1. Remove the transistor mounting hardware for Q202, turn the radio over and remove the hex nut and washer from the stud.
2. 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.
3. Lift out the transistor, and remove the 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.
4. 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 (see Figure 3 for transistor lead identification).
5. Apply a coat of silicon grease between the mounting surface of Q202 or Q203, being careful not to lose the spacer washer on Q202. Place the transistor in the mounting hole. Align the leads as shown on the Outline Diagram. Then hold the body of the transistor and replace the transistor mounting hardware, using a moderate torque of 0.5 Newton meters (N•m) .61 or 4.5 inch pounds for M2.5 screw size and 1.0 N•m (9 inch pounds) for the hex screw post. A torque wrench must be used for this adjustment since transistor damage can result if too little or too much torque is used.

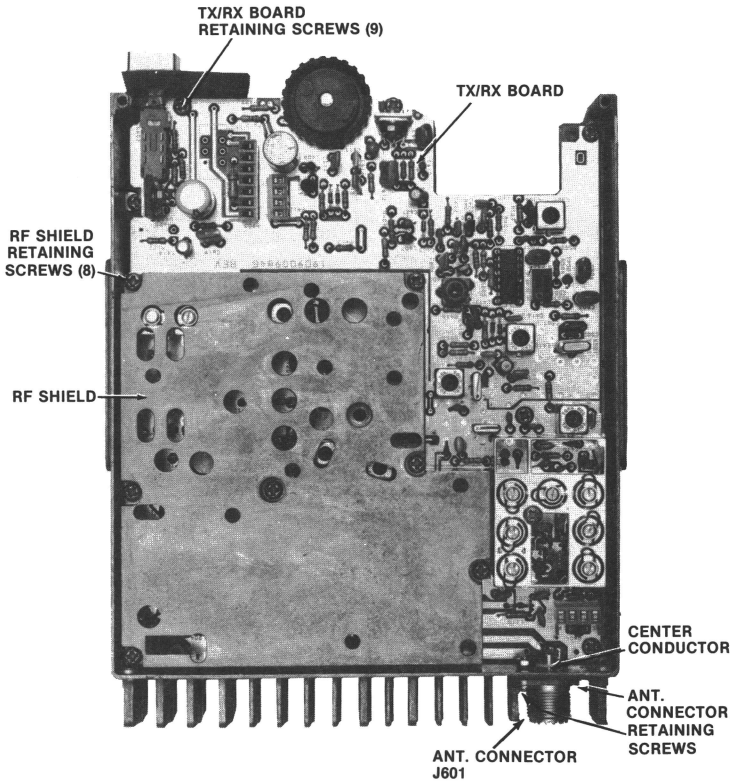


FIGURE 1 - TRANSMIT/RECEIVE BOARD REMOVAL

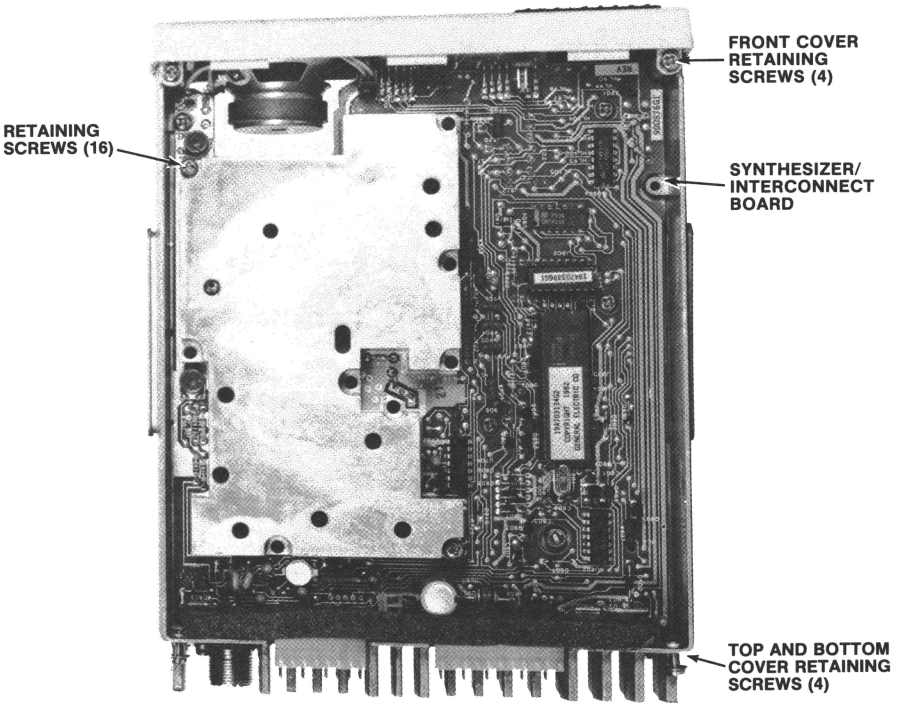


FIGURE 2 - SYNTHESIZER/INTERCONNECT BOARD REMOVAL

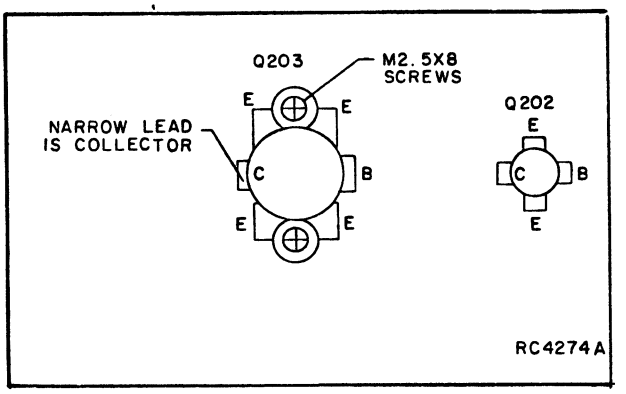


Figure 3 - Q202 and Q203 Lead Identification

6. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hold 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.

CAUTION

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

REPLACING CHIP COMPONENTS

Replacement of chip capacitors should always be done with a temperature-controlled soldering iron, using a controlled temperature of 536°F (280°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 or Solder-wick®.
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 simulataneously 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.

REMOVING IC'S

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

TEST AND TROUBLESHOOTING PROCEDURES

Maintenance of radio is facilitated by use of the Troubleshooting Charts and servicing techniques unique to this radio. The Troubleshooting Chart is designed to lead you rapidly to the defective component or circuit. Typical voltage readings are provided on the Schematic Diagram for your reference when troubleshooting.

Troubleshooting charts are provided for most major problems that might arise in the Transmitter/Receiver section of the radio. A microcomputer diagnostics section is provided for troubleshooting the microcomputer circuits.

SERVICE HINT

Since the radio will be inoperative with a defective microcomputer, it may be wise to run through the diagnostics as a first step when troubleshooting the radio.

SERVICING TECHNIQUES

The high density plug-in design of the modular radio lends itself well to rapid isolation of malfunctions in the voltage and signal paths. A majority of the signals and voltages pass through the connectors on the synthesizer/ interconnect board.

To isolate a signal or voltage path to determine loading effects, locate short circuits, etc. carefully insert an insulator (plastic wand, toothpick) between the appropriate pins of the related Molex connector to create an open circuit. Signals paths that may be isolated include: Volume SQ HI, filtered volume squelch HI, PTT, Rx MUTE, and SPKR HI.

Test Points

Test points for the receiver section are available for alignment purposes and to monitor the 1st receiver injection at TP401 and the 2nd IF at TP501.

Seven test points are provided at critical circuit locations to monitor operation.

They are as follows:

TRANSMITTER	RECEIVER
TP101 (Synthesizer/Interconnect VCO Range	
TP101 TRIPLER (Q102 Tx/Rx Bd.) Collector Voltage	TP351 Tripler Input - Q352
TP202 AMPL 2 (Q103, Tx/Rx Bd.) Collector Voltage	TP401 Receiver 1st oscillator injection
TP201 Pre Driver (Q201 Tx/Rx Bd.) Collector Voltage	TP501 455 kHz IF

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.

MICROCOMPUTER DIAGNOSTICS

The microcomputer contains self diagnostic programming which aids in troubleshooting. Since the radio cannot function with a defective microcomputer the self diagnostic tests include internal and input/output tests to varify the proper operation of the computer. The internal tests include a ROM test to make sure the proper program is in the chip and a RAM test to check the transfer of data to and from all memory locations. The input/output tests include a test which grounds one pin at a time on Port 1 and the data bus and a test which mirrors the inputs PTT, A/B switch, channel select switch, and Channel Guard disable onto the data bus. These tests verify operation of the ports and data bus, in addition to checking the input/output instructions of the microcomputer.

Test Equipment Required

- 13.8 VDC supply, 500 mA (unless being tested in radio)
- DC Voltmeter (Data Tech 30L on equivalent)
- Oscilloscope (Tektronix 404 or equivalent)

Test Procedure

NOTE

This procedure assumes the synthesizer/interconnect board is being tested in the radio. Alternate procedures for bench test are shown in parenthesis ( ).

1. Connect oscilloscopes to J903-7 and ground.
2. Enter the self diagnostic mode as follows:
   - Key microphone while on hook. (Ground J911-2).
   - Press channel select button (if present) or Ground J911-7 at the rear of radio.
   - Turn radio on. (Apply 13.8 VDC to J912-1).

ROM AND RAM Tests

Once power is supplied to the board the microcomputer will jump to the self diagnostic test and immediately begin execution of the ROM and RAM tests. Upon completion of the ROM and RAM test (less than a second) the display, data bus, or alert tone will indicate if the test has passed.

	D3	D2	D1	D0	DISPLAY	ALERT TONE
ROM TEST FAILED	0	0	0	0	0	NONE
ROM TEST PASSED RAM TEST FAILED	0	0	0	1	1	NONE
ROM TEST PASSED RAM TEST PASSED	0	0	1	0	2	1 kHz

If there is no display board then the alert tone will indicate if the tests have passed. If the tests have passed a 1 kHz tone will be heard on the speaker and displayed on the oscilloscope. If no alert tone is present then either the ROM or RAM test has failed. If there is no display the data bus can be used. Replace the microcomputer.

