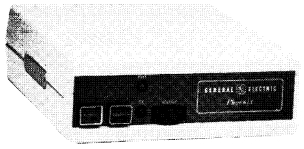
MOBILE RADIO

PHOENIX™

MAINTENANCE MANUAL LBI31071B

150-174 MHz, 25 WATT MOBILE COMBINATION



MOBILE RADIO

MICROPHONE

TWO-WAY FM MOBILE COMBINATIONS

EXTERNAL SPEAKER (OPTIONAL)

GENERAL ELECTRIC

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ILLUSTRATIONS

WARNING

Although the highest DC voltage in this mobile equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits!

High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

SYSTEM SPECIFICATIONS*

FCC IDENTIFICATION NUMBER	AXA9MZTR100A
GE IDENTIFICATION NUMBER	TR100A
FREQUENCY RANGE	150-174 MHz
Receiver	
Squelched	225 milliamperes
Unsquelched	650 milliamperes
Transmitter	5.9 Amperes @ 13.8 Volts
FREQUENCY STABILITY	0.0005%
TEMPERATURE RANGE	-30°C (-22°F) to +60°C (140°F)
DUTY CYCLE	20% Transmit, 100% Receive
DIMENSIONS, LESS ACCESSORIES (H X W X D)	65 MM X 190 MM X 240 MM (2.55 X 7.5 X 9.4 inches)
WEIGHT, LESS ACCESSORIES	2.07 kg (4.5 pounds)

TRANSMITTER

POWER OUTPUT	25 Watts
CONDUCTED SPURIOUS AND HARMONIC EMISSION	-70 dB
MODULATION	±4.5 kHz (±3.75 kHz voice modulation and 0.75 kHz CG modulation)
AUDIO SENSITIVITY	50 to 100 Millivolts at J911-4 20 to 50 Millivolts at J911-5
AUDIO FREQUENCY CHARACTERISTICS	Within +1 dB to -3 dB of a 6 dB per octave pre-emphasis from 300 to 3000 Hz per FIA standards. Post limiter filter per FCC and EIA.
DISTORTION	Less than 3% (1000 Hz) Less than 5% (300 to 3000 Hz)
DEVIATION SYMMETRY	0.5 kHz maximum
RF OUTPUT IMPEDANCE	50 ohms

RECEIVER

AUDIO OUTPUT (to 4.0 ohms speaker)	3 Watts (less than 5% distortion)
SENSITIVITY	
12 dB SINAD	0.3 uV
20 dB Quieting Method	0.35 uV
SELECTIVITY	
EIA Two-Signal Method	-85 dB @ ±30 kHz
SPURIOUS RESPONSE	-85 dB
IMAGE REJECTION	-75 dB
INTERMODULATION	-77 dB
MODULATION ACCEPTANCE	±7.0 kHz
SQUELCH SENSITIVITY	<8 dB SINAD
FREQUENCY RESPONSE	Within +2 and -8 dB of a standard 6 dB per octave de-emphasis curve from 300 to 3000 Hz (1000 Hz reference)
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 Phoenix mobile combinations are fully transistorized -- utilizing both discrete components and integrated circuits (IC's) for high reliability. The radio is a self-contained, FM transmitter/ receiver with built-in controls and speaker. Its small size makes it ideal for front mounting in conventional vehicles. The standard combinations are equipped with the following:

- One receive frequency, and one transmit frequency
- Plug-in crystals for ±0.0005% oscillator stability
- Channel Guard (tone squelch)

The radio consists of an effective heat-dissipating, aluminum die cast "H" frame on which two circuit boards are mounted. The transmitter/receiver board is mounted on the bottom of the "H" frame and includes RF and receiver audio circuitry. The Interconnect/Oscillator/Channel Guard (IOC) board contains all interconnections, oscillator circuits, transmitter audio processor, microphone preamplifier, and Channel Guard circuitry. All external connectors, controls and indicators are mounted directly on the two boards for reliability and ease of disassembly.

The boards plug into each other, eliminating the need for interconnecting wires. The only wires used in the radio are the plug-in leads for the internal speaker. The top and bottom covers enclose the "H" frame and provide optimum protection for the radio. The internal speaker mounts on the inside of the top cover.

The front control panel is made of highly durable plastic with rounded corners and recessed controls for passenger safety requirements. The panel provides access to three standard operator controls: a POWER On/Off pushbutton, a momentary MONITOR pushbutton (fixed squelch and Channel Guard monitor), and a rotary, edge-mounted Volume control. A red Transmit indicator LED (Light Emitting Diode) and a green power-on indicator LED are provided.

No power supply is required since the highest supply voltage used in the radio is provided by the vehicle battery. The radio is designed for operation only in 12 Volt, negative ground vehicle systems.

The radio is of modular construction. Both major modules and tuning adjustments are easily accessible. Loosening the two screws in the rear of the top cover provides access to the interconnect/ oscillator/Channel Guard board. Loosening the two screws in the rear of the bottom cover provides access to the transmitter/ receiver board.

An optional set of test probes can be plugged onto the test pins on the board for alignment and troubleshooting. Measurements can be made using GE Test Set 4EX3A11 or a multimeter.

TRANSMITTER

The transmitter consists of an FM exciter with an audio processor and a broadband, fixed-tuned power amplifier. The RF power output level is pre-set internally to rated power. Once the level is set, a sensing control circuit holds it constant as temperature and/or voltage vary within specified limits.

Frequency stability for both the transmitter and receiver is maintained by an electronic compensation network.

RECEIVER

The dual conversion receiver consists of a front end section and two mixer/IF sections operating at 10.7 MHz and 455 kHz. The receiver also contains a squelch and audio section. The audio section provides a 3-watt audio output into a 4-ohm load.

AC POWER SUPPLY OPTION

To use the radio as a base station, an optional 121 Volt AC, 60 Hertz power supply is available. An eight foot cable connects the power supply to the radio. The cable length permits the power supply to be located away from the radio. A green Power On LED is located on the front panel of the power supply.

MICROPHONE

The standard mobile combinations use an electret microphone. The microphone is housed in a sturdy case, and the extendable coiled cord plugs into a jack at the back of the radio. The microphone is secured to the radio by means of a strain relief hook on the microphone cable. A microphone hanger is supplied with the microphone.

HOOKSWITCH OPTION

In Channel Guard applications, a microphone hookswitch may be supplied with the radio. The Channel Guard is disabled when the microphone is removed from the hookswitch.

EXTERNAL SPEAKER (OPTIONAL)

A five-inch speaker, contained in a LEXAN® housing, provides an audio cutput of 3 watts. The nominal speaker impedance is 3.2 ohms. The speaker leads are connected to pins 3 and 7 of Systems Plug P910. When the External Speaker is used, the jumper from H13 to H14 on the (IOC) board can be removed or P904 unplugged to disconnect the built-in speaker. A LEXAN® bracket is supplied for mounting.

OPERATION

Complete operating instructions for the Two-Way Radio are provided in a separate Operator's Manual. The basic procedures for receiving and transmitting messages follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by pushing in the POWER pushbutton.
2. Push in the MONITOR button to disable the squelch circuit and Channel Guard decoder. Adjust the volume control for a comfortable listening level and then release the MONITOR button for normal operation.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Turn the radio on as directed in the "To Receive a Message" section.
2. Press the PTT switch on the microphone and speak across the face of the microphone in a normal voice level. Release the PTT switch as soon as the message has been given. The red indicator light on the control panel will glow each time the microphone PTT switch is pressed, indicating that the transmitter is on the air. The receiver is muted when the transmitter is keyed.

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

Adjustments for the transmitter include measuring the forward and reflected power and adjusting the antenna length for optimum VSWR, then setting the transmitter to rated power output. Next, measuring the frequency and modulation and entering these measurements on the FCC required station records. For the complete transmitter adjustment, refer to the Alignment Procedure (see Table of Contents).

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes tuning the input circuit to match the antenna. For the Receiver Adjustment Procedure, refer to the Alignment Procedure (see Table of Contents).

CHANNEL GUARD DISABLE

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. Also, remove the versatone if present.

RE-INSTALLATION

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

CIRCUIT ANALYSIS

TRANSMITTER

The transmitters utilize a crystal controlled, frequency modulated exciter for single-frequency operation in the 150-174 MHz frequency band. The solid state transmitter uses integrated circuits and discrete components for increased reliability. The transmitter consists of audio processor U101; oscillator Q151, buffer Q153, exciter stages Q201 through Q203, PA amplifier Q251 and Q252, and power control circuit Q254 through Q257. The exciter provides approximately 300 to 350 milliwatts of modulated RF to the PA which provides rated output power. Figure 1 is a block diagram of the radio showing both the transmitter and receiver.

MICROPHONE PREAMPLIFIER

A preamplifier stage (Q901 and associated circuitry) is provided for the standard electret microphone without a built-in preamplifier. The preamplifier circuit is located on the IOC board.

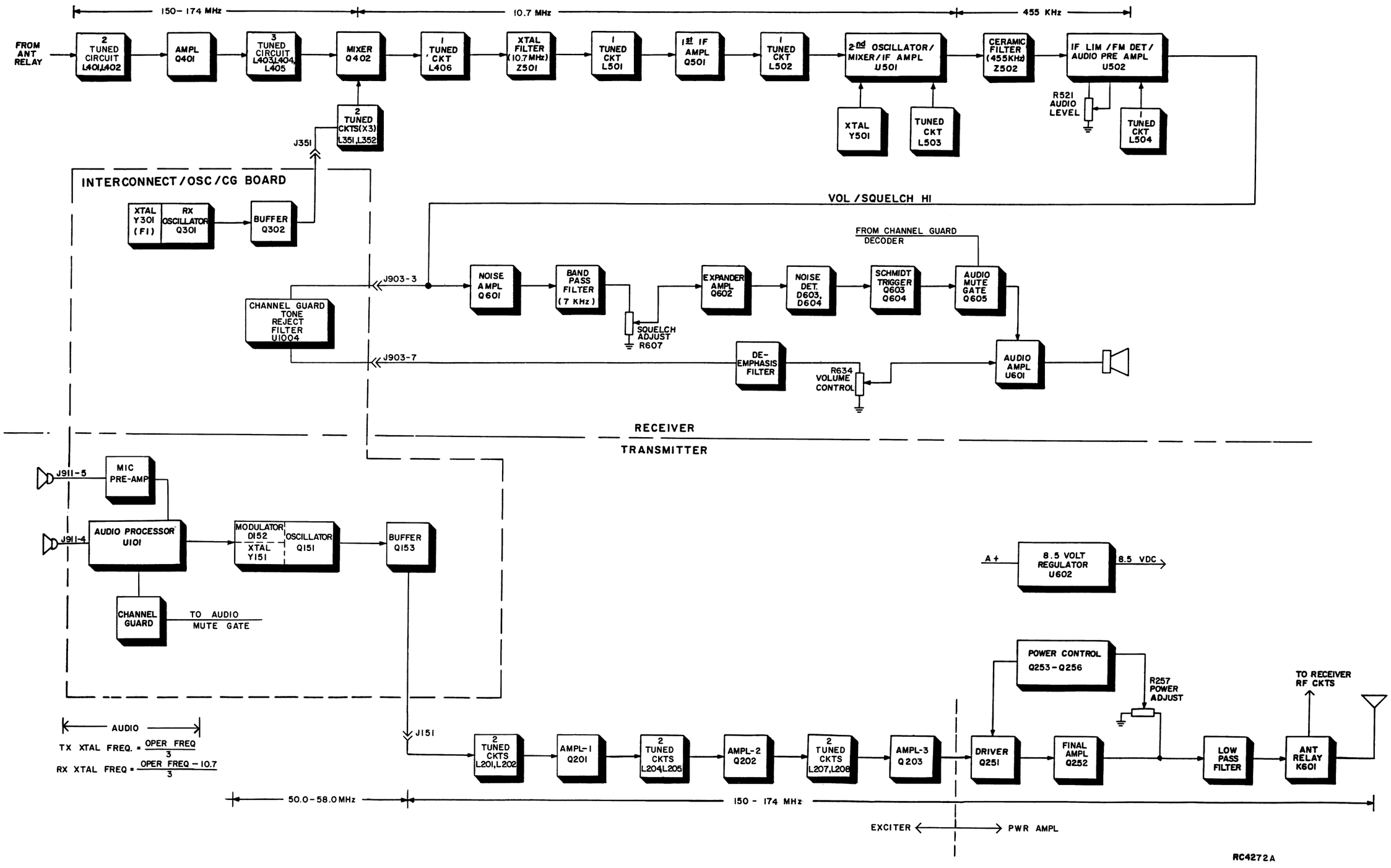

Figure 1 - Block Diagram

With this microphone, MIC HI is coupled through J911-5 to the preamplifier stage. The amplified output is coupled through R908 and C905 to the audio processor.

For optional microphones with a built-in preamplifier, audio is coupled through J911-4, bypassing MIC PRE AMP Q901.

AUDIO PROCESSOR U101

The audio processor provides audio pre-emphasis with amplitude limiting and post limiter filtering. A total gain of approximately 24 dB is realized through the audio processor. 20 dB is provided by U101B and 4 dB by U101A.

The 8.5 Volt regulator powers the audio processor and applies regulated +8.5V through P903-2 to a voltage divider consisting of R101, R111, R110 and R109. The +4.25V output from the voltage divider establishes the operating reference point for both operational amplifiers. C106 provides an AC ground at the summing input of both operational amplifiers.

Resistors R101, R109, R110, R111 and diodes D101 and D102 provide limiting for U101B. Diodes D101 and D102 are reverse biased at 1.7 VDC. Voltage divider network R101, R109, R110 and R111 provides +5.9 VDC at the cathode of D101 and +2.6 VDC at the anode of D102. The voltage at the junction of D101 and D102 is 4.25 VDC. C104 and C108 permit a DC level change between U101B-7 and the voltage divider network for diode biasing.

When the input signal to U101B-6 is of a magnitude such that the amplifier output at U101B-7 does not exceed 4 volts P-P, the amplifier provides a nominal 20 dB gain. When the audio signal level at U101B-7 exceeds 4 volts PP, diodes D101 and D102 conduct on the positive and negative half cycles providing 100% negative feedback to reduce the amplifier gain to 1. This limits the audio amplitude at U101B-7 to 5 volts PP.

Resistors R105, R106 and R107 and C107 comprise the audio pre-emphasis network that enhances the signal to noise ratio. R107 and C107 control the pre-emphasis curve below limiting. R106 and C107 control the cut-off point for high frequency pre-emphasis. As high frequencies are attenuated, the gain of U101 is increased.

Audio from the preamplifier or microphone is coupled to the input of operational amplifier U101B-6. The amplified output of U101B is coupled through R114, R112, R104 and R117 to a second operational amplifier U101A.

The Channel Guard (CG) tone input is applied to U101A-2. The CG tone is then combined with the microphone audio.

A post limiter filter consisting of U101A, R112-R114, C108 and C110 provides 12 dB per octave roll-off. R104 and C102 provide an additional 6 dB per octave roll-off for a total of 18 dB.

SERVICE NOTE

R112-R114 are 1% resistors. This tolerance must be maintained to assure proper operation of the post limiter filter. Use exact replacements.

The output of the post limiter filter is coupled through C110 to the temperature compensated transmitter oscillator Q151.

TRANSMIT OSCILLATOR

A temperature compensating network consisting of R151, R152, R153, R154, D151 and C151 maintains oscillator frequency over a temperature range of -30° to +60°C. The temperature compensating DC voltage and audio is applied to FM modulator D152 through MOD ADJ control R155 and R159. Modulator varactor D151 varies the transmit frequency at the audio rate applied from the audio processor.

Q151, Y151 and associated circuitry comprise a Colpitts oscillator which generates the third subharmonic (50 MHz) of the RF carrier frequency. The transmit Oscillator is adjusted to the assigned operating frequency by L151. The oscillator output is applied to buffer Q153, and is then coupled through P151 to the exciter circuitry on the transmitter/receiver (Tx/Rx) board.

EXCITER

The exciter consists of three amplifier stages which provide a minimum or 300 milliwatts to the PA section of the transmitter. In addition to providing approximately 22 dB of gain, the exciter contains filters which determine the bandwidth and spurious characteristics (exclusive of harmonics) of the transmitter.

The output of the oscillator and buffer stages is coupled to the input of the exciter via J151, which is connected to a tap on L201. This tap also supplies voltage to buffer transistor Q153. L201 and L202 select the third harmonic (150 MHz) which is present at J151.

C206 and C207 match the output of this two-pole filter to the base of Q201. Q201 provides approximately 10 dB of gain. C213 and C214 match the collector of Q201 to the input of a second two-pole filter, consisting of L204 and L205. The emitter voltage on Q201 (AMPL-1) can be monitored at TP201, and is typically +0.3 volts.

The collector of Q201 is matched to the second two-pole filter, consisting of L204 and L205. The output of this filter (approximately 10-15 mW) is matched to the base of second amplifier Q202. The collector of this transistor couples the signal to the third two-pole filter consisting of L207 and L208. The emitter voltage on Q202 is monitored at TP202, and is typically +0.5 volts.

The output of the third 2 pole filter (approximately 60-80 mW) is applied to amplifier Q203, which supplies 300-350 milliwatts (typically) to the PA driver. An "L" network (L209, L210, and C232) matches the output of Q203 to 50 ohms. A 50 ohm microstrip (W251) couples the 300-350 milliwatt signal to the PA circuitry. An additional metering point is available on this microstrip to monitor power at the exciter-PA interface. TP251 consists of 2 pins which will accept a special RF detector probe which can be used with any multimeter.

SERVICE NOTE

Since the exciter-PA interface is 50 ohms, W251 can be used as a convenient point to monitor or inject signals for troubleshooting and testing while using 50 ohm sources and terminations.

POWER AMPLIFIER

The two stage power amplifier consists of driver Q251, and power amplifier Q252 and associated circuitry. Collector voltage for driver Q251 is applied from A+ through pass transistor Q256 and L253, L252 and R252. The collector voltage for Q251 is a result of the output power setting and voltage variations at any given time. The output of driver Q251 is coupled to the base of Power Amplifier Q252 through impedance matching networks consisting of C258, C259, L254-L256, C261, C262 and R253.

Collector voltage for Q252 is provided from A+ through L258, L257 and R255.

The output of the PA is connected to the low-pass filter by W252-W254, and then to antenna relay K601.

RF POWER ADJUST CIRCUIT

The output power adjust circuit allows the transmitter to be set to rated output power. The power adjustment is attained by controlling the DC collector voltage to driver Q251 through pass transistor Q256. The pass transistor is controlled by a feedback loop consisting of Q253 through Q256, and diode D251. The power is set by potentiometer R257.

A change in output power is sensed by D251 causing the base voltage of Q253 to change accordingly. For example, if the output power increases, the base of Q253 goes more positive, causing it to increase conduction which lowers its collector voltage. Q253 controls Q254, therefore as Q253 increases conduction. Q254 decreases conduction. This raises the voltage applied to the base of Q255. The conduction of Q255 decreases proportionally, lowering the base voltage of pass transistor Q256. The resulting decrease in conduction of Q256 lowers the collector voltage of driver Q251, thereby lowering the output power in proportion to the excessive power originally sensed by the base circuit of Q253.

RECEIVER

The receiver is a dual conversion, superheterodyne FM receiver designed for one-frequency operation in the 150-174 MHz frequency range. A regulated 8.5 volts is used for all receiver stages except for the audio PA IC, which operates from the A+ supply.

The receiver has intermediate frequencies of 10.7 MHz and 455 kHz. Adjacent channel selectivity is obtained by using two band-pass filters: a 10.7 MHz crystal filter and a 455 kHz ceramic filter.

All of the receiver circuitry except the oscillator is mounted on the transmitter/receiver (Tx/Rx) board. The receiver consists of:

- Receiver Front End
- 10.7 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 antenna relay K601 and two tuned circuits (L401, C401, C402 and L402, C404, C405) to the emitter of RF amplifier Q401. The output of Q401 is coupled through three additional tuned circuits (L403, C408; L404, C411; and L405, C413) to the gate of first mixer Q402. The front end selectivity is provided by these five tuned circuits.

