MOBILE RADIO

MAINTENANCE MANUAL

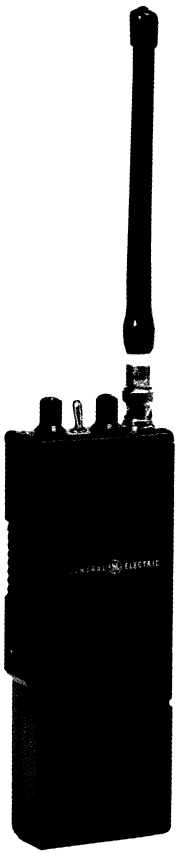
FOR

GENERAL ELECTRIC

MPI

PERSONAL RADIO

450-470 MHz, 2 Watts



GENERAL ELECTRIC

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COMBINATION NOMENCLATURE

DIGITS 1 & 2	DIGIT 3	DIGIT 4	DIGIT 5	DIGIT 6	DIGIT 7	DIGIT 8	DIGIT 9	DIGIT 10
Product Code	Package	TX Frequency Range	RX Frequency Range	Channel Spacing	RF Power Output	Max. Channel Capacity	Control	Power Source
P5 MPI	**B** Accessory Cover Local	**M** 403-425 MHz	**M** 403-425 MHz	**5** 25 kHz	**5** 1.7-3.8 Watts	**B** 2 Tx-2 Rx	**E** Standard	**N** NiCd 450 mAh
	C Local/ Remote	**N** 420-450 MHz	**N** 420-450 MHz		**6** 3.9-6.4 Watts	**C** 2 Tx-1 Rx		
		R 450-470 MHz	**R** 450-470 MHz			**D** 1 Tx-2 Rx		
		S 470-494 MHz	**S** 470-494 MHz					
		T 489-512 MHz	**T** 489-512 MHz					

RC4345A Sheet 1

STRUCTURED OPTIONS

A Option TX Xtals	**B** Option RX Xtals	**C** Option	**D** Option	**E** Option	**F** Option	**H** Option	**K** Alt IF
A 1 Xtal	**A** 1 Xtal	**O** None	**O** None	**O** None	**O** None	**O** None	**O** None
B 2 Xtals	**B** 2 Xtals	**2** 1 Tone Enc CG	**L** T-99 Ind.	**I** DTMF	**4** Int. Safe	**A** CGE UHF	**3** Alt IF
O No Xtals	**O** No Xtals	**U** 1 Tone/Enc DCG	**M** T-99 Ind.-Group			**B** CGE HB	
		4 1 Code Enc. DCG.	**N** T-99 Ind. CG Enc				
		D 1 Code Enc/ Dcc DCG					
		R 1 Tone CG Enc w/Switch					
		S 1 Tone DCG Enc w/Switch					

RC4345A Sheet 2

TYPICAL SPECIFICATIONS*

SYSTEM

FCC IDENTIFICATION NUMBER	AXA9MZTR102A
GE IDENTIFICATION NUMBER	TR102A
FREQUENCY RANGE	450-470 MHz
BATTERY DRAIN	
Receiver	
Standby	15 milliamperes
Rated Audio	150 milliamperes
Transmitter	800 milliamperes @ 7.5 Volts
TEMPERATURE RANGE	-30°C (-22°F) to +60°C (140°F)
DIMENSIONS (EIA) LESS ACCESSORIES (H X W X D)	7.11 x 2.59 x 1.46 inches (180.5 x 65.7 x 37.1 millimeters)
WEIGHT, WITH ANTENNA	455 grams (16 ounces)
BATTERY LIFE	
At 5% - 5% - 90% Duty Cycle	8 hours
At 2% - 8% - 90% Duty Cycle	12 hours

TRANSMITTER

POWER OUTPUT	2 Watts
FREQUENCY STABILITY	0.0005%
CONDUCTED SPURIOUS AND HARMONIC EMISSION	-16 dBm
RATED SYSTEM DEVIATION	±5 kHz
FM HUM & NOISE	Greater than 50 dB
AUDIO FREQUENCY CHARACTERISTICS FCC and EIA	Frequency Response per EIA RS 316-B. Post limiter filter per
DISTORTION	Less than 5% (300 to 3000 Hz)
DEVIATION SYMMETRY	0.5 kHz maximum
MAXIMUM FREQUENCY SPREAD	7 MHz
RF OUTPUT IMPEDANCE	50 ohms

RECEIVER

AUDIO OUTPUT (to 8.0 ohm speaker)	500 milliwatts (less than 5% distortion)
SENSITIVITY	
12 dB SINAD	0.35 uV
20 dB Quieting	0.50 uV
FREQUENCY STABILITY	0.0005%
SELECTIVITY EIA Two-Signal Method	-70 dB @ ±25 kHz
SPURIOUS RESPONSE	-60 dB
INTERMODULATION	-65 dB
MODULATION ACCEPTANCE	±6.7 kHz
SQUELCH SENSITIVITY	<6 dB SINAD
FREQUENCY RESPONSE	EIA RS 316-B

	NO DEGRADATION	3 dB DEGRADATION	6 dB DEGRADATION
MAXIMUM FREQUENCY SPREAD	2 MHz	4 MHz	6 MHz
RF INPUT IMPEDANCE	50 ohms		

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

DESCRIPTION

General Electric MPI Personal radios are extremely compact, high performance two-way FM radios designed for operation in the 450-470 MHz range. The lightweight radio utilizes both discrete components and Integrated Circuit modules (IC's).

All operating controls except the Push-To-Talk (PTT) switch and frequency select switch are conveniently located on the top of the radio. The frequency select and PTT switches are located on the side of the radio. An earphone jack, located above the PTT switch, is used with an earphone to provide message privacy, or to permit the operator to receive messages in noisy locations.

Power for the radio is supplied by a rechargeable nickel-cadmium battery pack that fits in the bottom front section of the case. The battery pack can be recharged either in or out of the radio.

Test Adaptor 4EX12A12 is available to provide audio connections for servicing the transmitter and receiver.

OPERATION

If the radio is equipped with an option switch, disable the option before adjusting the radio by placing the switch in the OFF or MONITOR position. After adjusting the radio, place the option switch back in the CG OR T99 position (See Figure 1).

ADJUSTING THE RADIO

To Receive a Message:

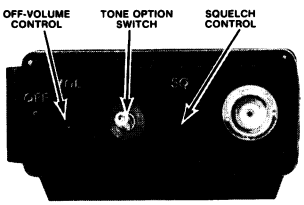
1. Turn the OFF-VOLUME control about half way to the right.
2. Disable any option by placing the option control toggle switch (if present) in the OFF or MONITOR POSITION.
3. Turn the SQUELCH (SQ) control to the right as far as possible. A hissing sound will be heard from the speaker.
4. Adjust the VOLUME control until the hissing sound is easily heard but not annoyingly loud.
5. Turn the SQUELCH control slowly to the left until the hissing noise just stops. This adjustment is very important as it eliminates annoying noise when no one is calling you. It also determines how sensitive your radio will be to incoming calls.
6. In two-frequency units, select the proper frequency. You are now ready to receive messages from other radios in your system.

To Send a Message:

1. Turn on the radio as directed in the "To Receive a Message" section.
2. In two-frequency units, select the proper frequency. Then listen to make sure that no one is using the channel.
3. Hold the radio so that the antenna is vertical. Then, press the Push-To-Talk (PTT) bar and speak directly into the microphone in a clear and distinctive voice. Always release the PTT bar as soon as you stop talking. You cannot receive messages while the PTT bar is pressed.

CHARGERS

Three battery chargers are available for recharging the Nickel-Cadmium battery pack. For specific instructions, refer to the applicable operating instruction or maintenance manual.



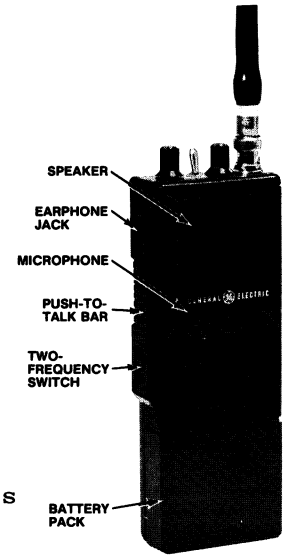
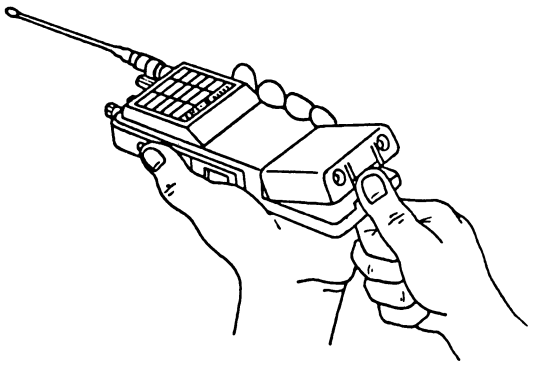


Figure 1 - Operating Controls

BATTERY PACK REPLACEMENT

To remove the battery pack from the radio:

1. Turn the radio OFF.
2. Place thumb on bottom of battery pack and press battery pack toward the top of radio as shown.
3. Then push bottom of battery pack away from the radio.



WARNING

Do not dispose of battery packs or batteries by burning. To do so may cause an explosion.

OSCILLATOR CRYSTAL REPLACEMENT

Crystals Y1, Y2, Y4, and Y5 are plug-in types for ease of replacement. Note that one lead is grounded to the crystal can. This lead must be plugged into the socket which is connected to the ground plane of the Transmit/Receive Board.

CIRCUIT ANALYSIS

TRANSMITTER

The Transmitter is a crystal-controlled, frequency modulated transmitter for one- or two-frequency operation in the 450-470 MHz bands. The transmitter utilizes discrete components to provide a minimum RF power output of two watts. The transmitter consists of the following assemblies.

- Audio Board - with the microphone amplifier/limiter, post-limiter filter and oscillator compensator circuits.
- Transmit/Receive (TR) Board - Oscillators, Multiplier stages, amplifier, driver and PA stages, TR switch, and low-pass filter.

All supply voltages for the transmitter are provided by the battery and the Regulator. The different transmitter voltages required are shown in the following chart:

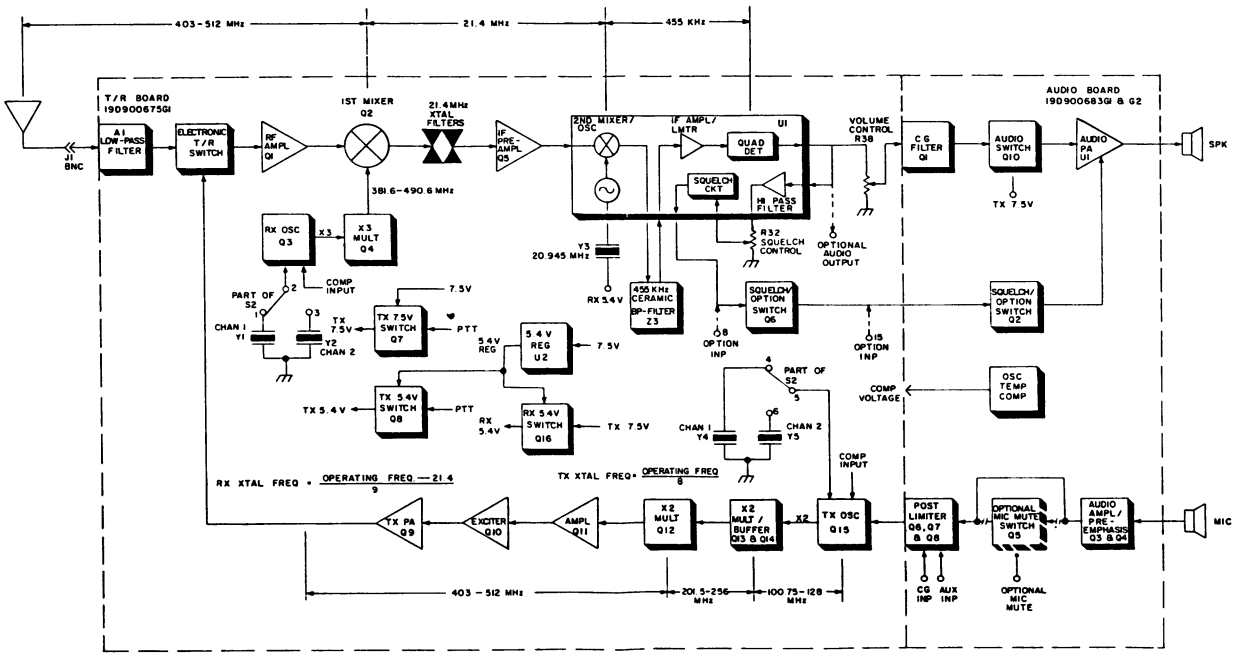


Figure 2 - Block Diagram

RC4346A

Voltage	Used For
Continuous 7.5 Volts	Post-limiter filter, driver and PA circuits
Switched TX 7.5 Volts	Multipliers, 1st amplifier, and drivers base voltage
Switched TX 5.4 Volts	Mic amp/limiter, microphone and oscillators
Regulated 5.4 Volts	Compensator and modulator circuits

References to symbol numbers mentioned in the following text are found on the Schematic Diagrams, Outline Diagrams and Parts List. A block diagram of the complete transmitter and receiver is shown in Figure 2.

AUDIO CIRCUITS

Audio from the microphone is applied to a 6 dB pre-emphasis network (R16, D1, C15, and C18) and then to amplifier-limiters Q3 and Q4. The output of Q4 is applied to the post-limiter filter consisting of Q6, Q7, Q8 and associated circuitry.

