ADDENDA 1 AND 2 FOLLOW PAGE 48

GE Mobile Communications

MPS

403-512 MHz, SYNTHESIZED TWO-WAY FM RADIO COMBINATIONS

Maintenance Manual

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ILLUSTRATIONS

SPECIFICATIONS

SYSTEM

Frequency Range	403-435 MHz 450-470 MHz 470-494 MHz 494-512 MHz
Dimensions (HxWxD)	
Case (without Knobs)	14.8 x 7.2 x 3.8 cm (5.8 x 2.8 x 1.5 ins)
Battery Pack: (excluding Connector)	
750 mAh	5.5 x 6.8 x 3.8 cm (2.2 x 2.7 x 1.5 ins)
1200 mAh	8.9 x 6.8 x 3.8 cm (3.5 x 2.7 x 1.5 ins)
Weight	
Radio (less battery pack)	570g (20 oz)
Battery Pack:	
750 mAh	285g (10 oz)
1200 mAh	370g (13 oz)
Operable Temperature Range	-30° to +60°C
Current Drain (less options)	
Standby (Squelched)	.065 Amperes
Receive (Unsquelched, Rated Audio)	0.185 Amperes
Transmit:	
2.0 Watts	1.3 Amperes
5.0 Watts	2.5 Amperes

TRANSMIT

Type Number	TR-126	TR-127
Power Output (Adjustable)		
	1 to 2.0 Watts	1 to 5 Watts
Conducted Spurious & Harmonic Emissions (EIA)	-61 dB	
RF Load Impedance	50 ohms	
Modulation Deviation	Adjustable ±5 kHz	
FM Hum and Noise (Companion Rec)	-45 dB	
Audio Response	Within +1 and -3 dB of 6 dB per octave pre-emphasis, 300 to 3000 Hz per EIA	
Audio Distortion	Less than 3%	
Maximum Frequency Spread (Full Performance)	12 MHz	

SPECIFICATIONS

RECEIVE

Sensitivity:

EIA 12 dB SINAD	0.35 uV
20 dB Quieting	0.50 uV
Critical Squelch	0.25 uV

Selectivity (@ 30 kHz)
-80 dB

Intermodulation	-72 dB
Spurious and Image Rejection	-80 dB
Channel Spacing	25 kHz

Frequency Spread:

Full Performance	4 MHz
With Sensitivity Degradation of 3 dB	10 MHz
Maximum	10 MHz

Frequency Stability:

Standard	5 ppm
Optional	2.5 ppm

Audio Response	Within +2 and -8 of 6 dB per octave de-emphasis, 300 to 3000 Hz per EIA
Audio Distortion	Less than 5% (2% @ 50 mW)
Audio Output (max)	500 mW
Modulation Acceptance	±7 kHz

BATTERY PACK

Capacities	750 & 1200 mAh
Maximum Charge Rate	1 hour
Fuse Rating	7 Amperes
Charging Temperature Range	+5° to +45°C
Discharging Temperature Range	-30° to +60°C

COMBINATION NOMENCLATURE

Digits 1&2	Digit 3	Digit 4	Digit 5
Product Code	Transmit Frequency Range	Power Source	Maximum Channel Capacity
P9	**M** 403-435 MHz	**N** 750 mAh NiCd	**A** 12 Freq.
	R 450-470 MHz	**M** 1200 mAh NiCd	**B** 24 Freq.
	S 470-494 MHz	**X** NO BATT	**C** 36 Freq.
	T 494-512 MHz		**D** 48 Freq. Numeric
			E 48 Freq. Alpha
			F 64 Freq.
			T 8 Freq.

STRUCTURED OPTIONS

A Progmng	C Option	D Option	E Option	F Option	G Option	H Channel Spacing	J Option	K Option
O Factory	**O** None	**O** None	**O** None	**O** None	**O** None	**O** Std.	**O** None	**O** None
1 Customer	**U** CG/DCG	**1** DTMF	**G** GE-STAR Toggle	**2** Int Safe Grp. D	**P** PSLM	**A** 2.5 MHz	**H** HI/Lo Pwr Man	**3** Alt IF 21.4 MHz
	L T99		**I** GE-STAR Lanyard	**4** Int. Safe Grp. C	**L** PSLM Pri. Load SW		**I** HI/Lo Pwr Auto	**4** Std. IF 23.0 MHz
	T CG & T99		**H** GE-STAR & HI/Lo				**M** HI/Lo Pwr Marine	**5** Alt. IF 23.0 MHz
							2 Lo Pwr	

DESCRIPTION

General Electric MPS personal radio is a modularized, frequency synthesized, two-way FM communications system, designed to afford performance specifications equivalent or, more generally, superior to both domestic and international specification requirements. The MPS synthesized radio offers outstanding advances in frequency selection capability, option flexibility, reliability, improved serviceability and repairability.

Each MPS radio uses approximately fifteen plug-in circuit modules (See Figure 1). Each module utilizes a thick film monolythic hybrid integrated circuit, containing, when possible, the complete electronic function; not requiring any externally mounted components to make it work. Each circuit module plugs into a specific socket on the system board.

Frequency Synthesis, in the MPS system, eliminates any need for crystals for each transmit and receive channel. Also, Frequency Synthesis provides the availability of sixty-four RF channels. Forty-eight is standard.

The MPS synthesizer circuit employees a single FM modulated reference oscillator with a circuit design that drastically reduces harmonic content, reducing the possibility of RF spurious. The synthesizer module contains a phase-lock- loop circuit and two voltage controlled oscillator circuits to insure the correct operating frequency for both transmit and receive functions. These synthesizer circuits are controlled by a microprocessor controller module.

The microprocessor controller module consists of a logic board with a CMOS microcontroller and an Electrically Erasable Programmable Read Only Memory (EEPROM). The controller module also contains a tone hybrid integrated circuit. This controller provides the ability to select one of sixty-four RF frequency channels and automatically control multi-tone Channel Guard or multi-code digital Channel Guard, HI/LO power and GE-STAR Options. The controller will also perform Priority Search Lock Monitor (PSLM) between any two RF channels in the radio. All of these functions are field programmable using suit case programmer TQ2310.

The transmit circuit uses a power control module to insure the correct level of power output at the antenna. There are two power levels available in the MPS transmit circuit and are designated by transmit type numbers, TR-126 and TR-127. TR-126 provides 1 to 2.0 watts output while TR-127 provides 1 to 5.0 watts output. The only adjustment to the transmit circuit are frequency modulation and power level. Because both the reference oscillator and the transmit voltage controlled oscillator circuit are modulated, to obtain a good low frequency transmit modulation response, two modulation controls are provided, MOD ADJ and BALance.

The MPS receive circuit is a single conversion circuit using an injection frequency generated by the frequency synthesizer. This injection frequency is steered through the Synthesizer Interface module to the Receive Converter module to product an IF of 21.4 MHz. An alternate IF of 23 MHz is also available.

There are seven tuning adjustments in the receive circuit, all in the front end. Five of the adjustments are RF helical resonators tuned for maximum receive quieting. The other two adjustments, also helical resonators, are in the injection frequency chain and are designed to filter spurious and noise from the injection frequency.

The power supply for the MPS radios is a rechargeable 7.5 VDC battery pack. Two battery packs are available: a 750 mAh capacity and a 1200 mAh capacity, as the application demands. A voltage regulator module supplies a continuous 5.4 VDC and a keyed 5.4 VDC both short circuit protected.

The MPS radio combination consists of nine assemblies plus a battery pack (See Figure 2). These seven assemblies can easily be disassembled in the field to replace any damaged or defective parts. All parts of similar MPS radios are directly interchangeable.

Radio Assembly

The radio assembly consists of a multi-layered system board and all modules for frequency synthesis, control, transmit, receive, voltage regulation and option circuits.

The system board has four layers of printed wire pattern. The layer on the module side of the board is a ground plane. The layer on the back side of the board is for DC distribution. The backside of the board also provides mounting for "chip" components. The two center layers of printed wire pattern are for signal interconnections. Fifty ohm strip line is used for all high frequency connections. All four layers of the system board printed wire pattern are shown on the Outline Diagram to aid with any troubleshoot where tracing of the print wire pattern is required.