OSCILLATOR & MULTIPLIER

Q301, Y301 and associated circuitry make up a Colpitts oscillator. The frequency is controlled by a third mode crystal operated at one third of the required injection frequency. Voltage-variable capacitor D301, L301 and Y301 are connected in series to provide compensation capability. The compensation voltage used to control the transmitter oscillators is applied to D301 to maintain stability. L301 is adjustable to set the oscillator frequency. R301 is in parallel with Y301 to insure operation on the third overtone of the crystal.

The output of Q301 is coupled through C304 to the emitter of buffer Q302. The output of Q302 is coupled through P301 to two tuned circuits (L351 and L352) on the Tx/Rx board. L351 and L352 are tuned to the third harmonic of the oscillator frequency which is applied to the source input of mixer Q402.

The RF frequency from the oscillator/multiplier chain and input level to the mixer can be measured at TP401. The meter reading at TP401 is typically 2 to 4 volts as measured using the Rx RF Detector Probe.

1ST MIXER

The 1st mixer uses a junction FET (Q402) 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 stage, RF from the front end filter is applied to the gate of the mixer. Injection voltage from the multiplier stages is applied to the source of the mixer. The 10.7 MHz mixer 1st IF output signal is coupled from the drain of Q402 through an impedance matching network (L406, C415 and C416) to crystal filter Z501.

The highly-selective crystal filter provides the first portion of the receiver IF selectivity. The output of the filter is coupled through impedance-matching network L501 to the 1st IF amplifier.

1ST & 2ND IF & DETECTOR STAGES

1st IF Amplifier Q501 is a dual-gate MOSFET. The crystal filter output is applied to Gate 1 of the amplifier, and the amplified signal is taken from the drain. The biasing on Gate 2 and the drain load determines the gain of the stage. The amplifier provides approximately 20 dB of IF gain. The output of Q501 is coupled through an impedance matching network (L502) that matches the amplifier output to the input of IC U501.

U501 and associated circuitry consists of the 2nd oscillator, mixer and 2nd IF amplifier. The crystal for the oscillator is Y501, and the oscillator operates at 10.245 MHz for low side injection of the 2nd IF (standard), or 11.155 MHz for high side injection with (Structured Option FT) for those radios determined to be operating on a tweet frequency. This frequency is mixed with the 10.7 MHz input. The output of the mixer is limited by D501 and D502. L503 is tuned for the 455 kHz 2nd IF frequency.

The output of U501 is coupled through ceramic filter Z502 which provides the 455 kHz selectivity, and applied to U502. Test Point TP501 is used in aligning the receiver, and can be used to check the output of U501.

U502 and associated circuitry consists of a 455 kHz limiter, a quadrature type FM detector and an audio preamplifier. L504 is the quadrature detector coil. Audio Level potentiometer R521 is used to set the audio output level to the audio amplifier.

AUDIO AND SQUELCH CIRCUITS

Audio

Audio is applied to the Channel Guard tone reject filter through P903-3 and back to the de-emphasis network through P903-7. The audio passes through the de-emphasis network (R633, C608 and C609) to Volume Control R634.

Audio amplifier IC U601 drives the speaker at the desired audio level (up to three watts). The feedback loop containing R637, R638 and C611 determines the amplifiers closed loop gain. R636 and C613 provide the high audio frequency roll-off above 6 kHz.

The audio amplifier can be muted by a DC voltage from 8.5V TX, or from receiver mute gate Q605. The two logic inputs for Q605 are a squelch signal and RX MUTE.

Squelch

The squelch circuit operates on the noise components contained in the FM detector output. The output of U502 is applied to frequency selective noise amplifier Q601 that has a resonant circuit (L601, R604 and C602) as the collector load. The output is noise in a band around 7 kHz.

The noise output is coupled through Squelch control R607 to expander amplifier Q602 which improves the level discrimination characteristics of the circuit. The output of Q602 is applied to a passive voltage doubler circuit (D603 and D604). This circuit has a high source impedance and operates as an average value rectifier.

Following the voltage doubler is a Schmitt trigger (Q603-Q604). The Schmitt trigger provides the necessary hysteresis and a well-defined output signal for Rx MUTE gate Q605 .

With no RF signal present, the detected noise at the voltage doubler output turns on Q603, turning off Q604. This causes Q605 to turn on, applying +1.8 volts to pin 2 of audio amplifier U601. This voltage turns off U601 and mutes the receiver.

When an RF signal is received, the noise at the output of Q601 decreases and drive to Q603 is removed. This turns off Q603 and allows Q604 to turn on. With Q604 turned on, Rx MUTE gate Q605 turns off. This turns on U601 so that audio is heard at the speaker.

The squelch sensitivity is adjusted by R607 in the base circuit of expander amplifier Q602.

Pressing in the MONITOR pushbutton on the front of the radio opens the Rx MUTE to disable the Channel Guard. It also grounds the base of Q601 and disables the squelch function.

CHANNEL GUARD

Channel Guard is a continuous tone encoder/decoder for operation on tone frequencies in the 71.9 Hz to 210.7 Hz range. The encoder provides tone-coded modulation to the transmitter. The decoder operates in conjunction with the receiver to inhibit all calls that are not tone coded with the proper Channel Guard frequency.

The Channel Guard circuitry consists of discrete components for the Encode disable, PTT switch, and receiver mute switch; four thick-film integrated circuit modules consisting of Decode Module U1001, Encode Module U1002, Frequency Switchable Selective Amplifier (FSSA) U1003, plug-in Versatone Network Z1001 and monolytic IC U1004 in the tone reject filter.

For a functional diagram of the Channel Guard Encoder/Decoder, refer to the troubleshooting procedures.

References to symbol numbers mentioned in the following text are found on the Schematic Diagram, Outline Diagram and Parts List.

FSSA

Frequency Switchable Selective Amplifier (FSSA) U1003 is a highly stable active bandpass filter for the 71.9 Hz to 210.7 Hz frequency range. The selectivity of the filter is shifted across the bandpass frequency range by switching Versatone Networks in the filter circuit.

The gain of the FSSA is a function of the tone frequency. The Tone Frequency is determined by the Tone Network connected in the FSSA circuit. Versatone Network Z1001 is a precision resistor network.

ENCODE

When PTT switch is operated, the Channel Guard encode tone is generated by coupling the output of FSSA bandpass filter U1003 back to its input through a phase inverting amplifier circuit and a limiter circuit. The output of the FSSA is coupled from U1003 to the input of the phase inverting amplifier at U1002-9.

An amplifier provides 180° phase shift of the tone frequency at the output. The output of the phase inverting amplifier circuit is coupled from U1002-6 to the input of the limiter circuit at U1002-5.

A limiting network sets the tone output coupled from U1002-4 to the input of the FSSA (U1003-12) at 53 millivolts peak to peak.

The limiter circuit is also used as an encode switch. Keying the transmitter applies +5.4 Volts to U1002-2. This starts the circuit oscillating. The tone frequency is determined by the tone network connected in the FSSA circuit.

The tone output of the encoder circuit is taken from U1002-7 and coupled through tone output amplifier Q1002 and modulation adjustment R1010 to the audio processor on the IOC board.

DECODE

Audio from Volume/Squelch high that contains the correct frequency is coupled to pin 1 of Decode Module U1001. Pin 1 of

U1001 is the input of an active, three stage, low pass filter. The low pass filter attenuates frequencies over 210.7 Hz. The output of the low pass filter at U1001-15 is applied to U1001-14. U1001-14 is the input of a limiter circuit, limiting the output at U1001-13 to 55 millivolts peak to peak.

The output from the limiter is coupled to Pin 12 of FSSA U1003. Since the tone is the proper frequency, the FSSA will allow it to pass. The output of the FSSA is coupled to U1001-3. U1001-3 is the input to an amplifier circuit. The output of the amplifier at U1001-4 is coupled to the input of a threshold detector at U1001-6.

In the mute mode, when the tone decoder in U1001 detects the Channel Guard frequency, Q1005 turns Q1006 off. This unmutes the receiver audio. In the squelch mode, Q1006 is operating, grounding the Rx MUTE lead and muting the receiver audio.

Audio from VOL/SQ HI is applied to the tone reject filter. The tone reject filter is an active filter consisting of U1004 and associated circuitry. All frequencies from 70 to 210.7 Hz are rejected by the filter, while passing all other audio frequencies back to the receiver audio circuits (filtered VOL/SQ HI).

STANDARD TONE FREQUENCIES (Hz)				
71.9	88.5	107.2	131.8	162.2
74.4	91.5	110.9	136.5	167.9
77.0	94.8	114.8	141.3	173.8
79.7	97.4	118.8	146.2	179.9
82.5	100.0	123.0	151.4	186.2
85.4	103.5	127.3	156.7	192.8
				203.5
				210.7

Encode Disable

SERVICE HINT

The Encode Disable circuit has been incorporated as a maintenance aid for the serviceman. This circuit disables the Channel Guard encode circuit and allows the serviceman to make transmitter distortion and modulation checks without removing the cover from the radio.

The Encode Disable circuit consists of Q1003 and Q1004. To disable the encode circuit, a positive voltage (+8.5 to 14 VDC) is applied to Molex connector P910-9 at the rear of the radio. This is accomplished by temporarily jumpering P910-9 (CG DISABLE) to P910-11 (A+). This positive voltage is applied to the base of Q1003, turning on both Q1003 and Q1004. When turned on, Q1004 applies +8.5 VDC to the base of PTT Switch Q1001, forcing it off. With Q1001 off, the operating voltage for the encoder IC U1002 and Encode Tone Output Stage transistor Q1002 is removed, preventing any tone output.

CAUTION

When using the Encode Disable circuit, do not remove the microphone from the optional hookswitch (if present). In station applications, do not place the CG MON Switch on the desk microphone in MON position. This will short the supply voltage to ground, resulting in possible damage to the equipment.

POWER DISTRIBUTION

The battery voltage (A+) connects to the radio through J910-1 and J910-11 at the rear system connector to the IOC board. Both inputs are connected to reverse polarity protection diodes D901 and D902. The ground lead is coupled through the same connector and is connected to chassis ground through a fusable printed wiring run which will open if the ground wire is accidently connected to A+ (see Figure 2).

One battery input goes directly from the IOC board through a feed-through capacitor in FL907 to the transmitter PA stages. The other input feeds through P903-6 to the main board for two functions. One branch for the audio amplifier passes through an RC-ripple filter (R642 and C619) and one of the sections of POWER On/Off switch S602. The other section of the POWER On/Off switch controls the A+ to voltage regulator U602. The regulator output is fixed at 8.5 volts by means of selected resistor R640. Refer to the Receiver Schematic Diagram for resistor selection instructions.

Regulated 8.5 volts is switched to either the receiver or the transmitter and Tx indicator by the antenna relay. The antenna relay is also powered by the 8.5 volt regulated supply. The non-latching relay is operated by the PTT switch on the microphone, completing the path to A-.

The squelch circuit, the audio processor and parts of the IF amplifier U502 are supplied directly from the continuous 8.5 volt supply.

The receiver front-end, the receiver oscillator, the 10.7 MHz IF stages and the second oscillator are supplied from 8.5 V Rx. The transmitter oscillator and the exciter are supplied from 8.5 V Tx.

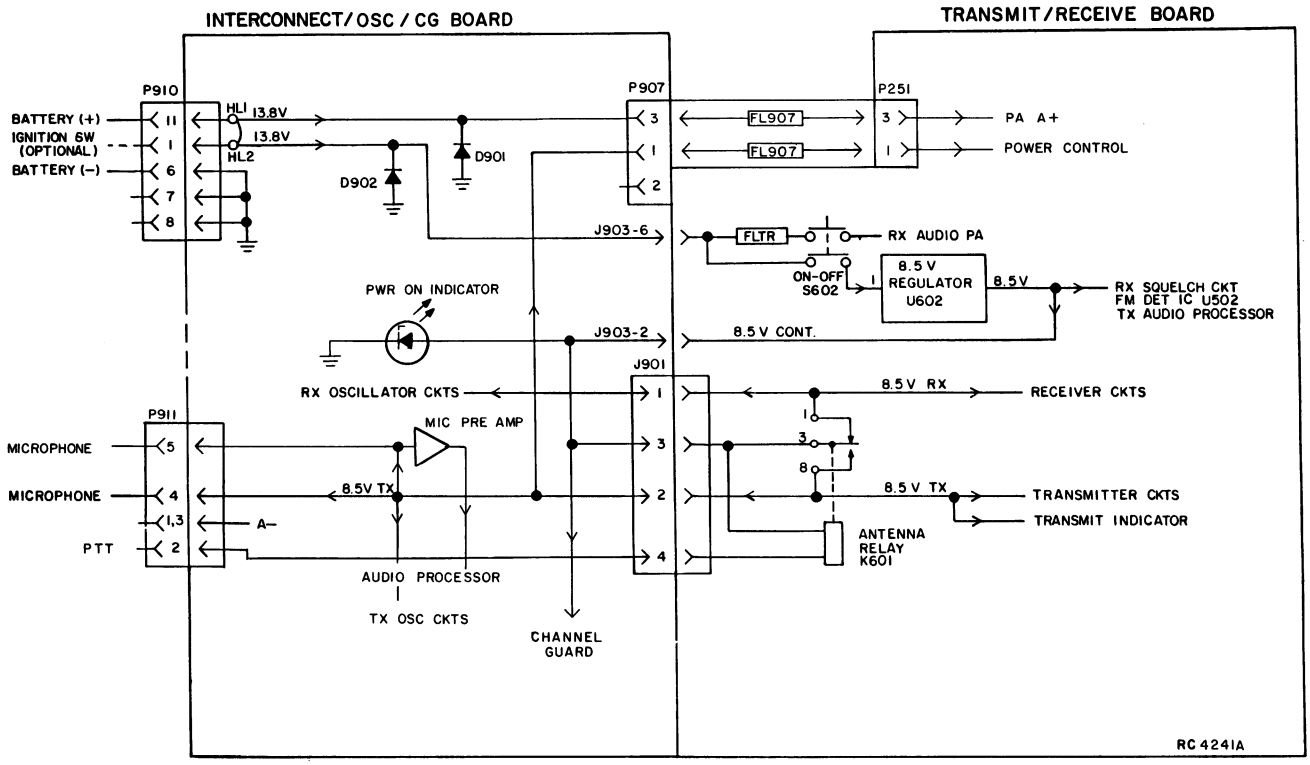

Figure 2 - Power Distribution

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.

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 IOC board, loosen the two screws at the rear of the radio and slide the cover out from the edge of the front control panel and lift off.

NOTE

Be careful when removing the top cover as the speaker leads are connected to the board.

- 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.
  3. Remove the eight screws securing the RF shield.
  4. Unsolder the antenna connector and remove the three retaining screws.
  5. Remove the four screws securing the PA transistor.
  6. Remove the 9 screws securing the Tx-Rx board and carefully lift up the board off of the interconnections pins.

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. Over-voltage 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 the 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

- To remove the IOC board.

1. Remove the top cover.
2. Remove the four screws in the front control panel, and remove panel.
3. Remove the 12 screws securing the board and carefully lift the board up to disconnect the interconnection pins.

DRIVER AND PA TRANSISTOR REPLACEMENT

WARNING

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

To replace PA RF transistors.

1. Remove the transistor mounting hardware.
2. Unsolder one lead at a time with a 50 watt soldering iron. Use a scribe or X-actro® 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 desoldering tool such as a SOLDA PULLT®. 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).

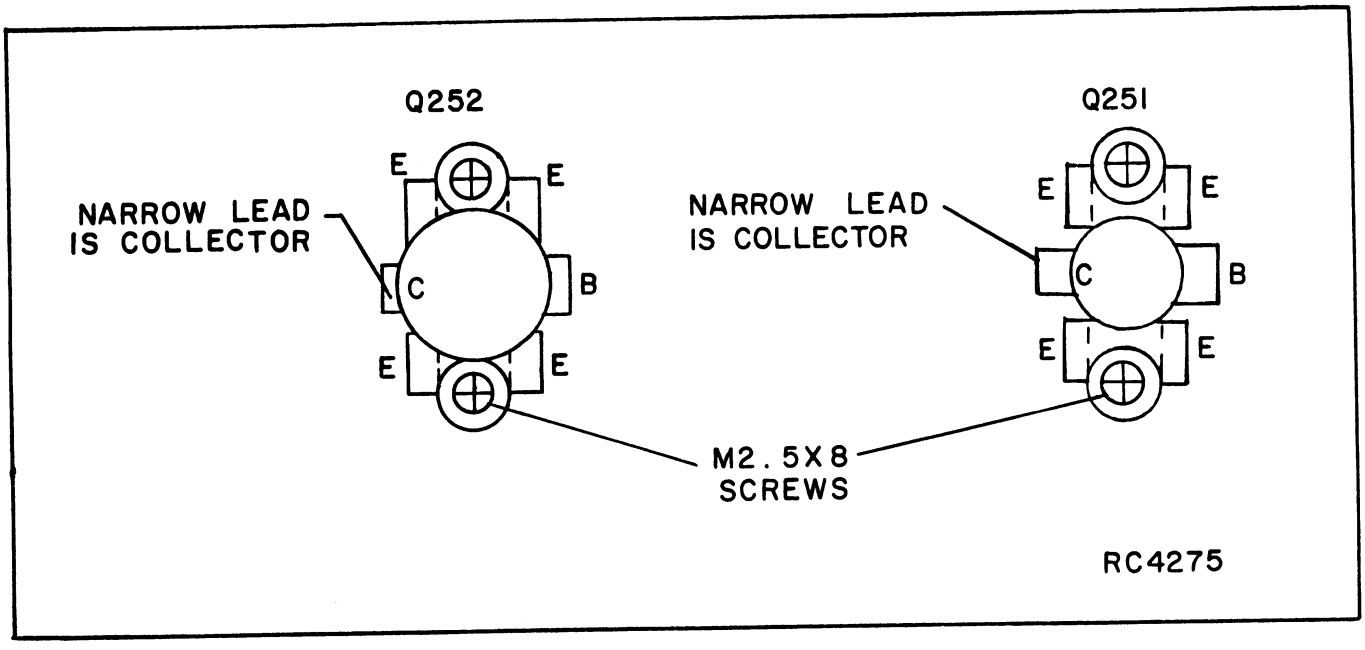

Figure 3 - Q251 Lead Identification

5. Apply a coat of silicon grease to the transistor mounting surface. Place the transistor in the mounting hole. Align the leads as shown on the Outline Diagram. Then replace the transistor mounting screws using a moderate torque of 0.5 Newton meters (N m) or 4.5 inch pounds for the M2.5 screws.

6. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board. Use care not to use excessive heat that causes the printed wire board runs to lift up from the board. Check for shorts and solder bridges before applying power.

CAUTION

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

REMOVING IC'S

Removing IC's (and all other soldered-in components) can be easily accomplished by using a de-soldering tool such as a SOLDA PULLT® or equivalent. 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.

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 IOC 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

RF Detector probes for the receiver section are available for alignment purposes and to monitor the 1st receiver injection at TP401 and the 2nd IF at TP501. An RF signal probe also is available to monitor the transmitter frequency.

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

They are as follows:

TRANSMITTER	RECEIVER
TP201 AMPL 1 (Q201) Emitter Voltage	TP401 Receiver 1st oscillator injection
TP202 AMPL 2 (Q202) Emitter Voltage	TP501 455 kHz IF
TP251 AMPL 3 (Q203) Relative Output	

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.