Input/Output Port Test

If the ROM and RAM tests passed release the PTT and channel select switches. (Remove ground from J911-2 and 7). The display will still indicate 2 but the alert tone should no longer be displayed on the scope or heard on the speaker.

NOTE

The next test will ground one line at a time on Port 1 and the data bus and is step through by operating the PTT switch (Grounding and ungrounding J911-2, hereafter referred to as S1).

1. Press and release the PTT switch (S1). The display will go blank and port 1 (U801-27-34) and data bus lines will all go high.
2. Repeat Step 1. The display (if present) will remain blank and P1-7 (U801-34) and D7 (U801-19) will go low. All other outputs should be high.
3. Repeat Step 1. The display (if present) will remain blank and P1-6 (U801-33) and D6 (U801-18) will go low. All other outputs should be high.
4. Repeat Step 1. The display (if present) will remain blank and P1-5 (U801-32) and D5 (U801-17) will go low. All other outputs should be high.

5. Repeat Step 1. The display (if present) will remain blank and P1-4 (U801-31) and D4 (U801-16) will go low. All other outputs should be high.

6. Repeat Step 1. The display (if present) will remain blank and P1-3 (U801-30) and D3 (U801-15) will go low. All other outputs should be high.

7. Repeat Step 1. The display (if present) will remain blank and P1-2 (U801-29) and D2 (U801-14) will go low. All other outputs should be high.

8. Repeat Step 1. The display (if present) will remain blank and P1-1 (U801-28) and D1 (U801-13) will go low. All other outputs should be high. Note that P1-1 will remain high. This is because this output switches the radio into the transmit mode when grounded. Thus this output is bypassed so that the radio will never go into the transmit mode during self test.

9. Repeat Step 1. The display (if present) will remain blank and P1-0 (U801-27) and D0 (U801-12) will go low. All other outputs should be high.

10. Repeat Step 1. The display (if present) will indicate zero and port 1 outputs (U801-27-34) will all be set high.

NOTE

At this point the program advances to mirror the outputs PTT, channel select, Channel Guard disable, Mode A/B switch onto the data bus D7, D5, D4, and D6, respectively. The lower nibble of the data bus will remain low so that the display (if present) will indicate zero.

11. Press the PTT switch (Ground J911-2) D7 (U801-19) should go low.

12. Release the PTT switch (Unground J911-2) D7 (U801-19) should go high.

13. Press Mode A/B switch (if present) (Ground U801-37). D6 (U801-18) should go low.

14. Release Mode A/B switch (if present) (Unground U801-37). D6 (U801-18) should go high.

15. Press channel select switch (Ground J911-7). D5 (U801-17) should go low.

16. Release channel select switch (Unground J911-7). D5 (U801-17) should go high.

17. Ground CG Disable J910-9. D4 (U801-16) should go low.

18. Remove ground from J910-9. D4(U801-16) should go high.

NOTE

If any of the above tests fail, the microprocessor function is not working properly. Do not replace microprocessor before checking all other possibilities. (The microprocessor is very reliable). Check associated circuitry for shorted printed wire runs and defective components.

To exit the Diagnostic routine turn the radio off and then back on.

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

GENERAL ELECTRIC* U.S.A.

TROUBLESHOOTING PROCEDURE

SYMPTOM	PROCEDURE
No 13.8 V Supply	Check power connections and continuity of supply leads. Check ON/OFF switch. Check radio for shorts. Check fuse in power line.
Low 13.8 V Supply	Check for low or uncharged battery possibly with bad cell in vehicle. Check radio for shorts or high resistance at A+ paths.
No 8.5 V Regulated Supply	Check 13.8 V supply at pin 1 of regulator U602. If 8.5 V is low, check for short on output of U602.
No Audio Output	1. Receiver may be squelched • Rotate R607 (SQ. Pot.) fully counterclockwise to unsquelch the receiver. • Measure DC voltage on pin 2 of U601 (audio amp.). If this voltage is greater than .8 volts, the audio is being squelched. Check Q603 and Rx Mute voltage at P912-4. This input voltage should be approximately 6.2 volts to unsquelch the audio. Note operation of S602 (Monitor switch) opens the input to Q603 which should always result in Q603 being biased off; thereby insuring that U601 is unsquelched. 2. No audio input to U601 • Check for audio at P902-7 (Filtered Volume/SQ. High). • Check for audio at P902-3 (VOL./SQ. Hi). If audio is present at either of these points but does not reach pin 1 of U601 (audio amp.), check for loss of signal in Channel Guard reject filter on synthesizer/interconnect board or through monitor switch (S602) and volume pot (R617). Check for open in VOL.CONT./DE-EMPHASIS CIRCUITS. Check DC voltages around U601 according to schematic.
Low Audio	Check supply voltage at pin 5 of U602. Verify correct audio levels at: P903-3 300 mV +100 -50 mV P903-7 270 mV +100 -50 mV U602 pin 1 37.5 ±10 mV at maximum volume (NOTE: 1 kHz modulation at ±3 kHz deviation) If audio levels are low, tune L501 for maximum level. If low level at pin 1 of U601, check for defective components, shorts or opens, between U601 and volume control.
Distorted Audio Output	Apply a strong RF signal with standard test modulation and measure audio distortion into an 4 ohm dummy load. Distortion should be less than 5% at 3.46 VRMS audio output. Check for 13.8 V at pin 5 of U601. Check DC voltages around U601 per schematic. Tune L501 slightly to note any improvement. Tune L410, L409 and L408 slightly and note any improvement. (It may be detuned). Check frequency of 2nd oscillator at U501-2 with high impedance counter. Should be 29.945 MHz ±200 Hz. If no improvement, check for defective filters (Z401, Z402, and Z501.

SYMPTOM	PROCEDURE
Poor or No Sensitivity	Verify that proper injection power is present and at the correct frequency, (f_o +21.4 MHz). This can be done by a high impedance probe from the junction of C406 and C407 to ground. The power seen should be approximately 10 dBm. If OK, then use a 50 ohm probe with a signal generator to inject signal into various portions of the radio to isolate the bad section. Set the generator with standard modulation to the level and frequency indicated on the large service schematic and probe those points starting with IC (U501) and moving forward to the antenna jack. In some cases parts must be adjusted for best sensitivity while probing. This is indicated on the schematic. Once the faulty stage is isolated, measure bias voltages.
No or Low Injection Power	Monitor the L.O. input with a high impedance probe at J351, synthesizer input. This level should be approximately +10 dBm at the injection frequency. Check the bias levels on Q301 with a DC volt meter.
Frequency Won't Adjust Properly	Check reference oscillator frequency at U101-2 and set to 13.2 MHz. Check VCO control line voltage at TP101 for 6.5 volts using a high impedance probe. Select the highest frequency in the radio and tone L104 for 6.5 volts.
No Transmit 8.5 V	Check the switching transistor Q604.
Radio Won't go into Transmit Mode	Check Q604. If OK, check pin 4 P901. There should be no voltage between pin 4 and ground when PTT is depressed.
Low or No Transmit Power	Check the voltage at TP101. When PTT is depressed, the DC voltage should decrease by about 1 volt. If not, then check J151. Make sure the feed thru pin from Interconnect board is making good contact with J151. If everything is OK, then check voltage at TP102. When keyed this voltage should be approximately 6.5 volts. If not refer to the Transmitter Alignment Procedure and tune L102, L105 and L106.
Oscillator Frequency Will Not Adjust Properly	Check circuitry associated with reference osillator Q101. Verify part values and check crystal Y101 and L101. Oscillator frequency should adjust to 13.2 MHz.
No Transmitter Deviation	Check audio processor U301 and its associated circuitry. If OK, check Q301 and audio levels at output of pots R320 and R316. If OK, check C122 and C101.

LBI31212

SYMPTOM	PROCEDURE
No or Incorrect Detector Output	Check audio level at P903-3, Vol/Sq Hi. Should be 300 mV (+100, -50 mV) under standard test conditions. Tune L501 and note improvement, if any. Check for shorts or opens around L501 circuitry. Check DC bias levels around U501 and Q601 under high RF input level (1 mV or more) per schematic. Check limiter output at pin 7 of U501 with scope; should be square wave at 455 kHz at .4 V P-P.
No 2nd Oscillator Activity	Substitute a known good crystal for Y501. Check voltages on U501 pins 1 and 2.
Radio Permanently Squelched	1. Squelch Circuit Apply an on channel RF signal of 1 mV with standard modulation. Measure the AC audio level at VOL/SQ HI (P903-3). The level should be 300 mV rms (+100, -50 mV). If this level is not met, follow the detector troubleshooting procedure. If the audio level is correct, measure the DC level at $\overline{\text{CAS}}$ (P912-4). The reading should be 0 V. Remove the RF signal from the receiver input and the reading should change to 7.5 VDC. If both measurements are correct, the squelch circuit is working and the audio switch circuit should be checked next. If not, measure the bias voltages on U501 pin 10-14. With no RF input signal, the voltage on pin 12 of U501 should vary as R607 is varied (see schematic). If not, check the noise detector diode D601 and its associated circuitry (C606, C607, C621, R608 and R609) and the noise filter circuitry (R604-R606 and C603-C605). Otherwise, U501 is probably defective and should be replaced. 2. Audio Switch Circuit Apply an on channel RF signal of 1 mV and standard modulation. Depress MONITOR switch (S602) momentarily. If audio is heard from the speaker, the audio switch and audio amplifier are working and the problem is on the systems interconnect board. (Check the operation of the Channel Guard, audio gate, and microprocessor sections on the systems interconnect board.) If audio is not heard from the speaker, measure the voltages on Q603 and on pins 2 and 4 of U501. Remove the RF signal from the receiver input and measure these voltages for the squelched condition (see schematic). If the voltages are correct, follow the procedure for "No Audio Output".
Radio Won't Squelch	1. Squelch Circuit Without a signal applied to the receiver input, ground $\overline{\text{RX MUTE}}$ (P903-4). If the receiver does not squelch, follow the audio switch circuit troubleshooting procedure. If the receiver does squelch, remove the ground from $\overline{\text{RX MUTE}}$ and turn R607 (SQUELCH ADJ) maximum clockwise. If the receiver now squelches, R607 was misadjusted. If the receiver remains unsquelched apply an on channel RF signal of 1 mV and standard modulation. Measure the AC audio level at VOL/SQ HI (P903-3). The level should be 300 mV rms (+100, -50 mV). If this level is not met, follow the detector troubleshooting procedure. If the audio level is correct measure the DC level at CAS (P912-4). The reading should be 0 V. Remove the RF signal from the receiver input and the reading should change to 7.5 VDC. If both measurements are correct, check the operation of the microprocessor section on the systems interconnect board. If the $\overline{\text{CAS}}$ readings don't change, measure the bias voltages on U501 pins 10-14. With no RF input signal, the voltage on pin 12 of U501 should vary as R607 is varied (see schematic). If not, check the noise detector diode D601 and its associated circuitry (C606, C607, C621, R608 and R609) and the noise filter circuitry (R604-R606 and C603-C605). Otherwise, U501 is probably defective and should be replaced. 2. Audio Switch Circuit Ground RX MUTE (P903-4) and measure the voltages at Q603 and pins 2 and 4 of U601 for the squelched condition (see schematic).