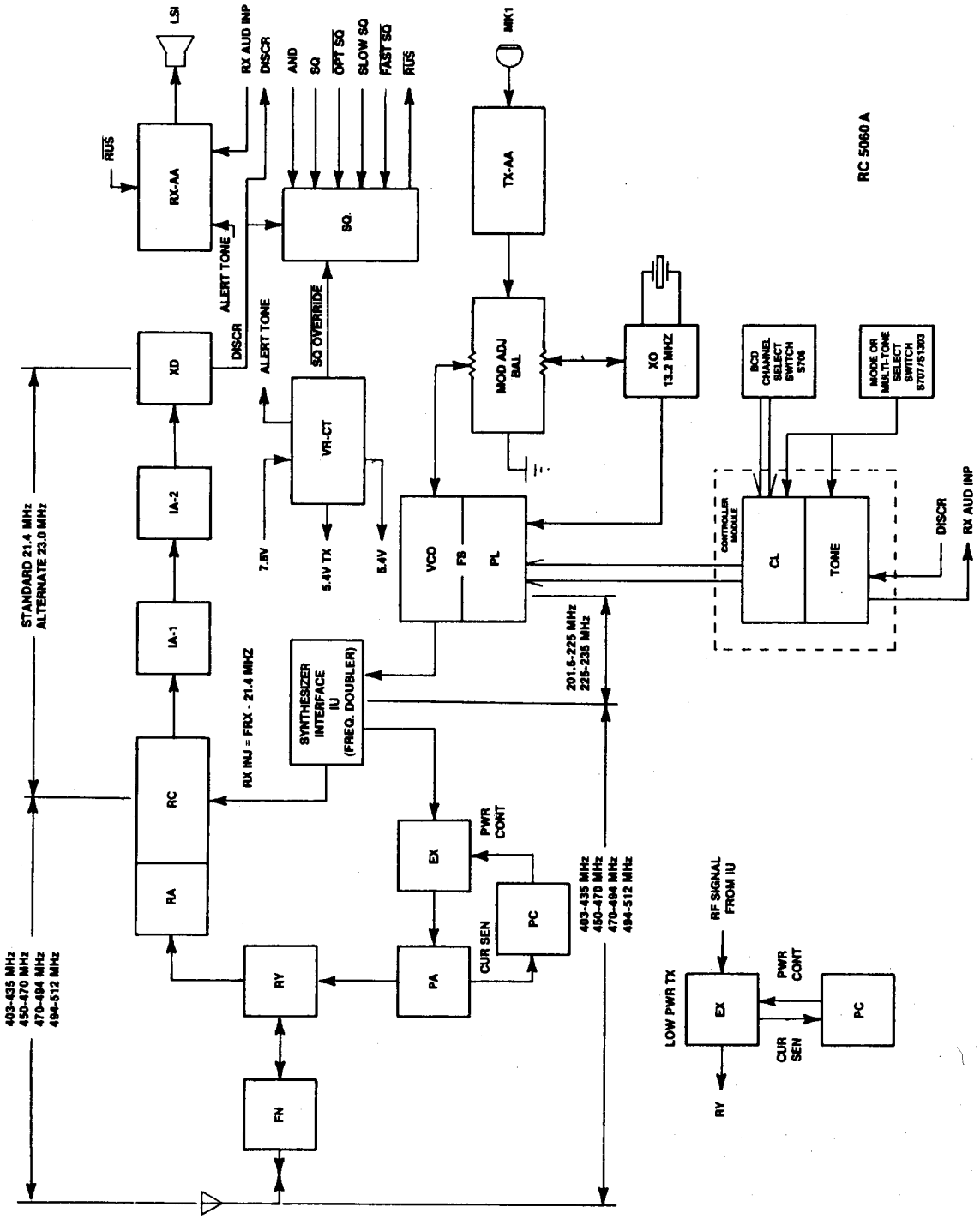
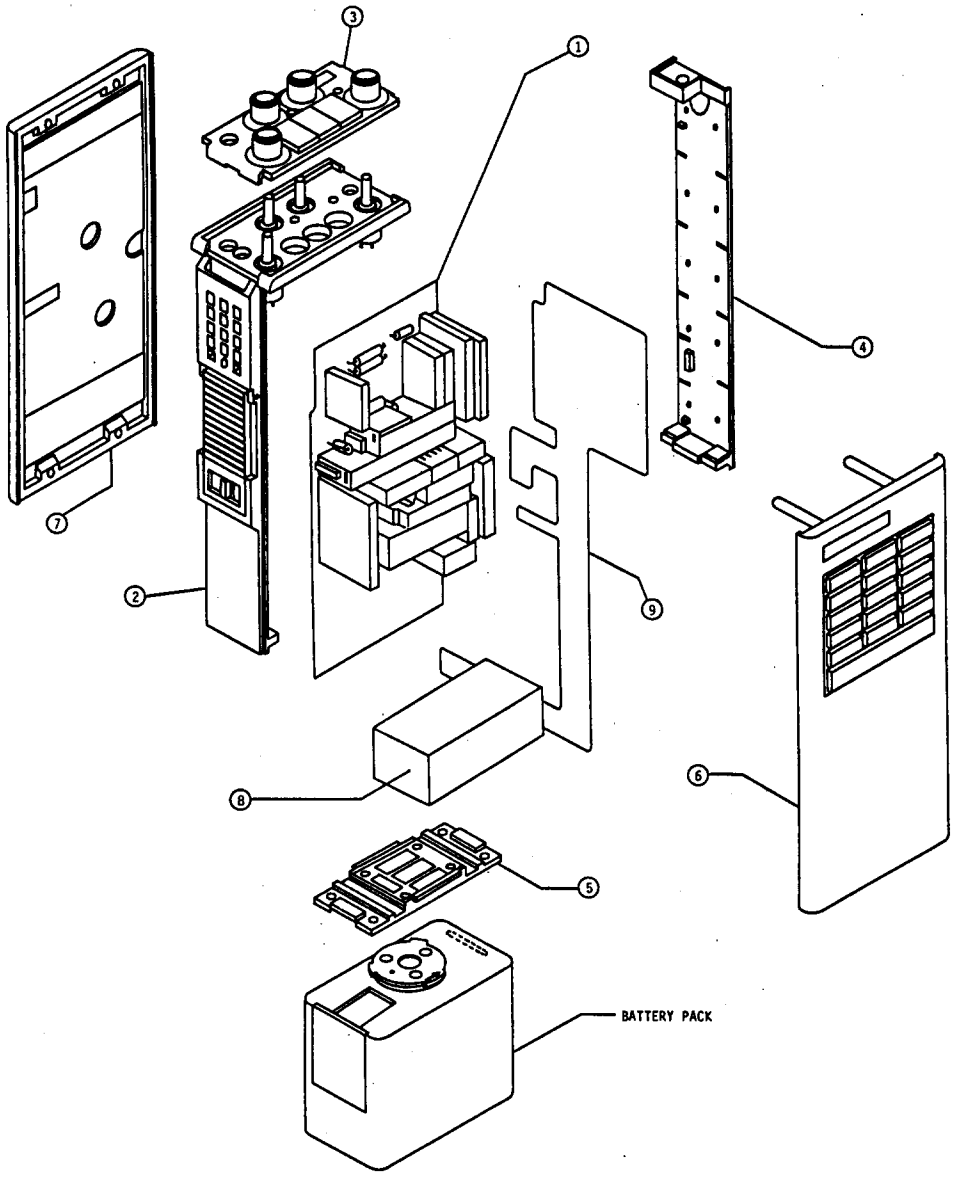


Figure 1 - Block Diagram



1. RADIO ASSEMBLY
2. CONTROL SIDE RAIL ASSEMBLY
3. TOP COVER ASSEMBLY
4. RIGHT SIDE RAIL ASSEMBLY
5. BASE ASSEMBLY
6. FRONT COVER ASSEMBLY
7. BACK COVER ASSEMBLY
8. CONTROLLER ASSEMBLY
9. SYSTEM CONTROL FLEX

Figure 2 - MPS Assemblies

Control Assembly

The Control Assembly consists of a molded Lexan® side rail, a molded Lexan® top plate and two flexible printed wire boards. The side rail provides a UDC accessory jack, PTT Bar, radio power, ON-OFF slide switch and an antenna mounting stud. The top plate provides a volume control, squelch control, a rotary channel select switch and a red LED transmit indicator. Also, provided on the top plate is a rotary tone or mode switch, three toggle switches for option control, plus a LED indicator for PSLM.