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

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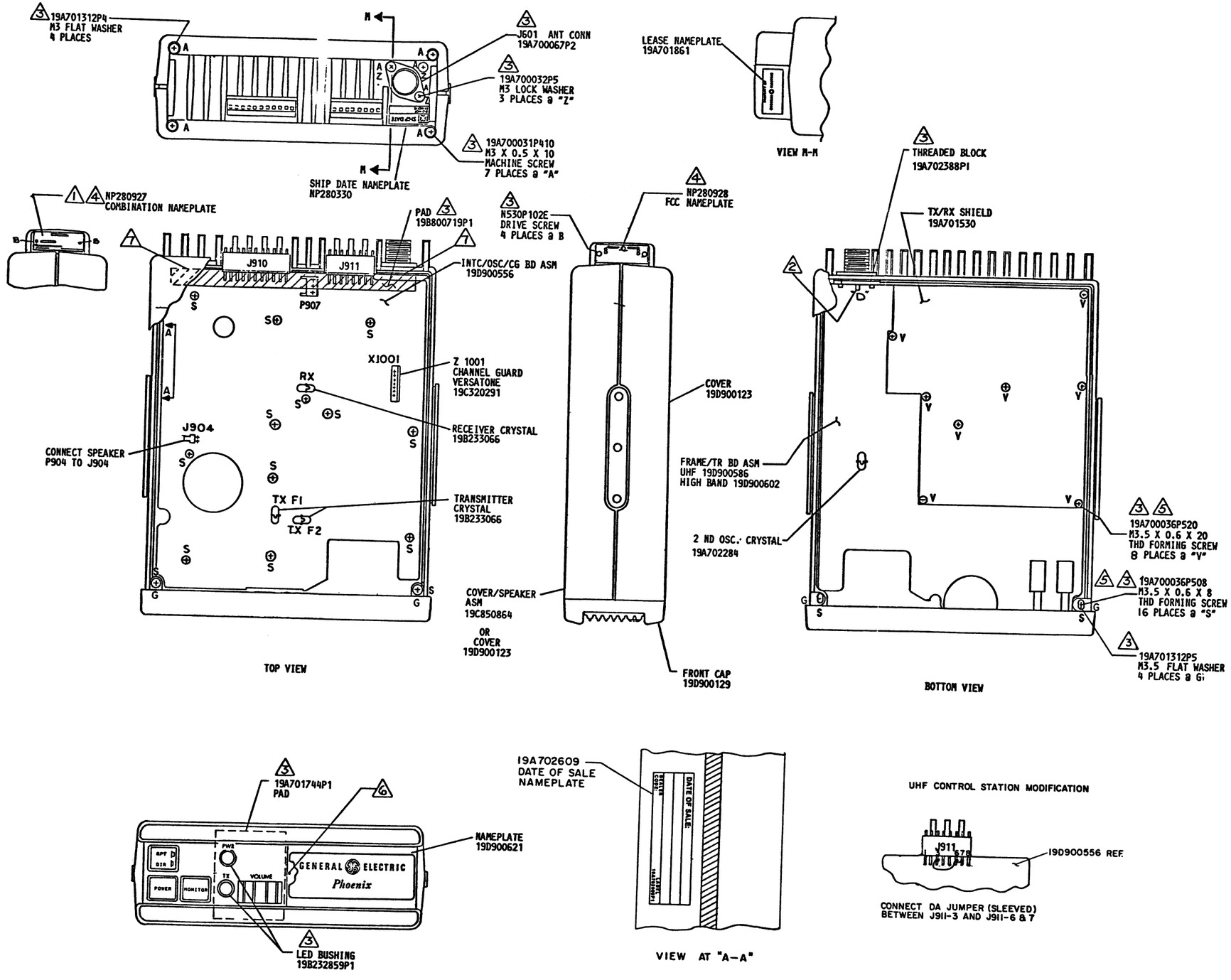


(19D900640, Sh. 1, Rev. 4)

PART NO.	DESCRIPTION
1	PHOENIX/HIGH BAND & UHF
2	HOOKSWITCH APPLICATION
3	EXTERNAL SPEAKER APPLICATION
4	DESK MICROPHONE WITH CHANNEL GUARD
5	UHF CONTROL STATION MODIFICATION

(1)

NOTES:

1. MARK AND APPLY PER 19A122529.
2. SOLDER ANT CONNECTOR ONE PLACE @ "D"
3. PART OF KIT PL 19A701522.
4. BEND NAMEPLATE SLIGHTLY TO ACCOUNT FOR TAPER IN CASTING.
5. DIP ENDS OF THD FORMING SCREWS INTO LUBRICANT 19A115204P1 BEFORE INSTALLING IN CASTING.
6. REMOVE FLASH LEFT BY GATE OF TOOL FLUSH TO SURFACE OF FRONT CAP IF NECESSARY.
7. APPLY 19A134084P1 OR P2 TAPE TO BOTH ENDS OF 19B800719 PAD.

Figure 4 - Mechanical Layout

CRYSTAL OSCILLATOR FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set with a frequency meter or counter with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained, and with the entire radio as near as possible to an ambient temperature of 27.0°C (80.6°F).

The oscillator should be reset only when the frequency shows deviation in excess of the following limits:

- ±0.5 PPM, when the radio is at 27.0°C (80.6°F).
- The specification limit of ±5 PPM at any temperature within the ranges of -30°C (-22°F) to +60°ccccc (+140°F).

If the radio is at an ambient temperature of 27.0°C (80.6°F), set the oscillator for the correct operating frequency.

If the radio is not at an ambient temperature of 27.0°C, offset the oscillator, as a function of actual temperature, by the amount shown in the frequency Off-set Chart.

For example: Assume the ambient temperature of the radio is 22°C (71.6°F). At that temperature, the curve shows a correction factor of +0.75 PPM. (At 150 MHz, 1 PPM is 150 Hz. At 174 MHz, 1 PPM is 174 Hz.)

With an operating frequency of 160 MHz, set the oscillator for a reading of 120 Hz (0.75 x 160 Hz) higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 27°C). set the oscillator for the indicated PPM lower than the licensed operating frequency.

When setting the transmitter oscillator frequency, adjust L151 to the assigned operating frequency.

To set the frequency of the receiver 1st injection oscillator, connect the RF signal probe to TP401 and adjust L301 for the assigned receiver frequency -10.7 MHz.

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

Set the transmitter oscillator frequency by adjusting L151 to the assigned operating frequency.

> **NOTE**
>
> Always set the frequency first before setting the modulation.

MODULATION LEVEL ADJUSTMENT

> **CAUTION**
>
> DO NOT remove microphone from the optional hookswitch (if present), when making this adjustment. DAMAGE to equipment may result.

A Channel Guard Encode Disable circuit has been incorporated as a maintenance aid to allow the service technician to make transmitter distortion and modulation checks without removing the cover from the radio.

The CG encode circuit can be easily disabled by temporarily connecting a jumper from J910-11 (A+) to J910-9 (CG DISABLE lead).

MOD ADJUST Control R155 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

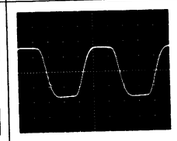
1. Connect the audio oscillator and the AC voltmeter across audio input terminals J911-4 (Hi) and J911-3 (Lo) on the IOC board.
2. Adjust the audio oscillator for 1 Volt RMS at 1000 Hz.
3. Connect RF Wattmeter to antenna jack.

   Set CHANNEL GUARD MOD ADJUST R1010 for zero tone deviation. Next, with the 1 Volt signal at 1000 Hz applied, set MOD ADJUST R155 (F1) for 3.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST R1010 for 0.75 kHz tone 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.

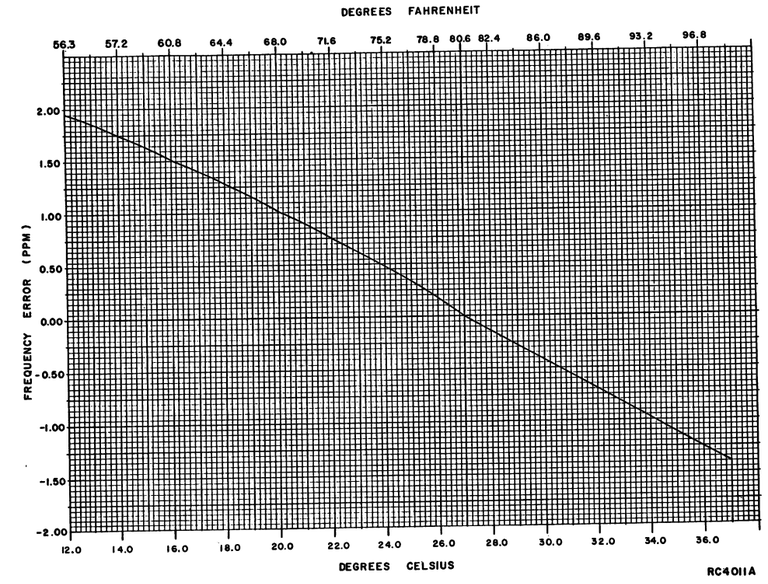
AUDIO AC VOLTAGES

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

		U101-7	C111 (+)
SCOPE SETTING	HORIZONTAL	200 U SEC/DIV	200 U SEC/DIV
	VERTICAL	2 VOLTS/DIV	2 VOLTS/DIV
SET AUDIO OSCILLATOR AT 1000 Hz WITH OUTPUT OF 1.0 VRMS. R155 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 100 millivolts.



Frequency Offset Chart

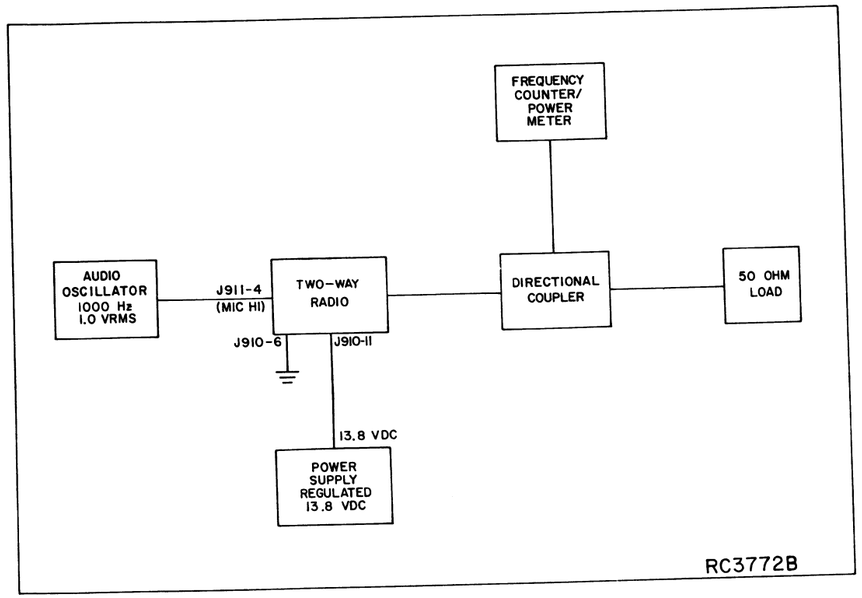


Figure 5 - Test Equipment Set Up

TRANSMITTER ALIGNMENT

TEST EQUIPMENT

1. 50-ohm Wattmeter
2. 50-ohm Load
3. DC Probe (19C330165G1)
4. TX RF Detector Probe (19C330130G1)
5. Voltmeter (20,000 ohms per volt)
6. 13.8 V Regulated Power Supply
7. Audio Signal Generator

PRELIMINARY CHECK AND ADJUSTMENTS

NOTE

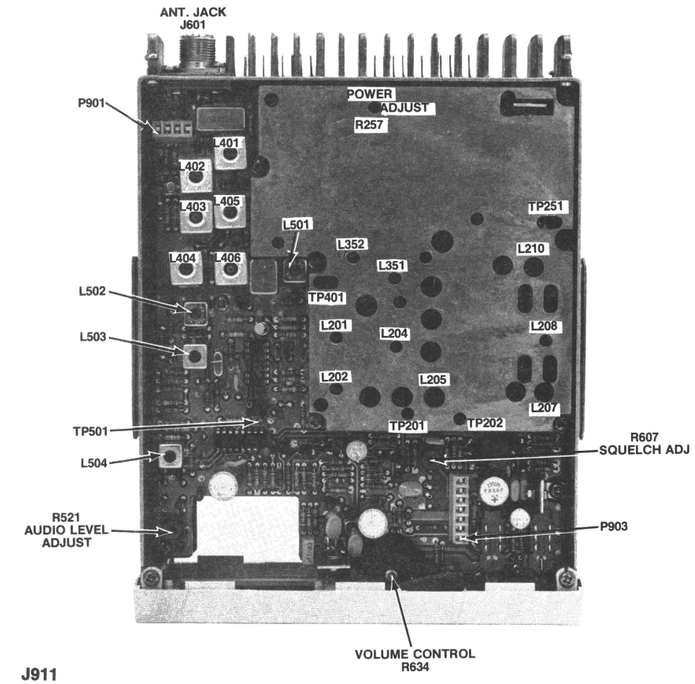
Refer to photographs to locate CONTROLS, TEST POINTS and CRYSTALS.

1. Check P903-2 for 8.5 volts ±0.15 volt before any alignment is attempted.
2. Install the transmit crystal in the appropriate socket.
3. Set the tuning cores in L201, L202, L204, L205, L207, L208, and L210 so that the tops of these cores are flush with the tops of the plastic coil forms. Then, turn the core in L201 5 turns clockwise and turn the core in L202 4 turns clockwise.
4. Set power adjust control R257 to maximum (fully clockwise).
5. All adjustments are made with transmitter keyed. Unkey the transmitter between steps to avoid overheating.
6. The DC probe is used to monitor TP201 and TP202. The RF Detector probe is used on TP251. The RF probe must be positioned properly so that the (+) terminal (colored red) must be positioned nearest the edge of the radio.

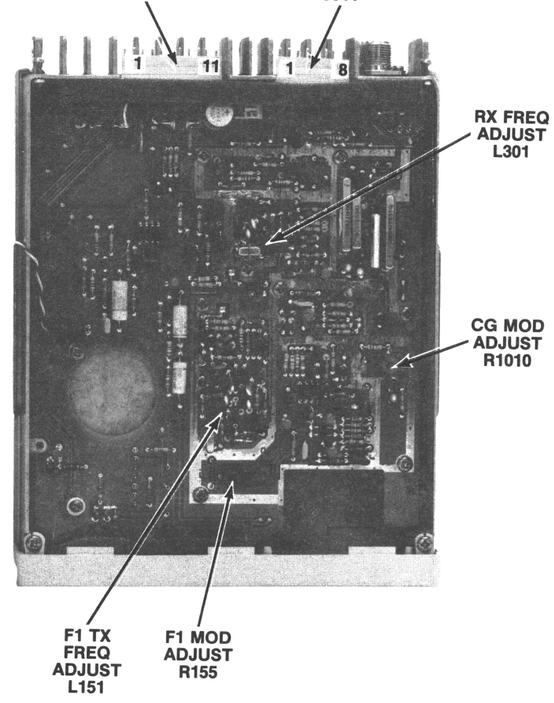
ALIGNMENT PROCEDURE

STEP	TEST PROBE	TUNING CONTROLS	METER READING	PROCEDURE
1.	TP201	L151,L201 L202	Maximum (+0.35V Typ.)	Adjust L151, L201 and L202 in that order for maximum meter reading.
2.	TP201	L204	Minimum	Adjust L204 for minimum meter reading. (+0.20V Typ.)
3.	TP201	L205	Maximum	Adjust L205 for maximum meter reading. (+0.30V Typ.)
4.	TP202	L201,L202 L204	Maximum (+1.0V Typ.)	Readjust L201, L202 and L204 in that order for maximum meter reading.
5.	TP202	L207	Minimum (+0.25V Typ.)	Adjust L207 for minimum meter reading.
6.	TP202	L208	Maximum (+0.5V Typ.)	Adjust L208 for maximum meter reading.
7.	TP251	L205,L207 L208,L210	Maximum (+0.70V Typ.)	Readjust L205, L207, and L208 for maximum, and adjust L210 for maximum in that order.
8.	Watt-meter	R257	Rated Power (25 Watts)	Set R257 from rated power output.
9.				Recheck the transmitter carrier frequency after completing the Alignment Procedure.

TX/RX BOARD



IOC BOARD



RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. RF Signal Generator (150-174 MHz).
2. DC Voltmeter
3. AC Voltmeter
4. Receiver RF Detector Probe 19C330130G2.
5. RF Signal Probe 19C330129G1.
6. DC Probe 19C330165G1.
7. Power Supply, 13.8 V Regulated
8. VOM (20K ohms/volt)
9. 4 ohm, 5 watt resistor

PRELIMINARY CHECKS

1. Plug crystal Y301 into oscillator socket X301.
2. Disable Channel Guard by connecting ground to J910-9 (or remove microphone from Optional Channel Guard Hookswitch if present.
3. Disconnect internal speaker from J904 on IOC board. Terminate either J910-3 or J904 with a 4 ohm, 5 Watt resistor.

NOTE

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

4. Connect the power supply to J910-11(+) and J910-6(-) and adjust for +13.8 VDC.
5. Turn radio on and measure the +8.5 V regulated line on P903 pin 2. The regulated voltage shall be +8.5 V ±0.15V. If this requirement is not met, check the value of R640 with the color code on U602.

ALIGNMENT PROCEDURE

STEP	METERING TEST POINT	PROBE	TUNING CONTROL (s)	PROCEDURE
			1ST OSCILLATOR MULTIPLIER	
1.	TP401	RF DET	L301	With voltmeter on lowest range adjust L301 for maximum meter reading. NOTE If no meter indication is observed at TP401, connect positive lead of RF Detector probe (red dot) to J351 using a short piece of DA jumper wire (AWG #18 or smaller - 1.024 mm). See photograph for access to J351. Adjust L301 for maximum meter reading, then adjust L351 for maximum and then dip L352. Re-connect RF DET Probe to TP401.
2.	TP401	RF DET	L351,L352	Alternately adjust L351 and L352 for maximum meter reading (Typically 2 to 4 volts).
3.	TP401	RF Signal	L301	Connect a frequency counter to TP401 using RF Signal Probe. Adjust L301 for channel operating frequency.
			IF ALIGNMENT	
4.	TP401, TP501	RF Signal RF DETECTOR	L406,L503 L502,L501	Connect RF signal generator to TP401 using RF Signal Probe. Connect RF DETECTOR Probe and VOM to TP501. Use 0.5 to 1.0 V scale. Set RF signal generator output to channel frequency at the minimum level sufficient to provide a mid scale meter indication. Reduce the output of the signal generator as required to keep the detected RF level within the 0.5 to 1.0 volt range. Adjust L406 first, then L503, L502 and L501 respectively for maximum indication on meter. Alternately adjust L406 and L501 to obtain maximum meter reading. Disconnect RF Signal Generator from TP401.
			FRONT END ALIGNMENT	
5.	TP501	Rx RF DETECTOR	---	Connect signal generator to Antenna input jack J601. Verify Rx RF Detector Probe is connected to TP501 and VOM. Adjust signal generator to RF channel frequency. Adjust output level of signal generator for a VOM reading between 0.5 and 1.0 Volts.
6.	TP501	Rx RF DETECTOR	L403,L405 L404	Detune L403 and L405 as much as possible. Tune L404 through entire range while noticing peak readings on VOM. Adjust L404 for maximum meter reading, reducing the output level of signal generator as required. Alternately readjust L405 and L403 for maximum VOM reading.
7.	TP501	Rx RF DETECTOR	L402,L401	Alternately adjust L402 and L401 for maximum VOM reading. Reduce generator output to maintain a VOM reading of 0.5 to 1.0 Volts. Remove RF Detector Probe and VOM from TP501.
8.		---	R521,R634	Connect external speaker leads J910-3 and J910-7 to a four-ohm resistive load. Set audio level control R521 and volume control R634 to mid position. Connect the AC voltmeter/audio distortion analyzer across the four-ohm load. Turn generator modulation off. NOTE If the quadrature coil L504 requires tuning, tune according to step 14 under Detector/Audio Alignment before turning the generator modulation off. Upon completion of step 14 continue with step 9.
9.		---		Push and hold squelch cancel pushbutton (S601). Adjust generator level for 1.0 V on VOM.
10.		--	L401,L405	Adjust L401, L402, L405, L404 and L403 or maximum quieting. Release the squelch cancel pushbutton (S601).
11.	TP401	RF DETECTOR	L351,L352	Connect Rx detector probe at TP401 and readjust L351 and L352 for a maximum reading on the VOM. Remove RF Detector probe from TP401.
12.			L401,L405	Adjust L401, L402, L405, L404 and L403 respectively for maximum quieting.
13.	---	---	---	Remove all test equipment.
			DETECTOR/AUDIO ALIGNMENT	
14.	Audio Output	---	L504	Apply a 1000 uV RF signal modulated with 1000 Hz to antenna input jack J601. Connect external speaker leads J910-3, J910-7 to a four-ohm resistive load. Set audio level control R521 and volume control R634 to mid position. Disable Channel Guard by grounding J910-9 on the INTR/OSC/CG board. Connect AC voltmeter/distortion analyzer across four ohm load. Adjust L504 for maximum meter reading. Reduce volume control as necessary to keep output voltage from exceeding 2.0 VRMS.
15.		---	L501,L406	Adjust volume control for a level of 2.0 VRMS on AC voltmeter. Note the position of tuning slugs in L501 and L406. Slowly adjust L501 and L406 +1/4 turn for minimum distortion on distortion analyzer. If no improvement is noted return slugs to original position.
16.	P903-3	---	R521	Connect AC voltmeter having a minimum input impedance of 1 megohm to P903-3. Adjust audio level control R521 for a meter reading of 300 mV RMS ±5 mV.
17.				Reconnect AC voltmeter across external speaker leads, J910-3 (SPKR HI) and J910-7 (SPEAKER LO). Adjust volume control for 3 Watts (3.46 VRMS across 4 ohm load).
18.				Measure audio distortion using Distortion Analyzer. Distortion should be less than 5%. Disconnect all test equipment.