The output of the post-limiter filter is coupled through C30 and the modulation circuitry to transmitter oscillator Q15.

A compensator circuit (Q9 and R36 through R40) provides frequency compensation at low temperatures for the transmitter and receiver oscillators.

T/R BOARD

OSCILLATOR

The temperature compensating DC voltage and audio is applied to FM modulators D6 and D7 through MOD ADJ controls R67 and R73. The modulator varactor varies the transmit frequency at the audio rate applied from the audio board.

Q15, Y4, Y5 and associated circuitry comprise a Colpitts oscillator. The transmit oscillator is adjusted to the assigned operating frequency by L39 and L42. The oscillator output is applied to buffer Q14. Channel 1 or Channel 2 is selected by S2.

L37 in the collector circuit of Q15 is tuned to the second harmonic. L36 provides additional filtering before multiplier/buffer stages Q13 and Q14. Drive to the multiplier/buffer stages can be monitored at J10 (TP4).

MULTIPLIERS

THe output of Q13 is tuned to the fourth harmonic by L34 and L35, and applied to the base of multiplier Q12.

The output of multiplier Q12 is tuned to the eighth harmonic by C78 and C81. The emitter voltage of Q12 can be monitored at J9 (TP5).

AMPLIFIERS AND PA

Following Q12 is Class B amplifier Q11. Emitter voltage can be monitored at J8 (TP6). The output of Q11 is tuned by C70 to provide maximum drive to Q10. The output of Q10 is applied to the base of PA transistor Q9. C63 is tuned to provide impedance matching to the PA stage.

A collector feed network consisting of L19, L20, L24, L25, L57, C61, C66, C68, R44 and R47 acts as a stablizing and decoupling network for Q9 and Q10.

Power adjust control C56 is used to set the output power to two watts. The PA output is applied to the antenna switch.

ANTENNA SWITCH

The solid state antenna switch consists of A1-D1, C1, C2, L1 and D1 on the TR board. The circuit acts as a 1/4-wave line simulator.

Keying the transmitter applies approximately 1.6 volts to the anode of A1-D1, forward biasing the diode. When A1-D1 is forward biased, the 1/4-wave line appears as an open circuit to the RF output of the transmitter. This allows the transmitter output to be coupled through the low-pass filter to the antenna. L17, C102 and R43 provide bias and decoupling for the antenna switch.

The antenna switch acts as a 50-ohm line in the receiver mode (A1-D1 not for ward biased).

RECEIVER

The receiver is a dual conversion, superheterodyne FM receiver designed for one or two-frequency operation in the 450-470 MHz frequency range. A regulated 5.4 volts is used for all receiver stages except for the audio PA IC, receiver RF amplifier, and mixer which operate from the 7.5 volt battery.

The receiver has intermediate frequencies of 21.4 MHz and 455 kHz.

Adjacent channel selectivity is obtained by using three band-pass filters: (2) 21.4 MHz two-pole crystal filters and a 455 kHz ceramic filter.

All of the receiver circuitry except the audio PA and oscillator compensator is mounted on the transmitter/receiver (TR) board. The receiver consists of:

- Receiver Front End
- 21.4 MHz 1st IF circuitry
- 1st and 2nd Oscillators
- 455 kHz 2nd IF circuitry with FM Detector
- Audio PA Circuitry
- Squelch Circuitry

RECEIVER FRONT END

An RF signal from the antenna is coupled through the low-pass filter, antenna switch, and image filter to the emitter of RF amplifier Q1. The image filter consists of C3, C4, C5, C108 and L2.

The output of Q1 is coupled through two tuned circuits that provide most of the front end selectivity. The tuned circuits are L3, R4, C8 and C9, L4 and L5.

OSCILLATOR AND MULTIPLIER

Q3, Y1, D2 and associated circuitry make up a Colpitts oscillator. The frequency is controlled by a third mode crystal operated at one ninth of the required injection frequency. Voltage-variable capacitor D2, L48 and Y1 are connected in series to provide compensation capability. The compensation voltage used to control the transmitter oscillators is applied to D2 to maintain stability. L48 is adjustable to set the oscillator frequency. R8 is in parallel with Y1 to insure operation on the third overtone of the crystal.

The oscillator output is coupled through two tuned circuits (L12-C25 and L13) to the base of tripler Q4. C25 and L13 are tuned to the third harmonic of the oscillator frequency. The output of tripler Q4 is coupled to the gate of first mixe Q2 through two tuned circuits (L14 and L15). L14 and L15 are tuned to the operating frequency minus 21.4 MHz which is the ninth multiple of the crystal frequency.

The DC level of the oscillator can be monitored at J6 (TP1). The meter reading at this point is typically 5.2 volts. The DC level of tripler Q4 can be measured at J7 (TP2). This meter reading is typically 5.2 volts.

1ST MIXER AND IF FILTER

The 1st mixer uses FET (Q2) as the active device. The FET mixer provides a high input impedance, high power gain and an output relatively free of intermodulation products.

In the mixer RF from the front end filter is applied to the gate of the mixer. Injection voltage from the multiplier stages is also applied to the gate of the mixer. The 21.4 MHz mixer 1st IF output signal is coupled from the drain of Q2 to crystal filters Z1 and Z2. Tuneable capacitor C12 is used to match the mixer output to the input of Z1.

The highly-selective crystal filter provides the first portion of the receiver IF selectivity. The output of the filter is coupled through R20 to the 1st IF amplifier.

Supply voltage for the RF amplifier and 1st mixer can be metered at J5 (TP3). The meter reading is typically 7.4 volts.

1ST AND 2ND IF AND DETECTOR STAGES

The 21.4 MHz IF output of the crystal filters is applied to the base of IF amplifier Q5. The amplifier provides approximately 12 dB of IF gain. The output of Q5 is coupled through C35 to the input of the 2nd Mixer IC.

U1A and associated circuitry consists of the 2nd oscillator and mixer. The crystal for the oscillator is Y3. The oscillator operates at 20.945 MHz for low side injection of the 2nd IF (standard), or 21.855 MHz for high side injection for those radios determined to be operating on a tweet frequency. This frequency is mixed with the 21.4 MHz input to provide the 455 kHz 2nd IF frequency.

The output of U1A is coupled through ceramic filter Z3 which provides the 455 kHz selectivity. The filter output is applied to U1B.

U1B and associated circuitry consists of an IF amplifier, 455 kHz limiter and a quadrature type FM detector. L10 is the quadrature detector coil. Volume control R38 is used to set the audio output level to the audio amplifier. R37 and C48 provide a low pass filter to remove 455 kHz from the audio.

AUDIO AND SQUELCH CIRCUITS

Audio

Audio from the VOLUME arm is coupled through a twin-T Channel Guard notch filter that consists of Q1 and associated circuitry. The filter attenuates any audio frequency below 211 Hz.

The audio output from the filter is coupled through receiver muting switch Q10 to audio amplifier U1. Q10 is turned on in the receive mode to pass the audio. The 500 milliwatt audio output of U1 is coupled through C10 to the speaker and earphone jack.

A 6 dB/octave de-emphasis is provided by C12, C34, C6 and R10 in the audio feedback path. R7 and C5 provide additional de-emphasis at higher frequencies.

Squelch

The squelch circuit operates on the noise components contained in the FM detector output. The output of U1B is applied to a high-pass filter consisting of U1C, and associated circuitry. The output of U1C is noise in a band around 8 kHz.

With no RF signal present, the noise is rectified by D4 and a negative voltage is applied to the input of U1D, keeping it turned off and the receiver muted.

Pressing the PTT switch also forward biases clamping diode D5, keeping U1D input bias at the correct standby voltage in the transmit mode.

When an RF signal is received (receiver unsquelches), no noise is rectified by D4 and the input voltage at pin 12 of U1D rises to approximately +1 volt. This positive voltage turns on U1D, causing the output at U1D-14 to go positive, turning on buffer Q6. When turned on, the collector voltage of Q6 goes low, turning on PNP audio board squelch switch Q2. Turning on Q2 applies 7.5 volts to audio amplifier U1. This turns on U1 so that audio is heard at the speaker.

VOLTAGE REGULATOR AND TR SWITCHES

Turning off-on switch to the "on" position applies 7.5 volts to voltage regulator U2. The regulator output is set for 5.4 volts by regulator adjust control R40.

TRANSMITTER SWITCHES

Pressing the PTT switch turns on Q7 and Q8. When Q7 is turned on, 7.5 volts from the battery is applied to the transmitter multipliers and 1st amplifier stages. The 7.5 volts is also applied to the gate of receiver muting FET Q10. The positive voltage on the gate turns Q10 off and mutes the receiver in the transmit mode. The switched 7.5 volts is also applied to the base of RX 5.4 volt switch Q16, turning the switch off in the transmode.

RECEIVER SWITCH

Releasing the PTT switch turns off the transmitter switches and turns on receiver switch Q16. This applies 5.4 volts to the receiver oscillators, IF amplifier, audio and squelch stages.

DISASSEMBLY

To remove the front cover for servicing, first remove the battery. Then remove the two screws at A and lift off the front cover (See Figure 3).

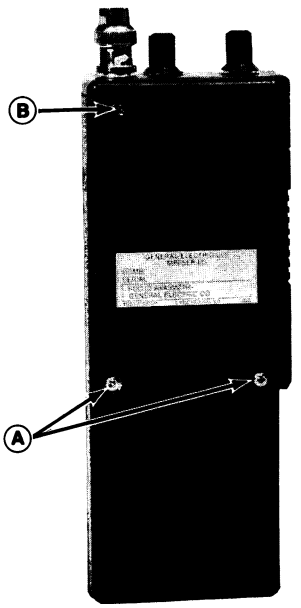


Figure 3 - Disassembly

To gain access to the back of the TR board, remove the two screws at A and the screw at B and remove the front and back covers.

CAUTION

Due to the excellent "drive" capability of the miniature TORX®-head screws, it is relatively easy to overtorque and damage the screws. The torque required for the screws is as follows:

1. 4 inch-pounds for the three M2.5 screws in the back cover.
2. 2 1/4 inch-pounds for the three M2 screws holding the accessory area cover plate (under the battery).

DO NOT OVERTORQUE!

If the radio is equipped with an option board, in addition to the above steps, the three screws holding the option cover must be removed.

NOTE

The option board must be slightly raised to clear the option cover mounting boss before removing the back cover.

CAUTION

Do not bend the thin option board material any more than necessary.

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

GENERAL ELECTRIC*
U.S.A.

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 flim 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.

REMOVING 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.

REPLACING 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.

HOLE CHART

HOLE	DESCRIPTION
1	PTT SWITCH GND
2	OPT. GND
3	OPT. SW. GND
4	OPT. +7.5V
5	$\overline{\text{PTT}}$ FROM OPT.
6	OPT. +5.4V REG.
7	DISCRIMINATOR OUTPUT
8	OPT. $\overline{\text{MUTE}}$
9	$\overline{\text{PTT}}$ OUTPUT TO OPTIONS
10	PTT SWITCH (HOT)
11	CG TONE INPUT TO XMTR
12	FROM OPT. TO OPT. SW. CONN.
13	FROM OPT. SW. TO OPT. CONN.
14	$\overline{\text{PTT}}$ OUTPUT FROM OPTIONS
15	SQUELCH FROM OPTIONS
16	TX +7.5V
0	
18	JUMPER WIRE
19	
20	GND. FOR RF CHOKE
21	OPTION SW GND FOR MIN LO VOL OPTION

TEST POINT CHART

TP	FUNCTION	TYP. V
1	RX INJ TUNING	5.2
2	RX INJ TUNING	5.2
3	RX INJ TUNING	7.4
4	TX DRIVE TUNING	0.4
5	TX DRIVE TUNING	0.6
6	TX DRIVE TUNING	0.8
7	BATTERY INPUT	7.5
8	GROUND	0

SYMPTOM	PROCEDURE
No 7.5V Supply	Check power connections and continuity of supply leads, and check fuse. If fuse is blown, check radio for shorts.
Low 7.5V Supply	Check for low or uncharged battery possibly with bad cell.
No 5.4V Regulated Supply	Check the 7.5V supply at pin 4 of regulator U2. Then check adjustment of the voltage adjustment pot, R40. If a large standby current (i.e., >100 mA) is seen, check for a short to ground on the 5.4V output line.
No Rx 5.4V	Check the 5.4V regulated supply. Then check switching transistor Q16.
No Audio Output	Check audio board squelching transistor, Q2. If the audio amplifier U1 is properly biased on, inject a 50 mV RMS, 1 kHz signal into the preceeding stages until the faulty stage is isolated as follows. This signal must be capacitively coupled from the audio generator using a 1 uF electrolytic capacitor to avoid shifting bias voltages. Sequentially inject signal into the following points on the audio board: Pin 3 of U1, emitter of Q1, base of Q1, and P2-5 (volume control dependent). If the problem is not found on the audio board, check for recovered audio on the main board with an oscilloscope. Recovered audio should be seen at Pin 9 of U1, at Hole 7, and at Pin 3 of R38 (as well as the wiper depending upon position).
Low Audio	Measure supply voltage at Pin 6 of audio board IC (U1) and gate voltage of Q10. Verify that at least 150 mV (424 peak-to-peak) is present at Hole 7 when a strong RF signal is applied to the radio with standard test modulation. Check quad coil (L16) setting.
Distorted Audio Output	Apply a strong RF signal with standard test modulation and measure audio distortion into an 8 ohm dummy load (e.g., test adaptor box). Distortion should be less than 5% at 2 volts output at 1 kHz. If there is low electrical distortion and acoustical distortion is still present, listen with test box or swap front covers with another radio to test speaker.
No or Incorrect Detector Output	Verify bias to Pins 4 and 8 of the main board IC, U1. Using a 50 ohm probe, inject a strong 21.4 MHz modulated signal into Pin 16 of U1. Recovered audio should be seen at Pin 9 and the level should vary with the setting of quad coil, L16. If none is seen, check the second oscillator for activity. At least 80 mV of RF should be seen on Pin 1 to ground.
No 2nd Oscillator Activity	Substitute a known good crystal for Y3. Check voltages on U1 pins 1 and 2.
Radio Permanently Squelched	Verify that main board IC, U1, is properly biased at Pins 4 and 8 and that quad coil L16 is correctly adjusted. The voltage at the Schmidt trigger input (U1 Pin 12) should rise and fall with the setting of R32. The output at pin 14 should switch bias on and off to the base of Q6 as the input threshold is crossed. The collector of Q6 should saturate and unsquelch the radio once the input (Pin 12) is above the threshold, approx. 0.8V.
Radio Won't Squelch	Verify that main board IC, U1, is properly biased at Pins 4 and 8 and that quad coil L16 is correctly adjusted. An oscilloscope should see high frequency (approx. 8 kHz) noise at the noise filter output, U1 pin 11. This noise should be seen at the wiper of R32 (dependent upon position) and should be negatively rectified by D4. The remainder of the squelch circuit is described under the "Radio Permanently Squelched" section.