The flexible printed wire boards folds around the radio assembly and makes all major interconnections between the radio assembly, UDC accessory jack and all operating controls including option controls. The flexible printed wire boards do not make coax power output connections or internal microphone and speaker connections.

Many control leads accessible on the flexible printed wire board, can be used to expedite isolation of defective modules.

Top Cover Assembly

The top cover is a decorative molded Lexan® top cap snapped in place over the top plate. When in place, the top cover seals the volume, squelch and option controls against water and provides the proper identificaion of each control.

Right Side Rail Assembly

The right side rail consists of a molded Lexan® side rail.

Base Assembly

The Base Assembly fastens to the bottom of the MPS housing and provides the female portion of the battery pack fastener. The assembly consists of a die cast base, a stainless steel contact spring, a rubber seal and a contact assembly.

Front Cover Assembly

The Front Cover Assembly fastens to the front of the MPS housing and mounts the system speaker and local microphone. The assembly consists of a die cast aluminum cover, speaker grille, speaker, microphone, a rubber boot for both the speaker and the microphone, providing isolation from vibration, a retaining clip, fastener, standoffs and Ensolite® foam shock pads.

The aluminum front cover assembly provides additional heat sinking for the transmit PA.

Rear Cover Assembly

The Rear Cover Assembly consists of a rear cover, a thin polyester insulator to prevent projecting sockets from shorting against the rear cover and an Ensolite® foam shock pad, identical to those in the front cover assembly. The rear cover fastens to the four stand-offs in the front cover.

The outside of the rear cover has a stainless steel receptical plate for attaching an optional swivel mount, hand strap or pocket clip. A customer identification plate, a combination nameplate, an FCC compliance statement and an intrinsically safe nameplate also may be present.

Battery Pack Assembly

The Battery Pack Assembly consists of a molded Lexan® case and slide, a stainless steel latch spring, a steel fastener plate, three round contact strips for charging contacts and six nickel-cadmium batteries. A thermistor, diode and fuse is also included in the Battery Pack Assembly. The fuse is accessable from outside the case.

The steel latch spring is operated by the side slide. The side slide on the opposite side of the case is for decorative purposes only.

Assembly

The top plate, control side rail and system board are interconnected by the control side flexible printed wire board. The top plate and connections to the controller module located on the system board are interconnected by the flexible printed wire board on the right side. This assembly is "folded up" and mounted together with two screws from the top control panel into the two side rail assemblies, and four screws through the base plate assembly into the side rail assemblies. After all modules are plugged into the system board, the front and rear covers are fastened together (after connecting the speaker and microphone) with four screws through the rear cover into the four standoffs on the front cover. The Lexan® top cover is snapped on the top of the top plate and knobs are assembled. The antenna is screwed on to the antenna stud and the battery pack attached. The MPS Synthesized Communication System is now ready for use.

OPERATION

TO RECEIVE A MESSAGE

1. Disable any options by placing the option control toggle switch(es) into a disabling position.

2. Rotate the volume control to approximately half of its rotation.

3. Rotate the squelch control fully clockwise.

4. Place the slide ON/OFF switch in the ON position. A hissing noise should be heard from the speaker.

5. Adjust the volume control so the noise is easily heard but not annoyingly loud.

6. Rotate the squelch control counterclockwise until the noise just stops. DO NOT rotate the squelch control any further. Too much squelch could prevent receiving messages.

7. Place the option controls back into the ON position.

8. Place the mode and frequency select switch into the desired positions (refer to RF CHANNEL SELECTION). Your MPS receive circuit is now ready to receive messages.

TO SEND A MESSAGE

1. Turn the radio on and select the desired channel as instructed in TO RECEIVE A MESSAGE.

2. LISTEN to insure no one is transmitting on the selected channel. NEVER interrupt another transmission.

3. While holding the radio so the antenna is vertical, press the Push-To-Talk (PTT) bar and speak directly into the Speaker grille or across the face of an external microphone. Use a normal tone of voice. Release the PTT bar as soon as you stop talking. Messages cannot be received when the PTT bar is pressed.

RF CHANNEL SELECTION

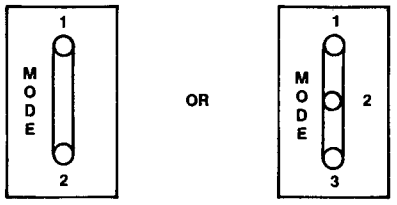
If your radio is equipped with only a Frequency Select switch, you may select one of twelve RF channels.

Your radio may be equipped with both a rotary Mode (Area) Select switch and a Frequency Select switch. If the Mode Select switch is labeled A, B, C, D, or 1, 2, 3, 4 you may select one of four modes plus one of twelve positions with the Frequency Select switch for a total selection of forty-eight RF channels.

If your mode switch and the Frequency select switch are labeled 1 through 8 you may select one of eight modes plus one of eight positions with the Frequency Select switch for a total selection of sixty-four RF channels.

These switches may also be labeled anything within the given limits for other selections of RF channels.

Instead of a rotary switch, the Mode Select may be a toggle switch located in the center option panel and labeled as follows:



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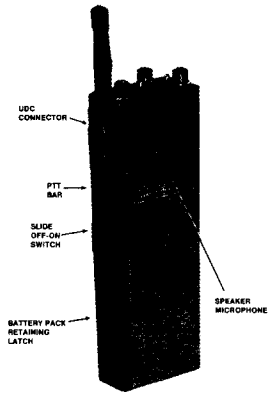


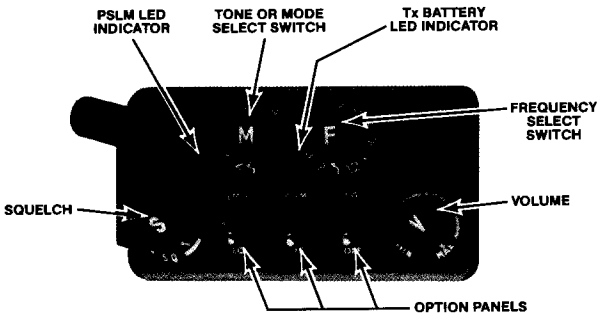
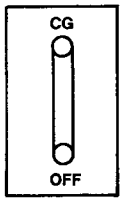


Figure 3 - Operating Controls

OPTIONS

Channel Guard

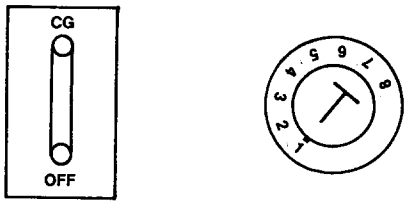
If your radio is equipped with a Channel Guard (CG) option, you have, on the control panel, a two position switch labeled CG-OFF. With the switch in the CG position the decoder permits you to hear only those calls that are tone-coded on your Channel Guard frequency. The encoder permits you to communicate with other radios in your system equipped with Channel Guard decoders, tone-coded on your Channel Guard frequency. Moving the switch to the OFF position permits you to hear all calls on the channel. When sending, with the switch in the OFF position, you will still transmit a Channel Guard tone. Before sending a message, listen to insure no one is using the channel.



RC4982

Multiple Tone Channel Guard

If your radio is equipped with a manual-select Multiple Tone Channel Guard, you have, on the control panel, a two position switch labeled CG-OFF and possibly a rotary switch labeled T and graduated 1 through 8. With the two position switch in the CG position, the decoder permits you to hear only those calls tone coded on the Channel Guard frequency selected by the rotary Tone-Select switch. If the Tone select switch is not present, you will hear only those calls tone-coded as pre-programmed on the RF channel selected by the frequency select switch. The encoder permits you to communicate with other radios in your system equipped with Channel Guard decoders. Encoder tone frequencies are also selected by the Tone select switch or pre-programmed on the RF channel selected by the frequency select switch.