FIXED SQUELCH ADJUSTMENT

1. Push and hold MONITOR pushbutton at its "IN" position.
2. Connect a signal generator to antenna jack J601 and adjust for a nominal 9 dB SINAD signal.
3. Release MONITOR 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).
7. Remove ground from J910-9 on INTR/OSC/CG Board.

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 .Hz 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 0.3 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.

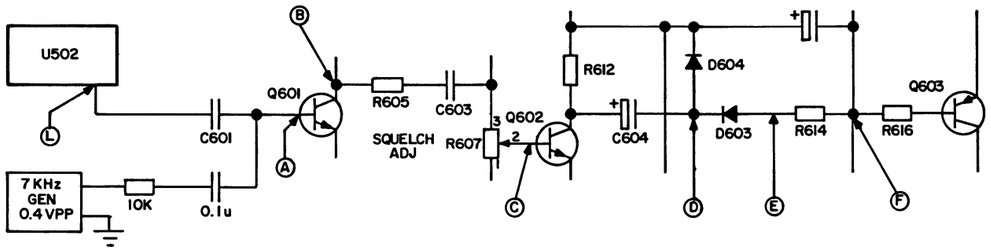
C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12 dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

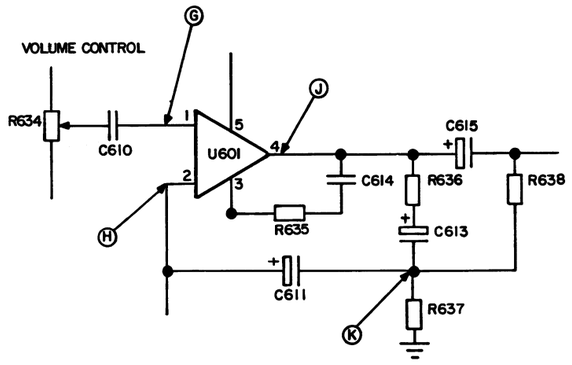
D. The deviation control reading for the 12 dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±6.5 kHz.

SERVICE CHECK

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

AUDIO AND SQUELCH WAVEFORMS



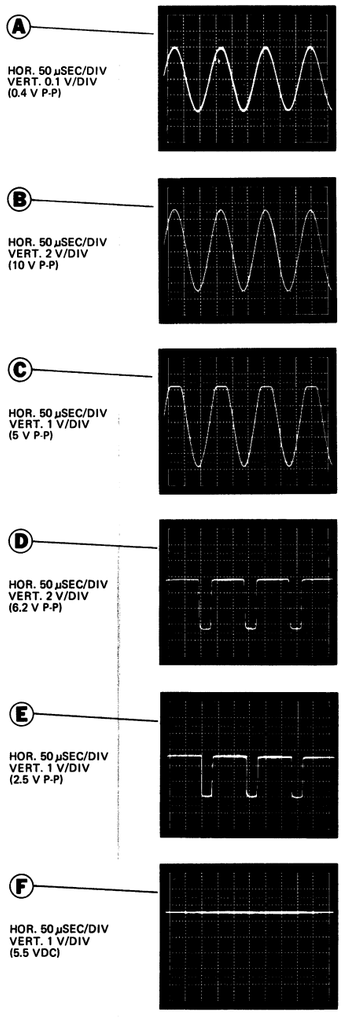


RC-4260A

SQUELCH CIRCUIT TEST WITH 7 kHz SIGNAL

PRELIMINARY STEPS

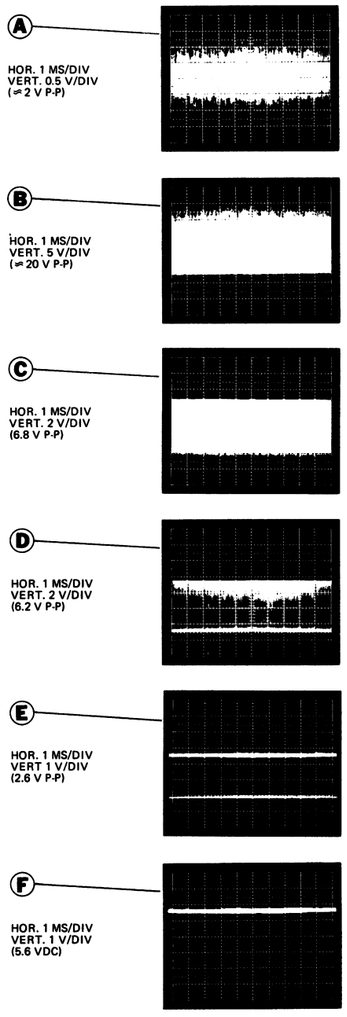
1. Quiet receiver with 1000 uv unmodulated signal.
2. Squelch Adjust at maximum squelch.
3. Monitor pushbutton in OUT position.
4. Use 10 megohm probe.



SQUELCH CIRCUIT CHECKS WITH NOISE

PRELIMINARY STEPS

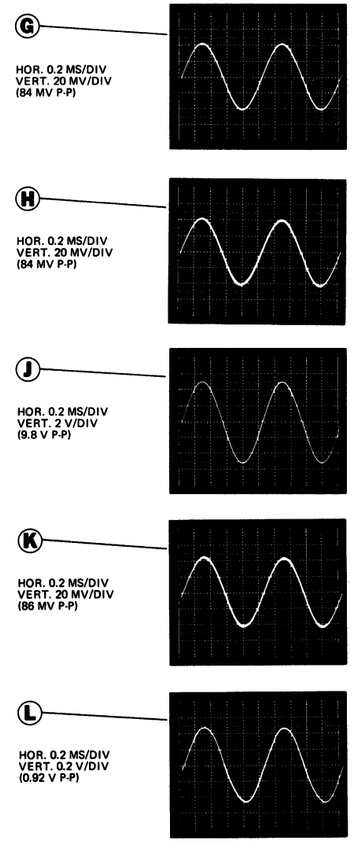
1. No input signal applied.
2. Squelch Adjust at maximum squelch.
3. Monitor pushbutton in OUT position.
4. Use 10 megohm probe.



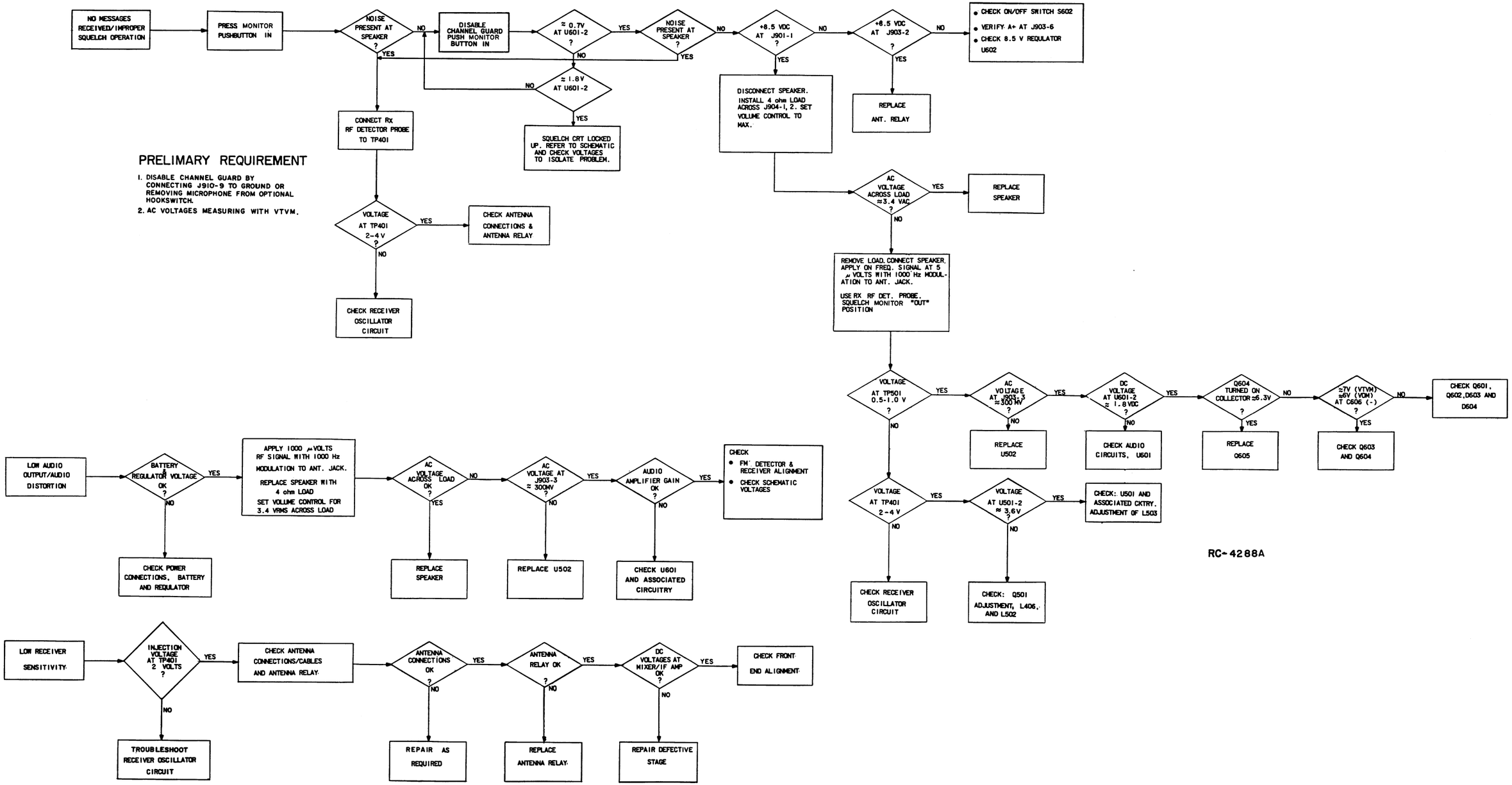
AUDIO CIRCUIT CHECKS

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.



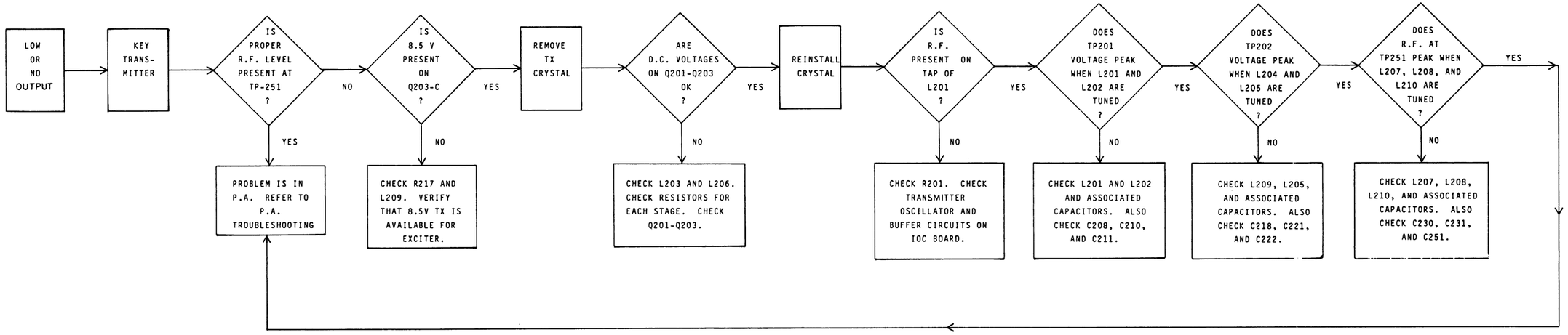
RECEIVER AUDIO AND SQUELCH WAVEFORM CHECKS



RC-4288A

RECEIVER TROUBLESHOOTING FLOWCHART

Figure 6



EXCITER TROUBLESHOOTING FLOWCHART

Figure 7

EXCITER VOLTAGE READINGS

Voltage Readings are typical readings made with the Transmitter keyed, and measured with a 20,000 ohms-per-volt VOM. An RF choke (10 microhenrys) is used in series with the hot meter lead to avoid detuning RF circuits.

RC4309A

TRANSISTOR	XTAL IN SOCKET	NO XTAL IN SOCKET
Q201-E	+0.32V	+0.20V
-B	+0.45V	+0.80V
-C	+7.5V	+7.8V
Q202-E	+0.75V	+0.45V
-B	+0.55V	+1.10V
-C	+7.6V	+8.0V
Q203-E	0V	0V
-B	+0.13V	+0.57V
-C	+6.2V	+8.5V

PA TROUBLESHOOTING CHART

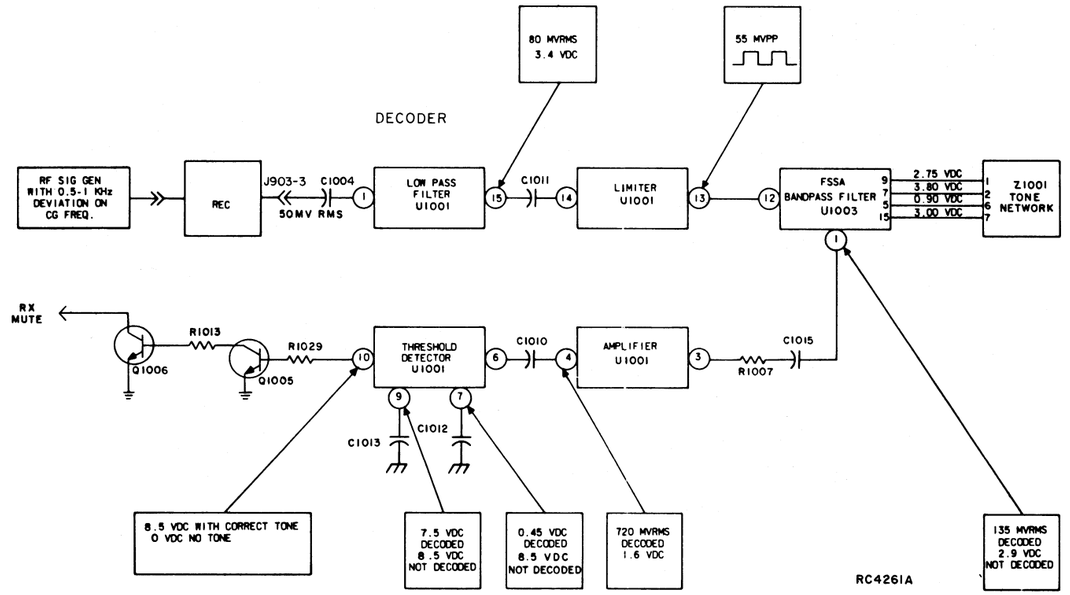
SYMPTOM	TYPICAL VOLTAGE/SIGNAL	PROBABLE CAUSE	TROUBLESHOOTING PROCEDURE
No output	25 Watt	Relay Not Keying	Listen for click of relay when mike button is pressed.
		Bad Relay	Check for keyed voltage (8.5V) at Pin 1 of P251.
		Bad Power Control Transistor Q256	Measure voltage at collector of Q251 PA Driver.
		Exciter Bad	Measure RF drive at TP251 (12 VDC).
Low output	Less than 25W	Power Supply Low	Measure DC voltage at P251 Pin 3 (13.2 VDC).
		R257 Set Low	Measure DC voltage at R252. Adjust pot R257 for rated Power output.
		Short in filter or open or short in relay	Remove strap W253 and transmit crystal. Key microphone. Check for short from W254 to ground (should not be shorted). Check for open from W254 to antenna connector J601 (should not be open).
		Q251 or Q252	If no problem is found with the above checks and the total current to the radio on transmit is above 1 amp, change Q252. If the current is below 1 amp, change Q251.

CHANNEL GUARD TROUBLESHOOTING

SYMPTOM	PROCEDURE
Unit does not encode.	1. Check for 3.1 VDC at U1002-7. 2. If reading is correct, check Mod. Adj. R1010 then check the transmitter oscillator module. 3. If reading is not correct, check voltage readings on connections between the tone network Z1001 and U1003. 4. If the readings between the tone network and U1003 are incorrect, insure good contact between the tone network and the network socket. 5. If readings are correct, check voltage readings at all other points identified.

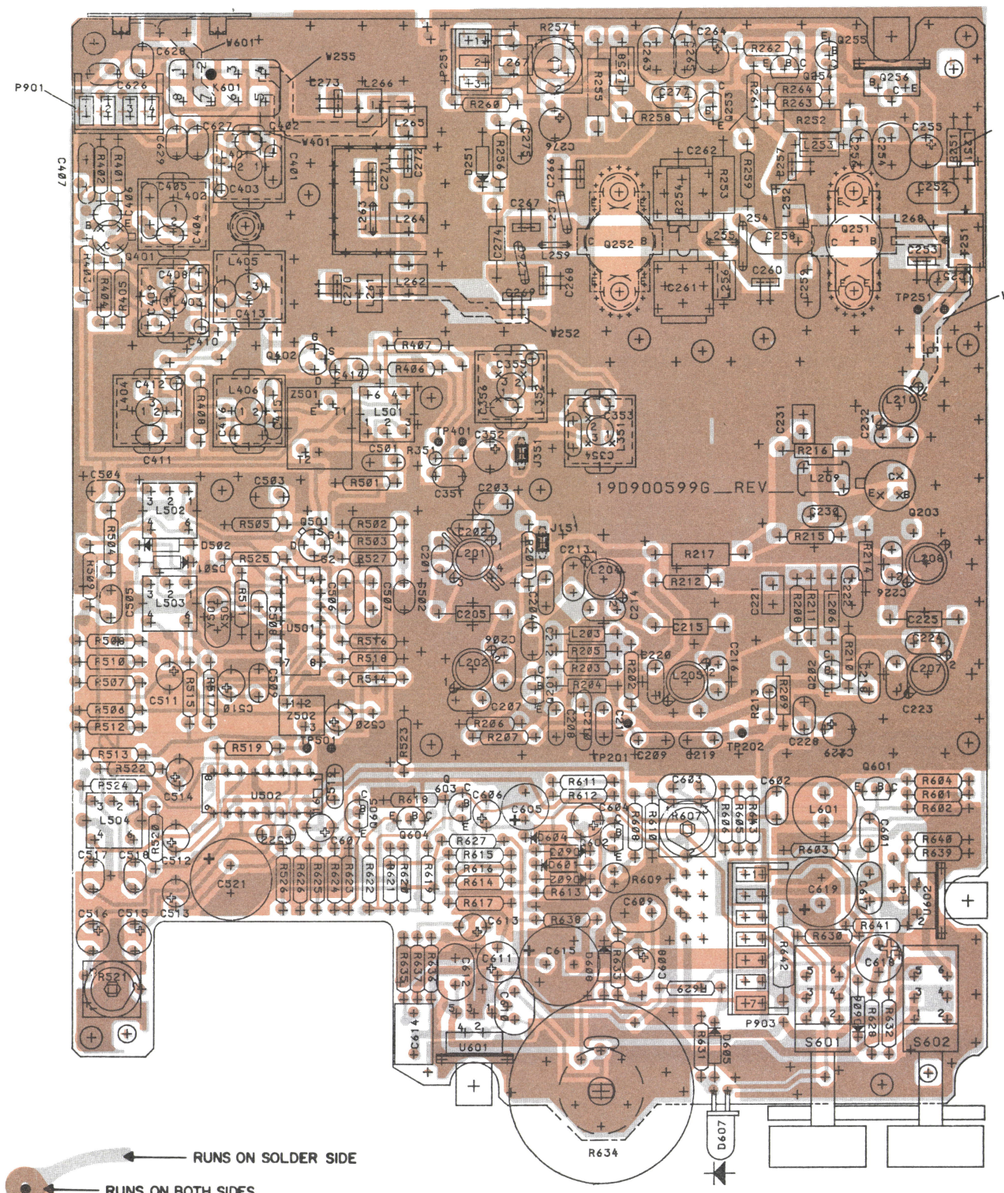
CHANNEL GUARD TROUBLESHOOTING

SYMPTOM	PROCEDURE
Unit does not decode.	1. Push in the MONITOR pushbutton and check for proper receiver operation. 2. If the receiver operates properly, apply the proper Channel Guard tone to the radio and check for 8.5 VDC at position U1001-10. 3. If reading is not correct, check voltage readings on connections between the tone network Z1001 and U1003. 4. If the readings between the tone network and U1003 are incorrect, insure good contact between the tone network and the network socket. 5. If readings are correct, check voltage readings at all other points indentified.