SYMPTOM	PROCEDURE
Poor or No Sensitivity	Verify that proper injection power is present and at the correct frequency, (f_c -21.4)/9. This can be done by 50 ohm probing from the junction of C33 and C103 to ground. The power seen should be approximately 0 dBm. If OK, then use the 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 the IC (U1) 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	Verify that tuning procedure has been done or tried. The oscillator string can be trouble shot by using a 50 ohm probe connected to a power meter capable of measuring power as low as -20 dBm. Probe the available power points to ground indicated on the large service schematic. The power seen should be approximately that shown on the schematic. Any adjustment needed during probing is indicated on the schematic. Start probing with the oscillator and proceed towards the mixer. Bias voltages are also shown on the schematic for both a running and non-running oscillator. To kill a running oscillator, place a .01 uF ceramic capacitor with short leads from the base to collector of the oscillator transistor Q3.
Frequency Won't Adjust Properly	Check compensator voltage at P3-2 and at varicap (D2, D6, D7 or D9). Check anode voltage of varicap.
No Transmit 5.4V	Check the switching transistor Q8.
Radio Won't Go Into Transmit Mode	Verify that Hole 9 is going to ground when the PTT switch is pushed. If Channel Guard is present, first short Hole 9 and then Hole 5 to ground. Both operations should cause the radio to go into transmit mode unless a problem exists with the Channel Guard circuitry.
Low or No Transmit Power	Check battery voltage when in transmit. Low or uncharged battery or shorted cell will be <7 volts. If the total transmit current is >500 mA, check the low pass filter and T/R switch. 1.6 VDC at C102 indicates that the radio is in the transmit mode. If the total transmit current is >100 mA, measure the base bias of Q10. Check for proper test point readings at TP4, TP5, TP6.
Low TP6	0.5 - 0.8 VDC indicates proper drive into Q11. 0.3 VDC indicates no drive. Check the bias voltages.
Low TP5	0.6 - 0.8 VDC indicates proper drive into Q12. 0 VDC indicates no drive. Check the bias voltages.
High TP4	0.3 - 0.6 VDC indicates proper drive from the oscillator. With no oscillator activity TP4 will be 0.7 VDC.
Oscillator Frequency Will Not Adjust Properly	Check the compensator voltage at P3-2. Check the anode voltage of the varicap.
No Transmitter Deviation	Disconnect the front cover and connect the test box. Apply 600 mV to TX audio. Check the DC and Audio Voltages on the Audio Board as indicated on the service schematic during transmit. If values are as indicated, substitute another front cover to test the microphone.

TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. Power Supply (7.5 Volts, 1 Ampere).
2. 50 ohm Wattmeter with 50 ohm load
3. Audio Oscillator
4. Deviation Monitor
5. Frequency Counter
6. Voltmeter
7. MPI Tune-up Kit TS10 (contains coil tuning tools, capacitor tuning tools, dummy battery, audio board jumper cables, and a 50 ohm probe).
8. Test adaptor 4EX12A12 and MPI cable 19B234242G1 (Option 2847).

PRELIMINARY STEPS AND ADJUSTMENTS

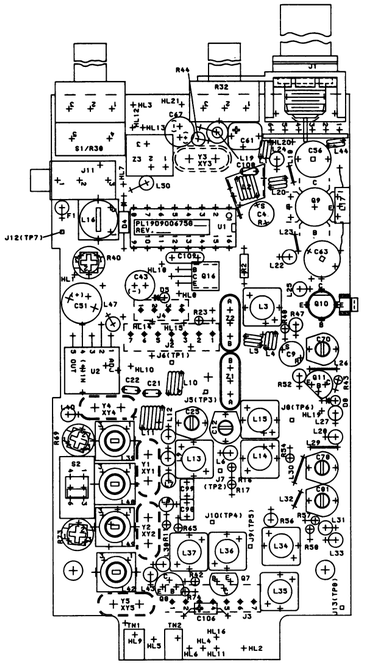
1. In addition to the antenna mounting bracket screw, the radio must be held tight against the back cover at the lower right corner near the negative battery terminal (e.g. use a 4-40 screw and nut).
2. Unplug the audio board and front cover from the main board.
3. Turn regulator output control R40 fully counterclockwise if voltage hasn't been previously adjusted. Insert the dummy battery into the battery pack area and apply 7.5 Volts to the RED terminal (BLACK terminal is ground) on dummy battery pack.
4. Connect multimeter to the output (Pin 5) of U2 (or J2-7) and ground, and adjust R40 for 5.4 Volts ±0.01 Volt. Try not to exceed 6 volts during adjustment.
5. Pre-set the tuning slugs in L39 (and L42 in two-frequency radios) to the center of their tuning range.
6. All adjustments are made with the transmitter keyed and Channel Guard enabled, if present.

NOTE

In two-frequency radios, switch to the highest frequency.

ALIGNMENT PROCEDURE

STEP	METERING POINT	TUNING CONTROL	PROCEDURE
1.	TP4	L37 and L36	Decrease the supply voltage to 6.0 volts. Adjust L37 and L36 in that order for a dip in meter reading.
2.	TP5	L35 and L34	Adjust L35 and L34 for a peak in meter reading.
3.	TP6	C81 and C78	Adjust C81 and C78 in that order for a peak meter reading.
4.	Wattmeter	C70, C63 C56	Adjust C70, C63 and C56 in that order for maximum power output.
5.	Wattmeter	C56	Increase the supply voltage to 7.5 volts. Turn C56 in the direction that causes both the power and current to decrease, and adjust C56 for an output of 2.0 Watts. NOTE The transmitter is designed to provide optional radiation efficiency (antenna matching) when the transmitter is adjusted for approximately two watts. Tuning for higher power will degrade both radiated power and battery life.
		FREQUENCY ADJUSTMENT	
6.	Frequency Counter	L39 and L42	Plug the audio board onto the main board. In single frequency radios, adjust L39 for the proper frequency. In two frequency radios, switch to Channel 1 and adjust L39 for the proper frequency. Then switch to Channel 2 and adjust L42 for the proper frequency.
		MODULATION ADJUSTMENT	
7.	Deviation Monitor	R69 and R73	Connect the test adaptor with cable to J4 and switch to channel 1. Apply 600 millivolts at 1 kHz to the test adaptor and adjust R69 for 4.5 kHz deviation. In two-frequency radios, switch to channel 2 and adjust R73 for 4.5 kHz deviation.



(19D900676)

RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. 7.5 Volt power supply.
2. Floating terminal (non-grounded) multimeter with at least 3 1/2 digits and a 200 millivolt DC lowest range.
3. RF generator.
4. Distortion analyzer.
5. MPI tune-up kit TS10 containing coil tuning tools, trimmer capacitor tuning tools, dummy battery, audio board jumper cables and a 50 ohm probe.
6. Test Adaptor 4EX12A12 and MPI Cable 19B234242G1 (OPTION 2849).

PRELIMINARY CHECKS AND ADJUSTMENTS

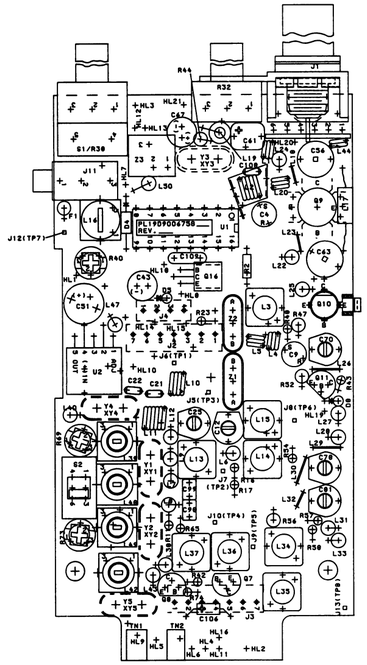
1. In addition to the antenna mounting bracket screw, the radio must be held tight against the back cover at the lower right corner near the negative battery terminal (e.g. use a 4-40 screw and nut).
2. Remove the front cover and unplug the Audio board from the main board. Then connect the audio board to the main board with the jumper cables.
3. Turn regulator output control R40 fully counterclockwise if voltage hasn't been previously adjusted. Insert the dummy battery into the battery pack area and apply 7.5 Volts to the RED terminal (BLACK terminal is ground) on dummy battery.
4. Connect multimeter to the output (Pin 5) of U2 (or J2-7) and ground, and adjust R40 for 5.4 Volts ±0.01 Volt. Try not to exceed 6 volts during adjustment.
5. Pre-set the tuning slugs in L3, L13, L14, L15, L48 and L49 to the top of the coil form. Next, set the arrow on the rotor of C12 and C25 so that it points towards the rounded end of the capacitor.
6. Disable Channel Guard, if present.

NOTE

In two-frequency radios, all adjustments are made on the lowest frequency except as directed.

ALIGNMENT PROCEDURE

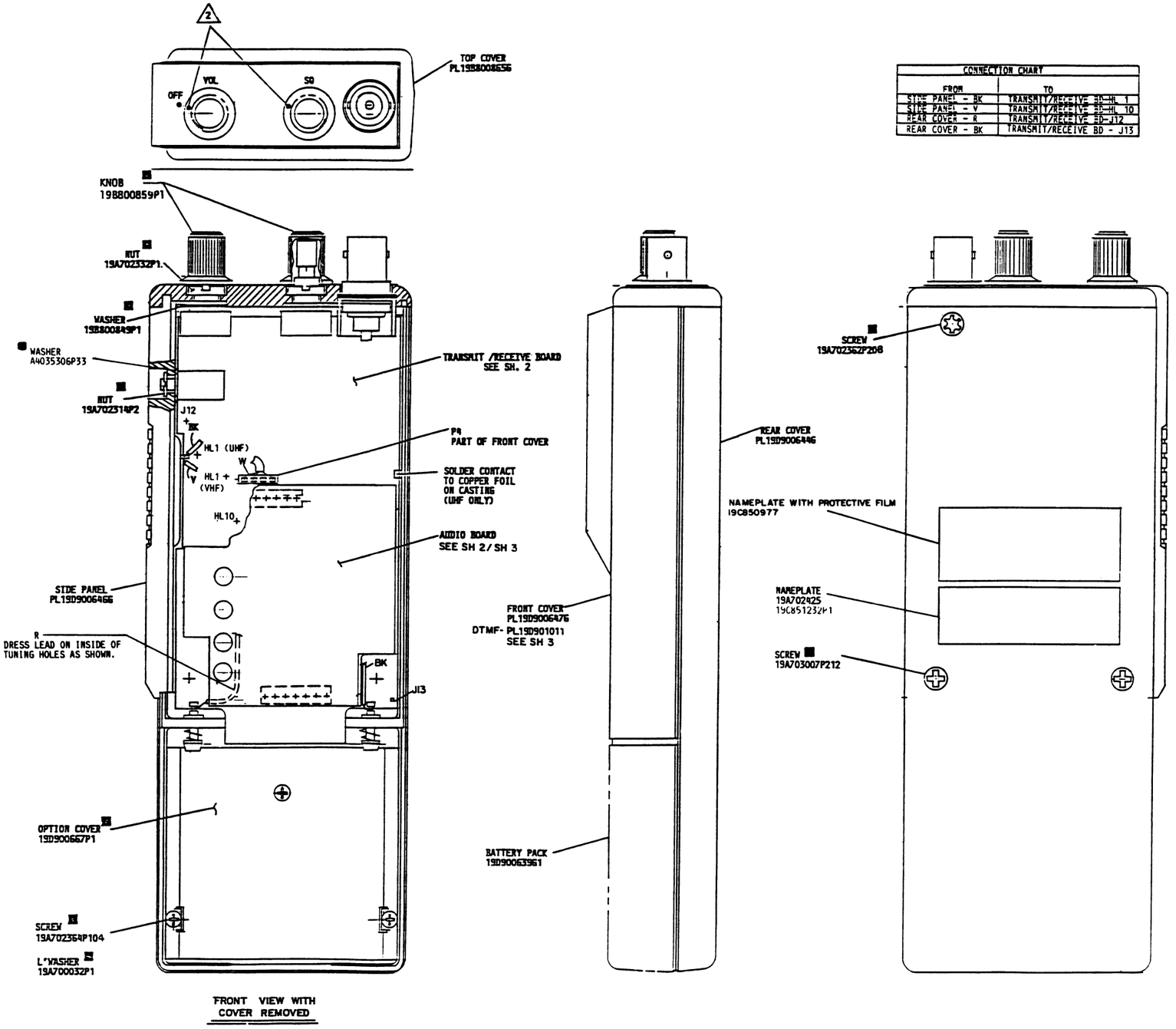
STEP	METERING POINT	TUNING CONTROL	PROCEDURE
		DETECTOR AND INJECTION ADJUSTMENT	
1.	J2-7 and TP1	L48 (Chan 1) or L49 (Chan 2)	For two frequency radios, select the lowest frequency. While measuring between J2-7 (regulator voltage) and TP1, adjust L48 or L49 for maximum meter reading (approximately 200 millivolts).
2.	J2-7 and TP2	C25 and L13	Measure between J2-7 (regulator voltage) and TP2, and adjust C25 and L13 for maximum meter reading. C25 will have more than one peak, so use only the highest peak. Then adjust C25 and L13 again for maximum meter reading.
3.	J2-1 and TP3	C9, L14 and L15	Measure between J2-1 (battery voltage) and TP3. Adjust C9, then L14 and L15 for maximum meter reading. If adjusting C9 shows no change, adjust L14 and then C9 and L15. L15 must be adjusted last.
4.	U1B-9 (on TR board)	L16	Using the 50 ohm probe, apply a strong unmodulated 21.4 MHz signal (>-60 dBm) to U1A-16 on T/R board and adjust L16 for a reading of 2.7 Volts ±0.1 Volt at U1B-9. Remember this reading. NOTE If a 21.4 MHz generator is not available, set L16 for 2.9 Volts ±0.01 Volt.
		FREQUENCY AND FRONT END ADJUSTMENT	
5.	U1B-9	L48 or L49	Connect the audio board to the TR board with the jumper cables in TS10. Apply a strong on-frequency signal (approx. 0 dBm) with no modulation to the antenna jack while metering U1B-9, and set the radio on frequency by adjusting L48 (Chan. 1) or L49 (Chan. 2) to the voltage obtained in Step 4. Then on two-frequency radios, switch to the higher frequency and adjust L48 or L49 for the same reading. NOTE If no signal source was used in Step 1, adjust L48 or L49 for 2.7 Volts ±0.1 Volt at U1B-9.
6.	Distortion Analyzer	C12, C4, L3 and C9	Switch to the lowest frequency. Then adjust C12, C4, L3 and C9 in that order for best quieting. Use a ceramic-tipped tuning tool for tuning C4 and C9 to prevent some tuning error.
7.	Distortion Analyzer	C4	On two-frequency radios, switch to the lowest frequency. Set the signal generator to the image frequency (42.8 MHz below the carrier frequency) and increase the RF level to approximately -60 dBm. Then adjust C4 for the worst quieting or SINAD.
8.	Distortion Analyzer	L3, L48 or L49	If the radio does not make sensitivity, readjust L3 (See Step 3). If radio still does not make sensitivity, slightly adjust the frequency on the appropriate channel, L48 (for Chan 1) or L49 (for Chan 2).