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 ohm resistive load): 18 Volts

Transmitter keyed (no load or non-resistive load): 15.5 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 (13.8 VDC for loads of 0 to 6 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 may be usable when operated in parallel with a 12 Volt automotive storage battery.

In all PHOENIX-S model radios, in which the EE PROM is not custom programmed, (Option AO) the EE PROM is programmed with the personality shown in Table I below. Note that personalities for VHF and UHF frequency bands wideband and narrowband radio combinations with tone and digital Channel Guard and carrier control timer are pre-programmed. When selecting a test channel be sure the channel/mode selected is compatable with the radio being serviced. Refer to the combination number on the audio and the combination nomenclature chart in this manual to verify operating frequency range.

FREQUENCY/TYPE	CHAN. NO.	TX FREQ. (MHz)	RX FREQ. (MHz)	CHANNEL GUARD	CARRIER CONTROL TIMER
150-162 MHz (Narrow Band)	1A,1B 2A,2B 3A,3B	156.000 156.000 156.000	156.075 156.075 156.075	71.9 --- 023	--- --- 30 sec
161-174 MHz (Narrow Band)	1A,1B 2A,2B 3A,3B	168.000 168.000 168.000	168.060 168.060 168.060	71.9 --- 023	--- --- 30 sec
136-153 MHz (Wide Band)	1A,1B 2A,2B 3A,3B 4A,4B 5A,5B	144.025 136.030 144.025 152.970 152.970	144.075 136.090 144.075 152.920 152.920	71.9 023 023 023 ---	--- --- 30 sec --- ---
150-174 MHz (Wide Band)	1A,AB 2A,2B 3A,3B 4A,4B 5A,5B	162.250 150.030 162.250 173.975 173.975	162.300 150.090 162.300 173.925 173.925	71.9 023 023 023 ---	--- --- 30 sec --- ---
450-470 MHz (Narrow Band)	1A,1B 2A,2B 3A,3B	461.025 461.025 461.025	460.975 460.975 460.975	71.9 --- 023	--- --- 30 sec
450-470 MHz (Wide Band)	1A,1B 2A,2B 3A,3B 4A,4B 5A,5B	461.025 450.025 461.025 469.900 469.900	460.975 450.075 460.975 469.950 469.950	71.9 023 023 023 ---	--- --- 30 sec --- ---

FREQUENCY AND MODULATION ADJUSTMENT

Test Equipment Required

1. Audio Oscillator
2. Deviation Monitor
3. AC Voltmeter
4. Wattmeter, 50 ohm, 50 Watts
5. Frequency Counter

FREQUENCY ADJUSTMENT

Select channel 1 and set the transmit frequency by adjusting L101.

NOTE

All channels in Tx must be tuned to proper frequency per Tx Alignment Procedure before Modulation Level Adjustment Procedure is performed.

SYNTHESIZER VCO ADJUSTMENT

Select channel with highest RF frequency, in transmitter. Monitor TP101 with high impedance DC voltmeter and adjust L104 for a DC voltage of 6.5 VDC, or the highest tunable voltage up to 6.5 VDC.

MODULATION LEVEL ADJUSTMENT

CAUTION

DO NOT remove microphone from the optional hookswitch (if present). DAMAGE to equipment will result.

The CG encode circuit can be easily disabled to allow transmitter distortion and modulation checks (without removing cover) by temporarily connecting a jumper from J910-11 (A+) to J910-9 (CG DISABLE lead).

MOD ADJUST Control R320 has been adjusted to the proper setting before shipment and normally does not require readjustment. This setting permits approximately 75% modulation for the average-voice level.

NOTE

The Channel Guard modulation level adjustment should be checked each time the tone frequency is changed.

Procedure

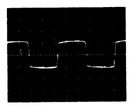
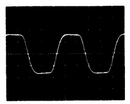
1. Connect the audio oscillator and the AC voltmeter across audio input terminals J911-4 (Hi) and J911-3 (Lo) on the synthesizer/interconnect board. Set the radio channel to the centermost frequency in the customer's band.
2. Adjust the audio oscillator for 1 Volt RMS at 1000 Hz.
3. Connect RF Wattmeter to antenna jack.
4. Set CG Mod adjust and R724 and R316 fully counterclockwise.
5. Adjust R320 for 4.5 kHz deviation (3.75 kHz when Channel Guard is used).
6. If Digital Channel Guard is used remove audio oscillator from J911 and using a 100 uf capacitor (+ end toward radio) couple a 300 Hz signal to J301 and adjust input level to obtain 1.5 kHz deviation. Keeping input level constant, adjust frequency for 10 Hz. Adjust R316 for 15 kHz deviation.
7. Remove any other audio signals and set R724 for 0.75 kHz deviation.

NOTE

If the deviation reading plus (+) or minus (-) differs more than 0.5 kHz, recheck Step 1 as shown in the Transmitter Alignment Chart.

AUDIO AC VOLTAGES

1. Connect audio oscillator output across J911-4 (Mic Hi) and J911-3 (Mic Lo)

		U301-7	U301-1 (+)
SCOPE SETTING	HORIZONTAL	200 U SEC/DIV	200 U SEC/DIV
	VERTICAL	2 VOLTS/DIV	0.5 VOLTS/DIV
SET AUDIO OSCILLATOR AT 1000 Hz WITH OUTPUT OF 1.0 VRMS. R320 ADJUSTED FOR 3.75 kHz DEVIATION. NOTE: AN RMS OR PEAK READING VOLT METER WILL READ 1/2 TO 1/3 OF PEAK-TO-PEAK READINGS			

AUDIO SENSITIVITY

1. Connect audio oscillator output across J911-4 (Mic Hi) and J911-3 (Mic Lo). Adjust output for 1000 Hz at 1.0 VRMS.
2. Reduce generator output until deviation falls to 2.25 kHz. Voltage should be less than 1000 millivolts.

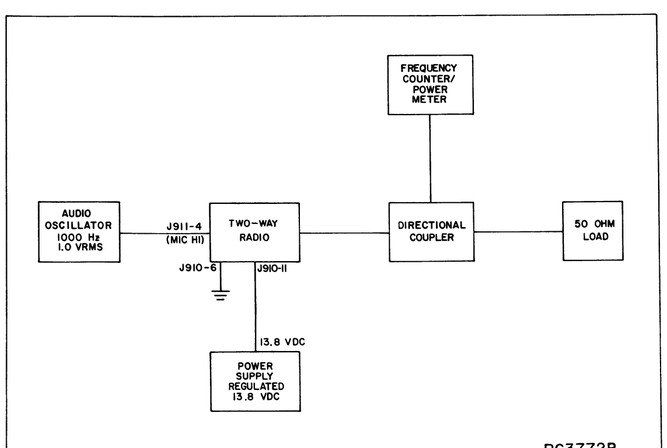
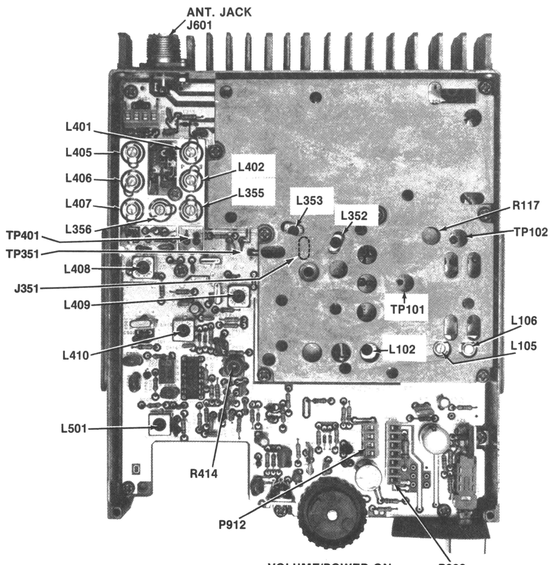
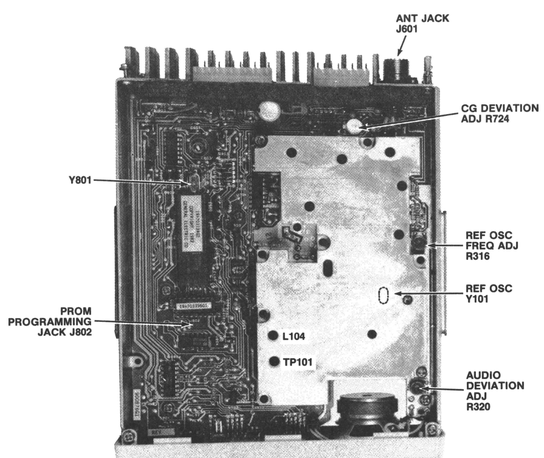


Figure 4 - Test Equipment Set Up.