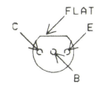


TROUBLESHOOTING

150—174 MHz POWER AMPLIFIER AND CHANNEL GUARD



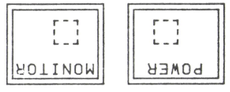
LEAD IDENTIFICATION
FOR Q201,Q202,Q253,Q254,&
Q601-Q605



IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

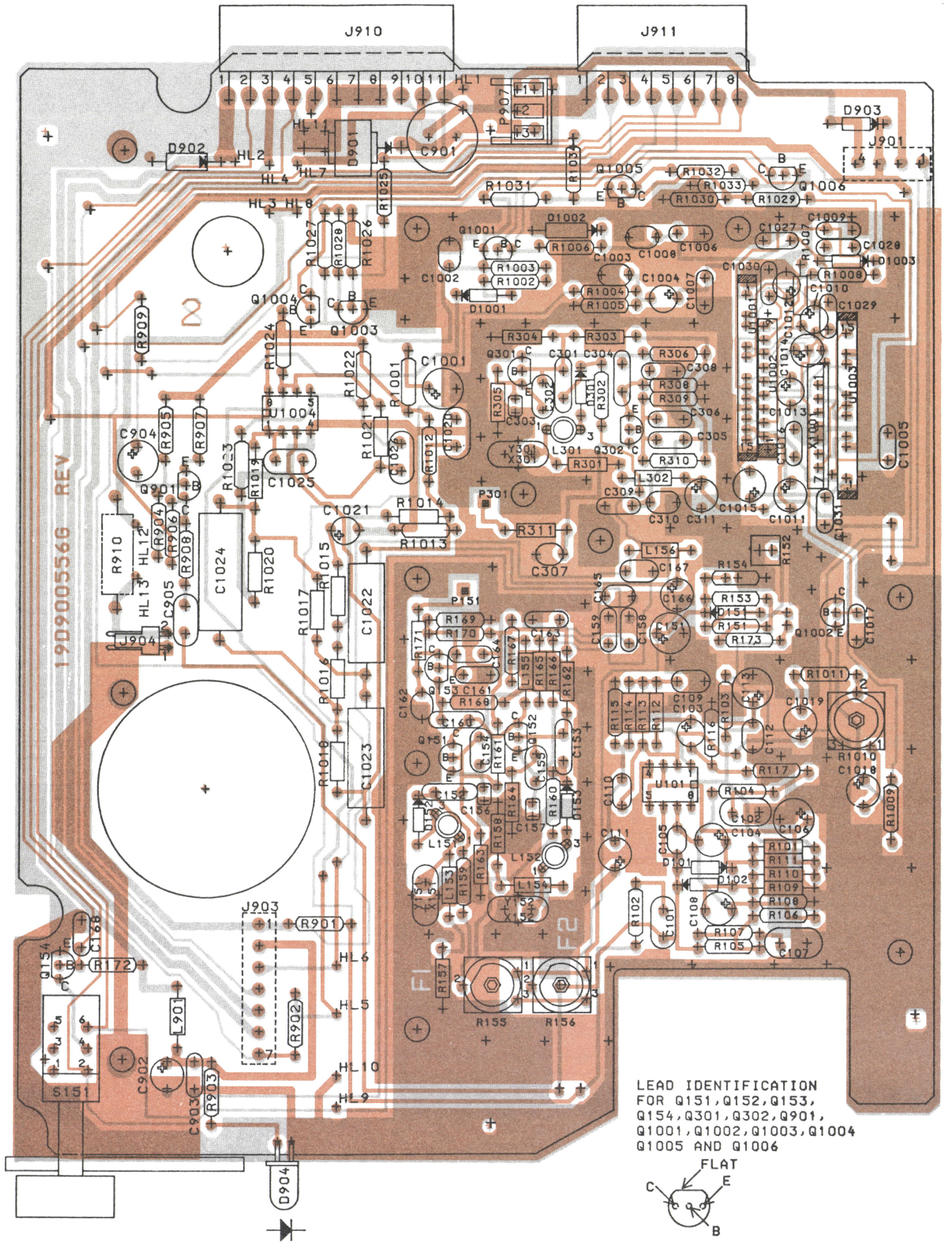
LEAD IDENTIFICATION
FOR Q255



OUTLINE DIAGRAM

150—174 MHz HIGH BAND
TRANSMITTER/RECEIVER BOARD

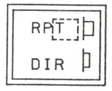
(19D900600, Rev. 4)
(19A702305, Sh. 1, Rev. 1)
(19A702305, Sh. 2, Rev. 2)



LEAD IDENTIFICATION
FOR Q151,Q152,Q153,
Q154,Q301,Q302,Q901,
Q1001,Q1002,Q1003,Q1004
Q1005 AND Q1006

IN-LINE
TOP VIEW

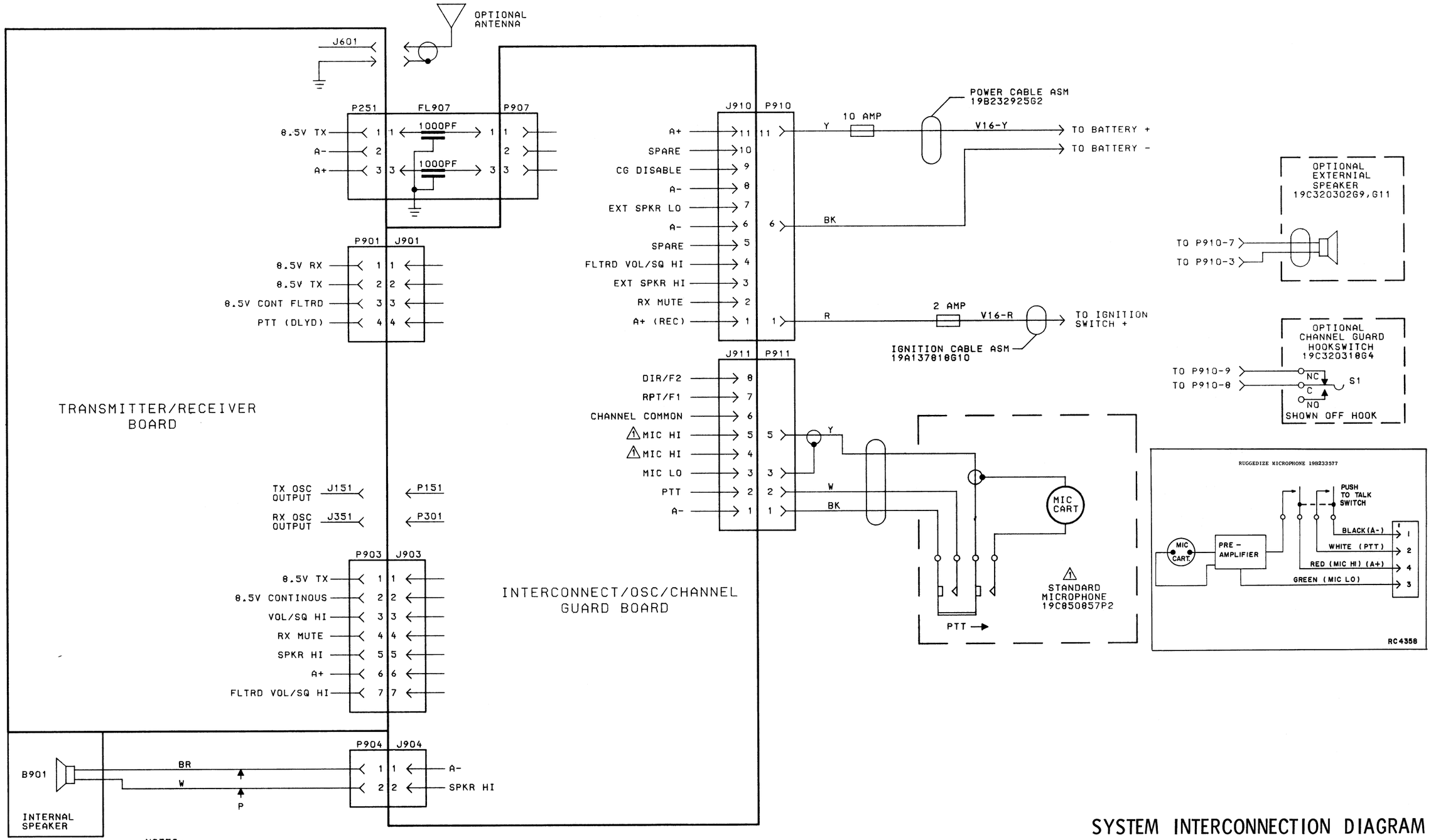
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



(19D900557, Rev. 2)
(19A702264, Sh. 1, Rev. 2)
(19A702264, Sh. 2, Rev. 2)

OUTLINE DIAGRAM

INTERCONNECT/OSCILLATOR/CHANNEL GUARD BOARD



NOTES:

⚠ STANDARD MICROPHONE MIC HI CONNECTS TO J911-5 AS SHOWN. FOR OPTIONAL MICROPHONES WITH BUILT IN PRE AMPLIFIER, MIC HI CONNECTS TO J911-4.

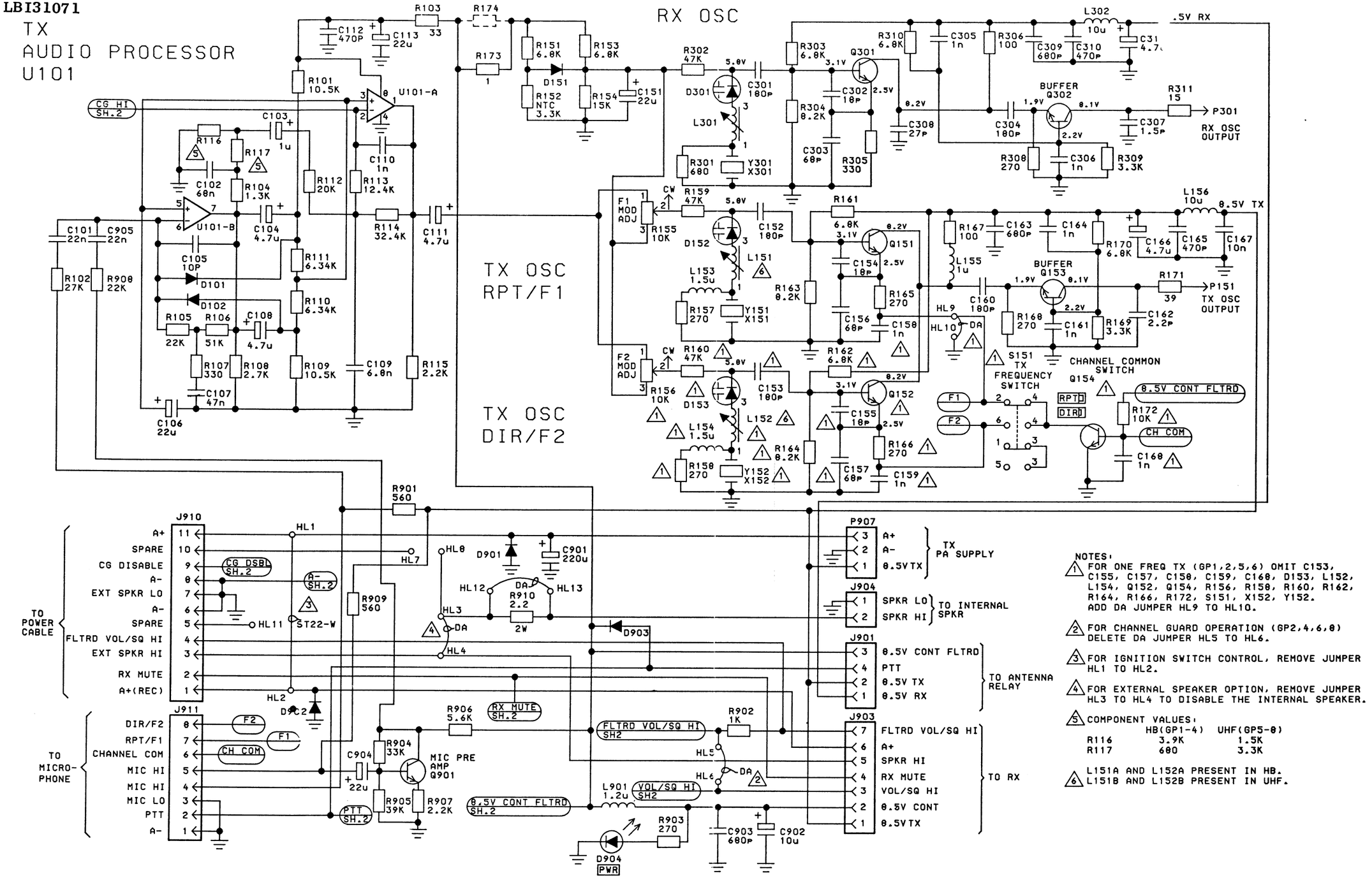
(19D900656, Rev. 1)

SYSTEM INTERCONNECTION DIAGRAM

PHOENIX COMBINATIONS

LBI31071

TX
AUDIO PROCESSOR
U101



NOTES:

1. FOR ONE FREQ TX (GP1,2,5,6) OMIT C153, C155, C157, C158, C159, C160, D153, L152, L154, Q152, Q154, R156, R158, R160, R162, R164, R166, R172, S151, X152, Y152. ADD DA JUMPER HL9 TO HL10.
2. FOR CHANNEL GUARD OPERATION (GP2,4,6,8) DELETE DA JUMPER HL5 TO HL6.
3. FOR IGNITION SWITCH CONTROL, REMOVE JUMPER HL1 TO HL2.
4. FOR EXTERNAL SPEAKER OPTION, REMOVE JUMPER HL3 TO HL4 TO DISABLE THE INTERNAL SPEAKER.
5. COMPONENT VALUES:

	HB(GP1-4)	UHF(GP5-8)
R116	3.9K	1.5K
R117	680	3.3K

6. L151A AND L152A PRESENT IN HB. L151B AND L152B PRESENT IN UHF.

SCHEMATIC DIAGRAM

SYSTEM INTERCONNECT

(19D900589, Sh. 1, Rev. 6)

IOC BOARD

PTT SWITCH
Q1001

TONE CIRCUITY

ENCODE TONE
OUTPUT STAGE
Q1002

8.5V CONT FLTRD SH.1
R1001 33
PTT SH.1
D1001
8.5V
R1002 22k
R1003 5.6k
A
B
R1006 470
VOL/SQ HI SH.1
R1004 10k
C1004 470n
R1005 10k
C1001 22u
C1002 470p
C1003 470p
D1002 5.4V
A- SH.1
C1005 27p
C1006 27p
C1027 27p
C1007 27p
C1008 150p
C1010 1u
C1011 3.3u
C1028 27p
D1003
R1008 100k
C1029 27p
U1001 DECODE
U1002 ENCODE
U1003 FSSA
C1009 27p
C1012 470n
C1013 1u
R1007 22.6k
C1030 27p
C1014 3.3u
C1015 3.3u
C1031 27p
Z1001 X1001 TONE NETWORK
C1016 120p
C1017 27p
R1009 2.7k
C1018 3.3u
B
CW
R1010 10K
R1011 68k
C1019 2.2u
CG MODULATION
CG HI SH.1

TONE REJECT FILTER

C1020 68n
R1012 10k
R1013 15k
C1022 33n
R1014 16.2k
R1016 11k
R1015 16.5k
C1021 220n
C1023 33n
R1017 7.32k
R1018 14.7k
C1024 68n
U1004-A
C1025 33n
C1026 33n
R1021 8.25k
R1019 332
R1020 12.1k
R1022 39k
R1023 47k
R1024 22k
U1004-B
8.5V CONT.FLTRD SH.1
FLTRD VOL/SQ HI SH.1

CG DISABLE SH.1
R1034 1.8k
R1025 100k
R1026 10k
R1028 10k
R1027 22K
8.5V
A
Q1003 Q1004
ENCODE DISABLE

R1029 56k
R1031 22K
R1032 10k
R1030 22K
R1033 5.6K
8.5V
RX MUTE SH.1
Q1005 Q1006
RX MUTE SWITCH

MODEL NO.	REV. LETTER
PL19D90055661	-
62	B
63	-
64	-
65	-
66	-
67	-
PL19D90055668	D

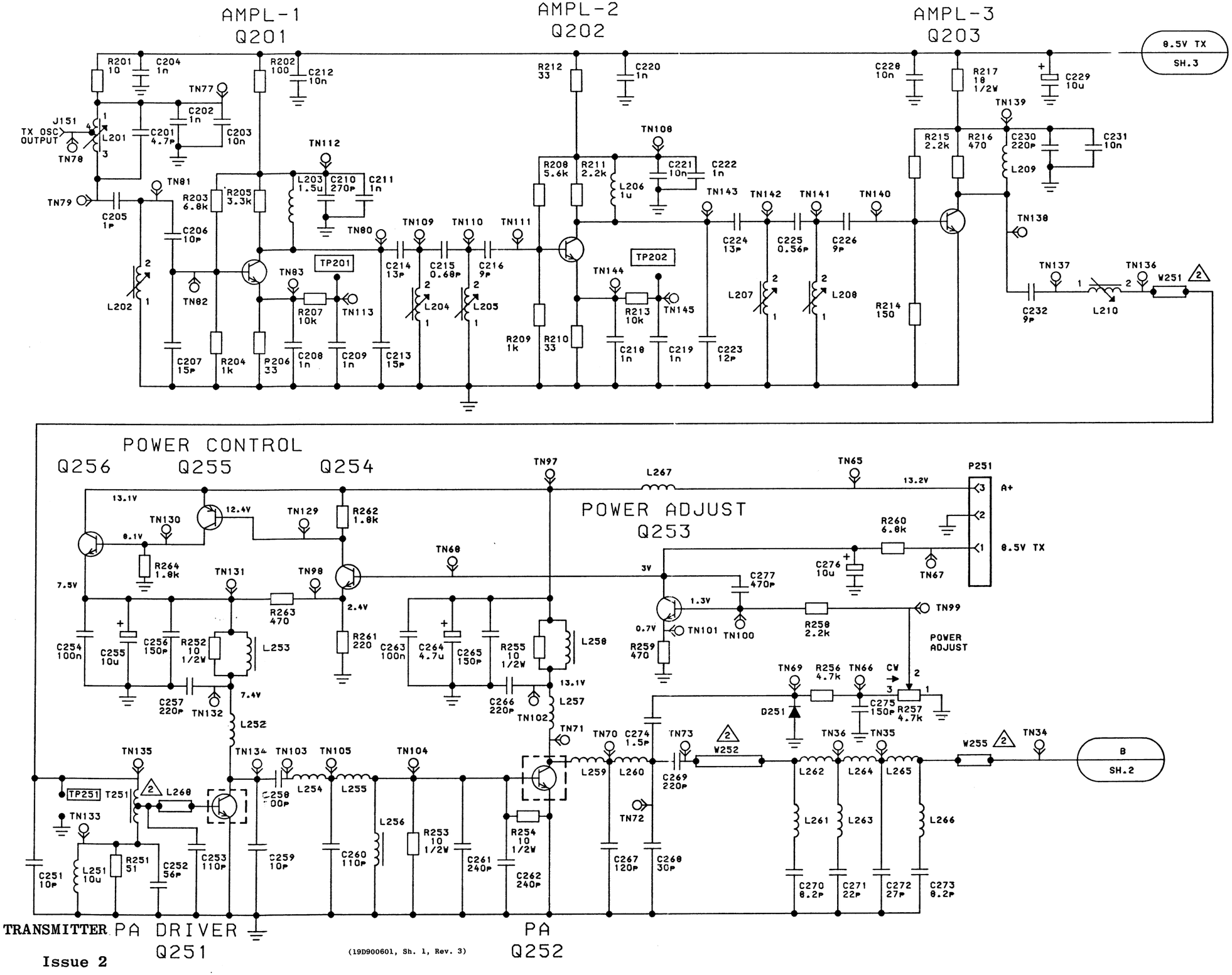
CHANNEL GUARD

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

(19D900589, Sh. 2, Rev. 6)