(19D900676)

ALIGNMENT PROCEDURE

RECEIVER



CONNECTION CHART	
FROM	TO
SIDE PANEL - BK	TRANSMIT/RECEIVE BD-HL 1
SIDE PANEL - V	TRANSMIT/RECEIVE BD-HL 10
REAR COVER - R	TRANSMIT/RECEIVE BD-J12
REAR COVER - BK	TRANSMIT/RECEIVE BD - J13

NOTES:

1. ITEMS MARKED ■ ARE PART OF HARDWARE KIT PL19A702379G1.

2. ROTATE OFF/ON-VOL POT TO EXTREME COUNTER CLOCKWISE (OFF) POSITION. ASSEMBLE KNOB WITH INDICATOR MARK ALIGNED WITH MARK ON TOP COVER. ROTATE SQUELCH TO EXTREME COUNTER - CLOCKWISE POSITION. ASSEMBLE KNOB WITH INDICATOR MARK IN APPROX. SAME POSITION AS THE OFF-ON/VOL KNOB.

3. CUT RUN ON SOLDER SIDE OF TX/RX BOARD 19D900722G1 WHEN LOWEST TX FREQ SPECIFIED IS BELOW 144 MHz OR ON TX/RX BOARD 19D900722G2 WHEN LOWEST TX FREQ SPECIFIED IS BELOW 158 MHz AS SHOWN IN DETAIL "G" (SH. #2).

4. WHEN NO TX CRYSTALS ARE SPECIFIED ON PRODUCTION TAG DO NOT CUT RUN SHOWN IN DETAIL "G" (SH. #2)

5. CUT RUN ON SOLDER SIDE OF TX/RX BOARD AND ADD JUMPERS AS SHOWN IN DETAIL "D" (SH. #2)

6. CUT RUN ON SOLDER SIDE OF TX/RX BOARD AND ADD JUMPERS AS SHOWN IN DETAIL "E" (SH. #2)

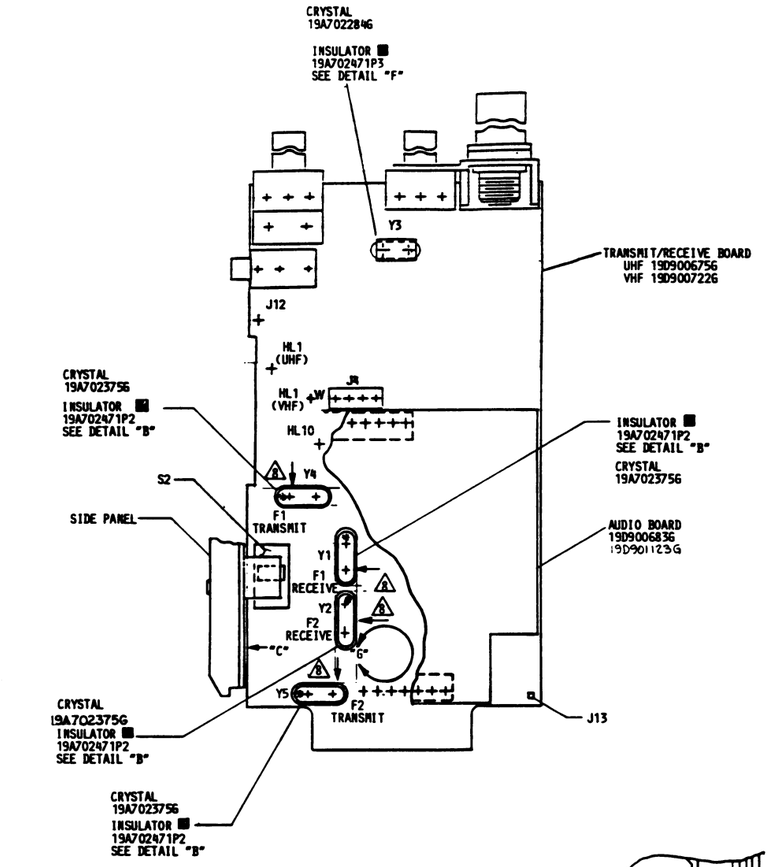
7. REFER TO PRODUCTION TAG TO DETERMINE WHICH OF THE FOLLOWING APPLY

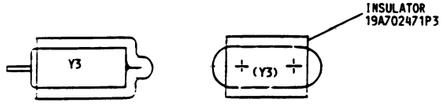
OPTION	INSTRUCTIONS
AO, BO	TX & RX CRYSTALS OMITTED DO NOT REMOVE SWITCH STOP SHOWN IN DETAIL "C" (SH. #2)
AA, BA AO, BA AA, BO	SINGLE FREQ. TX & RX DO NOT REMOVE SWITCH STOP SHOWN IN DETAIL "C" (SH. #2)
AB.BB AO.BB AB.BO	TWO FREQ. TX & RX REMOVE SWITCH STOP SHOWN IN DETAIL "C" (SH. #2)
AA, BA WITH ONE OR MORE FREQ'S LISTED AS OPEN	TWO FREQ. TX & RX WITH ONE SET OF CRYSTALS OMITTED. REMOVE SWITCH STOP SHOWN IN DETAIL "C" (SH. #2)

1. VHF SEE NOTES 3, 4 & 7
2. UHF SEE NOTE 1
3. VHF - TWO FREQ TX & SINGLE FREQ RX SEE NOTES 1 & 3
4. UHF - TWO FREQ TX & SINGLE FREQ RX SEE NOTE 1
5. DTMF SEE SH. #3
6. VHF - SINGLE FREQ TX & TWO FREQ RX SEE NOTES 1 & 6
7. UHF - SINGLE FREQ TX & TWO FREQ RX SEE NOTE 6

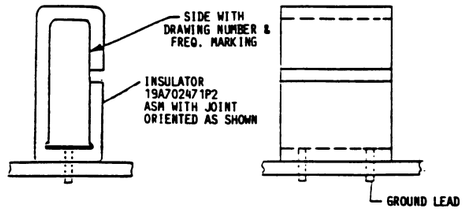
(19D900649, Sh. 1, Rev. 12)

MECHANICAL LAYOUT

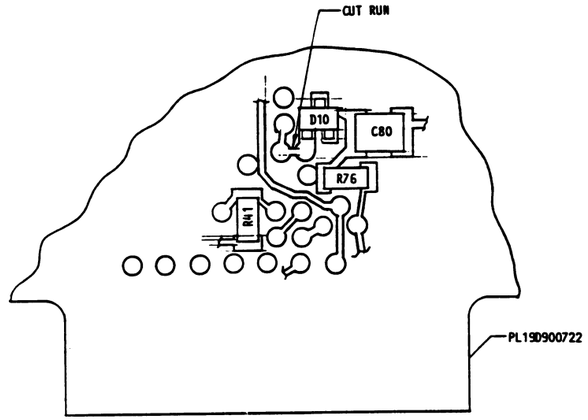




DETAIL "F"



DETAIL "B"
TYP. ASM. FOR Y1, Y2, Y4 & Y5

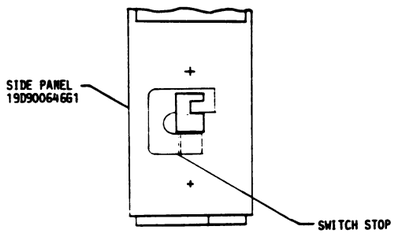


DETAIL "G"
SOLDER SIDE VIEW
(ENLARGED)

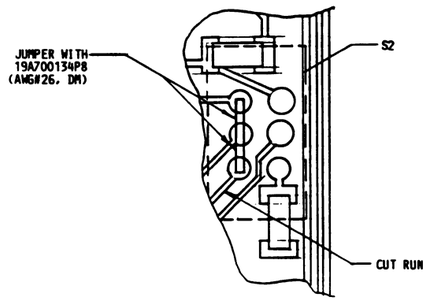
NOTES:

1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. PARTS MARKED ■ ARE PART OF HARDWARE KIT PL19A702379G1

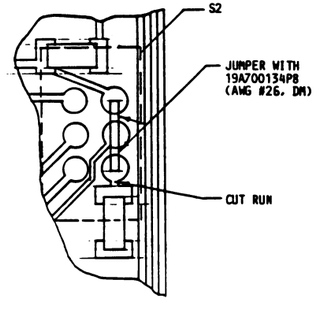
⚠8 ORIENT Y1 & Y4 AND Y2 & 5 SO THAT DWG. NO. & FREQ. MARKING IS AT SIDE INDICATED. GROUND LEAD MUST BE IN POSITION AS INDICATED BY ✱



VIEW AT "C"

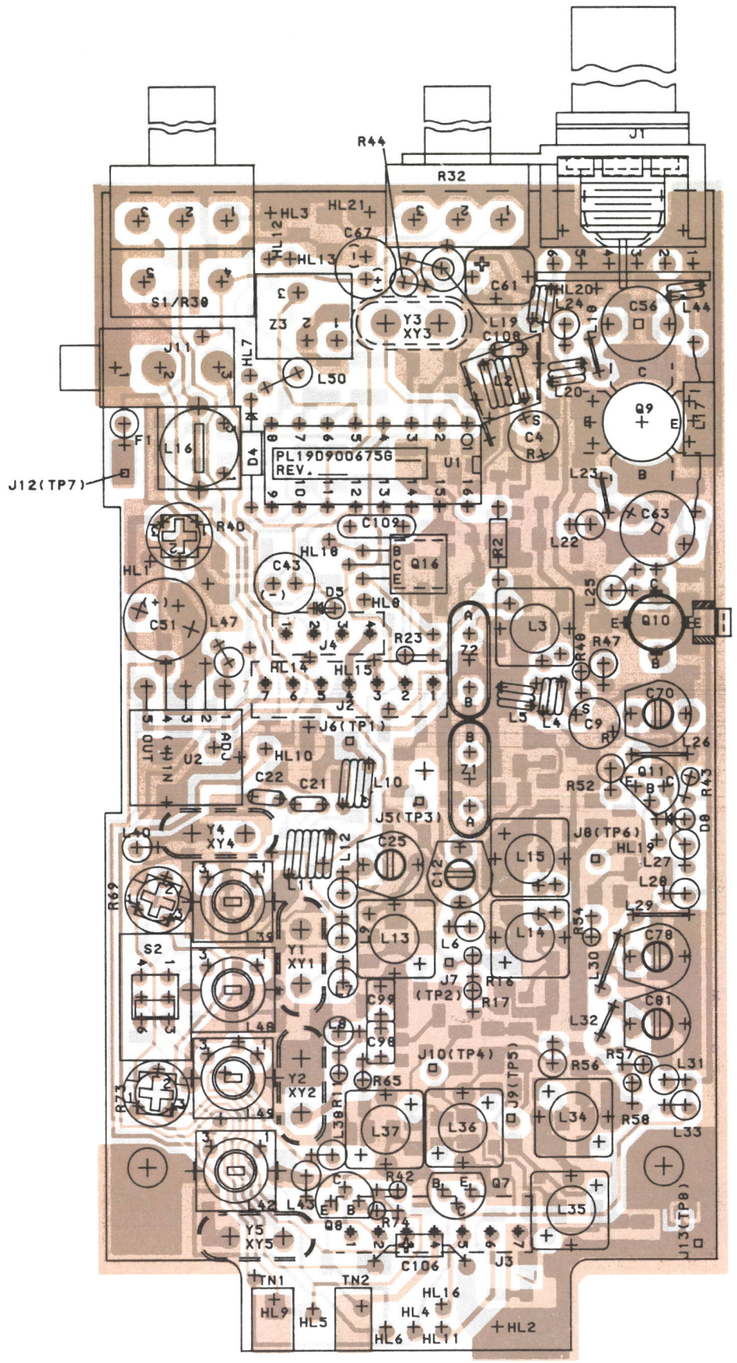


DETAIL "D" PART 3 & 4 ONLY
SOLDER SIDE VIEW
(ENLARGED)