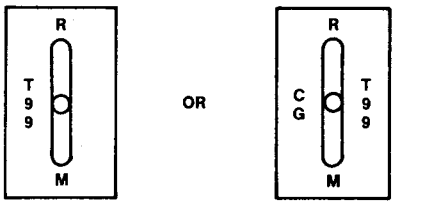


RC4983

Moving the two position switch to the OFF position permits you to hear all calls on the selected channel. When sending, with the switch in the OFF position, you will transmit a Channel Guard tone. Before sending a message, listen to insure no one is using the channel.

Type 99 Tone

If your radio is equipped with a Type 99 tone option, you have on the control panel a switch labeled T99, R-M or T99, R-CG-M. With the switch momentarily pushed in the R position, the Type 99 option is preset to decode the Type 99 tones and open the receive audio circuit. With the switch in the CG position, both a Type 99 tone decode and a Channel Guard tone are required to open the receive audio. Placing the switch in the M position allows you to monitor the channel.



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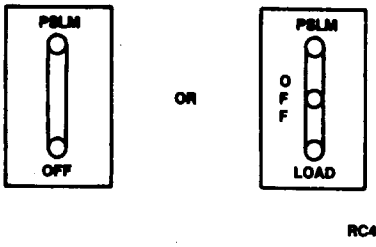
Priority Search Lock Monitor

If your radio is equipped with a Priority Search Lock Monitor (PSLM) option, you have on the control panel a two position switch labeled PSLM-OFF or a three position switch labeled PSLM-OFF-LOAD. When the switch is in the PSLM position and a signal is not present, the PSLM alternately searches between two receive channels and the LED indicator blinks at a fast rate. One of the receive channels is a pre-programmed priority channel. The other receive channel is selected by the Mode and Frequency Select switch(es). When a signal is present, the PSLM locks on the active channel. If the active channel is the pre-programmed priority channel, the LED indicator lights. If the active channel is the selected non-priority channel, the PSLM continues to search the priority channel while monitoring the non-priority channel. If a signal occurs on the priority channel while monitoring the non-priority channel, the PSLM switches to monitor the priority channel. Before transmitting, the search must be defeated by placing the two-position switch into the OFF position.

When the switch is in the OFF position, the radio transmits on or monitors only the channel selected by the frequency select switch. Although search should be defeated before transmitting, the transmit circuit will key on the channel selected by the Frequency Select switch if the two-position switch is in the PSLM position.

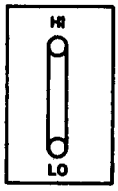


If your radio is equipped with the three position switch labeled PSLM-OFF-LOAD, the priority channel can be changed as follows:

1. Set the Mode switch and Frequency Select switch to the desired priority channel.
2. Momentarily push the PSLM switch to the LOAD position.
3. Set the Mode switch and Frequency Select switch to the desired non-priority channel.

HI/LO Power

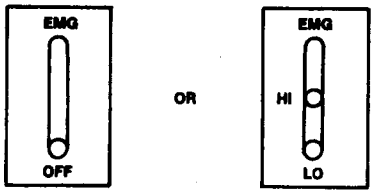
If your radio is equipped with a manual HI/LO Power option, you have, on the top cover, a two position switch labeled HI-LO. With the switch in the HI position the RF power output is a maximum. With the switch in the LO position the RF power output is a predetermined reduced power.



Operation with the HI/LO Power switch in the LO position will extend battery life when the higher power output is not necessary for reliable communication.

GE-STAR

If your radio is equipped with a GE-STAR option without a lanyard, you have, on the control panel, a switch labeled EMG-OFF or EMG-HI-LO. With this spring loaded switch held in the EMG position and the transmit circuit keyed, an emergency message will be transmitted. With the switch in the OFF position no GE-STAR emergency message will be transmitted. The switch labeled EMG-HI-LO is a GE-STAR option combined with a HI-LO power option. When this spring loaded switch is held in the EMG position and the transmit circuit is keyed, an emergency message will be transmitted at the HI power level.



REPLACEMENT OF BATTERY PACKS

To remove the battery pack from the radio:

1. Turn the radio OFF.
2. Press the battery pack retaining latch toward the battery pack, and turn the battery pack one-quarter turn to the left. The battery pack can now be detached from the radio.

To re-connect the battery pack to the radio:

1. Hold the battery pack at a 90° angle to the radio as shown in Figure 4.
2. Align the large tab marked with an arrow on the battery pack connector with large cut-out on the radio socket.
3. Press the battery pack connector into the socket on the radio and turn the battery pack onequarter turn to the right until the latch clicks.

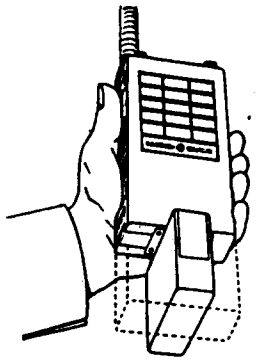


Figure 4 - Battery Pack Replacement

RECHARGING BATTERY PACKS

The MPS radio is equipped with a battery pack transmit voltage LED indicator. This indicator blinks rapidly while transmitting with a fresh charged battery pack. As the battery pack gets weaker, the indicator will blink slower. When the battery pack needs recharging, the indicator will not light.

There are several chargers and charge rates available for charging the MPS battery packs. For specific instructions refer to the applicable charger Operating Manual.

OPERATING TIPS

The following conditions tend to reduce the effective range of Two-Way radios, and should be avoided whenever possible.

- Operating the radio in low areas of the terrain, or while under power lines or bridges.
- Operating the radio inside of a vehicle, or in a metal or steel-framed building unless using an outside antenna.
- Obstructions such as mountains or buildings between the person sending and the person receiving the messages.

In areas where transmission or reception is poor, some improvement maybe obtained by insuring the antenna is vertical. Moving a few yards in another direction or moving to a higher elevation may also improve communication.

SYSTEM ANALYSIS

General Electric's frequency synthesized, MPS radio is a completely modularized, two-way, FM communication system, utilizing a multi-layered system board. The system board contains all circuit modules for the frequency synthesis, transmit, receive, voltage regulation and option circuits. Flexible printed wire boards fold around the system board to make all interconnections between the system board and radio controls.

Many control leads, accessible on the flexible printed wire boards, can be used to expedite isolation of defective circuit modules. Refer to the Troubleshooting Procedures.

All control leads for the MPS radio are "barred", such as $\overline{\text{PTT}}$ or $\overline{\text{RUS}}$. This means the lead is in a low voltage condition when the function name is true. For example, PTT is low when the radio is keyed. Refer to the Table of Contents for a list of Control leads and a description of their function.

A Signal lead has its name chosen so the function of the lead is obvious, such as:

VOL - DC voltage used to control volume

SQ - DC voltage used to control squelch

DISCR - DC and audio from discriminator

PWR CONT - DC output from power control used to control the transmit gain

Circuit illustrations shown in the following text are simplified representatives of actual circuits. They are intended only to illustrate basic functions.

FREQUENCY SYNTHESIZER CIRCUIT

The MPS frequency synthesizer circuit, as shown in Figure 1 - Block Diagram, consists of the following integrated circuit modules:

Reference Oscillator (XO)

Frequency Synthesizer (FS)

Frequency Synthesizer Interface (IU)

This circuit generates the transmit frequencies and receive injection frequencies for all RF channels under control of the controller circuit.

Reference Oscillator Module (XO)

Two designs of the reference oscillator are available: a 5 parts per million (ppm) and a 2.5 ppm. The 5 ppm oscillator uses an FET Colpitts oscillator circuit, temperature compensated with a descrete thermistor (RT1) mounted adjacent to the oscillator on the system board (See Figure 5). The optional more stringent 2.5 ppm design is a self/contained compensated oscillator. Both circuits have FM modulation capability and will support digital Channel Guard operation.