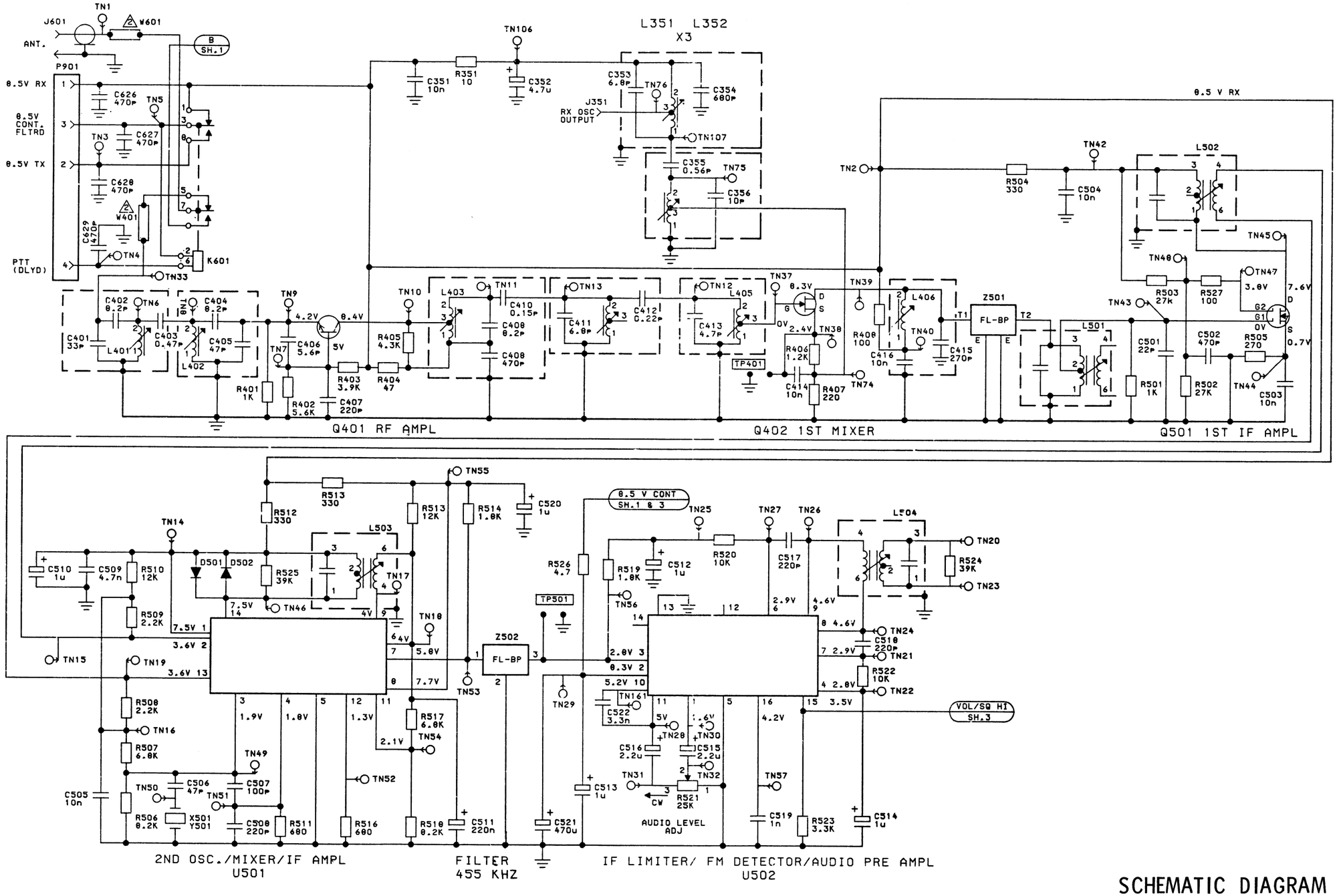
SCHEMATIC DIAGRAM

IOC BOARD (CHANNEL GUARD)



SCHEMATIC DIAGRAM

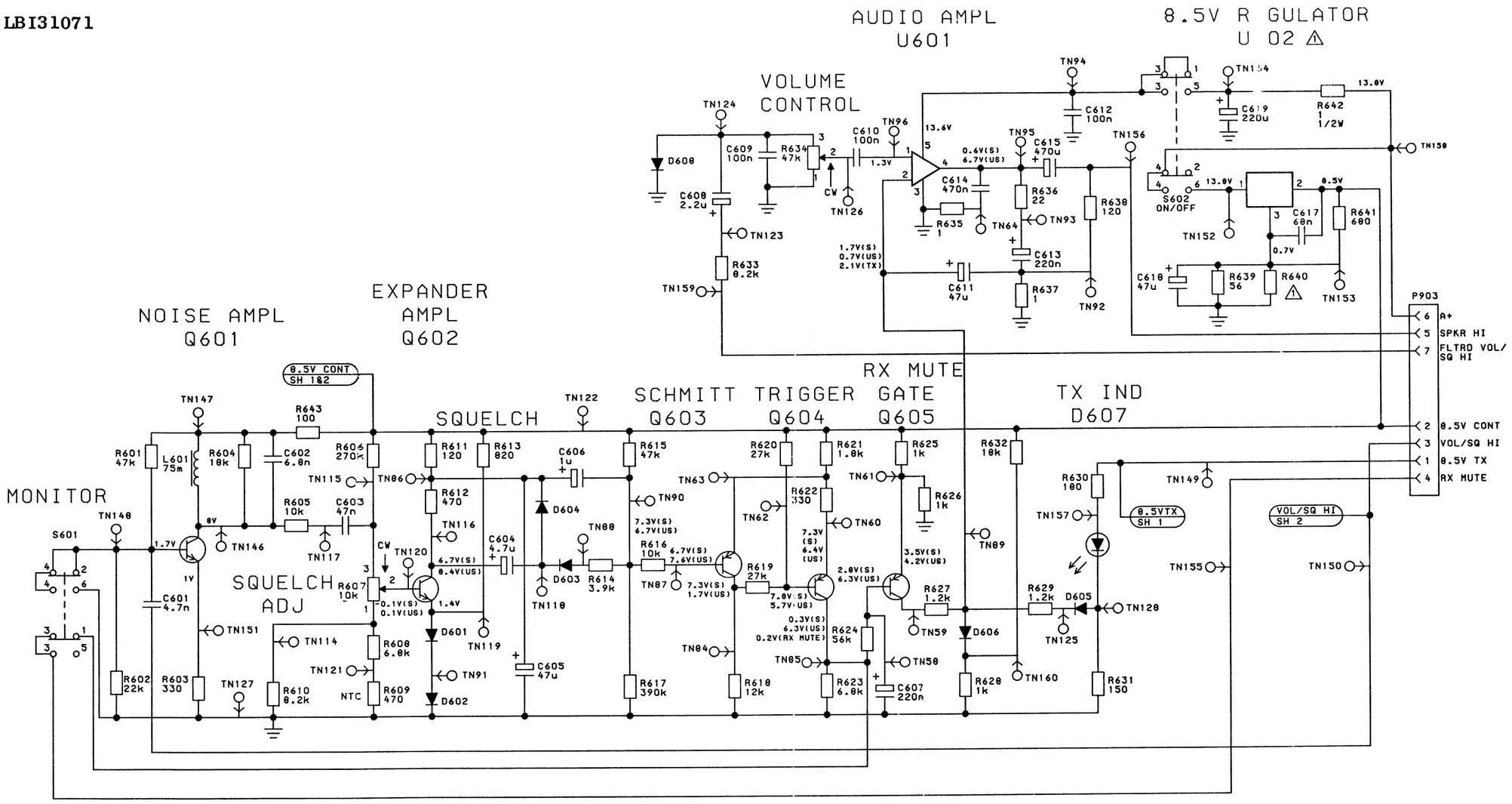
150—174 MHz HIGH BAND TRANSMITTER



(19D900601, Sh. 2, Rev. 3)

SCHEMATIC DIAGRAM

150—174 MHz HIGH BAND RECEIVER



NOTES:

⚠1 VALUE OF R640 DEPENDS ON COLOR CODE ON U602.

U602 COLOR CODE	R640 VALUE
BROWN	OMIT R640
RED	270
ORANGE	100
YELLOW	47
GREEN	22
BLUE	6.8

⚠2 PART OF PRINTED CIRCUIT BOARD.

3. TN1 ⟵○ SYMBOL DESIGNATES TEST NODE ON SOLDER SIDE ARTWORK USED BY MANUFACTURING FOR TEST. LAST TEST NODE = 162

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

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE WITH A 20,000 OHM-PER-VOLT DC VOLTMETER UNDER THE FOLLOWING CONDITIONS:

1. NO SIGNAL INPUT
2. VOLUME CONTROL (R634) SET TO MINIMUM
3. MONITOR SWITCH (S601) IN OUT POSITION
4. UNSQUELCHED (US)-SQUELCH ADJUST (R607) SET TO MINIMUM (CW)
5. SQUELCHED (S)-SQUELCH ADJUST (R607) SET TO MAXIMUM (CCW)

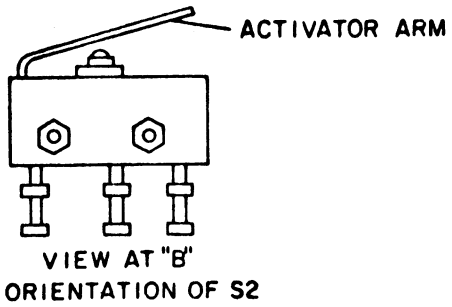
MODEL NO.	REV LTR	DESCRIPTION
19D900599G1	B	TX/RX BD ASSEMBLY
19D900602G1	-	CHASSIS ASSEMBLY

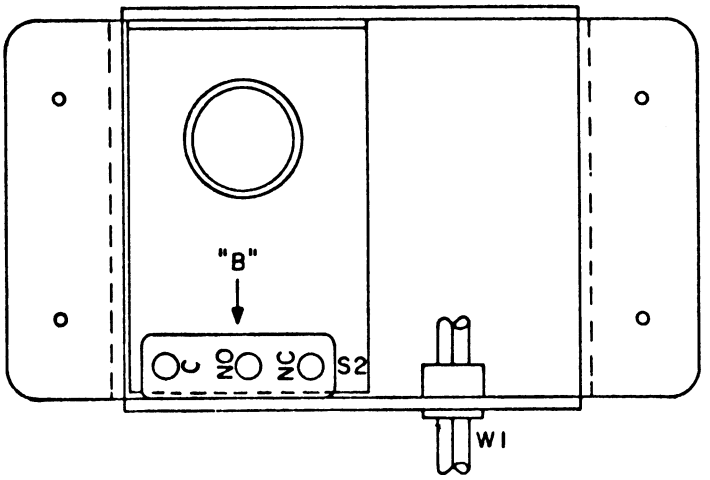
SCHEMATIC DIAGRAM

150—174 MHz HIGH BAND RECEIVER

(19D900601, Sh. 3, Rev. 5)

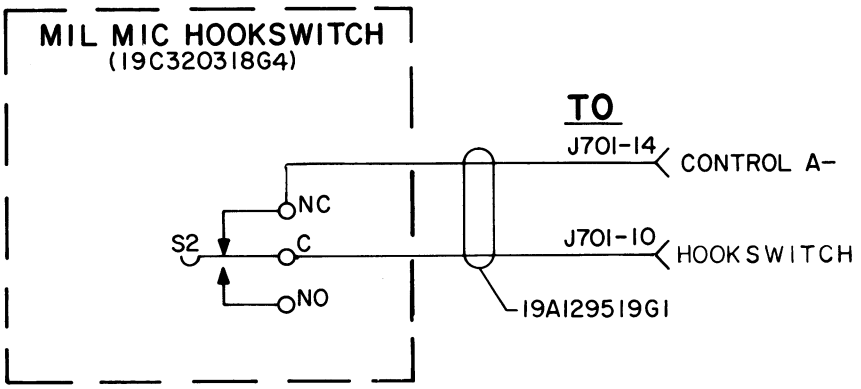
OUTLINE DIAGRAM





(19B233291, Rev. 0)

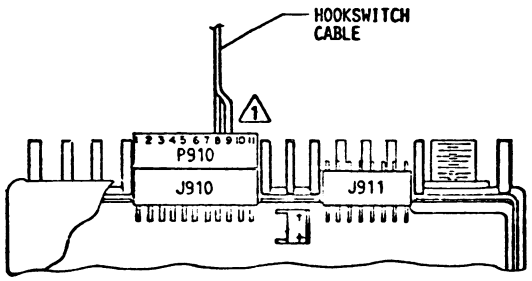
SCHEMATIC DIAGRAM



S2 - SHOWN OFF HOOK

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.	
THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER

(19A142554, Rev. 0)

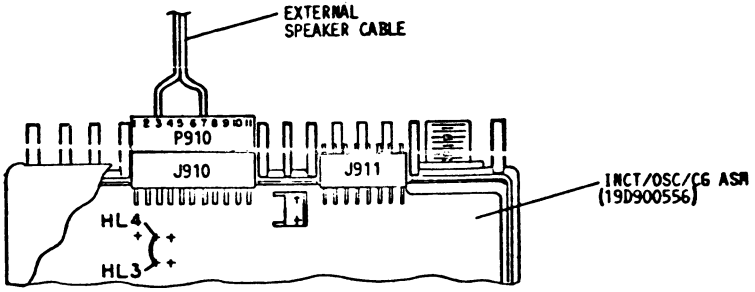


TOP VIEW

HOOKSWITCH APPLICATION (MOBILE MICROPHONE)

NOTES:

1. CONNECT HOOKSWITCH TO P910-8 AND P910-9 FOR CHANNEL GUARD.

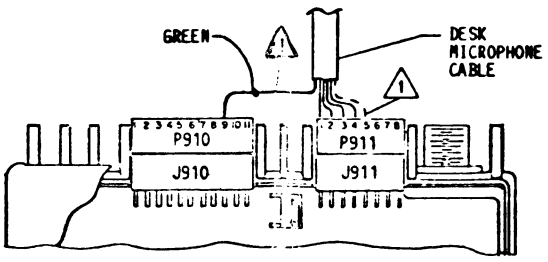


TOP VIEW

EXTERNAL SPEAKER APPLICATION

NOTES:

1. CONNECT SPEAKER LEADS TO P910-3 AND P910-7. TO DISCONNECT INTERNAL SPEAKER (FIELD ONLY) REMOVE JUMPER BETWEEN HL3 AND HL4.
2. FOR EXTERNAL SPEAKER WITH THE AC POWER SUPPLY, REMOVE JUMPER IN POWER CABLE BETWEEN P910-3 & P910-10 AND CONNECT PER NOTE 1.



TOP VIEW

DESK MICROPHONE WITH CHANNEL GUARD (WITHOUT DC REMOTE)

NOTES:

1. FOR CHANNEL GUARD MOVE GREEN WIRE FROM P911-5 TO P910-9 .

(19D900640, Sh. 2, Rev. 0)

OPTION CONNECTIONS

PARTS LIST

150-174 MHz TRANSMITTER/RECEIVE ASSEMBLY
19D900600G1 - REV. A
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
A1		TRANSMIT/RECEIVE BOARD 19D900599G1 REV. B
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	19A700035P9	Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef -150 PPM.
C202	19A700033P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C203	19A700034P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C204	19A700033P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C205	19A700013P13	Phenolic: 1.00 pF ±5%, 500 VDCW.
C206	19A701624P8	Ceramic, disc: 10 pF ±0.5 pF, 500 VRMS, temp coef 0 PPM.
C207	19A701624P12	Ceramic, disc: 15 pF ±5%, 500 VRMS, temp coef 0 PPM.
C208 and C209	19A700033P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C210	19A700035P30	Ceramic: 270 pF ±5%, 50 VDCW.
C211	19A700033P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C212	19A700034P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C213	19A701624P12	Ceramic, disc: 15 pF ±5%, 500 VRMS, temp coef 0 PPM.
C214	19A701624P11	Ceramic, disc: 13 pF ±5%, 500 VRMS, temp coef 0 PPM.
C215	19A700013P11	Phenolic: 0.68 pF ±5%, 500 VDCW.
C216	19A701624P7	Ceramic, disc: 9 pF ±0.5 pF, 500 VRMS, temp coef 0 PPM.
C218	19A701602P20	Ceramic: 1000 pF ±10%, 1000 VDCW.
C219 and C220	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C221	19A700005P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C222	19A701602P20	Ceramic: 1000 pF ±10%, 1000 VDCW.
C223	19A701624P10	Ceramic, disc: 12 pF ±5%, 500 VRMS, temp coef 0 PPM.
C224	19A701624P11	Ceramic, disc: 13 pF ±5%, 500 VRMS, temp coef 0 PPM.
C225	19A700013P10	Phenolic: 0.56 pF ±5%, 500 VDCW.
C226	19A701624P7	Ceramic, disc: 9 pF ±0.5 pF, 500 VRMS, temp coef 0 PPM.
C228	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C229	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C230	19A701602P10	Ceramic: 220 pF ±10%, 1000 VDCW.
C231	19A700005P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C232	19A701624P7	Ceramic, disc: 9 pF ±0.5 pF, 500 VRMS, temp coef 0 PPM.
C251	19A701624P8	Ceramic, disc: 10 pF ±0.5 pF, 500 VRMS, temp coef 0 PPM.
C252	19A700234P7	Ceramic: 56 pF ±5%, 50 VDCW, temp coef 0 PPM.
C253	19A701413P35	Mica: 110 pF ±5%, 100 VDCW.
C254	19A700234P13	Polyester: 0.1 uF ±10%, 50 VDCW.
C255	19A700534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C256	19A701602P8	Ceramic: 150 pF ±10%, 1000 VDCW.
C257	19A701413P44	Mica: 220 pF ±5%, 100 VDCW.
C258	19A700105P6	Mica: 10 pF ±5%, 500 VDCW.
C259	19A700105P34	Mica: 100 pF ±5%, 500 VDCW.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
C260	19A701413P35	Mica: 110 pF ±5%, 100 VDCW.
C261 and C262	19A700014P38	Metallized teflon: 240 pF ±5%, 250 VDCW.
C263	19A700234P13	Polyester: 0.1 uF ±10%, 50 VDCW.
C264	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C265	19A701602P8	Ceramic: 150 pF ±10%, 1000 VDCW.
C266	19A701413P44	Mica: 220 pF ±5%, 100 VDCW.
C267	19A701413P36	Mica: 120 pF ±5%, 100 VDCW.
C268	19A701413P20	Mica: 30 pF ±5%, 100 VDCW.
C269	19A701413P44	Mica: 220 pF ±5%, 100 VDCW.
C270	19A701413P4	Mica: 8.2 pF ±10%, 100 VDCW.
C271	19A701413P17	Mica: 22 pF ±5%, 100 VDCW.
C272	19A701413P19	Mica: 27 pF ±5%, 100 VDCW.
C273	19A701413P4	Mica: 8.2 pF ±10%, 100 VDCW.
C274	19A700013P15	Phenolic: 1.50 pF ±5%, 500 VDCW.
C275	19A701602P8	Ceramic: 150 pF ±10%, 1000 VDCW.
C276	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C277	19A701602P13	Ceramic: 470 pF ±20%, 1000 VDCW; sim to Type JF Discap.
C351	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C352	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C353	19A700235P11	Ceramic: 6.8 pF ±5%, 50 VDCW.
C354	19A700233P6	Ceramic: 680 pF ±20%, 50 VDCW.
C355	19A700013P10	Phenolic: 0.56 pF ±5%, 500 VDCW.
C356	19A700235P13	Ceramic: 10 pF ±5%, 50 VDCW.
C401	19A700235P19	Ceramic: 33 pF ±5%, temp coef -150 PPM.
C402	19A700235P12	Ceramic: 8.2 pF ±0.25 pF, 50 VDCW.
C403	19A700013P9	Phenolic: 0.47 pF ±5%, 500 VDCW.
C404	19A700235P12	Ceramic: 8.2 pF ±0.25 pF, 50 VDCW.
C405	19A700235P21	Ceramic: 47 pF ±5%, 50 VDCW.
C406	19A700235P10	Ceramic: 5.6 pF ±0.25 pF, 50 VDCW.
C407	19A700235P29	Ceramic: 220 pF ±5%, 50 VDCW.
C408	19A700002P12	Ceramic disc: 8.2 pF ±0.25 pF, 50 VDCW, temp coef -150 +60 PPM.
C409	19A700001P5	Ceramic: 470 pF ±20%, 500 VDCW.
C410	19A700013P3	Phenolic: 0.15 pF ±5%, 500 VDCW.
C411	19A700335P11	Ceramic: 6.8 pF ±5%, 50 VDCW.
C412	19A700013P5	Phenolic: 0.22 pF ±5%, 500 VDCW.
C413	19A700235P9	Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef -150 PPM.
C414	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C415	19A700235P30	Ceramic: 270 pF ±5%, 50 VDCW.
C416	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C501	19A700235P17	Ceramic: 22 pF ±5%, 50 VDCW.
C502	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C503 thru C505	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C506	19A700235P21	Ceramic: 47 pF ±5%, 50 VDCW.
C507	19A700235P25	Ceramic: 100 pF ±5%, 50 VDCW.
C508	19A700233P29	Ceramic: 220 pF ±5%, 50 VDCW.
C509	19A700234P5	Polyester: 4700 pF ±10%, 50 VDCW.
C510	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C511	19A701534P2	Tantalum: 0.22 uF ±20%, 35 VDCW.
C512 thru C514	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C515 and C516	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C517 and C518	19A700233P3	Ceramic: 220 pF ±10%, 50 VDCW.
C519	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C520	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C521	19A134730P3	Electrolytic: 470 uF +100 -10%, 16 VDCW.
C522	19A700234P4	1Polyester: 3300 pF ±10%, 50 VDCW.
C601	19A700234P5	Polyester: 4700 pF ±10%, 50 VDCW.
C602	19A700234P6	Polyester: 6800 pF ±10%, 50 VDCW.
C603	19A700034P11	Polyester: 0.047 uF ±10%, 50 VDCW.
C604	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C605	19A134730P1	Electrolytic: 47 uF +100 -10%, 16 VDCW.
C606	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C607	19A701534P2	Tantalum: 0.22 uF ±20%, 35 VDCW.
C608	19A701534P5	Tantalum: 2.2 uF, ±20%, 35 VDCW.
C609 and C610	19A700234P13	Polyester: 0.1 uF ±10%, 50 VDCW.
C611	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C612	19A700234P13	Polyester: 0.1 uF ±10%, 50 VDCW.
C613	19A701534P2	Tantalum: 0.22 uF ±20%, 35 VDCW.
C614	19A700004P6	Metallized polyester: 0.47 uF ±10%, 63 VDCW.
C615	19A134730P3	Electrolytic: 470 uF +100 -10%, 16 VDCW.
C617	19A700234P12	Polyester: 0.068 uF ±10%, 50 VDCW.
C618	19A134730P1	Electrolytic: 47 uF +100 -10%, 16 VDCW.
C619	19A134730P2	Electrolytic: 220 uF +100 -10%, 25 VDCW.
C620 thru C629	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
		- - - - - - - - - - DIODES - - - - - - - - - -
D251	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D501 and D502	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D601 thru D606	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D607	19A134738P1	Diode, optoelectronic: red; sim to Siemans LD41/11.
D608	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J151	19A701883P4	Contact, electrical; sim to AMP 86444-1.
J351	19A701883P4	Contact, electrical; sim to AMP 86444-1.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K601	19A700061P1	Hermetic sealed: 180 to 341 ohms coil res, K=16.3 VDC; sim to GE 3SAY176042, CPClare HFW-1201S58, or Potter-Brumfield HC861SO.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L201	19J706258P15	Coil, RF.
L202	19J706213P6	Coil, RF.
L203	19A700024P15	Coil, RF: 1.5 uH, 100 VRMS operating.
L204 and L205	19J706213P6	Coil, RF.
L206	19A700024P13	Coil, RF: 1.0 uH ±10%.
L207 and L208	19J706213P6	Coil, RF.