TRANSMIT/RECEIVER BOARD



SYNTHESIZER/INTERCONNECT BOARD



TRANSMITTER ALIGNMENT

Test Equipment

1. 50-ohm Wattmeter
2. 50-ohm Load
3. Voltmeter (20,000 ohms-per-volt)
4. 13.8 V Regulated Power Supply
5. Audio Signal Generator
6. Frequency Counter

PRELIMINARY CHECK AND ADJUSTMENTS

NOTE

Refer to photographs to locate CONTROLS, TEST POINTS and CRYSTALS.

1. Preset cores in helical castings (front end) as follows:
   L105 - Set top of core level with top of casting, then screw in 1-1/2 turns.
   L106 - Set top of core level with top of casting, then screw in 2 full turns.
2. Set power adjust control R204 to maximum (fully clockwise).
3. All adjustments are made with transmitter keyed. Unkey the transmitter between steps to avoid overheating.
4. Check P903-2 for 8.5 volts ±0.15 volt before starting the alignment.
5. Select transmitter frequency nearest center frequency.

ALIGNMENT PROCEDURE

STEP	MONITOR	TUNING CONTROLS	ADJUST FOR:	REMARKS
1.	TP101	L102	Minimum	Select center frequency.
2.	TP201	L105	Minimum	Select highest frequency.
3.	TP201	L106	Minimum	Select lowest frequency.
				NOTE: Repeat steps 1-3 until no further change in core setting of L102, L105 and L106 occurs.
4.	Ant. Jack J601	R204	25 Watts Output Power	If output power exceeds 25 watts, adjust to 25 watts. Check all channels. RF output power should be between 22 and 25 watts across the band.

RECEIVER ALIGNMENT

Test Equipment Required

1. RF Signal Generator (450-470 MHz)
2. AC Voltmeter
3. Power Supply, 13.8 V Regulated
4. VOM (20K ohms/volt)
5. 4 ohm, 5 watt resistor

PRELIMINARY CHECKS

1. Connect 13.8 VDC to J910-11(+) and J910-6(-).
2. Set MONITOR switch to "out" position
3. Turn radio on. Verify 8.5 VDC ±0.15 VDC at P903-2.
4. If signal generator is used, set the output level for +10 dBm at a frequency of Rx Freq +21.4 MHz / 3
5. Select channel with highest RF frequency, in transmitter. Monitor TP101 with high impedance DC voltmeter and adjust L104 for a DC voltage of 6.5 VDC, or the highest tunable voltage up to 6.5 VDC.
6. Select desired channel.
7. Disable Channel Guard by removing microphone from the optional Channel Guard hookswitch (if present), or by connecting ground to J910-9.
8. Disconnect internal speaker from J904 on synthesizer/interconnect board. Terminate either J910-3 or J904 with a 4 ohm, 5 Watt resistor.

NOTE

Refer to photographs to locate CONTROLS, and TEST POINTS.

ALIGNMENT PROCEDURE

STEP	METERING TEST POINT	INDICATION	TUNING CONTROL(s)	PROCEDURE
			L.O. AND MULTIPLIER	
1.	TP351	-0.5 VDC	L352, L353	Alternately adjust L352 and L353 for a negative peak. NOTE Preset L407, L353, and L356 as indicated: RX Freq — Preset Position L407: 450-460 MHz — Flush with top 460-470 MHz — 3 turns down from flush L355: 450-460 MHz — 3-1/4 turns down from flush 460-470 MHz — Flush with top L356: 450-460 MHz — Flush with top 460-470 MHz — 3 turns down from flush
2.	TP401		L355	Adjust for peak indication
3.	TP401		L356	Adjust for peak indication
4.	J351		L101	Connect counter to J351. Set L101 to specified Rx injection frequency. (Rx Freq +21.4 MHz / 3). Adjust L101 for correct frequency.
5.	TP501	Maximum	L408,L409 L410	Connect RF signal generator to antenna jack J601. Connect AC voltmeter to TP501. Set RF signal generator output to channel frequency at the minimum level sufficient to provide a mid scale meter indication. (50-100 millivolts). Reduce the output of the signal generator as required to keep the RF level within the 50-100 mV range. Adjust L408 first, then L410 and L409, respectively for maximum indication on meter. Alternately adjust L408 and L409 to obtain maximum meter reading.
			FRONT END ALIGNMENT	
				NOTE Preset L401, L402, L405 and L406 flush to top of front end casting. Then set L405 and L406 as shown below: RX 450-460 MHz: Set L406 flush to top, L405 flush to top 460-470 MHz: Set L406 3 turns down from flush, L405 flush to top
6.	TP501	50-100 millivolts	100 millivolts Maximum	Connect signal generator to antenna input jack J601. Verify AC voltmeter is connected to TP501. Adjust signal generator to RF channel frequency. Adjust output level of signal generator for a VOM reading between 50 and 100 millivolts. Readjust as necessary.
				NOTE If RF frequency is between 460-470 MHz, proceed to step 10.
7.	TP501	Maximum	L407	Tune L407 through range, noting peaks. Set L407 for maximum indication with L407 tuned no more than 3-1/2 turns down from core being flush with top of casting.
8.	TP501	Maximum	L406	Tune L406 through range and set for maximum indication.
9.	TP501	Maximum	L405, L402 L401	Tune L405, L402, and L401 in that order for maximum indication.
				NOTE Perform steps 10 thru 14 for radios operating in the 460-470 MHz range. Other frequency ranges proceed to step 15.
10.	TP501	Maximum	L407	Tune L407 for maximum indication.
11.	TP501	See Procedure	L405	Preset L406 flush with top of casting then turn down 3 full turns.
12	TP501	Maximum	L406, L405	Tune L406 for maximum indication then peak L405.
13.	TP501	See Procedure	L401	Preset L401 flush with top of casting, then turn down 3 full turns.
14.	TP501	Maximum	L402, L401	Tune L402 for maximum indication, then peak L401.
15.	TP501	Maximum	L408, L409	Tune for maximum indication.
			DETECTOR/AUDIO ALIGNMENT	
16.	Audio Output	See Procedure	L501, R617	Apply a 1000 uV RF signal modulated with 1000 Hz to antenna input jack J601. Connect external speaker leads J910-3, J910-7 to four-ohm resistive load. Set volume control R617 to mid position. Connect AC voltmeter/distortion analyzer across four ohm load. Adjust L501 for maximum meter reading. Reduce volume control as necessary to keep output voltage from exceeding 2.0 VRMS.
17.		---	R617	Adjust volume control for a level of 3.46 VRMS on AC voltmeter. (3 watts).

FIXED SQUELCH ADJUSTMENT

1. Connect a signal generator to antenna jack J601.
2. Press in and hold in the MONITOR pushbutton and adjust the signal generator for a nominal 9 dB SINAD signal.
3. Set SQUELCH CONTROL pushbutton to its "out" position.
4. Adjust squelch control R607 to maximum squelch. Receiver must be muted.
5. Adjust squelch control R607 slowly until receiver unmutes.
6. Check that the squelch opens at an input signal level corresponding to 8 dB SINAD (±1 dBs).

TEST PROCEDURES

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

TEST EQUIPMENT REQUIRED

- Distortion Analyzer
- Signal Generator
- 6 dB attenuation pad, and 4.0 ohm, 5 Watt resistor

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. Disable the squelch by adjusting squelch control R607.

NOTE

Be sure to reset the squelch control after completing the Test Procedures.

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 hertz with ±3.0 kHz deviation to antenna jack J601.

B. With 3 Watt Speaker

Disconnect speaker J904.

Connect a 4.0 ohm, 5 Watt load resistor across J904-1 & 2.

Connect the Distortion Analyzer input across the resistor as shown.

C. Adjust the VOLUME control for 3 Watt output 3.46 VRMS using the Distortion Analyzer as a voltmeter.

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than 3 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 0.4 µV. 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 1.5 Watts (0.56 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 BANDWIDTH (IF BANDWIDTH)

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

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

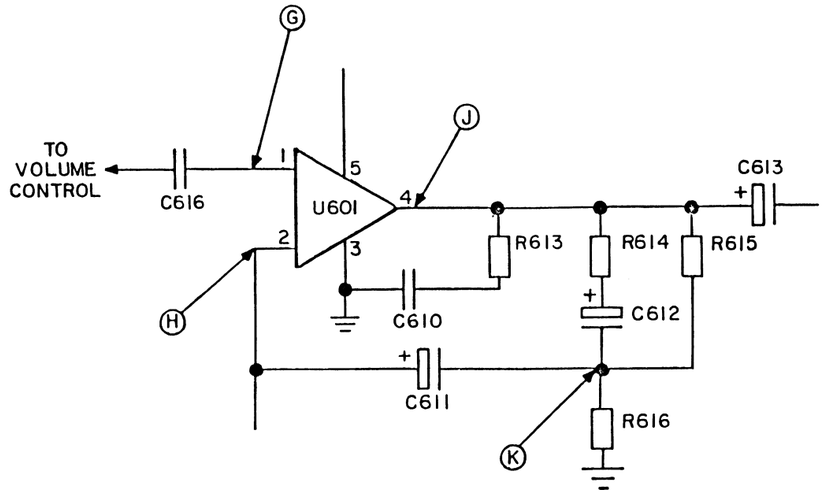
B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000 Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

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

D. The deviation control reading for the 12 dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7 kHz.

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, refer to the Receiver Troubleshooting Procedure.