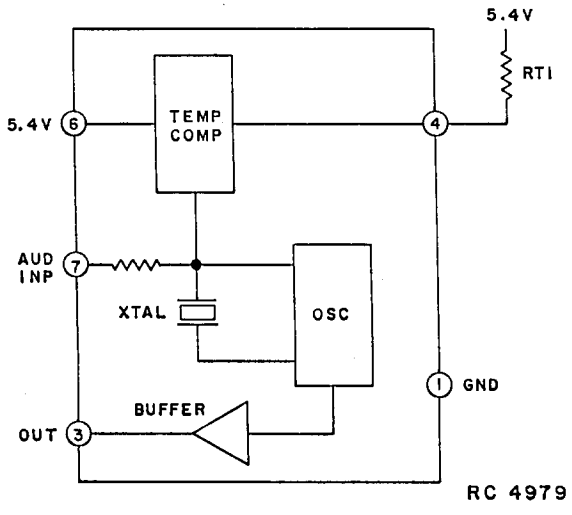


Figure 5 - Reference Oscillator

The standard reference oscillator frequency is 13.2 MHz with an optional frequency of 13.8 MHz available to eliminate "tweets". This is a condition when the receiver is operating on a frequency which is an exact harmonic of the reference oscillator frequency and self quieting spurs are generated.

Frequency Synthesizer FS

The frequency synthesizer module contains a phase-lock-loop (PLL) module and a voltage controlled oscillator (VCO) module (See Figure 6). The PLL module consists of a synthesizer IC, an acquisition circuit with a bandwidth switch and low-pass filter (LPF) and a dual modulus prescaler. The synthesizer IC contains three dividers, a phase detector, two shift registors and lock detect circuitry. When the push-to-talk bar is pressed (transmit) or released (receive) or a different RF frequency channel selected, new frequency data is received on the clock, data and strobe input lines. The synthesizer immediately begins generating the new RF frequency. This serial data determines the VCO frequency by setting the internal dividers. The reference oscillator frequency (13.2 MHz) applied to the programmable divide by R counter is divided down to a lower frequency (6.25 kHz), as directed by the input data, and applied to the internal phase detector.

The phase detector compares the output of the divide by R counter to the output of the divide by N counter. The output of the N counter is a function of the RF frequency which is divided down by the dual modulus prescaler and the N counter. When operating on the correct frequency, the input frequencies to the phase detector are equal and the output voltage of the phase detector is constant. With this condition, the VCO is stabilized or locked on frequency. When locked, the VCO has a long term stability equal to that of the reference oscillator.

If the compared frequencies (phases) are different, a ± error voltage is generated by the phase detector and applied to the VCO module through the acquisition circuit and low-pass filter. This error voltage steers the VCO to the correct operating frequency.

The lock detect line provides lock status information to the Controller Module.

The output of the phase detector is applied to the low-pass filter to eliminate undersired pulses on the VCO control line, providing a constant DC level to the VCO module.

When an acquisition pulse is received, on the acquisition line, the bandwidth switch removes the low-pass filter from the circuit, effectively increasing the bandwidth end decreasing channel acquisition time. The acquisition pulse is 10 milliseconds wide.

The VCO output frequency is fed back to the dual modulus prescaler. The prescaler divides the VCO frequency by 64 or 65 depending on the status of the modulus control line. The divided down reference frequency is 6.25 kHz.

The output of the dual modulus counter is applied to the divide by N counter in the synthesizer IC. It is further divided down and compared in frequency and phase with the divided down frequency from the reference oscillator. The divide by N counter is set by the controller module.

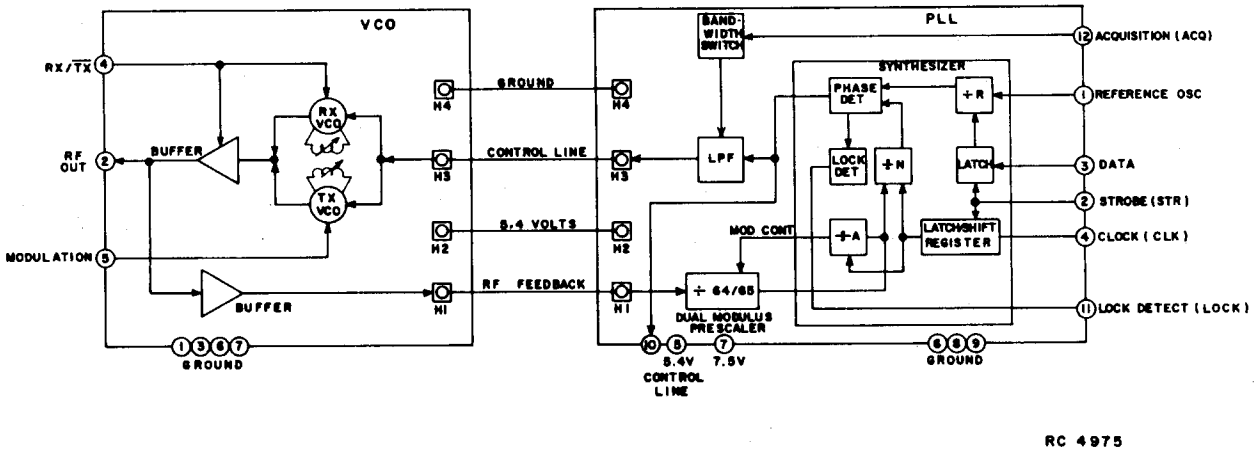


Figure 6 - Frequency Synthesizer

The VCO module consists of two separate VCO circuits, one for transmit and one for receive. Each circuit consist of a JFET Colpitts oscillator, tunable by a tunable inductor (L1 or L2). The receive VCO circuit also employs two varactors while the transmit VCO circuit uses one. The control line adjusts the VCO frequency by channging the capacitance of the varactors. An additional varactor is used to modulate the transmit VCO. The RX/TX input lead selects the VCO circuit to operate and its corresponding section of a RF buffer/combiner. Having two separate VCO circuits allows the transmit and receive circuits to have different frequency ranges. The RF buffer drives another buffer for the prescaler in the PLL module. It also drives the sythesizer interface module.

Synthesizer Interface Module (IU)

This interface module accepts the input RF from the synthesizer module, buffered output (refer to Figure 7). The RF signal is doubled, amplified and "steered" to either the receive front end as an injection frequency or to the transmit exciter module.

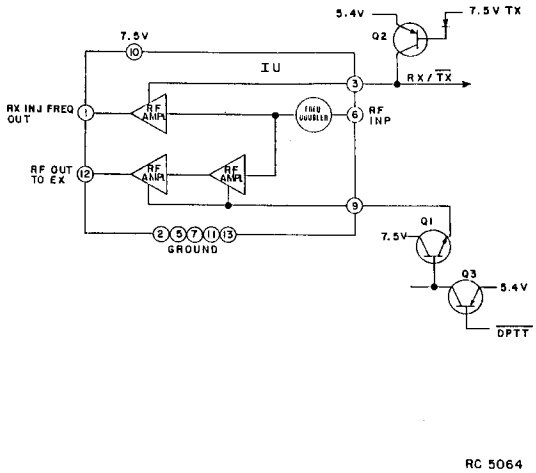


Figure 7 - Synthesizer Interface

The control signal for directing this RF signal flow is provided by the controller module. When the PTT bar is pressed and relay K1 activates, 7.5 volts TX is applied to the base of PNP switching transistor Q2. Transistor Q2 switches off, causing the RX/TX line to go low activating the transmit VCO in the FS module. The receive "steering" amplifier is also turned off. When the DPTT lead goes low, coming from the controller module, PNP switching transistor Q3 conducts. Transistor Q3 conducting causes NPN transistor Q1 to conduct, placing 5.4 volts on Pin 9 of the IU module. The transmit "steering" amplifiers are turned on and the RF signal is routed to the EX module. When the PTT bar is released, the RX/TX line goes high (5.4 volts) activating the receive VCO and the receive "steering" amplifier. The RF signal is routed to the receive injection frequency input on the RA/RC module.