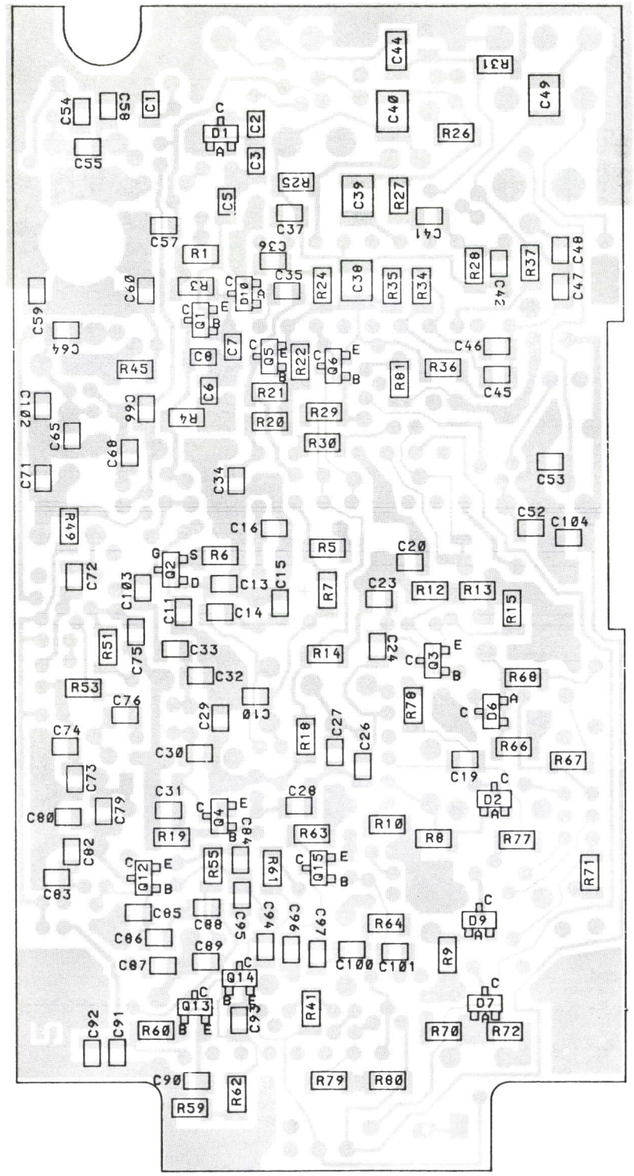
DETAIL "E" PART 6 & 7 ONLY
SOLDER SIDE VIEW
(ENLARGED)

(19D900649, Sh. 2, Rev. 10)



FRONT VIEW

(19D900676, Rev. 7)
(19A702246, Sh. 1, Rev. 5)
(19A702246, Sh. 2, Rev. 5)



REAR VIEW

(19D900675, Rev. 7)
(19A702246, Sh. 2, Rev. 5)

CAUTION

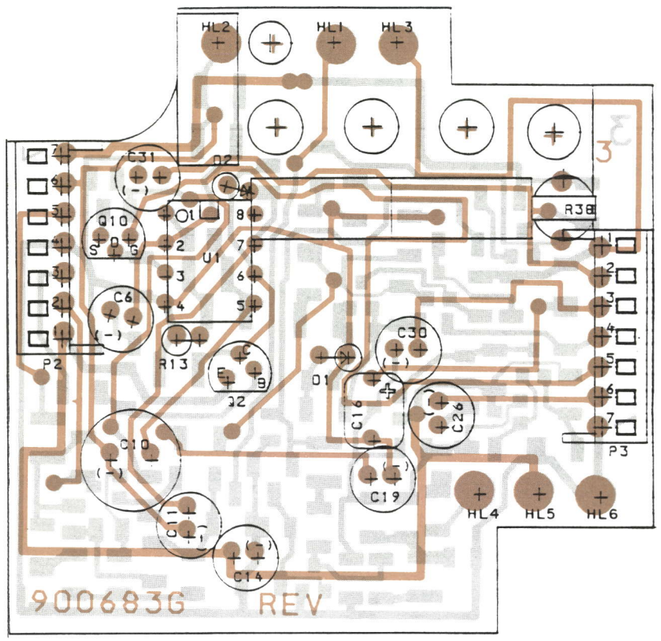
OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES

Q1 & Q2 on Main Board
Q10 on Audio Board

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

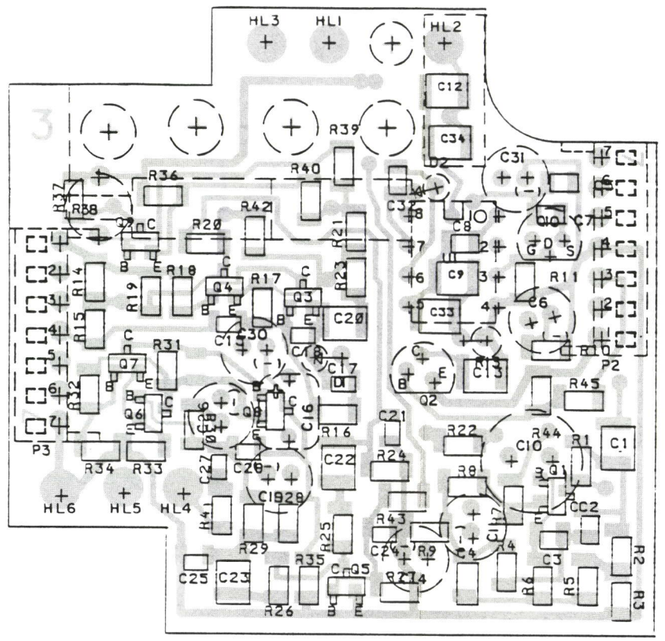
OUTLINE DIAGRAM

TRANSMITTER/RECEIVER BOARD



FRONT SIDE

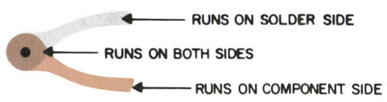
(19A702253, Sh. 1, Rev. 3)
(19A702253, Sh. 2, Rev. 3)



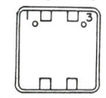
BACK SIDE

(19A702253, Sh. 2, Rev. 3)

(19D900684, Rev. 5)

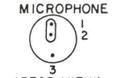


L16, L39, L42, L48 & L49



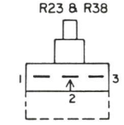
(BOTTOM VIEW)

MICROPHONE



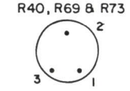
(REAR VIEW)

R23 & R38



(BOTTOM VIEW)

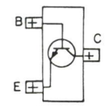
R40, R69 & R73



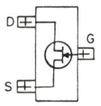
(BOTTOM VIEW)

STANDARD OUTLINE TRANSISTORS (SOTS)

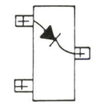
(TOP VIEW)



BIPOLAR



FET



DIODES & VARACTORS

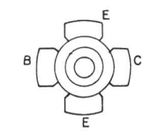
TO-92
(BOTTOM VIEW)

NPN

PNP

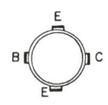
FET

Q9



LEADS ON BOTTOM OF BOARD

Q10



TOP OF BOARD

U2

TOP OF BOARD

RC 4372B

OUTLINE DIAGRAM

AUDIO BOARD

14 Issue 1

VOLTAGE READINGS:

VOLTAGE READINGS ARE TYPICAL VALUES MEASURED WITH A HIGH IMPEDANCE (ee:10MΩ) MULTI-METER FROM THE INDICATED POINT TO GROUND. CONDITIONS FOR READINGS ARE INDICATED BY THE FOLLOWING KEY:

R INDICATES VOLTAGES ARE TO BE MEASURED DURING RECEIVE MODE
T INDICATES MEASUREMENT DURING TRANSMIT
C INDICATES CONTINUOUS VOLTAGE ALWAYS PRESENT WHEN RADIO IS ON

NOTES:

⚠1 PART OF PWB.

3. # IDENTIFIES "CHIP" COMPONENTS (EXAMPLE C57#) WHICH ARE LOCATED ON SOLDER SIDE OF PWB.

4. † SEE COMPONENT IDENTIFICATION CHART.

5. ALL CHIP RESISTORS ARE 1/8 WATT.
ALL OTHER RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER k OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER u,n OR p.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m,u OR n.

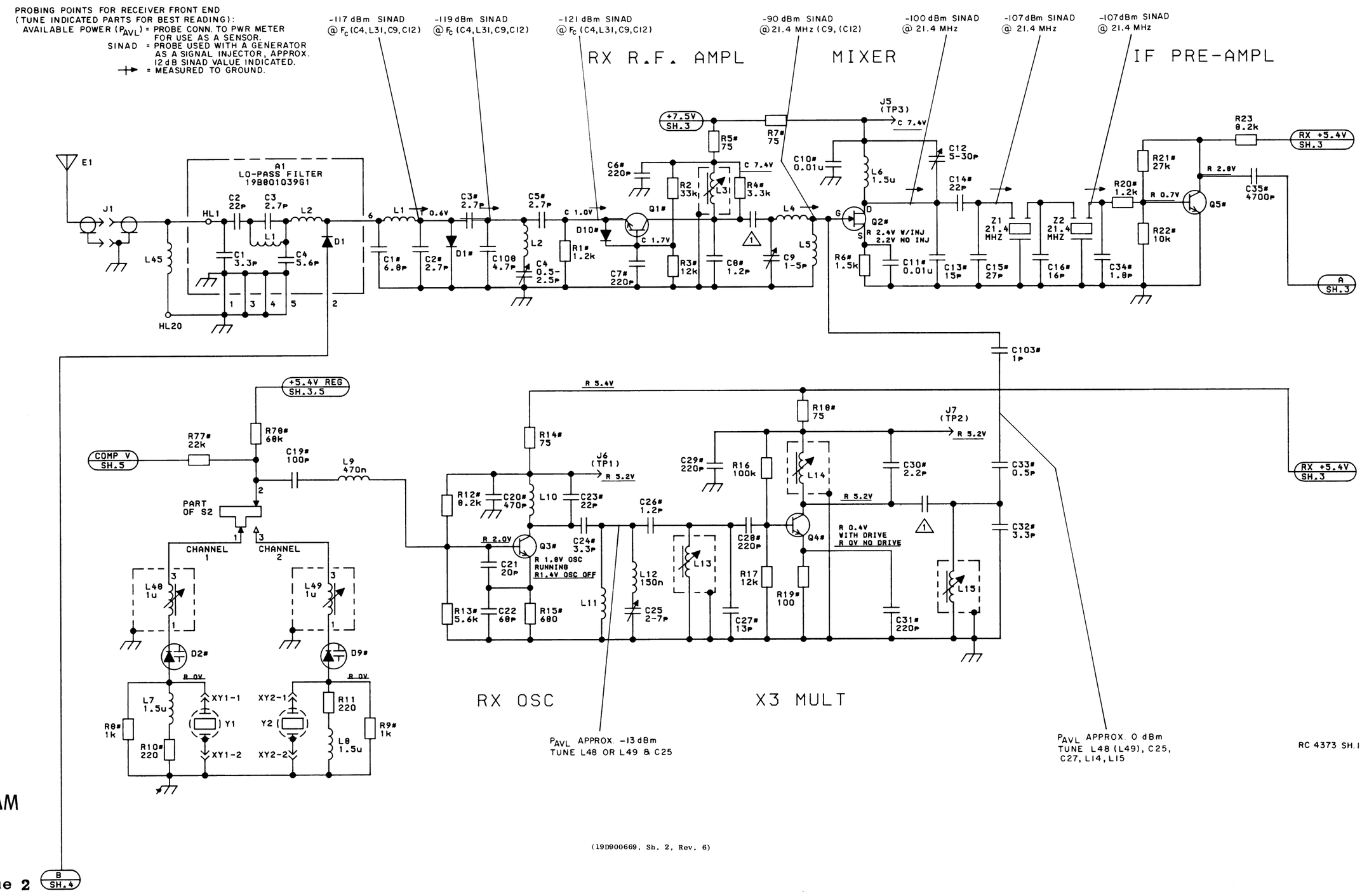
⚠6 CUT THIS RUN FOR CG/CCT OPTION.