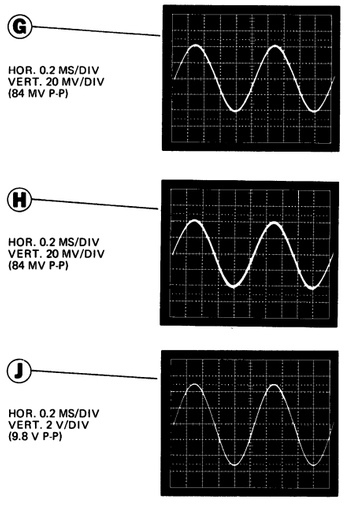


RC-4413A

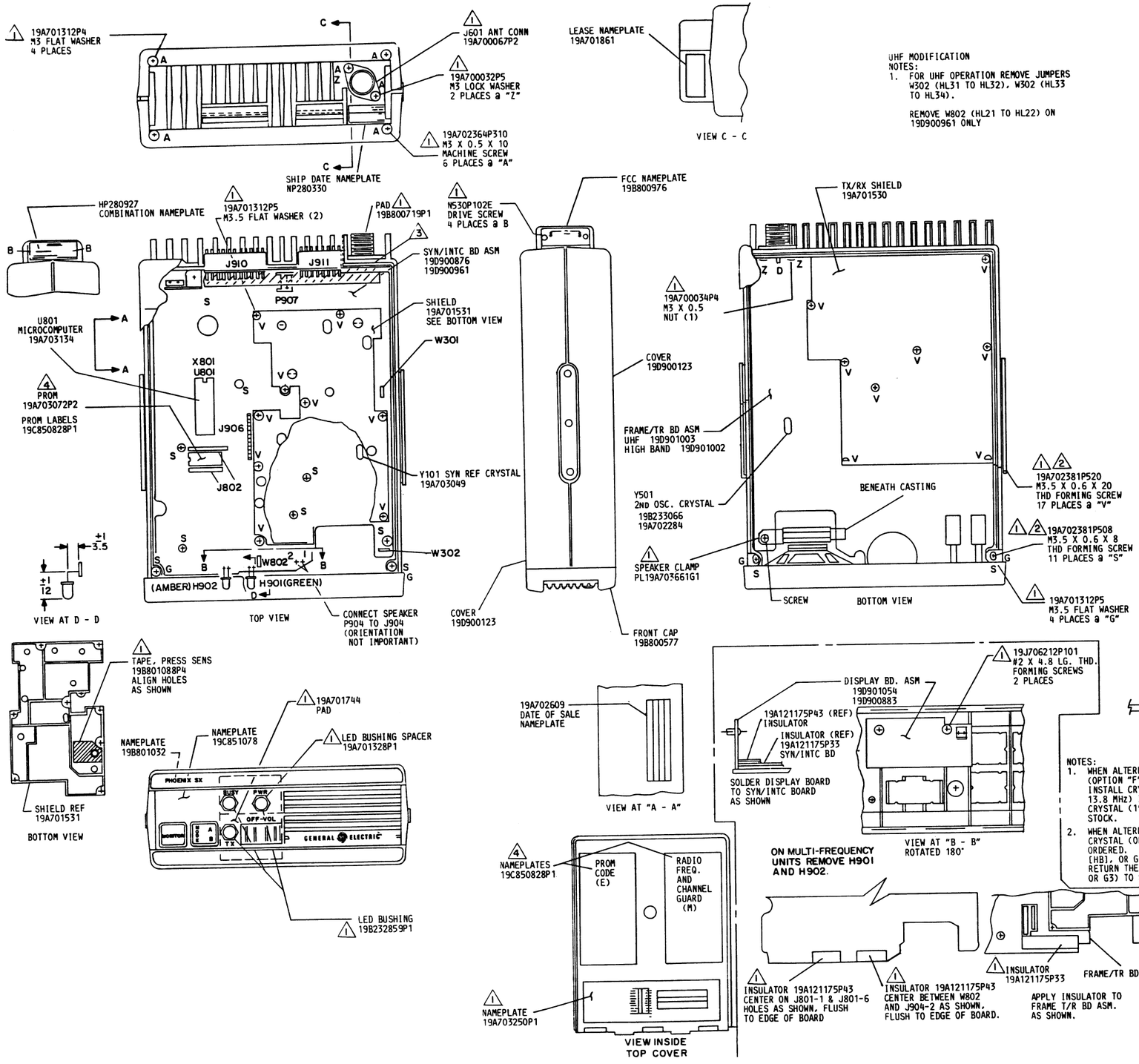
AUDIO CIRCUIT CHECKS

PRELIMINARY STEPS

1. Apply 1000 uv on frequency signal with 1000 Hz modulation and 3 kHz deviation to antenna jack J601.
2. Monitor pushbutton "IN".
3. Output set for 3-Watts (3.46 VRMS) into 4 ohm load.
4. Use 1 megohm probe.



RECEIVER AUDIO CHECKS



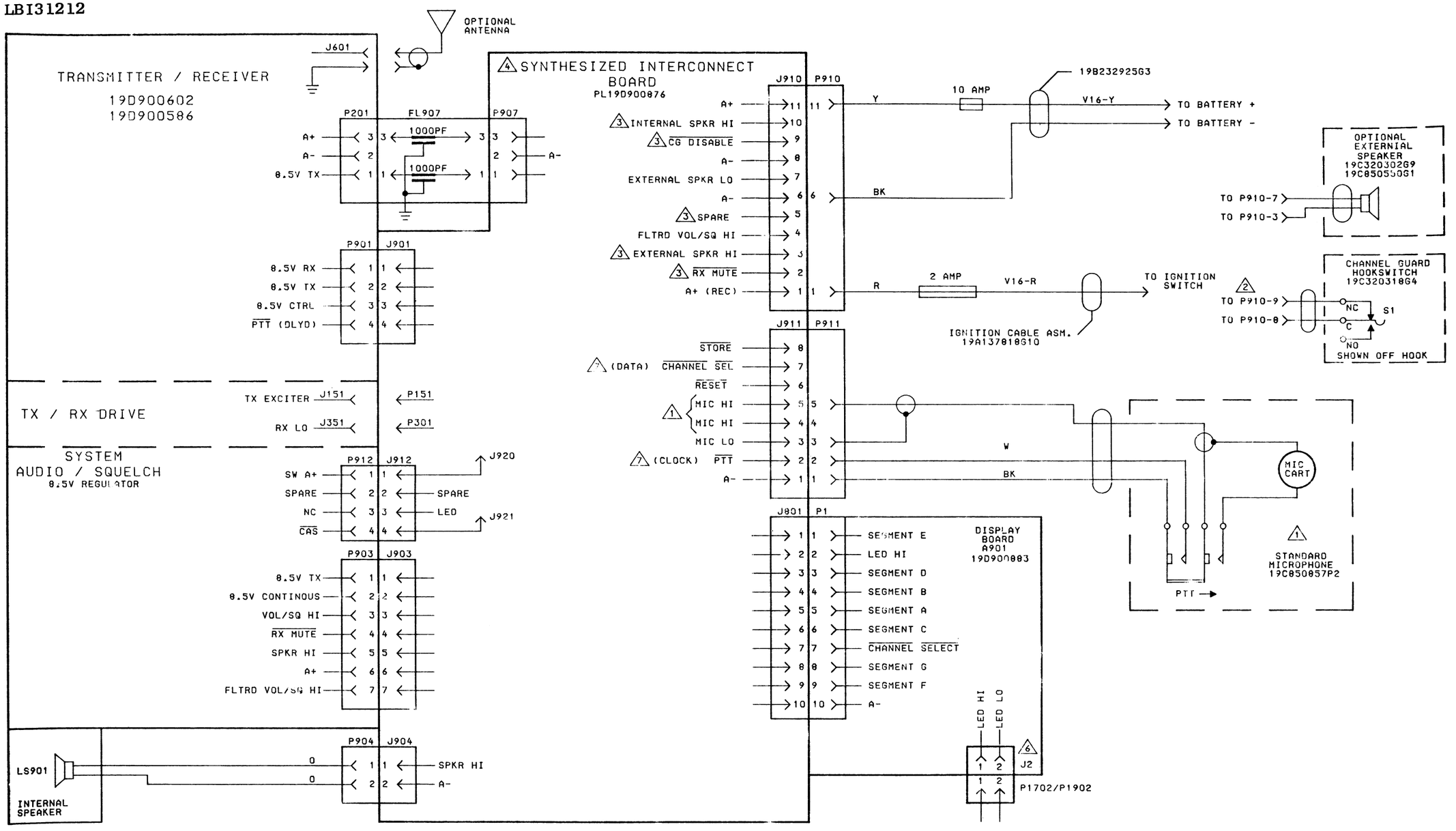
NOTES:

1. PART OF KIT PL 19A701522.
2. DIP ENDS OF THD FORMING SCREWS INTO LUBRICANT 19A115204P1 BEFORE INSTALLING IN CASTING.
3. APPLY 19A134084P2 TAPE 3 TO BOTH ENDS OF 19B800719 PAD.
4. PART OF 19A703396

RC 4423

(19D901052, Sh. 1, Rev. 1)