TRANSMIT CIRCUIT

The MPS transmit circuit, as shown in Figure 1 - Block Diagram, consists of the following integrated circuit modules:

Audio Processor (TX-AA)

Exciter (EX)

Power Amplifier (PA)

Power Control (PC)

Antenna Relay (RY)

Filter Network (FN)

Audio Processor Module (TX-AA)

The audio processor module provides an audio input designated EXT MIC at Pin 13 for an external microphone and an audio input designated INTL MIC at Pin 14 for an internal microphone (refer to Figure 8). Normally, audio is accepted from the external microphone unless, the PTT lead is in a low voltage condition. Tvhe PTT lead in a low voltage condition means the radio has been keyed by the PTT bar on the control side of the radio. Keying the radio with the PTT bar gates off the external microphone and gates on the internal microphone. Microphone gating is typically -55 dB.

Audio from either microphone input is amplified and brought out of the processor at the output designated PRE-AMPL OUT at Pin 9. The audio is jumpered to the input designated AUDIO IN at Pin 6. An additional 10 dB of microphone gain can be obtained by connecting a 3.6K resistor in series with a 2.2 mfd tantalum capacitor between the MIC GAIN lead and ground.

Audio jumpered to Pin 6 is connected through an active pre-emphasis amplifier and an active peak-to-peak clipper limiter circuit. The limiter output can be attenuated by more than 60 dB by pulling the lead designated MIC MUTE at Pin 4 to ground. The MIC MUTE lead is used to mute microphone inputs when options are used which transmit data. The output of the limiter circuit is applied to the input of a summing amplifier. The summing amplifier provides two inputs for modulation. One input, designated ENC at Pin 5, is the input for Channel Guard

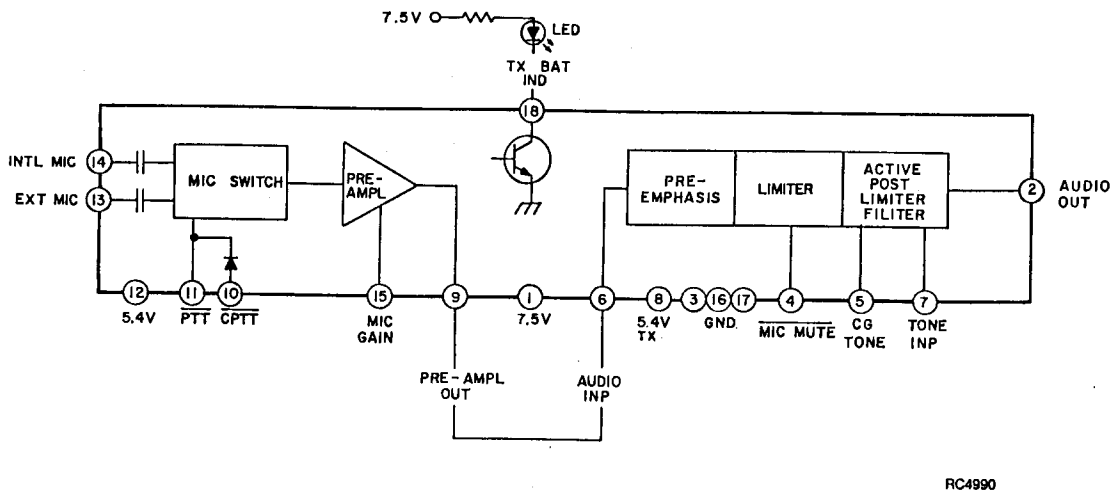


Figure 8 - Audio Processor

modulation and is added to the fixed output from the limiter circuit. The input, designated TONE INP at Pin 7 is intended for touch tone or optional multiple tone Channel Guard encoders. The output of the summing amplifier passes through an active post limiter filter and out of the processor at the lead designated AUDIO OUT, Pin 2. The output of the audio processor is applied through balance pot R9 to the input of the reference oscillator module at Pin 7. Also, the output of the audio processor is applied through MOD ADJ pot R10 to the input of the frequency synthesizer module, voltage control oscillator at Pin 5.

A battery indicator circuit is also part of the audio processor. LED transmit indicator DS701 connects to the audio processor module at the lead designated TX BAT IND at Pin 18. During transmit, the battery pack voltage is measured and the transmit indicator blinks at a rate determined by the voltage under load. A rapidly blinking indicator indicates a fully charged battery pack with the blink rate slowing as the voltage decreases. The indicator will not light when the end of the voltage has been reached and the battery must be recharged.

Exciter Module (EX)

The EX module is a two stage RF amplifier module with an input and output impedance of 50 ohms. The first stage has its DC power supplied by the Power Control Module (PC).

The 50 milliwatts of RF drive from Pin 12 of the synthesizer interface module to Pin 11 of the EX module is coupled to the input of the first RF amplifier stage (See Figure 9). The first RF amplifier stage amplifies the 50 milliwatts to approximately 550 milliwatts. The output of the first RF amplifier stage is connected to the input of the second RF amplifier stage. The second RF amplifer stage amplifies the 550 milliwatts to approximately 1.8 watts (1.5 watts minimum). The 1.8 watts output from Pin 1 of the EX module is connected to Pin 8 of the Power Amplifier Module (PA).

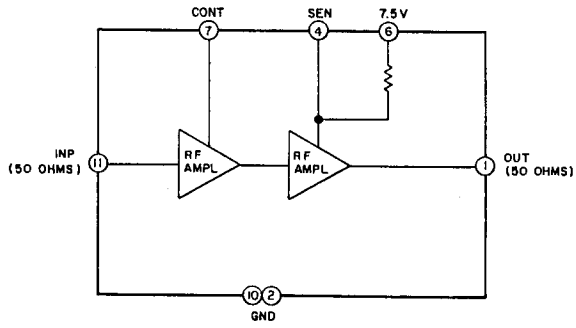


Figure 9 - Exciter

Exciter/Power Amplifier Module (EX/PA)

The EX/PA module is used in low power applications and is identical, except for the output stage, to the EX module. The output RF amplifier stage, in the EX/PA module, amplifies the 550 milliwatts on its input to, typically, 3.0 watts (2.0 watt minimum).

A current sensing metering resistor is in the DC power feed of output stage for the Power Control Module (PC).

Power Amplifier Module (PA)

The PA module is a single stage RF amplifier module and like the exciter module has an input and output impedance

of 50 ohms. The RF power output from Pin 1 of the EX module is connected to Pin 8 of the PA module where it is applied to the input of the RF power amplifier stage (See Figure 10).

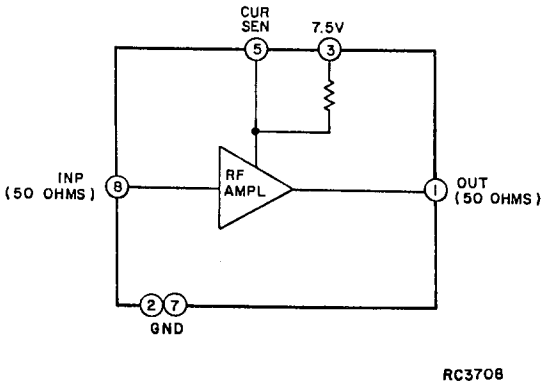


Figure 10 - Power Amplifier

The RF power amplifier stage amplifies the 1.8 watt input from the EX module to a minimum power output level of 6.5 watts at Pin 1. The output at Pin 1 is connected through the antenna relay (RY) to Pin 1 of the filter network module (FN).

Power Control Module (PC)

The RF power output of the MPS radio is regulated by sensing variations in the current drain of the transmit final PA module to control the supply voltage of an earlier driver stage. Supply voltage cannot be applied to the driver stage until the transmit circuit is keyed, applying 5.4 volts to Pin 5 of the PC module. Also, the $\overline{\text{UNLOCK}}$ lead at Pin 1 of the PC module must be high, indicating that the TX VCO is running on the correct operating frequency.