SYMBOL	GE PART NO.	DESCRIPTION
L209	19J706085P4	Coil, RF: 0.065 uH ind., ±5%; sim to Paul Smith LM-2.
L210	19J706213P6	Coil, RF.
L251	19A700024P25	Coil, RF: 10.0 uH ±10%, 3.70 ohms DC res max.
L252	19A138304P1	Coil.
L253	19A701091G1	Coil.
L254	19A138303P1	Coil.
L255	19A138296P1	Coil.
L256	19A701091G1	Coil.
L257	19A138303P2	Coil.
L258	19A701091G1	Coil.
L259	19A138296P1	Coil.
L260	19A138303P2	Coil.
L261	19A138297P1	Coil.
L262	19A701419P3	Coil.
L263	19A138296P1	Coil.
L264 and L265	19A701419P3	Coil.
L266	19A138297P1	Coil.
L267	19A138298P1	Coil.
L351	19J706083P5	Coil, RF: sim to Paul Smith SK426-1.
L352	19J706083P17	Coil, RF: sim to Paul Smith SK426-1.
L401	19J706083P20	Coil, RF: sim to Paul Smith SK426-1.
L402	19J706083P19	Coil, RF: sim to Paul Smith SK426-1.
L403	19J706083P18	Coil, RF: sim to Paul Smith SK426-1.
L404	19J706083P13	Coil, RF: sim to Paul Smith SK426-1.
L405	19J706083P14	Coil, RF: sim to Paul Smith SK426-1.
L406	19A134728P2	Coil, RF: variable.
L501 and L502	19A134747P2	Intermediate freq: 10.7 MHz; sim to TOKO Inc. 154 FC-47007XN3.
L503 and L504	19A134747P1	Intermediate freq: 455 KHz res. freq; sim to TOKO Inc. RMC 45225-2NO.
L601	19A702322P1	Reactor, audio freq: 75 MHz ±10%; sim to Festinductivetaten DN 2707/5-CL.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P251	19A700102P10	Printed wire: 3 contacts; sim to Molex 09-52-3032.
P901	19A116659P15	Connector, printed wiring: 4 contacts rated at 5 amps; sim to Molex 09-52-3042.
P903	19A116659P83	Connector, printed wiring: 7 contacts rated at 5 amps; sim to Molex 09-52-3072 SPECIAL.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q201	19A115330P1	Silicon, NPN.
Q202	19A70135IP1	Silicon, NPN; sim to MPJ3646.
Q203	19A116869P1	Silicon, NPN; sim to Type 2N4427.
Q253 and Q254	19A700023P1	Silicon, NPN; sim to Type 2N3904.
Q255	19A700020P1	Silicon: PNP, 500 mW; sim to BC558A.
Q256	19A700054P1	Silicon, NPN, 60 w; sim to HO-201.
Q401	19A116859P1	Silicon, NPN: sim to Type 2N5033 or 2N3570.
Q402	19A134402P2	N Type, field effect; sim to J310.
Q501	19A700074P1	N-Channel, field effect.
Q601 and Q602	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q603 thru Q605	19A134749P1	Silicon, PNP; sim to Type 2N5087.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	19A700019P13	Deposited carbon: 10 ohms ±5%, 1/4 w.
R202	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R203	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R204	R20S19A700106P45	Composition: 1K ohms ±5%, 1/4 w.
R205	19A701385P5	Composition: 3.3K ohms ±5%, 1/4 w.
R206	19A700019P19	Deposited carbon: 33 ohms ±5%, 1/4 w.
R207	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R208	19A700019P46	Deposited carbon: 5.6K ohms ±5%, 1/4 w.
R209	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R210	19A700019P19	Deposited carbon: 33 ohms ±5%, 1/4 w.
R211	19A700106P71	Composition: 2.2K ohms ±5%, 1/4 w.
R212	19A700019P19	Deposited carbon: 33 ohms ±5%, 1/4 w.
R213	19A700141P93	Deposited carbon: 10K ohms ±5%, 1/4 w.
R214	19A701406P43	Composition: 150 ohms ±5%, 1/4 w.
R215	19A700019P41	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R216	19A700106P55	Composition: 470 ohms ±5%, 1/4 w.
R217	19A700113P21	Composition: 18 ohms ±5%, 1/2 w.
R251	19A1434009P21	Deposited carbon: 51 ohms ±5%, 1/4 w.
R252 thru R255	19A700113P15	Composition: 10 ohms ±5%, 1/2 w.
R256	19A700019P45	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R257	19A701385P3	Variable: 5000 ohms ±20%, temp coef -450+150 PPM, 1/5 w; sim to CTS Series 208.
R258	19A700019P41	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R259	19A700019P33	Deposited carbon: 470 ohms ±5%, 1/4 w.
R260	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R261	19A700019P29	Deposited carbon: 220 ohms ±5%, 1/4 w.
R262	19A700019P40	Deposited carbon: 1.8K ohms ±5%, 1/4 w.
R263	19A700019P33	Deposited carbon: 470 ohms ±5%, 1/4 w.
R264	19A700019P40	Deposited carbon: 1.8K ohms ±5%, 1/4 w.
R351	19A700019P13	Deposited carbon: 10 ohms ±5%, 1/4 w.
R401	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R402	19A700019P46	Deposited carbon: 5.6K ohms ±5%, 1/4 w.
R403	19A700019P44	Deposited carbon: 3.9K ohms ±5%, 1/4 w.
R404	19A700019P21	Deposited carbon: 47 ohms ±5%, 1/4 w.
R405	19A1434009P44	Deposited carbon: 4.3K ohms ±5%, 1/4 w.
R406	19A700019P38	Deposited carbon: 1.2K ohms ±5%, 1/4 w.
R407	19A700019P29	Deposited carbon: 220 ohms ±5%, 1/4 w.
R408	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R501	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R502 and R503	19A700019P54	Deposited carbon: 27K ohms ±5%, 1/4 w.
R504	19A700019P31	Deposited carbon: 330 ohms ±5%, 1/4 w.
R505	19A700019P30	Deposited carbon: 270 ohms ±5%, 1/4 w.
R506	R19A700019P48	Deposited carbon: 8.2K ohms ±5%, 1/4 w.
R507	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R508 and R509	19A700019P41	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R510	19A700019P50	Deposited carbon: 12K ohms ±5%, 1/4 w.
R511	19A700019P35	Deposited carbon: 680 ohms ±5%, 1/4 w.
R512 and R513	19A700019P31	Deposited carbon: 330 ohms ±5%, 1/4 w.
R514	19A700019P40	Deposited carbon: 1.8K ohms ±5%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
R515	19A700019P50	Deposited carbon: 12K ohms ±5%, 1/4 w.
R516	19A700019P35	Deposited carbon: 680 ohms ±5%, 1/4 w.
R517	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R518	19A700019P48	Deposited carbon: 8.2K ohms ±5%, 1/4 w.
R519	19A700019P40	Deposited carbon: 1.8K ohms ±5%, 1/4 w.
R520	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R521	19A700185P5	Variable: 22K ohms ±20%, 1/3 w.
R522	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R523	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R524 thru R525	19A700019P56	Deposited carbon: 39K ohms ±5%, 1/4 w.
R526	19A700019P9	Deposited carbon: 4.7 ohms ±5%, 1/4 w.
R527	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R601	19A700019P57	Deposited carbon: 47K ohms ±5%, 1/4 w.
R602	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R603	19A700019P31	Deposited carbon: 330 ohms ±5%, 1/4 w.
R604	19A700019P52	Deposited carbon: 18K ohms ±5%, 1/4 w.
R605	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R606	19A700019P66	Deposited carbon: 0.27M ohms ±5%, 1/4 w.
R607	19A700185P4	Variable: 10K ohms ±20%, 1/3 w.
R608	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R609	19A134732P2	Thermistor: 470 ohms ±10%, at 0 power, color code brown; sim to Philips 2322-662-11471.
R610	19A700019P48	Deposited carbon: 8.2K ohms ±5%, 1/4 w.
R611	19A700019P26	Deposited carbon: 120 ohms ±5%, 1/4 w.
R612	19A700019P33	Deposited carbon: 470 ohms ±5%, 1/4 w.
R613	19A700019P36	Deposited carbon: 820 ohms ±5%, 1/4 w.
R614	19A700019P44	Deposited carbon: 3.9K ohms ±5%, 1/4 w.
R615	19A700019P57	Deposited carbon: 47K ohms ±5%, 1/4 w.
R616	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R617	19A700019P68	Deposited carbon: 0.39M ohms ±5%, 1/4 w.
R618	19A700019P50	Deposited carbon: 12K ohms ±5%, 1/4 w.
R619 and R620	19A700019P54	Deposited carbon: 27K ohms ±5%, 1/4 w.
R621	19A700019P40	Deposited carbon: 1.8K ohms ±5%, 1/4 w.
R622	19A700019P31	Deposited carbon: 330 ohms ±5%, 1/4 w.
R623	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R624	19A700019P58	Deposited carbon: 56K ohms ±5%, 1/4 w.
R625 and R626	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R627	19A700019P38	Deposited carbon: 1.2K ohms ±5%, 1/4 w.
R628	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R629	19A700019P38	Deposited carbon: 1.2K ohms ±5%, 1/4 w.
R630	19A700019P28	Deposited carbon: 180 ohms ±5%, 1/4 w.
R631	19A700019P27	Deposited carbon: 150 ohms ±5%, 1/4 w.
R632	19A700019P52	Deposited carbon: 18K ohms ±5%, 1/4 w.
R633	19A700019P48	Deposited carbon: 8.2K ohms ±5%, 1/4 w.
R634	19A134733P1	Variable, carbon film: 47K ohms ±20%, 0.1 w.
R635	19A700019P1	Deposited carbon: 1 ohms ±5%, 1/4 w.
R636	19A700019P17	Deposited carbon: 22 ohms ±5%, 1/4 w.
R637	19A700019P1	Deposited carbon: 1 ohms ±5%, 1/4 w.
R638	19A700019P26	Deposited carbon: 120 ohms ±5%, 1/4 w.
R639	19A700019P22	Deposited carbon: 56 ohms ±5%, 1/4 w.
R640A	19A700019P30	Deposited carbon: 270 ohms ±5%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
R640B	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R640C	19A700019P21	Deposited carbon: 47 ohms ±5%, 1/4 w.
R640D	19A700019P17	Deposited carbon: 22 ohms ±5%, 1/4 w.
R640E	19A700019P11	Deposited carbon: 6.8 ohms ±5%, 1/4 w.
R641	19A700019P35	Deposited carbon: 680 ohms ±5%, 1/4 w.
R642	19A700018P1	Deposited carbon: 1 ohm ±5%, 1/3 w.
R643	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S601	19B800563P3	Push: DPDT, contacts rated 15 mA at 130 VDC; sim to IEEE/SCHADOW 51203.
S602	19B800563P1	Push: DPDT, 1 station, alternate action; sim to IEEE/SCHADOW 51281 (FIGURE).
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T251	19A129564G1	Transformer.
		- - - - - - - - - - TEST POINTS - - - - - - - - - -
TP201 and TP202	19A700115P1	Contact, electrical.
TP251	19A700115P1	Contact, electrical.
TP401	19A700115P1	Contact, electrical.
TP501	19A700115P1	Contact, electrical.
		- - - - - - - - - - INTEGRATED CIRCUITS - - - - - - - - - -
U501	19A134735P1	Linear, Dual Differential Amplifier, 14 Pin Dip.
U502	19A134766P1	Linear, Outline For 16-Pin Dip case.
U601	19A701830P1	Linear, Audio AMPLIFIER; sim to TDA 2003.
U602	19A138414G1	Regulator: 8.5 V.
		- - - - - - - - - - CABLES - - - - - - - - - -
W251 and W252	19A700019P44	Part of printed board 19D900598P1.
W254 and W255	19A700019P40	Part of printed board 19D900598P1.
W401		Part of printed board 19D900598P1.
W601		Part of printed board 19D900598P1.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
X501	19A703274P1	Crystal socket.
		- - - - - - - - - - FILTERS - - - - - - - - - -
Z501	19A134745P2	Filter, bandpass: freq: 10.7 MHz 25 kHz channel spacing; sim to ITT No. 033CA.
Z502	19A702171P1	Bandpass filter: 455 ±1.5 kHz; sim to Murata CFU455DZ.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q251	19A134340P2	Silicon, NPN: VHF Amplifier, 4 watts, 12.5 v.
Q252	19A134340P2	Silicon, NPN: NHF Amplifier, 25 watts, 12.5 v.
		- - - - - - - - - - CABLES - - - - - - - - - -
W253	19A701093P1	Strap.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A700038P508	Screw, thd. forming: No. 3.5-0.6 x 8. (Secures A1).
	19B232290P1	Support. (U601, U602, U257).
	19A700068P1	Insulator, bsaning. (Used with U602).
	19A700115P3	Insulator, plate. (Used with U602 & Q256).

SYMBOL	GE PART NO.	DESCRIPTION
	19A700069P1	Cas. (Used with L351 & L352; L401-L406).
	19A138274P1	Insulator. (Used with L351 & L352).
	RP280878P1	Nameplate. (POWER).
	RP280878P13	Nameplate. (MONITOR).
	19C328587P1	Pushbutton. (Used with S601 & S602).
	19A134753P5	Machine screw. (Used with H634).
	19J700078P1	Washer, spring. (Used with H634).
	19A134753P2	Washer. (Used with H634).
	19D429828P1	Knob. 0Used with H634).
	19A701743P1	Pad. (Used with H634).
	19A701332P4	Insulator, washer: nylon. (Used with Q203).
	19A700033P3	Lockwasher, external tooth: M2.5. (Secures Q251 & Q252).
	19A700031P308	Machine screw, pashed, metric: M2.5-.45x 8. (Secures Q251 & Q252).