MECHANICAL LAYOUT



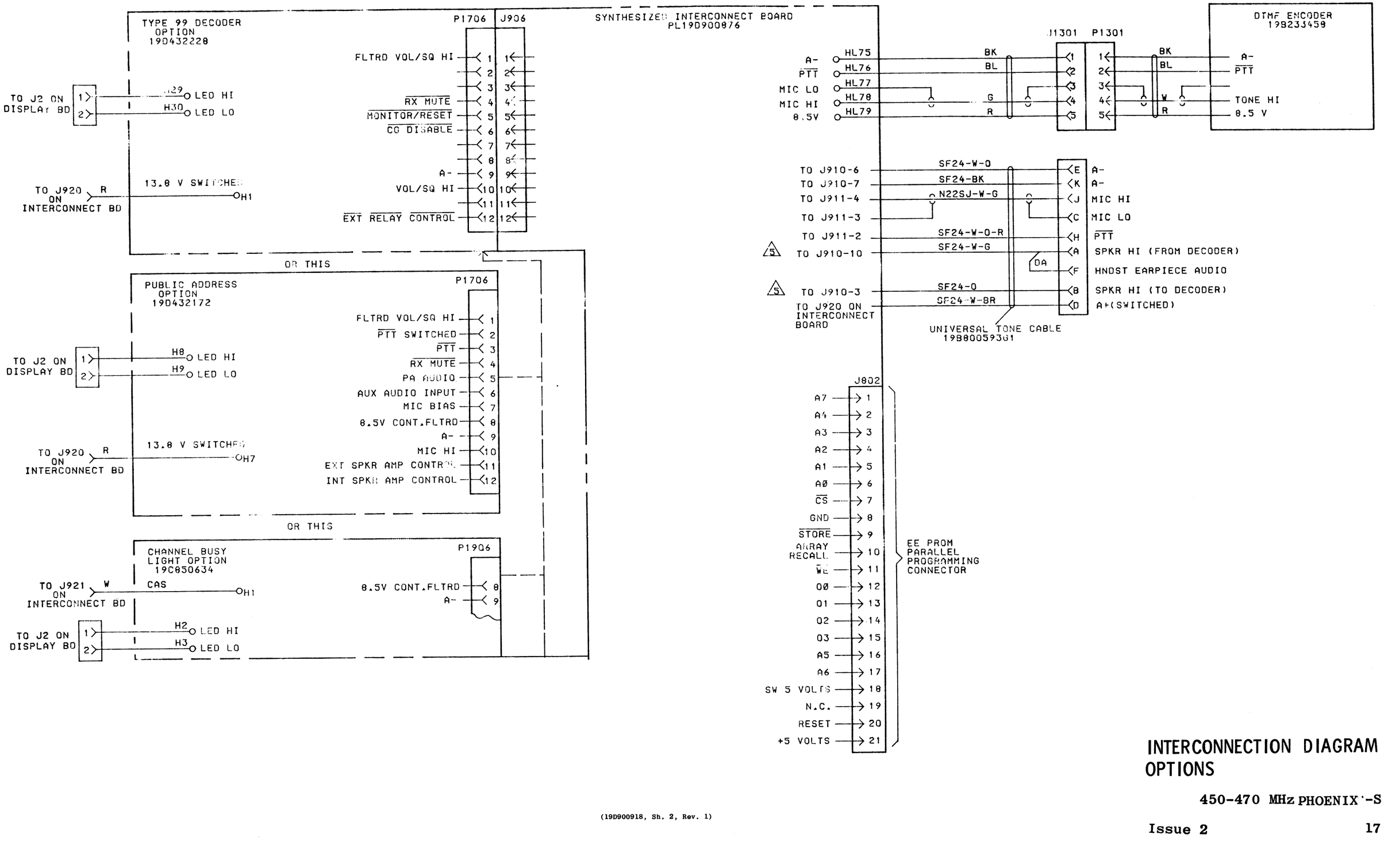
NOTES:

1. J911-5 USED ON MICROPHONES NOT HAVING PREAMPLIFIERS. J911-4 USED ON MICROPHONES WITH INTERNAL PREAMPLIFIERS.
2. FOR T99 DECODER OPTION, CONNECT TO P910-5 (MONITOR/RESET).
3. FUNCTIONS AT J910 ARE DIFFERENT FOR VARIOUS OPTIONS. REFER TO THE SYNTHESIZED INTERCONNECT WIRING DIAGRAM FOR THESE FUNCTIONS.
4. SEE SHEET 2 FOR OPTION INTERFACE.
5. WHEN THE UNIVERSAL TONE CABLE IS USED WITH PA OPTION, CONNECT THE WHITE-GREEN WIRE TO H6 AND THE ORANGE WIRE TO H11 ON THE SYNTHESIZED INTERCONNECT BOARD.
6. J2 USED WHEN T99, PUBLIC ADDRESS, OR DTMF DECODERS ARE USED. R911 MUST BE REMOVED ON THE INTERCONNECT BOARD AND R8 MUST BE REMOVED ON THE DISPLAY BOARD.
7. PIN DEFINITIONS SHOWN IN BRACKETS APPLY WHEN LOADING THE EEPROM.

SYSTEM INTERCONNECTION DIAGRAM

450-470 MHz PHOENIX-S

(19D900918, Sh. 1, Rev. 1)

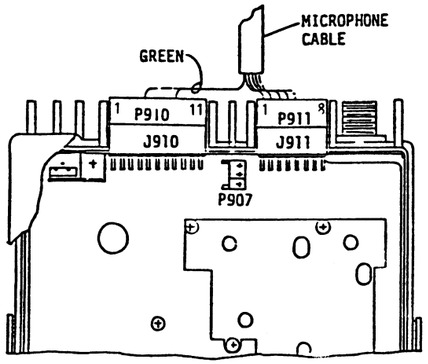


(19D900918, Sh. 2, Rev. 1)

INTERCONNECTION DIAGRAM OPTIONS

450-470 MHz PHOENIX™-S

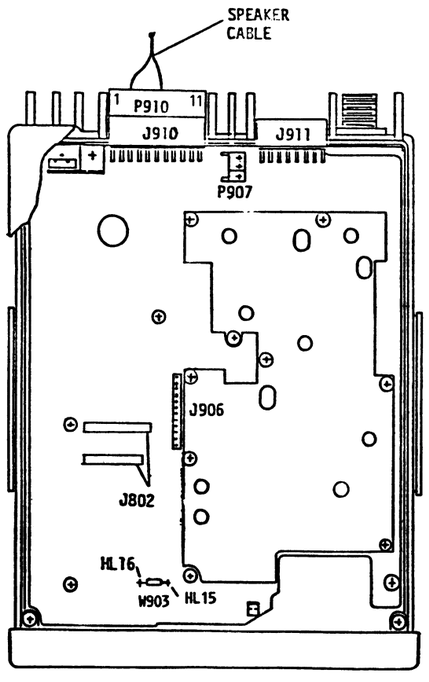
DESK MICROPHONE WITH OR WITHOUT TYPE 99 DECODER



TOP VIEW

NOTES:
1. FOR USE WITHOUT TYPE 99 DECODER, MOVE GREEN WIRE FROM P911-5 TO P910-9
2. FOR USE WITH TYPE 99 DECODER, MOVE GREEN WIRE FROM P911-5 TO P910-5

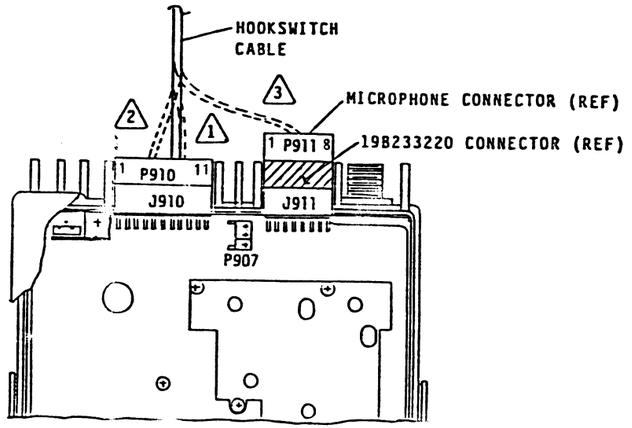
EXTERNAL SPEAKER APPLICATION



TOP VIEW

NOTES:
1. CONNECT SPEAKER LEADS TO P910-3 AND P910-7. TO DISCONNECT INTERNAL SPEAKER (FIELD ONLY) REMOVE W903 BETWEEN H15 & H16.
2. FOR EXTERNAL SPEAKER WITH THE AC POWER SUPPLY, REMOVE JUMPER IN POWER CABLE BETWEEN P910-3 & P910-10 AND CONNECT PER NOTE 1.

HOOKSWITCH APPLICATION

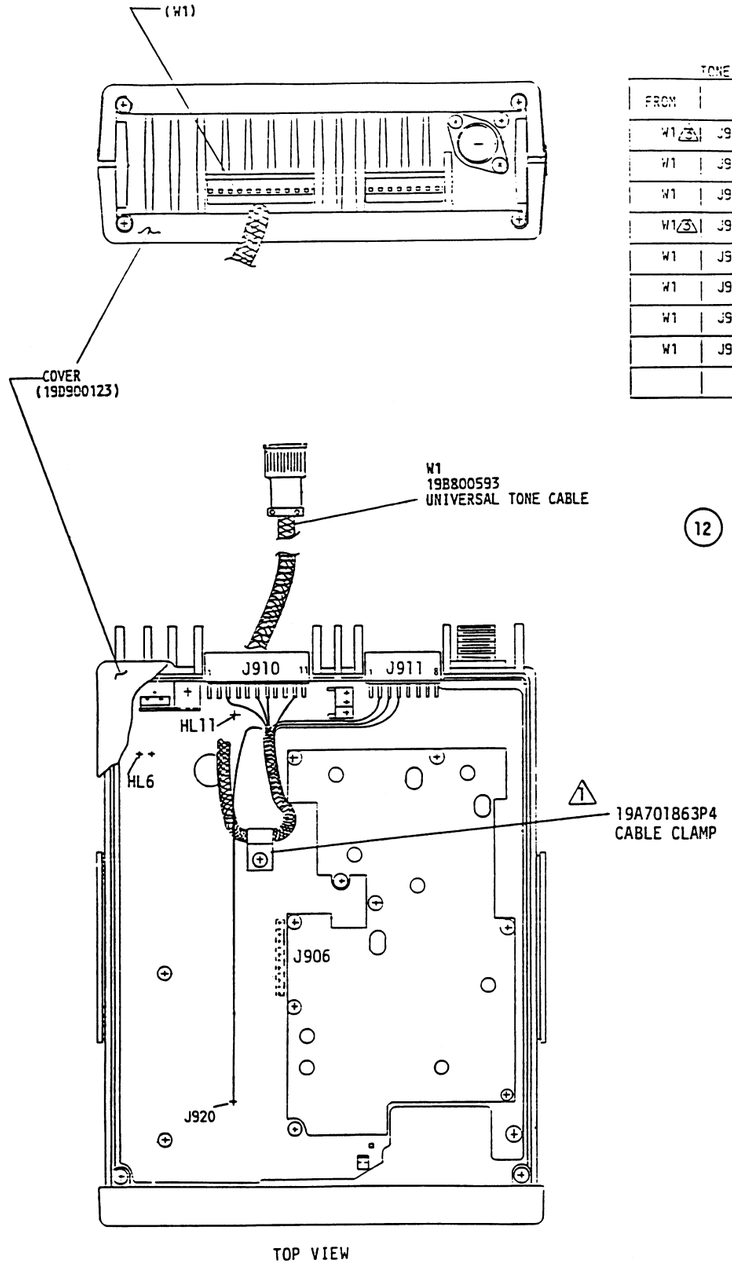


TOP VIEW

NOTES:

1. CONNECT HOOKSWITCH TO P910-8 AND P910-9.
2. CONNECT HOOKSWITCH TO P910-5 AND P910-8 FOR TYPE 99 DECODER.
3. CONNECT HOOKSWITCH TO P910-8 AND P911-5 FOR DC REMOTE.