When the transmit circuit is keyed, the output of a reference generator, determined by the HI and LO power adjust controls, is applied to the positive (+) input of a comparator amplifier (See Figure 11). The current sensing element in the final PA module is connected to Pin 7 of the PC module and to the negative (-) input of the comparator amplifier. The amplifier is enabled when the $\overline{\text{UNLOCK}}$ lead goes high. Until then, the output of the amplifier is high and the series regulator is held off. When the $\overline{\text{UNLOCK}}$ lead goes high, the output of the amplifier goes low causing the series regulator to conduct and apply maximum supply voltage to the driver stage.

As the PA module begins to draw more current and the power increases, the changing voltage drop across the sensing element causes the series regulator circuit to regulate the supply voltage to maintain constant current flow through the PA module and constant RF power output.

Filter Network Module (FN)

The output of the EX/PA module or the output of the PA module is connected to Pin 1 of the filter network module (FN). The FN module is a passive L/C general parameter low-pass filter with an insertion loss of less than .4 dB in the pass band range of 403-512 MHz. It also has a rejection of greater than 40 dB in the stop band range of 812-1200 MHz. The output of the FN module on Pin 7 is connected to the system antenna.

Optional Carrier Controlled Timer (CT)

The carrier controlled timer module provides a transmit interrupt, 30 seconds after the transmit circuit has been keyed. Other time periods of 50 to 90 seconds can be obtained by replacing the printed run between H907 and H908, on the system board, with a resistor (See Figure 12).

Keying the transmit circuit causes the PTT lead on Pin 8, of the CT module to go low and start the time-out timing sequence. When the time period for the

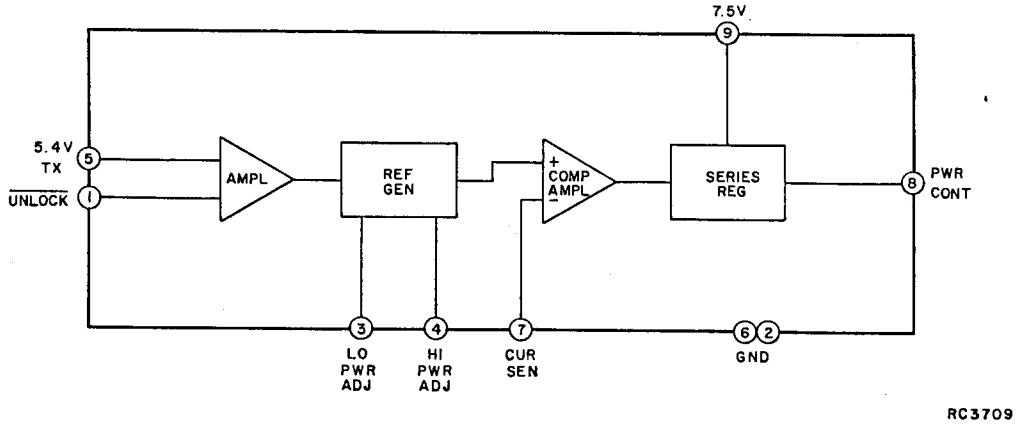
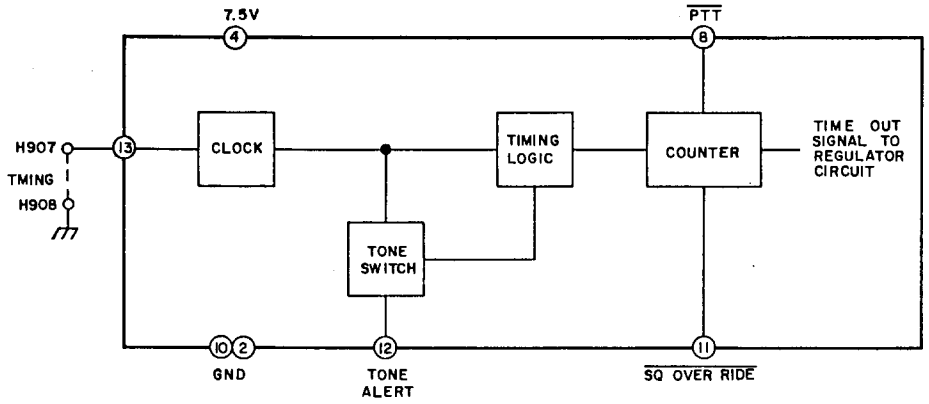


Figure 11 - Power Control



TMING	RESISTOR VALUE CONNECTED BETWEEN H907 AND H908	GE PART NO.
60 SECONDS	430K	3RI51P434J
90 SECONDS	820K	3RI51P824J

RC3723A

Figure 12 - Carrier Controller Timer

transmit interrupt has elapsed, a timeout signal to the regulated circuit unkeys the transmit circuit. The SQ OVER RIDE lead on Pin 11, of the CT module, will go low, defeating the receive squelch circuit and opening the receive audio. A DC voltage on Pin 12, of the CT module, will mute the receive audio and an alert tone, also on Pin 12 of the CT module, will be applied to the receiver audio. The alert tone will be heard from the speaker as the PTT bar is pressed. A momentary release of the PTT bar resets the CT module.

RECEIVE CIRCUIT

The MPS receive circuit, as shown in Figure 1 consists of the following integrated circuit modules:

Low-Pass Filter (FN)

Receive Converter Module (RA/RC)

IF Pre-amplifier Module (IA-1)

IF Amplifier Module (IA-2)

Crystal Discriminator Module (XD)

Audio Amplifier Module (RX-AA)

Squelch Module (SQ)

Low-Pass Filter (FN)

RF is coupled from the antenna through low-pass filter FN and antenna relay RY to the input of receive converter module RA/RC. Low-pass filter FN is used with the receive circuit because of the third mode response at the helical resonator in the receive converter circuit. The low-pass filter also provides additional selectivity for the receive circuit.

Receive Converter Module RA/RC

The receive converter module contains seven helical resonators, tuned for best receive circuit quieting, an RF amplifier and a passive doubly balanced, diode mixer (See Figure 13). The 403-512 MHz RF signal on the RF input of the RA/RC module and the 381.6-409.6 MHz, low side injection frequency on the injection frequency input, provides a difference of 21.4 MHz as an IF on the output.

The RF signal on the input of the receive converter module is coupled through two helical resonators to the input of a grounded emitter broadband RF amplifier. This amplifier provides 10 dB of power gain and 75 dB of intermodulation capability. The output of the RF amplifier is coupled through three helical resonators to drive one of two inputs of the mixer circuit.

The low side injection signal from the synthesizer interface module is coupled through two helical resonators to the other input of the mixer circuit. These two helicals filter spurious and broadband noise from the mixer injection signal. All inputs and the IF output of the RF/RC module have 50 ohm impedances. The +7 dBm injection frequency level, provided by the synthesizer interface module, is connected to the receive converter module through a buried 50 ohm stripline on the system board.

The output of the RC module is connected to the input of IF preamplifier module (IA-1).

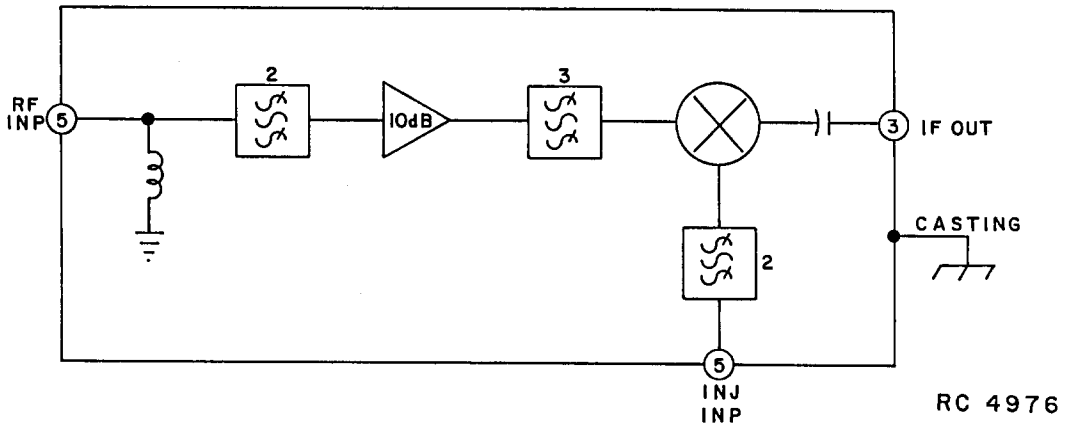


Figure 13 - RF Amplifier/Receive Converter

IF Pre-Amplifier Module (IA-1)

The IF pre-amplifier module contains an amplifier circuit and a four pole crystal filter (See Figure 14). The 21.4 MHz IF signal from the RC module feeds the input of an amplifier stage providing a 15 dB power gain. The 21.4 MHz IF is connected through the crystal filter with the output on Pin 1. The IA-1 module has an input impedance of 50 ohms and an output impedance of approximately 1200 ohms. The output of the IA-1 module is connected to the input of IF amplifier module IA-2.