PARTS LIST

LB131148C

ASSOCIATED PARTS AND ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
	19D900123P2	Cover.
	19A701530G2	Shield casting Tx/Rx.
	19D900129P2	Front cap.
	19D900823P1	Faceplate. (GENERAL ELECTRIC - Standard).
		TOP COVER AND SPEAKER ASSEMBLY 19C850864G1
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - -
B901	19B800867P1	Permanent magnet: 290 Hz ±45 Hz resonant freq, 3 w.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P904		Connector. Includes:
	19A700041P28	Shell.
	19A700041P26	Contact, electric: sim to Molex 08-50-0113. (Quantity 2).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A702603P1	Screen. (Used with B901 speaker).
	N842130808	Machine screw, phillips head: No. 6-32 x 3/8. (Secures B901 speaker).
		HARDWARE KIT 19A703523G4
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J601B	19A700087P2	Connector, receptacle; sim to Amphenol 83-876-1002.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A700036P520	Screw, thd. forming: No. M3.5-0.6 x 20. (Secures Tx/Rx shield).
	19A700031P410	Machine screw. No. M3-0.5 x 10. (Secures J601 and covers at rear).
	19A700036P508	Screw, thd. forming: No. 3.5-0.6 x 8. (Secures Interconnect/Oscillator/Channel Guard Board).
	19A700032P5	Lockwasher, internal tooth: No. 3MM. (Secures J601).
	19B232859P1	Bushing. (Used with LED's on faceplate).
	19A701744P1	Pad. (Located behind volume switch).
	19B800719P1	Dust pad. (Located at J910 and J911).
	19A702388P1	Threaded block. (Located behind J601).
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering, give GE part number and specify exact operating frequency needed.
		Tx 150 - 174 MHz $Fx = \frac{Fo}{3}$
Y151	19B233066G1	Tx Crystal.
		Rx 150 - 174 MHz $Fx = \frac{Fo - 10.7}{3}$
Y301	19B233066G2	Rx Crystal.
Y501	19A702284G1	2nd Oscillator Crystal: Quartz 10,245.000 KHz. (NB Std).
	19A702284G2	2nd Oscillator Crystal: Quartz 11,155.000 KHz (NB Tweet Freq).
	19A702284G3	2nd Oscillator Crystal: Quartz 30945.000 kHz. (UHF Std).
	19A702284G4	2nd Oscillator Crystal: Quartz 21,855.000 KHz. (UHF Tweet Freq).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - MICROPHONES - - - - - - - - - -
	19C850857P2	Microphone: Phoenix Dynamic, with Electret cartridge DA-90, supplied with hang up bracket and screws. Consists of subassy of 19A116659P20 shell and (4) 19A116781P6 contacts.
		STANDARD MOUNTING HARDWARE KIT 19A138501G5 BLACK 19A138501G6 PEBBLE 19A138501G7 DESK TOP SUCTION TYPE
	19A134653P4008	Bolt, machine, hex: Metric, 8MM. (Secures radio to mounting bracket).
	19A700032P7	Lockwasher, internal tooth: No. M2.2. (Metric). (Secures radio to mounting bracket).
	19J700152P9	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 mounting surface with thin mounting surface).
	N130P1624C6	Screw, thread forming: No. 10-16 x 1-1/2. (Secures mounting bracket to mounting surface when thick carpet is on mounting surface).
	549040T96	Rubber grommet. (Located on fire wall).
	19C850838P2	Mounting bracket. (BLACK).
	19C850838P3	Mounting bracket. (PEBBLE).
	19A702241G1	Mounting bracket, desk top, suction type.
		POWER CABLE 19B232895G2
	19A116659P143	Connector, printed wiring; sim to Molex 09-05-3111.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A137818G3	Lead, black. (Includes 19A116781P5 contact).
		FUSED LEAD ASSEMBLY 19A137819G9 15 AMP 19A137819G10 2 AMP
	19A116781P5	Contact, electrical: wire range No. 18-24 AWG; sim to Molex 08-50-0106. (Hung in wiring on red & yellow wires).
	19A115776P3	Contact: sim to Littelfuse 904-88. (Located in fuseholder - Quantity 2).
	748439D93	Cartridge, quick blow: 15 amp at 250 v; sim to Bussmann ABC15.
	1816P5	Cartridge, quick blowing: 2 amp at 250 v; sim to Littelfuse 312002 or Bussmann AGC-2.
	19A115776P6	Fuseholder; sim to Bussmann 9835. (Mates with 19A115776P9 knob).
	19A115775P7	Spring; sim to Bussman 1A1853. (Used with fuseholder).
	19A115776P5	Spring; sim to Bussman 9953 1/2. (USed with fuseholder).

PARTS LIST

SPEAKER (PEBBLE)
19C320201G01
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS2	19A116910P1	Permanent magnet: 5 inch, 3.2 ohms ±15% imp, 5 w max operating; sim to Pioneer 002009.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19A129414G1	2 conductor cable: approx 5 feet long, includes (2) 19A116781P5 contacts.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B219490G4	Grille.
	19B227593G4	Housing.
	19C320016P3	Mounting bracket. (Located between housing & retaining bracket).
	19A116898P108	Tap screw, with lockwasher: No. 7-19 x 1/2. (Secures speaker to housing).
	19A116898P112	Tap screw, with lockwasher: No. 7-19 x 3/4. (Secures grille to housing).
	N187P1610C6	Screw, beshead, slotted: No. 10-32 x 5/8. (Quantity 2- Secures mounting bracket to housing).
	N403P19C6	Lockwasher, external tooth: No. 10. (Quantity 2- Secures mounting bracket to housing).
	N402P39C6	Flatwasher: No. 10. (Quantity 2- Secures mounting bracket to housing).
	N130P1610C6	Tap screw, thd. forming: No. 10-16 x 5/8. (Secures mounting bracket to mounting surface).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

SPEAKER
OPTIONAL EXTERNAL - BLACK
19C320302G9
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS2	19A116910P1	Permanent magnet: 5 inch, 3.2 ohms ±15% imp, 5 w. max operating; sim to Pioneer 002009.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19A129414G1	2 conductor cable: approx 5 feet long, includes (2) 19A116781P5 contacts.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B227593G2	Housing.
	19B219890G2	Grille.
	19C320016P2	Mounting bracket. (Mounts speaker to mounting surface).
	N187P1610C6	Machine screw: No. 10-32 x 5/8. (Secures speaker to mounting bracket).
	N403P19C6	Lockwasher, internal tooth: No. 10. (Secures speaker to mounting bracket).
	N402P39C6	Flatwasher: No. 10. (Secures speaker to mounting bracket).
	N130P1610C6	Screw, thread forming: No. 10-16 x 5/8. (Secures mounting bracket to mounting surface).
	19A116986P108	Screw, thread forming, assembled washer; Phillips POZIDRIV®, HI-LO thread, No. 7-19 x 1/2. (Secures speaker to grille).
	19A116986P112	Screw, thread forming, assembled washer; Phillips POZIDRIV®, HI-LO thread, No. 7-19 x 3/4. (Secures housing to grille).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

MIKE HANGER/HOOKSWITCH
19C320218G4
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 111SM1-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 714141402
	403145T91	Support.
	403145R91	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
19D209368P1
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		Whip assembly. Decibel Products 068110-001.
		Whip nut assembly. Decibel Products 068067-001.
		Base nut assembly. Decibel Products 068068-001.
		"O" Ring (LARGE). Decibel Products 007059-122.
		Stud assembly. Decibel Products 068066-001.
		RG58/U Cable, 15 feet. Decibel Products 068115-001.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

TRANSISTORIZED MICROPHONE
19B230167P1
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
	19A116659P20	Cable connector shell; sim to Molex 09-50-3081.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0107. (Quantity 4- Used with 19A116659P20 connector shell).
	RP280575	Faceplate. (GENERAL ELECTRIC).
	403327I1G1	Strain relief. (Located on cable 10 inches from connector).
	MP101	Case, front & back with push to talk switch.
	MP102	Cartridge, with leads.
	MP103	Cable assembly.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

NOGGINIZED MICROPHONE
19B232577P1 BLACK
19B232577P2 PEBBLE
ISSUE 2

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

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 & B - Tx/Rx Board 19D800599G1
Incorporated in initial shipment.

PARTS LIST

INTERCONNECT/OSCILLATOR/CHANNEL GUARD BOARD
19D900556G2 150-174 MHz, 1 TX/1 RX W CHAN GD - REV B
19D900556G8 450-470 MHz, 2 TX/1 RX W CHAN GD - REV D
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C101	19A700234P9	Polyester: 0.022 uF ±10%, 50 VDCW.
C102	19A702059P12	Polyester: 0.068 uF ±5%, 50 VDCW.
C103	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C104	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C105	19A700234P13	Polyester: 0.1 uF ±10%, 50 VDCW.
C106	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C107	19A702059P11	Polyester: 0.047 uF ±5%, 50 VDCW.
C108	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C109	19A702059P6	Polyester: 6800 pF ±5%, 50 VDCW.
C110	19A702059P1	Polyester: 1000 pF ±5%, 50 VDCW.
C111	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C112	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C113	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C151	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C152 and C153	19A700235P28	Ceramic: 180 pF ±5%, 50 VDCW.
C154 and C155	19A701624P714	Ceramic: 2 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C156 and C157	19A700227P59	Ceramic: 68 pF ±5%, 500 VDCW, temp coef -1500 PPM.
C158 and C159	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C160	19A700235P28	Ceramic: 180 pF ±5%, 50 VDCW.
C161	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C162	19A700235P5	Ceramic: 2.2 pF ±0.25 pF, 50 VDCW, temp coef -150 PPM.
C163	19A700233P6	Ceramic: 680 pF ±20%, 50 VDCW.
C164	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C165	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C166	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C167	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C168	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C301	19A700235P28	Ceramic: 180 pF ±5%, 50 VDCW.
C302	19A701624P714	Ceramic: 2 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C303	19A700227P59	Ceramic: 68 pF ±5%, 500 VDCW, temp coef -1500 PPM.
C304	19A700235P28	Ceramic: 180 pF ±5%, 50 VDCW.
C305 and C306	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C307	19A700235P3	Ceramic: 1.5 pF ±0.25 pF, 50 VDCW, temp coef -150 PPM.
C308	19A700235P18	Ceramic, disc: 27 pF ±5%, 50 VDCW.
C309	19A700233P6	Ceramic: 680 uF ±20%, 50 VDCW.
C310	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C311	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C901	19A134730P2	Electrolytic: 220 uF +100 -10%, 25 VDCW.
C902	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C903	19A700233P6	Ceramic: 680 pF ±20%, 50 VDCW.
C904	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C905	19A700234P9	Polyester: 0.022 uF ±10%, 50 VDCW.
C1001	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C1002 and C1003	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C1004	19A701534P3	Tantalum: 0.47 uF ±20%, 35 VDCW.
C1005 thru C1007	19A700235P18	Ceramic, disc: 27 pF ±5%, 50 VDCW.
C1008	19A700233P2	Ceramic, disc: 100 pF ±20%, 50 VDCW.
C1009	19A700235P18	Ceramic, disc: 27 pF ±5%, 50 VDCW.
C1010	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C1011	19A701534P15	Tantalum: 3.3 uF ±20%, 35 VDCW.
C1012	19A701534P3	Tantalum: 0.47 uF ±20%, 35 VDCW.
C1013	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C1014 and C1015	19A701534P15	Tantalum: 3.3 uF ±20%, 35 VDCW.
C1016	19A700235P26	Ceramic, disc: 120 pF ±5%, 50 VDCW, temp coef -750 PPM.
C1017	19A700235P18	Ceramic, disc: 28 pF ±5%, 50 VDCW, temp coef -150 PPM.
C1018	19A701534P15	Tantalum: 3.3 uF ±20%, 35 VDCW.
C1019	19A701534P5	Tantalum: 2.2 uF, ±20%, 35 VDCW.
C1020	19A702059P12	Polyester: 0.068 uF ±5%, 50 VDCW.
C1021	19A701534P2	Tantalum: 0.22 uF ±20%, 35 VDCW.
C1022 and C1023	19A701594P1	Polyester: 0.033 uF ±2%, 100 VDCW.
C1024	19A701594P2	Polyester: 0.068 uF ±20%, 100 VDCW.
C1025 and C1026	19A702059P10	Polyester: 0.033 uF ±5%, 50 VDCW.
C1027 thru C1031	19A700235P18	Ceramic, disc: 27 pF ±5%, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
D101 and D102	19A702015P1	Silicon; sim to IN458A.
D151	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D152 and D153	19J706262P1	Silicon, capacitive: sim to BB117.
D301	19J706262P1	Silicon, capacitive: sim to BB117.
D901	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D902	19J706100P1	Rectifier, silicon; sim to 1N4001.
D903	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D904	19J706135P4	Optoelectronic: green; sim to Hewlett Packard 4855.
D1001	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D1002	4036887P5	Zener: 500 mW, 5.4 v. nominal.
D1003	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J901	19A134734P1	Contact, electrical: sim to Molex A 2461 (09-67-1042).
J903	19A134735P1	Contact, electrical: sim to Molex A 2461 (09-67-1072).
J904	19A700072P132	Printed wire: 2 contacts rated at 2.5 amps; sim to Molex 22-05-3021.
J910	19A116659P151	Connector, printed wiring: sim to Molex 09-75-1111.
J911	19A116659P145	Connector, printed wiring: sim to Molex 09-75-1081.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L151A	19J706029P1	Coil, RF: sim to Paul Smith EF223.
L151B	19J706029P4	RF Coil, variable; sim to Paul Smith EF 223.
L152B	19J706029P4	RF Coil, variable; sim to Paul Smith EF 223.
L153 and L154	19A700024P15	Coil, RF: 1.5 uH ±10%, 100 VRMS operating.
L155	19A700024P13	Coil, RF: 1.0 uH ±10%.
L156	19A700024P25	Coil, RF: 10.0 uH ±10%, 3.70 ohms DC res max.
L301	19J706029P4	RF Coil, variable; sim to Paul Smith EF 223.
L302	19A700024P25	Coil, RF: 10.0 uH ±10%, 3.70 ohms DC res max.
L901	19A700024P14	Coil, RF: 1.2 uH ±10%.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P151	19A701785P3	Contact, electrical.
P301	19A701785P3	Contact, electrical.
P907	19A700102P10	Printed wire: 3 contacts; sim to Molex 09-52-3032.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q151 thru Q153	19A701351P1	Silicon, NPN; sim to MPJ3646.
Q154	19A700023P1	Silicon, NPN; sim to Type 2N3904.
Q310 and Q302	19A701351P1	Silicon, NPN; sim to MPJ3646.
Q901	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q1001 and Q1002	19A700022P1	Silicon, PNP; sim to Type 2N3906.
Q1003	19A700023P1	Silicon, NPN; sim to Type 2N3904.
Q1004	19A700022P1	Silicon, PNP; sim to Type 2N3906.
Q1005 and Q1006	19A700023P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101	19A701250P303	Metal film: 10.5K ohms ±1%, 1/4 w.
R102	19A700019P54	Deposited carbon: 27K ohms ±5%, 1/4 w.
R103	19A700019P19	Deposited carbon: 33 ohms ±5%, 1/4 w.
R104	19A143400P38	Deposited carbon: 1.3K ohms ±5%, 1/4 w.
R105	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R106	19A143400P57	Deposited carbon: 51K ohms ±5%, 1/4 w.
R107	19A700019P31	Deposited carbon: 330 ohms ±5%, 1/4 w.
R108	19A700019P42	Deposited carbon: 2.7K ohms ±5%, 1/4 w.
R109	19A701250P303	Metal film: 10.5K ohms ±1%, 1/4 w.
R110 and R111	19A701250P278	Metal film: 6.34K ohms ±1%, 1/4 w.
R112	19A701250P330	Metal film: 20K ohms ±1%, 1/4 w.
R113	19A701250P310	Metal film: 12.4K ohms ±1%, 1/4 w.
R114	19A701250P350	Metal film: 32.4K ohms ±1%, 1/4 w.
R115	19A700019P41	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R116A	19A700019P44	Deposited carbon: 3.9K ohms ±5%, 1/4 w.
R116B	19A700019P39	Deposited carbon: 1.5K ohms ±5%, 1/4 w.
R117A	19A700019P35	Deposited carbon: 680 ohms ±5%, 1/4 w.
R117B	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R151	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R152	19A701828P1	Thermistor, 3.3K ohms ±5%, sim to Philips 2322-642-63332.
R153	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

LBI31071

SYMBOL	GE PART NO.	DESCRIPTION
R154	19A700019P51	Deposited carbon: 15K ohms ±5%, 1/4 w.
R155 and R156	19A700185P4	Variable: 10K ohms ±20%, 1/3 w.
R157 and R158	19A700106P49	Composition: 270 ohms ±5%, 1/4 w
R159 and R160	19A700019P57	Deposited carbon: 47K ohms ±5%, 1/4 w.
R161 and R162	19A700106P83	Composition: 6.8K ohms ±5%, 1/4 w.
R163 and R164	19A700106P85	Composition: 8.2K ohms ±5%, 1/4 w.
R165 and R166	19A700106P49	Composition: 270 ohms ±5%, 1/4 w
R167	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R168	19A700019P30	Deposited carbon: 270 ohms ±5%, 1/4 w.
R169	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R170	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R171	19A700106P29	Composition: 39 ohms ±5%, 1/4 w.
R172	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R173	19A700019P1	Deposited carbon: 1 ohms ±5%, 1/4 w.
R301	19A700106P59	Composition: 680 ohms ±5%, 1/4 w.
R302	19A700019P57	Deposited carbon: 47K ohms ±5%, 1/4 w.
R303	19A700106P83	Composition: 6.8K ohms ±5%, 1/4 w.
R304	19A700106P85	Composition: 8.2K ohms ±5%, 1/4 w.
R305	19A700106P51	Composition: 330 ohms ±5%, 1/4 w.
R306	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R308	19A700019P30	Deposited carbon: 270 ohms ±5%, 1/4 w.
R309	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R310	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R311	19A700106P19	Composition: 15 ohms ±5%, 1/4 w.
R901	19A700019P34	Deposited carbon: 560 ohms ±5%, 1/4 w.
R902	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R903	19A700019P30	Deposited carbon: 270 ohms ±5%, 1/4 w.
R904	19A700019P55	Deposited carbon: 33K ohms ±5%, 1/4 w.
R905	19A700019P56	Deposited carbon: 39K ohms ±5%, 1/4 w.
R906	19A700019P46	Deposited carbon: 5.6K ohms ±5%, 1/4 w.
R907	19A700019P41	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R908	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R909	19A700019P34	Deposited carbon: 560 ohms ±5%, 1/4 w.
R910	19A700050P17	Wirewound: 2.2 ohms ±10%, 2 w.
R1001	19A700019P19	Deposited carbon: 33 ohms ±5%, 1/4 w.
R1002	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R1003	19A700019P46	Deposited carbon: 5.6K ohms ±5%, 1/4 w.
R1004	19A700019P52	Deposited carbon: 18K ohms ±5%, 1/4 w.
R1005	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R1006	19A700019P33	Deposited carbon: 470 ohms ±5%, 1/4 w.
R1007	19A701250P335	Metal film: 22.6K ohms ±1%, 250 VDCW, 1/4 w.
R1008	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R1009	19A700019P42	Deposited carbon: 2.7K ohms ±5%, 1/4 w.
R1010	19A700185P4	Variable: 10K ohms ±20%, 1/3 w.
R1011	19A700019P59	Deposited carbon: 68K ohms ±5%, 1/4 w.
R1012	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R1013	19A700019P51	Deposited carbon: 15K ohms ±5%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
R1014	19A701250P321	Metal film: 16.2K ohms ±1%, 250 VDCW, 1/4 w.
R1015	19A701250P322	Metal film: 16.5K ohms ±1%, 250 VDCW, 1/4 w.
R1016	19A701250P305	Metal film: 11K ohms ±1%, 250 VDCW, 1/4 w.
R1017	19A701250P284	Metal film: 7.32K ohms ±1%, 250 VDCW, 1/4 w.
R1018	19A701250P317	Metal film: 14.7K ohms ±1%, 250 VDCW, 1/4 w.
R1019	19A701250P151	Metal film: 332 ohms ±1%, 250 VDCW, 1/4 w.
R1020	19A701250P309	Metal film: 12.1K ohms ±1%, 250 VDCW, 1/4 w.
R1021	19A701250P289	Metal film: 8.25K ohms ±1%, 250 VDCW, 1/4 w.
R1022	19A700019P56	Deposited carbon: 39K ohms ±5%, 1/4 w.
R1023	19A700019P57	Deposited carbon: 47K ohms ±5%, 1/4 w.
R1024	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R1025	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R1026	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R1027	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R1028	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R1029	19A700019P58	Deposited carbon: 56K ohms ±5%, 1/4 w.
R1030 and R1031	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R1032	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R1033	19A700019P46	Deposited carbon: 5.6K ohms ±5%, 1/4 w.
R1034	19A700019P40	Deposited carbon: 1.8K ohms ±5%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S151	19B800563P1	Push: DPDT, 1 station, alternate action; sim to IEEE/SCHADOW 51281 (F2UEE).
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U101	19A700086P4	Operation Amplifier, Dual OP AMP; sim to 4558 Type.
U1001	19D417763G1	Decoder.
U1002	19C321133G1	Encoder.
U1003	19D417833G1	Selective Amplifier.
U1004	19A134511P2	Linear: LOW POWER OP AMP.
		- - - - - - - - - - - SOCKETS - - - - - - - - - - -
X151 and X152		Socket. Includes:
	19A702742P1	Crystal socket. (Quantity 2 each).
	19B232322P1	Spring.
X301		Socket. Includes:
	19A702742P1	Crystal socket.
	19B232322P1	Spring.
X1001	19C320299G1	Connector. Includes:
	19D416714P1	Shell.
	19B219681P1	Contact, electrical. (Quantity 7).
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A129811P2	Insulator. (Used with U1002).
	19C328587P1	Pushbutton. (S151).
	19A701743P1	Pad. (Located at S151).
		ASSOCIATED ASSEMBLIES
		- - - - - - - - - - - NETWORKS - - - - - - - - - -
		NOTE: When reordering give GE part number and specify exact frequency needed.
Z1001	19C320291G1	Versatone Network: 71.9-203.5 Hz.

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 & B - 19D900556G2
Incorporated into initial shipment.