(19D901052, Sh. 2, Rev. 1)



TOP VIEW

TONE CABLE TO RADIO CONNECTION CHART

FROM	TO	WIRE COLOR	NOTES
W1 (3)	J910-3	O	SOLDER
W1	J910-6	W-O	SOLDER
W1	J910-7	BK	SOLDER
W1 (3)	J910-10	W-G	SOLDER
W1	J911-2	W-O-R	SOLDER
W1	J911-3	SHIELD	SOLDER
W1	J911-4	W-G(SHIELDED)	SOLDER
W1	J920	W-BR	SOLDER

(12) UNIVERSAL TONE CABLE
NOTES:

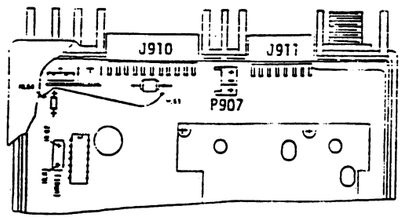
⚠1 PART OF CABLE KIT 19B800593

2 . DISCARD RUBBER CHANNEL SUPPLIED IN KIT

⚠3 WHEN THE TONE CABLE IS USED WITH THE PUBLIC ADDRESS OPTION (P10), CONNECT ORANGE WIRE TO HL 11 AND THE WHITE-GREEN WIRE TO HL6

(19D901052, Sh. 5, Rev. 2)

CHANNEL MEMORY (100 ma CONTINUOUS BATTERY DRAIN)



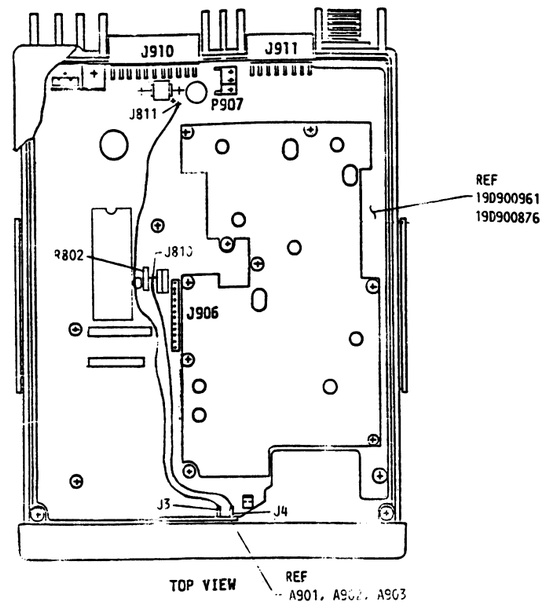
TOP VIEW

(16) CHANNEL MEMORY (200 MA MAX CONTINUOUS BATTERY DRAIN)

NOTES:

1. ADD JUMPER SN22-W FROM HL63 TO HL64.
2. REMOVE JUMPER (W801) FROM HL81 TO HL82.

CHANNEL MEMORY 15 ma CONTINUOUS BATTERY APPLIED ONLY WITH MASK VERSION OF U801 (NOT 19A703134G2)

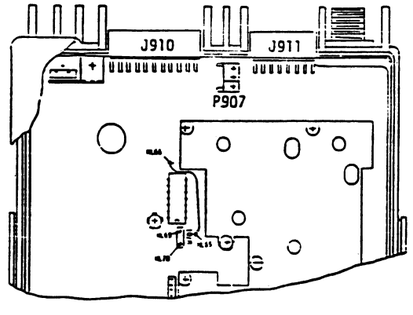


TOP VIEW

(15) CHANNEL MEMORY (15 MA CONTINUOUS BATTERY DRAIN APPLIED ONLY WITH MASK VERSION OF U801 [NOT 19A703134])

NOTES: ADD JUMPER SN22-W FROM A901, A902, A903-J4 TO J810, A901, A902, A903-J3 TO J811.
1. REMOVE R802 AND W911.

DIGITAL CG POLARITY REVERSAL



(17) DIGITAL CG POLARITY REVERSAL

NOTES:

1. ADD JUMPER SN22-W FROM HL65 TO HL66.
2. REMOVE JUMPER (W701) FROM HL69 to HL70.

INSTALLATION DIAGRAM

(19D901052, Sh. 6, Rev. 3)

PARTS LIST

LBI31249B

PHOENIX S, SX
ASSOCIATED PARTS AND ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
	19A701530G2	Transmit/Receive Shield.
	19A701531G1	Frequency Synthesizer, Audio Processor Shield.
	19A703396G1	PROM Kit.
	19D900123P2	Top Cover.
		- - - - - - - - - - MICROPHONES - - - - - - - - - -
	19D900141G5	Microphone: Transistorized. (Electret cartridge), with connector. (Delta Style).
	19C850857P2	Microphone: Transistorized. (Electret cartridge); sim to PRIMO DM-1532 with EM-96 cartridge). (Phoenix Style).
	19B209694P1	Desk Microphone: Transistorized with Channel Guard.
	19C851086P2	Desk Microphone: Transistorized. (Electret cartridge); sim to PRIMO MX-1781A.
	714141G2	Microphone mounting kit.
	19B800593G1	Universal Tone Cable. (Encode or Decode).
		INTERCONNECT CABLE 19D417126G1
		- - - - - - - - - - - JACKS - - - - - - - - - - -
J1 and J2	7489183P7	Plug: 9 contacts rated at 7.5 amps max; sim to Winchester M9P-LS-H19CS.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	7489183P10	Plug: 9 contacts rated at 7.5 amps max; sim to Winchester M9P-LS-H19C.
		FUSED LEAD ASSEMBLY 19A137818G10
	1R16P5	Quick blowing: 2 amp at 250 v; sim to Littelfuse 312002 or Bussmann AGC-2.
	19A115776P6	Fuseholder: sim to Bussmann 9835.
	19A115776P5	Fuse housing cap.
	19A115776P7	Spring: sim to Bussmann 1A1853. (Located in fuse housing).
	19A115776P3	Contact: sim to Littelfuse 904-88. (Crimped on wire inside fuse housing and cap).
	19A116781P5	Contact, electrical: wire range No. 18-24 AWG; sim to Molex 08-50-0106. (Located on end of lead).
		POWER CABLE 19B232925G3
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P910		Connector. Includes:
	19A116659P143	Shell.
	19A116781P5	Contact, electrical: wire range No. 18-24 AWG; sim to Molex 08-50-0106.
		FUSED LEAD ASSEMBLY 19A137818G11 (Part of Power Cable 19B232925G3)
	7484390P3	Cartridge, quick blow: 15 amp at 250 v; sim to Bussmann ABC15.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
	19A115776P6	Fuseholder: sim to Bussmann 9835.
	19A115776P5	Fuse housing cap.
	19A115776P7	Spring: sim to Bussmann 1A1853. (Located in fuse housing).
	19A115776P3	Contact: sim to Littelfuse 904-88. (Crimped on wire inside fuse housing and cap).
		FRONT CAP ASSEMBLY 19B800577G7
		- - - - - - - - - - SPEAKERS - - - - - - - - - -
LS901	19A703265P1	Permanent Magnet: 4 ohm imp., 4 watt.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4034221P1	Clip. (Secures LS901).
		Connector. (Used with LS901). Includes:
	19A700041P28	Shell.
	19A700041P26	Contact. (Quantity 2).
		DASH MOUNTING HARDWARE KIT 19A138051G6 DASH MOUNT
	19A134653P4008	Bolt, machine, hex: Metric, 8MM. (Secures radio to mounting bracket).
	19A700032P7	Lockwasher, internal tooth: M4. (Secures radio to mounting bracket).
	19J706152P9	Retaining strap; sim to Dennison BAR-LOK 08471. (Secures power leads under dash).
	N130P1610C6	Screw, thread forming: No. 10-16 x 5/8. (Secures mounting bracket to thin mounting surface).
	N130P1624C6	Screw, thread forming: No. 10-16 x 1-1/2. (Secures mounting bracket to thick mounting surface).
	5490407P6	Rubber grommet. (Located in fire wall).
	19C850638P3	Mounting bracket.
		UNIVERSAL TONE CABLE DECODE CABLE 19D417126G1
		- - - - - - - - - - - JACKS - - - - - - - - - - -
J1 and J2	7489183P7	Plug: 9 contacts rated at 7.5 amps max; sim to Winchester M9P-LS-H19CS.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	7489183P10	Plug: 9 contacts rated at 7.5 amps max; sim to Winchester M9P-LS-H19C.
		FRONT CAP ENCODER 19B233458G4
		- - - - - - - - - - - JACKS - - - - - - - - - - -
J1301		Connector. Includes:
	19B209505P205	Shell.
	19B209505P21	Contact. (Quantity 5).
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1301		Connector. Includes:
	19B209505P105	Shell.
	19B209505P24	Contact. (Quantity 5).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B209731P2	Encoder. (DTMF); sim to Challenger Electronics PE-0705.
	19A142673P1	Support, left. (Mounts DTMF encoder).
	19A142672P1	Support, right. (Mounts DTMF encoder).