DESCRIPTION	MODEL NO.	REV LTR
UHF T/R BOARD	PL19D900675G1	B
AUDIO BOARD	PL19D900683G1	A
AUDIO BOARD W/OPTION PARTS	PL19D900683G2	A
BATTERY	PL19D900639G1	
REAR COVER	PL19D900644G1	A
SIDE RAIL	PL19D900646G1	
FRONT COVER (STANDARD)	PL19D900647G1	
FRONT COVER (LICENSEE)	PL19D900647G2	
BATTERY	PL19D900639G2	

(19D900669, Sh. 1, Rev. 8)

SCHEMATIC DIAGRAM

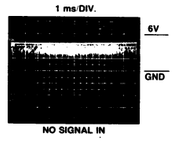
Sheet 1

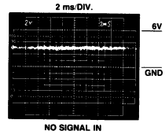


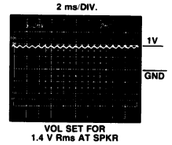
SCHEMATIC DIAGRAM

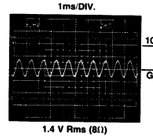
450-470 MHz RX
Sheet 2

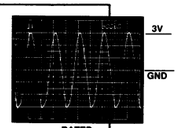
(19D900669, Sh. 2, Rev. 6)











HI PASS FILTER

SQUELCH

+5.4V REG SH.2,5

RX 5.4V SH.2

+7.5V SH.2,4,5

PART OF AUDIO BOARD PL19D900683

PTT

HL7

TONE OPTION HL2 RX AUDIO

EARPHONE J11

A SH.2

-100 dBM SINAD @ 21.4 MHz

XY3-1

Y3 20.945 MHz

XY3-2

RX +5.4V SH.2

SECOND MIXER

IF/DETECTOR

CHAN. GD. FLTR.

AUDIO AMPLIFIER

SIDE PANEL PL19D900646

PTT SWITCH

S1

EXT PTT TN1

TX +7.5V SH.4

TX +7.5V SWITCH

+7.5V

+5.4V REG

TX +5.4V SH.5

TX +5.4V SWITCH

VOLTAGE REGULATOR

RX +5.4V SH.2

RX +5.4V SWITCH

S1 PART OF R30

F1 3A

J12 (TP7)

REAR COVER PL19D900644

BATTERY PL19D900639

J13 (TP8)

7.5V

USED FOR OPTION SWITCH

PART OF FRONT COVER PL19D900647

B1 SPEAKER

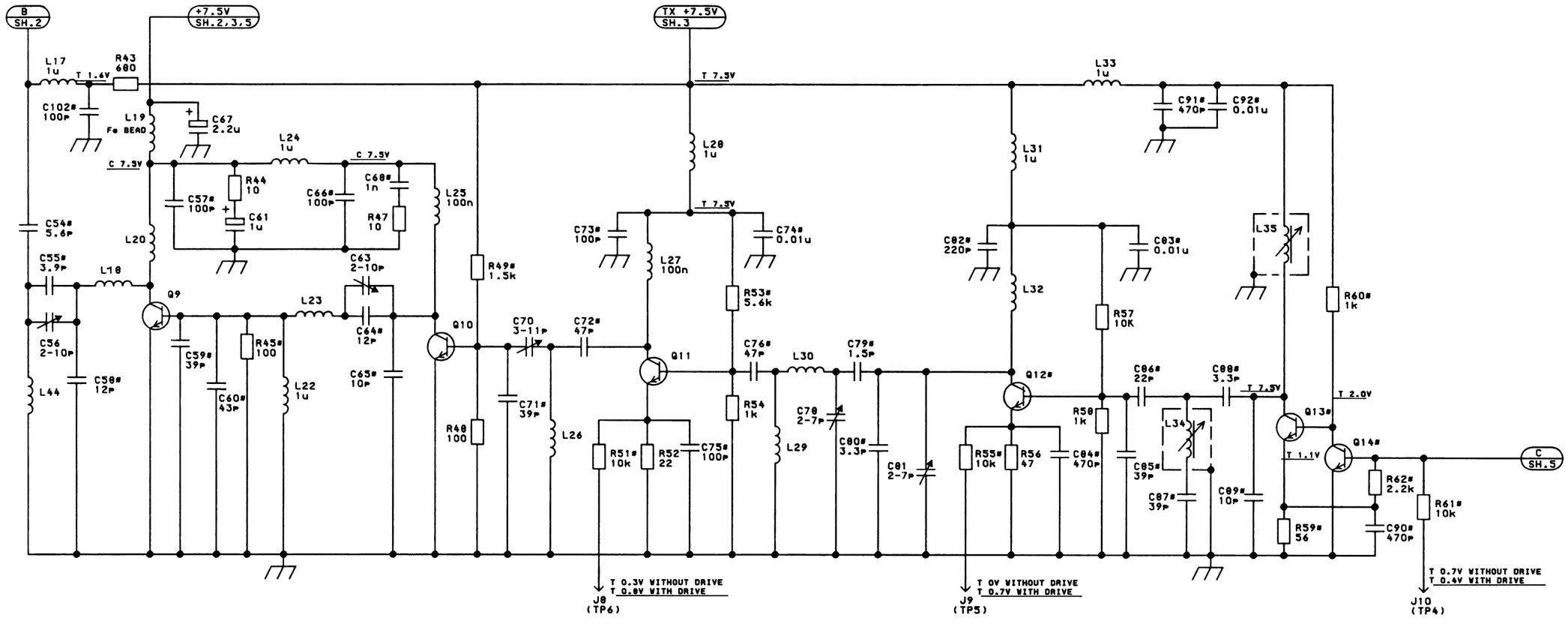
RC 4373 SH.2

D SH.5

(19D900669, Sh. 3, Rev. 7)

SCHEMATIC DIAGRAM

450-470 MHz RX
Sheet 3

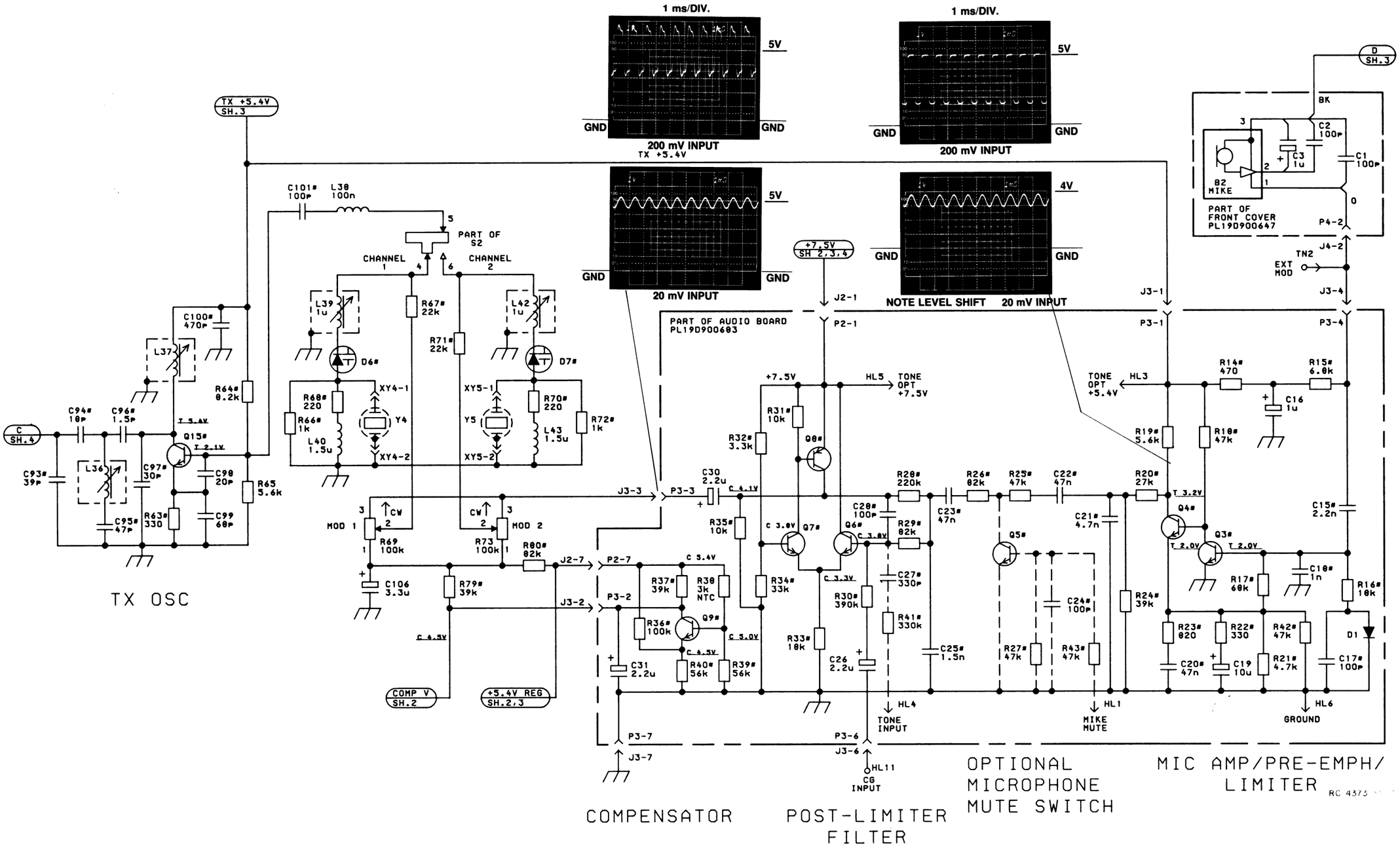


(19D900669, Sh. 4, Rev. 5)

SCHEMATIC DIAGRAM

RC 4373 SH.3

450-470 MHz TX
Sheet 4



(19D900669, Sh. 5, Rev. 2)