SYMBOL	GE PART NO.	DESCRIPTION
	19B233457G4	Front cap.
	19A701863P12	Clip loop.
	19D430583P13	Faceplate.
	19A116773P606	Tap screw, phillips, POZIDRIV®: No. 5-20 x 3/8. (Secures DTMF Encoder).
H901	19J706135P4	Diode, Optoelectronic: green; sim to Hewlett Packard 4855. (Power Indicator).
J601A	19A701432P1	Antenna connector. Receptacle: coax; sim to UG58AU.
J601B	19A700067P2	Antenna connector. Receptacle; sim to Amphenol 83-876-1002.

PARTS LIST

3 x 5 INCH SPEAKER
19C850550G1 DASH MOUNT
19C850550G2 WINDOW MOUNT
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS1	19A702080P3	Permanent magnent: 76 x 1 mm, 8 ohms ±10% imp at 400 Hz, 18 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19A129414G1	2 conductor cable: approx 5 feet long, includes (2) 19A116781P5 contacts.
W1	19B226189G1	Window mount: approx. 17 inches retracted, 84 inches extended. (Includes 2 19A116781P5 contacts).
		BREAKAWAY MOUNTING KIT 19A129461G1
	19C320022P1	Retaining bracket. (With locking jaws).
	19B219578G1	Safety Release Disc. (Mates with mounting surface).
	N187P16010C6	Machine screw, hexhead, slotted: No. 10-32 x 5/8. (Quantity 1 - Used with safety release disc with retaining bracket0.
	N130P16012C6	Tap screw, thd. forming: No. 10-16 x 3/4. (Quantity 3 - Used without safety release disc & retaining bracket).
	N130P16024C6	Tap screw, thd. forming: No. 10-16 x 1-1/2. (Quantity 3 - Used without safety release disc & retaining bracket - for extra thick carpet).
	N402AP9C6	Flatwasher: No. 10. (Used with 10-16 thread forming screws).
		DASH MOUNT KIT FOR WINDOW MOUNT SPEAKER OPTION 19A13023G2
	19B226190P1	Backing plate.
	19B226185P1	Clip bracket.
	N193P1408C6	Tap screw, phillips head: No. 8-18 x 1/2. (Secures backing plate to mounting surface).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B800534G1	Housing. (DASH MOUNT).
	19B800534G2	Housing. (WINDOW MOUNT).
	19C850549P1	Grille.
	19A702464P3	Strain relief. (Used with W1 window mount cable at housing).
	19A701354P2	Nameplate. (GENERAL ELECTRIC).
	19C320016P1	Mounting bracket. (Secures speaker assembly to mounting surface).
	19A701631P516	Machine screw: No. 10-32 x 5/16. (Secures speaker housing to mounting support).
	19A701312P7	Lockwasher: No. 10. (Secures speaker housing to mounting support).
	19A700033P10	Lockwasher, external tooth: No. 10. (Secures speaker housing to mounting support).
	19A116986P112	Screw, thread forming, assembled washer: Phillips POZIDRIV®, HI-LO thread, No. 7-19 x 3/4. (Secures grille to housing).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

EXTERNAL ALARM RELAY
19B226025G4
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1701	4037822P2	Silicon, 1000 mA, 600 PIV.
		- - - - - - - - - - - - RELAYS - - - - - - - - - - - -
K1701	7486515P2	Armature, enclosed: 12 VDC nominal, 85 to 90 ohms coil res, 1 form A contact, rated at 15 amps; sim to R.B.M. Co.
		FUSED LEAD 19B226454G1
	1R16P3	Quick blowing: 1 amp at 250 v; sim to Littelfuse 312001 or Bussmann AGC -1.
	19A115776P6	Fuseholder: sim to Bussmann 9835.
	19A115776P5	Knob: sim to Bussmann 99531/2.
	19A115776P7	Spring: sim to Bussmann 1A1853.
	19A115776P3	Contact, electrical: sim to Littelfuse 904-88. (Crimped on wires inside holder).
		WIRE ASSEMBLY 19A129937G2
	19B209260P12	Terminal, solderless: wire range No. 22-16; sim to AMP 41310.
	19A116781P5	Contact, electrical: wire range No. 18-24 AWG; sim to Molex 08-50-0106.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	N80P13005C6	Machine screw: No. 6-32 x 5/16. (Secures relay to support).
	N404P13C6	Lockwasher, internal tooth: No. 6. (Secures relay to support).
	N402P37C13	Flatwasher: No. 6. (Secures relay to support).
	N80P15005C6	Machine screw: No. 8-32 x 5/16. (Secures wires to relay terminals).
	19A129833P1	Support. (K1701).
	N130P1608C6	Tap screw, thd. forming: No. 10-16 x 1/2. (Secures relay support).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

MIKE HANGER/HOOKSWITCH
19C320318G4
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S2	19A116676P1	Sensitive: SPDT, 5 amps at 24 VDC or 5 amps at 250 VRMS; sim to Microswitch 11SM1-T2.
		- - - - - - - - - - - - CABLES - - - - - - - - - - - -
W1	19A129414G1	2 conductor cable: approx 5 feet long, includes (2) 19A116781P5 contacts.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B219694P1	Base plate.
	19B219698G5	Housing.
	19A702464P2	Strain relief. (W1).
	N193P1410C6	Tap screw, phillips head: No. 8-18 x 5/8. (Secures assembly to mounting surface).
		ASSOCIATED PARTS
		MIKE KIT 7141414G2
	4031457P1	Support.
	4031458P1	Spring.
	N193P1408C6	Tap screw, phillips head: No. 8-18 x 1/2.
	19A116773P105	Tap screw, phillips POZIDRIV®: No. 7-19 x 5/16.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

132-512 MHz ANTENNA
19B209568P1
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		Whip assembly. Decibel Products 058110-001.
		Whip nut assembly. Decibel Products 068047-001.
		Base nut assembly. Decibel Products 068048-001.
		"O" Ring (LARGE). Decibel Products 007059-122.
		Stud assembly. Decibel Products 068046-001.
		RG58/U Cable, 15 feet. Decibel Products 068115-001.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

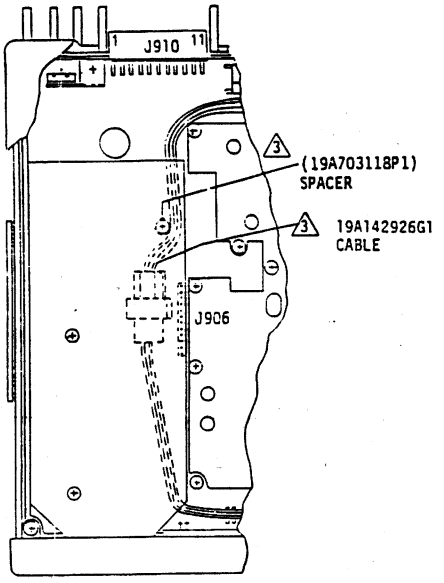
PARTS LIST

RUGGEDIZED MICROPHONE
19B233577P1 BLACK
19B233577P2 PEBBLE
ISSUE 2

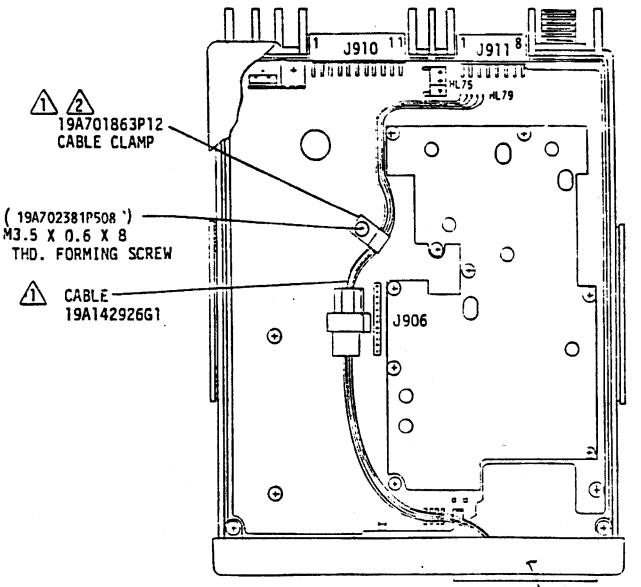
SYMBOL	GE PART NO.	DESCRIPTION
	RP117	Transistorized cartridge.
	RP128	Switch assembly.
	RP261	Switch button, Black.
	RP277	Switch button, Pebble.
	RP262	Case set, Black.
	RP275	Case set, Pebble.
	RP263	Cable assembly. (Includes connector shell 19A116659P20 & 4 contacts 19A116781P6).
	RP276	Chassis assembly, inner module.

ADDENDUM NO. 1 TO LBI31212A

This addendum incorporates the DTMF encoder installation instructions for the PHOENIX-S and PHOENIX-SX model radios. See Installation Diagram 19D901052 Sheet 5.



ALTERNATE ROUTING OF CABLE/CONNECTOR WHEN USED WITH OPTION BOARD



TOP VIEW

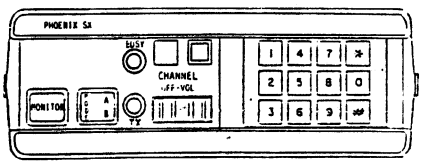
ENCODER-FRONT CAP
19B233458

DTMF ENCODER CONNECTION CHART

WIRE COLOR	CONNECT TO	NOTES
BK	HL75	SOLDER
BL	HL76	SOLDER
SHIELD	HL77	SOLDER
G	HL78	SOLDER
R	HL79	SOLDER

(13) DTMF ENCODER
NOTES:

1. PART OF FL19B233458.
2. CABLE CLAMP MUST BE POSITIONED OVER WIRE JUMPER W908
3. LACE CABLE TO SPACER



(19D901052, Sheet 5)

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

GENERAL ELECTRIC*
U.S.A.