SCHEMATIC DIAGRAM

450-470 MHz TX
Sheet 5

PARTS LIST

TRANSMIT/RECEIVE BOARD
19D900675G1 - REV B
ISSUE 5

SYMBOL	GE PART NO.	DESCRIPTION
A1		FILTER BOARD 19B801039G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A700219P14	Ceramic: 3.3 pF ±10%, 100 VDCW, temp coef 0 PPM.
C2	19A700219P40	Ceramic: 22 pF ±10%, 100 VDCW, temp coef 0 PPM.
C3	19A700219P12	Ceramic: 2.7 pF ±10%, 100 VDCW, temp coef 0 PPM.
C4	19A700219P20	Ceramic: 5.6 pF ±10%, 100 VDCW, temp coef 0 PPM.
		- - - - - - - - - - - DIODES - - - - - - - - - -
D1	19A702411P1	Silicon; sim to Hewlett Packard 5082-3188.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A702472P3	Coil.
L2	19A702472P1	Coil.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A702061P11	Ceramic: 6.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM.
C2 and C3	19A702061P6	Ceramic: 2.7 pF ±0.5 pF, 50 VDCW, temp coef 0 ±120 PPM.
C4	19B800873P7	Variable, ceramic: 0.5 to 2.5 pF, 150 VDCW; sim to Johanson 9620.
C5	19A702061P6	Ceramic: 2.7 pF ±0.5 pF, 50 VDCW, temp coef 0 ±30 PPM.
C6 and C7	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C8	19A702236P7	Ceramic: 1.2 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM.
C9	19B800873P8	Variable, ceramic: 1 to 5 pF, 150 VDCW; sim to Johanson 9621.
C10 and C11	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C12	19A702168P4	Variable, ceramic: 5.2 to 30 pF, 100 VDCW; sim to JFD DV2SN30D.
C13	19A702061P21	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C14	19A702061P29	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C15	19A702061P33	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C16	19A702061P23	Ceramic: 16 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C19	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C20	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C21	19A700227P39	Ceramic: 20 pF ±5%, 100 VDCW, temp coef -1500 PPM.
C22	19A700231P59	Ceramic: 68 pF ±5%, 100 VDCW, temp coef -4700 PPM.
C23	19A702061P29	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C24	19A702061P7	Ceramic: 3.3 pF ±0.5 pF, 50 VDCW, temp coef 0 ±120 PPM.
C25	19A702168P1	Variable, ceramic: 2 to 7 pF, 100 VDCW; sim to JFD DV2SN7A.
C26	19A702061P2	Ceramic: 1.2 pF ±0.5 pF, 50 VDCW, temp coef 0 ±250 PPM.
C27	19A702061P19	Ceramic: 13 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C28 and C29	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C30	19A702236P10	Ceramic: 2.2 pF ±2.5 pF, 50 VDCW, temp coef 0 ±30 PPM.
C31	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C32	19A702061P7	Ceramic: 3.3 pF ±0.5 pF, 50 VDCW, temp coef 0 ±120 PPM.
C33	19A702236P1	Ceramic: 0.5 pF ±.1 pF, 50 VDCW, temp coef 0 ±30 PPM.
C34	19A702061P4	Ceramic: 1.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±250 PPM.
C35	19A702052P10	Ceramic: 4700 pF ±10%, 50 VDCW.
C36	19A702061P41	Ceramic: 39 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C37	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C38 thru C40	19A702052P24	Ceramic: 0.068 uF ±10%, 50 VDCW.
C41	19A702061P13	Ceramic: 10 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C42	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C43	19B800755P4	Electrolytic: 10 uF ±20%, 16 VDCW.
C44	19A702052P28	Ceramic: 0.022 uF ±10%, 50 VDCW.
C45	19A702052P105	Ceramic: 1000 pF ±5%, 50 VDCW.
C46	19A702052P110	Ceramic: 4700 pF ±5%, 50 VDCW.
C47	19A702052P112	Ceramic: 6800 pF ±5%, 50 VDCW.
C48	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C49	19A702052P24	Ceramic: 0.068 uF ±10%, 50 VDCW.
C51	19A700003P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C52 and C53	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C54	19A702236P19	Ceramic: 5.6 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM.
C55	19A702236P15	Ceramic: 3.9 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM.
C56	19B800873P3	Variable, ceramic: 2.5 to 10 pF, 150 VDCW; sim to Johanson 9611.
C57	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C58	19A702236P28	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C59	19A702236P40	Ceramic: 39 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C60	19A702236P41	Ceramic: 43 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C61	19A701352P7	Aluminum: 1.0 uF ±20%, 16 VDCW.
C63	19B800873P3	Variable, ceramic: 2.5 to 10 pF, 150 VDCW; sim to Johanson 9611.
C64	19A702236P28	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C65	19A702236P25	Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM.
C66	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C67	19B800755P2	Electrolytic: 2.2 uF ±20%, 50 VDCW.
C68	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C70	19A702168P2	Variable, ceramic: 3 to 11 pF, 100 VDCW; sim to JFD DV2SN11C.
C71	19A702236P40	Ceramic: 39 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C72	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C73	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C74	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C75	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C76	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C78	19A702168P1	Variable, ceramic: 2 to 7 pF, 100 VDCW; sim to JFD DV2SN7A.
C79	19A702061P3	Ceramic: 1.5 pF ±0.5 pF, 50 VDCW, temp coef 0 ±250 PPM.
C80	19A702061P7	Ceramic: 3.3 pF ±0.5 pF, 50 VDCW, temp coef 0 ±120 PPM.
C81	19A702168P1	Variable, ceramic: 2 to 7 pF, 100 VDCW; sim to JFD DV2SN7A.
C82	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C83	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C84	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C85	19A702061P42	Ceramic: 39 pF ±10%, 50 VDCW, temp coef 0 ±30 PPM.
C86	19A702061P30	Ceramic: 22 pF ±10%, 50 VDCW, temp coef 0 ±30 PPM.
C87	19A702061P42	Ceramic: 39 pF ±10%, 50 VDCW, temp coef 0 ±30 PPM.
C88	19A702061P7	Ceramic: 3.3 pF ±0.5 pF, 50 VDCW, temp coef 0 ±120 PPM.
C89	19A702061P13	Ceramic: 10 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C90 and C91	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C92	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C93	19A702061P41	Ceramic: 39 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C94	19A702061P25	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C95	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C96	19A702061P3	Ceramic: 1.5 pF ±0.5 pF, 50 VDCW, temp coef 0 ±250 PPM.
C97	19A702061P35	Ceramic: 30 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C98	19A700227P39	Ceramic: 20 pF ±5%, 100 VDCW, temp coef -1500 PPM.
C99	19A700231P59	Ceramic: 68 pF ±5%, 100 VDCW, temp coef -4700 PPM.
C100	19A702052P3	Ceramic: 470 pF ±10%, 50 VDCW.
C101 and C102	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C103	19A702236P6	Ceramic: 1.0 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM.
C104	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C106	19B800650P15	Tantalum: 3.3 uF ±20%, 10 VDCW.
C108	19A700219P18	Ceramic: 4.7 pF ±5%, 100 VDCW, temp coef 0 PPM.
C109	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
		- - - - - - - - - - - DIODES - - - - - - - - - -
D1	19A700155P1	Silicon; sim to Bat 18.
D2	19A700079P3	Silicon, capacitive.
D4 and D5	19A702015P1	Silicon; sim to IN458A.
D6 and D7	19A700079P3	Silicon, capacitive.
D8	19A702015P1	Silicon; sim to IN458A.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
D9	19A700079P3	Silicon, capacitive.
D10	19A700155P1	Silicon; sim to Bat 18.
		- - - - - - - - - - - FUSES - - - - - - - - - - -
F1 Littelfuse	19A702169P9	Enclosed link: rated 3 amps @ 125 v; sim to 255003.
		- - - - - - - - - - - JACKS - - - - - - - - - - -
J1	19B801108G1	Connector, coax: BNC Series, 500 VRMS.
J2 and J3	19A703248P4	Contact, electrical. (Quantity 7 each).
J4	19A703248P1	Contact, electrical. (Quantity 4).
J5 thru J8	19A703248P1	Contact, electrical.
J9	19A703248P4	Contact, electrical.
J10	19A703248P1	Contact, electrical.
J11	19A702314P5	Telephone jack: 250 VAC; sim to N.TT 310 ENC-1.
J12 and J13	19A703248P1	Contact, electrical.
		- - - - - - - - - - - INDUCTORS - - - - - - - - - - -
L1	19A702472P3	Coil.
L2	19A702472P30	Coil.
L2	19C850826P211	Coil, RF: sim to Paul Smith SK-800-1.
L4 and L5	19A702472P3	Coil.
L6 thru L8	19A700024P15	Coil, RF: 1.5 uH ±10%.
L9	19A700024P9	Coil, RF: 470 nH ±10%.
L10	19A702472P24	Coil.
L11	19A702472P26	Coil.
L12	19A700024P3	Coil, RF: 150 nH ±10%.
L13	19C850826P322	Coil, RF: sim to Paul Smith SK-800-1.
L14	19C850826P221	Coil, RF: sim to Paul Smith SK-800-1.
L15	19C850826P211	Coil, RF: sim to Paul Smith SK-800-1.
L16	19A702213P1	Coil, RF: 1.0 mH ±6%; sim to TOKO 126AN-A5318HM.
L17	19A700024P13	Coil, RF: 1.0 uH ±10%.
L18	19A702988P1	Coil.
L19	19A702473G1	Coil.
L20	19A702472P8	Coil.
L22	19A700024P13	Coil, RF: 1.0 uH ±10%.
L23	19A702474P2	Coil.
L24	19A700024P13	Coil, RF: 1.0 uH ±10%.
L25	19A700024P1	Coil, RF: 100 nH ±10%, 0.08 ohms DC res max, 100 v.
L26	19A702474P4	Coil.
L27	19A700024P1	Coil, RF: 100 nH ±10%, 0.08 ohms DC res max, 100 v.
L28	19A700024P13	Coil, RF: 1.0 uH ±10%.
L29 and L30	19A702474P5	Coil.
L31	19A700024P13	Coil, RF: 1.0 uH ±10%.
L32	19A702474P1	Coil.
L33	19A700024P13	Coil, RF: 1.0 uH ±10%.
L34 and L35	19C850826P212	Coil, RF: sim to Paul Smith SK-800-1.
L36	19C850826P612	Coil, RF; sim to Paul Smith SK-800-1.
L37	19C850826P312	Coil, RF: sim to Paul Smith SK-800-1.

SYMBOL	GE PART NO.	DESCRIPTION
L38	19A700024P1	Coil, RF: 100 nH ±10%, 0.08 ohms DC res max, 100 v.
L39	19B800855P1	Coil, RF: 1.0 uH ±10%; sim to TOKO M113CN-K1366HM.
L40	19A700024P15	Coil, RF: 1.5 uH ±10%.
L41	19A700024P1	Coil, RF: 100 nH ±10%, 0.08 ohms DC res max, 100 v.
L42	19B800855P1	Coil, RF: 1.0 uH ±10%; sim to TOKO M113CN-K1366HM.
L43	19A700024P15	Coil, RF: 1.5 uH ±10%.
L44	19A702472P7	Coil.
L45	19A703161P2	Coil, RF: 120 nH ±10%.
L47	19A700024P13	Coil, RF: 1.0 uH ±10%.
L48 and L49	19B800855P1	Coil, RF: 1.0 uH ±10%; sim to TOKO M113CN-K1366HM.
L50	19A700024P13	Coil, RF: 1.0 uH ±10%.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A702413P1	Silicon, NPN; sim to Philips BFR92.
Q2	19A703795P1	N Type: field effect; sim to MMBF4416.
Q3	19A700092P2	Silicon, NPN.
Q4	19A700236P2	Silicon, NPN; sim to BFS17.
Q5	19A700092P2	Silicon, NPN.
Q6	19A700076P2	Silicon, NPN; sim to MMBT3094.
Q7 and Q8	19A700026P1	Silicon, PNP.
Q9	19A702448P1	Silicon, NPN; sim to 2N5945.
Q10	19A701940P3	Silicon, NPN.
Q11	19A701808P1	Silicon, NPN; sim to MPS 6595.
Q12 and Q13	19A700236P2	Silicon, NPN; sim to BFS17.
Q14 and Q15	19A700092P2	Silicon, NPN.
Q16	19A700026P1	Silicon, PNP.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19B800607P122	Metal film: 1.2K ohms ±5%, 200 VDCW, 1/8 w.
R2	19A702585P99	Composition: 33K ohms ±5%, 150 VDCW, 1/8 w.
R3	19B800607P123	Metal film: 12K ohms ±5%, 200 VDCW, 1/8 w.
R4	19B800607P332	Metal film: 3.3K ohms ±5%, 200 VDCW, 1/8 w.
R5	19B800607P750	Metal film: 75 ohms ±5%, 200 VDCW, 1/8 w.
R6	19B800607P152	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 w.
R7	19B800607P750	Metal film: 75 ohms ±5%, 200 VDCW, 1/8 w.
R8 and R9	19B800607P102	Metal film: 1K ohms ±5%, 200 VDCW, 1/8 w.
R10	19B800607P221	Metal film: 220 ohms ±5%, 200 VDCW, 1/8 w.
R11	19A702585P47	Composition: 220 ohms ±5%, 150 VDCW, 1/8 w.
R12	19B800607P822	Metal film: 8.2K ohms ±5%, 200 VDCW, 1/8 w.
R13	19B800607P562	Metal film: 5.6K ohms ±5%, 200 VDCW, 1/8 w.
R14	19B800607P750	Metal film: 75 ohms ±5%, 200 VDCW, 1/8 w.
R15	19B800607P681	Metal film: 680 ohms ±5%, 200 VDCW, 1/8 w.
R16	19A702585P111	Composition: 100K ohms ±5%, 150 VDCW, 1/8 w.
R17	19A702585P89	Composition: 12K ohms ±5%, 150 VDCW, 1/8 w.
R18	19B800607P750	Metal film: 75 ohms ±5%, 200 VDCW, 1/8 w.
R19	19B800607P101	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 w.
R20	19B800607P122	Metal film: 1.2K ohms ±5%, 200 VDCW, 1/8 w.
R21	19B800607P273	Metal film: 27K ohms ±5%, 200 VDCW, 1/8 w.

SYMBOL	GE PART NO.	DESCRIPTION
R22	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R23	19A702585P85	Composition: 8.2K ohms ±5%, 150 VDCW, 1/8 w.
R24	19B800607P104	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 w.
R25 and R26	19B800607P222	Metal film: 2.2K ohms ±5%, 200 VDCW, 1/8 w.
R27	19B800607P473	Metal film: 47K ohms ±5%, 200 VDCW, 1/8 w.
R28	19B800607P223	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 w.
R29	19B800607P153	Metal film: 15K ohms ±5%, 200 VDCW, 1/8 w.
R30	19B800607P563	Metal film: 56K ohms ±5%, 200 VDCW, 1/8 w.
R31	19B800607P682	Metal film: 6.8K ohms ±5%, 200 VDCW, 1/8 w.
R32	19B800762P1	Variable, carbon film: 5K ohms ±20%, 150 VDCW, .1 w; sim to TOCOS PRP124.
R34	19B800607P563	Metal film: 56K ohms ±5%, 200 VDCW, 1/8 w.
R35	19B800607P823	Metal film: 82K ohms ±5%, 200 VDCW/ 1/8 w.
R36	19B800607P152	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 w.
R37	19B800607P821	Metal film: 820 ohms ±5%, 200 VDCW, 1/8 w.
R38		(Part of S1).
R40	19B800751P16	Variable, solid carbon: 100K ohms ±25%, 0.05 w; sim to ALSP H0651A.
R41	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R42	19A702585P55	Composition: 470 ohms ±5%, 150 VDCW, 1/8 w.
R43	19A702585P59	Composition: 680 ohms ±5%, 150 VDCW, 1/8 w.
R44	19A702289P4	Metal film: 10 ohms ±5%, 1/4 w; sim to Corning FP55.
R45	19B800607P101	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 w.
R47	19A702289P4	Metal film: 10 ohms ±5%, 1/4 w; sim to Corning FP55.
R48	19A702585P39	Composition: 100 ohms ±5%, 150 VDCW, 1/8 w.
R49	19B800607P152	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 w.
R51	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R53	19A702289P7	Metal film: 22 ohms ±5%, 1/4 w; sim to Corning FP55.
R53	19B800607P562	Metal film: 5.6K ohms ±5%, 200 VDCW, 1/8 w.
R54	19A702585P63	Composition: 1K ohms ±5%, 150 VDCW, 1/8 w.
R55	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R56	19A702289P11	Metal film: 47 ohms ±5%, 1/4 w; sim to Corning FP55.
R57	19A702585P87	Composition: 10K ohms ±5%, 150 VDCW, 1/8 w.
R58	19A702585P63	Composition: 1K ohms ±5%, 150 VDCW, 1/8 w.
R59	19B800607P560	Metal film: 56 ohms ±5%, 200 VDCW, 1/8 w.
R60	19B800607P102	Metal film: 1K ohms ±5%, 200 VDCW, 1/8 w.
R61	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R62	19B800607P222	Metal film: 2.2K ohms ±5%, 200 VDCW, 1/8 w.
R63	19B800607P331	Metal film: 330 ohms ±5%, 200 VDCW, 1/8 w.
R64	19B800607P822	Metal film: 8.2K ohms ±5%, 200 VDCW, 1/8 w.
R65	19A702585P81	Composition: 5.6K ohms ±5%, 150 VDCW, 1/8 w.
R66	19B800607P102	Metal film: 1K ohms ±5%, 200 VDCW, 1/8 w.
R67	19B800607P223	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 w.
R68	19B800607P221	Metal film: 220 ohms ±5%, 200 VDCW, 1/8 w.
R69	19B800751P16	Variable, solid carbon: 100K ohms ±25%, 0.05 w; sim to ALSP H0651A.
R70	19B800607P221	Metal film: 220 ohms ±5%, 200 VDCW, 1/8 w.
R71	19B800607P223	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 w.
R72	19B800607P102	Metal film: 1K ohms ±5%, 200 VDCW, 1/8 w.
R73	19B800751P16	Variable, solid carbon: 100K ohms ±25%, 0.05 w; sim to ALSP H0651A.
R74	19A702585P71	Composition: 2.2K ohms ±5%, 150 VDCW, 1/8 w.
R77	19B800607P223	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 w.

SYMBOL	GE PART NO.	DESCRIPTION
R78	19B800607P683	Metal film: 68K ohms ±5%, 200 VDCW, 1/8 w.
R79	19B800607P393	Metal film: 39K ohms ±5%, 200 VDCW, 1/8 w.
R80	19B800607P823	Metal film: 82K ohms ±5%, 200 VDCW/ 1/8 w.
R81	19B800607P123	Metal film: 12K ohms ±5%, 200 VDCW, 1/8 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19B800762P3	Variable, carbon film: 10K ohms ±20%, 150 VDCW, .1 w; sim to TOCOS PRP124S65. (Includes R38).
S2	19A702244P1	Slide switch: DPDT, contact rating 1 mA @ 10 VDC; sim to Alps SSS02200.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U1	19A701780P1	Linear: IF AMPLIFIER AND DETECTOR.
U2	19A702536P2	Linear. POSITIVE VOLTAGE REGULATOR; sim to LM2931T.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY1 and XY2	19A115834P1	Contact, electrical; sim to AMP 2-330808-8.
XY3	19A700042P3	Contact, electrical: sim to AMP 2-332070-2.
XY4 and XY5	19A115834P1	Contact, electrical; sim to AMP 2-330808-8.
		- - - - - - - - - - - FILTERS - - - - - - - - - - -
Z1	19A702522G11	Crystal pair. (Includes Z2).
Z2		(Part of Z1).
Z3	19A702171P1	Bandpass filter: 455 ±1.5 kHz; sim to Murata CFU455D2.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A702471P2	Crystal pad. (Used with Z1 & Z2).
	19A134793P1805	Screw, thread forming: No. 1-64 x 7/32. (Secures J1 mounting).
	19A702521P1	Heat sink. (Q9).
	19B800911P1	Contact. (Used with Q10).
	19A702945P1	Shield.
		ASSOCIATED PARTS
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering specify GE part number and exact frequency needed.
		$Fx = \frac{Fo - 21.4}{9}$
Y1 and Y2	19A702375G2	Quartz.
		$Fx = \frac{Fo}{8}$
Y3	19A702284G3	Quartz: 20945.000 kHz.
Y4 and Y5	19A702375G1	Quartz.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B800886P3	Helical antenna. 403-470 MHz.
	19B800886P4	Helical antenna. 470-494 MHz.
	19B800886P5	Helical antenna. 489-512 MHz.
	19D900639G2	Battery Pack.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter," which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - T/R Board 19D900675G1

To incorporate new low-pass filter to meet DOC specifications. Replaced filter 19B800877G1 with 19B801039G1.

REV. A - Rear Cover 19D900844G1

To prevent corosion at battery (-) contact from causing an intermittent connection.
Added a black wire terminated with P4 from battery (-) to J13 (TPS).

REV. B - T/R Board 19D900675G1,2

To prevent receiver degradation due to reverse bias created from feedthru transmit power.
Added diode D10 from the emitter of Q1 (Anode) to the base of Q1 (Cathode).

REV. A - Audio Board 19D900683G1,2

To improve audio board stability. Changed C9 and C33.
C9 and C33 were: 19A702052P22 Ceramic, 0.047 uf ±10%, 50VDCW.

PARTS LIST

FRONT COVER
19D900647G1 STANDARD
19D900647G2 LICENSEE
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - SPEAKERS AND MIKES - - - - - - - -
B1	19A134460P1	Loudspeaker, permanent magnet: 2 inches, 8 ohms ±10%, coil imp., 450 ±100 Hz resonance, 500 mW; sim to Pioneer A50AP13-01F.
B2	19J706041P1	Microphone cartridge: 200-850 ohms output imp., 1.5 to 10 VDC; sim to Primo EM-60.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A700232P64	Ceramic: 100 pF ±10%, 100 VDCW, -5600 PPM temp coef.
C3	19B800650P13	Tantalum: 1 uF -20+40%, 10 VDCW.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P4		Connector. Includes:
	19A702405P4	Shell.
	19A702405P28	Contact, electrical.
W1	19B800860G1	Cable assembly. (Includes P4).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A702396P1	Nameplate. (GENERAL ELECTRIC).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

AUDIO BOARD
19D900683G1 STANDARD - REV A
19D900683G2 DTMF - REV A
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A702052P120	Ceramic: 0.033 uF ±5%, 50 VDCW.
C2 and C3	19A702052P112	Ceramic: 6800 pF ±5%, 50 VDCW.
C4	19A702052P128	Ceramic: 0.022 uF ±5%, 50 VDCW.
C5	19A702052P12	Ceramic: 6800 pF ±10%, 50 VDCW.
C6	19A702844P1	Tantalum: 22 uF ±20%, 6.3 VDCW.
C7	19A702052P10	Ceramic: 4700 pF ±10%, 50 VDCW.
C8	19A702052P4	Ceramic: 680 pF ±10%, 50 VDCW.
C9	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C10	19B800755P7	Electrolytic: 100 uF ±20%, 10 VDCW.
C11	19B800755P4	Electrolytic: 10 uF ±20%, 16 VDCW.
C12	19A702052P22	Ceramic: 0.047 uF ±10%, 50 VDCW.
C13	19A702052P24	Ceramic: 0.068 uF ±10%, 50 VDCW.
C14	19B800755P5	Electrolytic: 22 uF ±20%, 10 VDCW.
C15	19A702052P107	Ceramic: 2200 pF ±5%, 50 VDCW.
C16	19A700003P4	Tantalum: 1.0 uF ±20%, 35 VDCW.
C17	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C18	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C19	19B800755P4	Electrolytic: 10 uF ±20%, 16 VDCW.
C20	19A702052P122	Ceramic: 0.047 uF ±5%, 50 VDCW.
C21	19A702052P110	Ceramic: 4700 pF ±5%, 50 VDCW.
C22 and C23	19A702052P122	Ceramic: 0.047 uF ±5%, 50 VDCW.
C24	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C25	19A702052P106	Ceramic: 1500 pF ±5%, 50 VDCW.
C26	19B800755P2	Electrolytic: 2.2 uF ±20%, 50 VDCW.
C27	19A702061P73	Ceramic: 330 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C28	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C30 and C31	19B800755P2	Electrolytic: 2.2 uF ±20%, 50 VDCW.
C32	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C33	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C34	19A702052P22	Ceramic: 0.047 uF ±10%, 50 VDCW.
		- - - - - - - - - - DIODES - - - - - - - - - -
D1 and D2	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P2 and P3	19A700041P56	Printed wire: 7 contacts rated @ 2.5 amps; sim to Molex 22-02-2075.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A134739P2	Silicon, NPN.
Q2	19A700026P1	Silicon, PNP.
Q3 thru Q7	19A700076P2	Silicon, NPN.
Q8	19A700059P2	Silicon, PNP.
Q9	19A700076P2	Silicon, NPN.
Q10	19A702760P1	P type, field effect.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19B800607P333	Metal film: 33K ohms ±5%, 200 VDCW, 1/8 w.
R2	19B800607P683	Metal film: 68K ohms ±5%, 200 VDCW, 1/8 w.
R3	19B800607P393	Metal film: 39K ohms ±5%, 200 VDCW, 1/8 w.
R4	19B800607P333	Metal film: 33K ohms ±5%, 200 VDCW, 1/8 w.
R5 and R6	19B800607P473	Metal film: 47K ohms ±5%, 200 VDCW, 1/8 w.
R7	19B800607P153	Metal film: 15K ohms ±5%, 200 VDCW, 1/8 w.
R8	19B800607P821	Metal film: 820 ohms ±5%, 200 VDCW, 1/8 w.
R9	19B800607P153	Metal film: 15K ohms ±5%, 200 VDCW, 1/8 w.
R10	19B800607P180	Metal film: 18 ohms ±5%, 200 VDCW, 1/8 w.
R11	19B800607P104	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 w.
R13	19A702289P1	Metal film: 1 ohms ±5%, 1/4 w; sim to Corning FL55.
R14	19B800607P471	Metal film: 470 ohms ±5%, 200 VDCW, 1/8 w.
R15	19B800607P682	Metal film: 6.8K ohms ±5%, 200 VDCW, 1/8 w.
R16	19B800607P183	Metal film: 18K ohms ±5%, 200 VDCW, 1/8 w.
R17	19B800607P683	Metal film: 68K ohms ±5%, 200 VDCW, 1/8 w.
R18	19B800607P473	Metal film: 47K ohms ±5%, 200 VDCW, 1/8 w.
R19	19B800607P562	Metal film: 5.6K ohms ±5%, 200 VDCW, 1/8 w.
R20	19B800607P273	Metal film: 27K ohms ±5%, 200 VDCW, 1/8 w.
R21	19B800607P472	Metal film: 4.7K ohms ±5%, 200 VDCW, 1/8 w.
R22	19B800607P331	Metal film: 330 ohms ±5%, 200 VDCW, 1/8 w.
R23	19B800607P821	Metal film: 820 ohms ±5%, 200 VDCW, 1/8 w.
R24	19B800607P393	Metal film: 39K ohms ±5%, 200 VDCW, 1/8 w.
R25	19B800607P473	Metal film: 47K ohms ±5%, 200 VDCW, 1/8 w.
R26	19B800607P823	Metal film: 82K ohms ±5%, 200 VDCW, 1/8 w.
R27	19B800607P473	Metal film: 47K ohms ±5%, 200 VDCW, 1/8 w.
R28	19B800607P224	Metal film: 220K ohms ±5%, 200 VDCW, 1/8 w.
R29	19B800607P823	Metal film: 82K ohms ±5%, 200 VDCW, 1/8 w.
R30	19B800607P394	Metal film: 390K ohms ±5%, 200 VDCW, 1/8 w.
R31	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R32	19B800607P333	Metal film: 33K ohms ±5%, 200 VDCW, 1/8 w.
R33	19B800607P183	Metal film: 18K ohms ±5%, 200 VDCW, 1/8 w.
R34	19B800607P333	Metal film: 33K ohms ±5%, 200 VDCW, 1/8 w.
R35	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R36	19B800607P104	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 w.
R37	19B800607P393	Metal film: 39K ohms ±5%, 200 VDCW, 1/8 w.
R38	19A701828P1	Thermistor, 3.3K ohms ±5%, sim to Philips 2322-642-63332.
R39 and R40	19B800607P563	Metal film: 56K ohms ±5%, 200 VDCW, 1/8 w.
R41	19B800607P334	Metal film: 330K ohms ±5%, 200 VDCW, 1/8 w.
R42 and R43	19B800607P473	Metal film: 47K ohms ±5%, 200 VDCW, 1/8 w.
R44	19B800607P102	Metal film: 1K ohms ±5%, 200 VDCW, 1/8 w.
R45	19B800607P471	Metal film: 470 ohms ±5%, 200 VDCW, 1/8 w.
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - - - - -
U1	19A702410P1	Linear: Audio Amplifier; sim to TBA-820M.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B232682P11	Pad. (Quantity 4).
	N503P304P15	Cotter pin.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

HARDWARE KIT
19A702379G1 SINGLE/MULTI FREQ
19D702379G2 UHF
19D702379G3 HIGH BAND
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
	19A702471P3	Crystal pad. (Used with Y3).
	19A702471P2	Crystal pad. (Used with Y1, Y2, Y4, Y5).
	19A702332P1	Nut, slotted: M7 x .75. (Secures R32 & S1).
	19B800849P1	Washer, rectangular. (Located between ON-OFF switch and housing).
	19A702314P2	Knurled nut. (Secures J11).
	19A703007P212	Machine screw, Torx drive: M2.5-.45 x 12. (Secures rear cover below nameplates).
	19A702362P208	Machine screw, Torx drive: M2.5-.45 x 8. (Secures rear cover at top).
	19B800859P1	Knob, push on. (Used with R32 & S1).
	19A702364P103	Machine screw, Torx drive: M2-.4 x 3. (Secures option cover).
	19A700032P1	Lockwasher, internal tooth: No. 2. (Secures option cover).
	19D900667P1	Option Cover.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

SIDE PANEL

19D900646G1 - 1 FREQ.
19D900646G3 - 2 FREQ.

Issue 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19B800847P1	Push switch: contacts rated 25 mA @ 9 VDC; sim to Bowmar KB3256-1D.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B800864G1	Pushbutton.
	19C850854P1	Slide button.
	19A702460P1	Contact, electrical. (Quantity 2).
	19A702471P6	Crystal Pad.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

REAR COVER
19D900644G1
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1		Connector. Includes:
	19B800852P1	Contact, electrical.
	19A701728P2	Washer, non-metallic.
	19A701488P2	Retaining ring.
	19B216401P5	Spring.
	19B800851P1	Insulator.
P2		Connector. Includes:
	19B800852P1	Contact, electrical.
	19A701728P2	Washer, non-metallic.
	19A701488P2	Retaining ring.
	19B216401P5	Spring.
P3	19A702405P26	Contact, electrical: rated @ 3 amps.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19C850865P1	Receptacle.
	N327P9008E	Rivet, tubular. (Secures 19C850865P1 receptacle to rear cover).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.