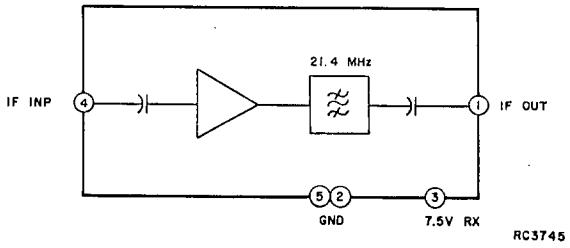


Figure 14 - IF Amplifier

IF Amplifier Module (IA-2)

IF amplifier module IA-2 contains a 45 dB power gain stage and a 4-pole crystal filter. Input and output impedances of this module are approximately 1200 ohms. The input to the IA-2 module is fed from the output of the IA-1 module. Both input and output pins of the IA-2 module are AC coupled, with the output driving the crystal discriminator module (XD).

Crystal Discriminator Module (XD)

The crystal discriminator module contains two additional IF amplifier stages for an added 90 dB gain. The discriminator module also contains a crystal resonator, audio detector circuit and audio amplifier circuit (See Figure 15). The 21.4 MHz IF input is connected to the input of the IF amplifier stages for gain and limiting. The output of the amplifier stages is connected through the crystal resonator to the audio detector circuit.

The recovered audio from the detector circuit is amplified, buffered and drives the DISC output lead. This lead feeds the audio to the squelch, audio, and optional tone modules. A typical audio level of 200 millivolts rms is achieved with a 3 kHz deviation at an audio frequency of 1 kHz. The frequency response is flat within ±1 dB over the useful audio range of 70-3000 Hz.

Audio Amplifier Module (RX-AA)

The audio amplifier module contains an active low-pass filter, an active notch filter, an attenuator circuit and an audio power amplifier circuit (See Figure 16). Audio from the DISCR lead is connected through the low-pass filter to de-emphasize the audio high frequencies and provide the desired audio response. The output of the low-pass filter is connected to the input of the notch filter. The notch filter eliminates the presence of any Channel Guard tone in the recovered audio. The output of the notch filter is connected to the input of the attenuator circuit.

The attenuator circuit is DC voltage controlled and provides a greater than 70 dB range for the volume control. The module provides filtering for the DC control voltage, reducing any noise from a dirty control. The output of the attenuator circuit is connected to the input of the audio power amplifier circuit.

The audio power amplifier circuit provides 500 milliwatts audio output, with 5% maximum distortion, into a capacitor coupled eight ohm speaker.

The output of the audio power amplifier has thermal overload protection making it indestructable into open or shorted loads.

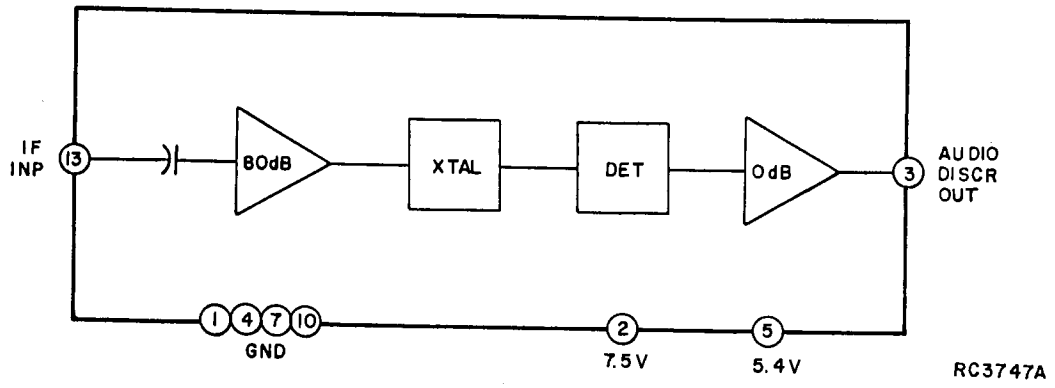


Figure 15 - Crystal Discriminator

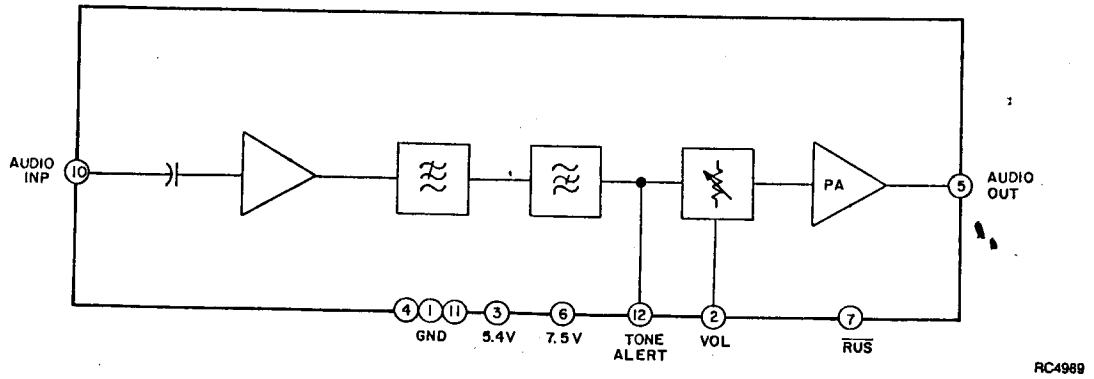


Figure 16 - Audio Amplifier

The audio power amplifier is controlled by the $\overline{\text{RUS}}$ control lead. When the lead is high the amplifier is in the standby mode. The $\overline{\text{RUS}}$ lead shuts down the current to the attenuator circuit and the audio power amplifier circuit.

Squelch Module (SQ)

The squelch module contains an attenuator circuit, limiter circuit, high-pass filter, level detector and rectifier circuit, fast/slow squelch circuit and logic circuit (See Figure 17).

Audio and noise is applied to the input of the attenuator circuit. The attenuator circuit is DC controlled by squelch control R702 connected to the SQ lead. The control voltage is from 2.5 to 4.5 VDC with the SQ lead indicating a low voltage for a squelch condition. The output of the attenuator circuit is connected to the input of the limiting circuit. The output of the limiting circuit is connected through the high-pass filter to filter out any audio signal present, preventing squelch clipping.

The filter is peaked at approximately 8 kHz. The noise from the output of the filter is connected to the input of the detector.

The detector senses the noise level present and controls the FAST SQUELCH output. When squelched the FAST SQUELCH control lead is low. The detector also has hysteresis that prevents instant squelching of the receive circuit when there is a sudden loss of signal. The squelch tail is 50-500 milliseconds depending on how close the squelch control is set to critical. When the signal strength is 20 dBNQ the fast/slow squelch comparator circuit defeats the hysteresis making the squelch tail approximately 8 milliseconds.

The output of the squelch circuit is connected to the input of the logic circuit.

The logic circuit preforms all system control of the $\overline{\text{RUS}}$ lead, using inputs from two external tone option modules, $\overline{\text{SQUELCH OVERRIDE}}$ and noise squelch from the squelch switch.

The external tone decoder inputs, $\overline{\text{OPT SQ1}}$ and $\overline{\text{OPT SQ2}}$, are normally high and are pulled low by external tone decoders which have not decoded. The radio automatically converts to the normal noise squelch when an external decoder is removed from the circuit. Grounding the $\overline{\text{SQUELCH OVERRIDE}}$ forces the squelch to open regardless of any decoder or noise squelch condition.

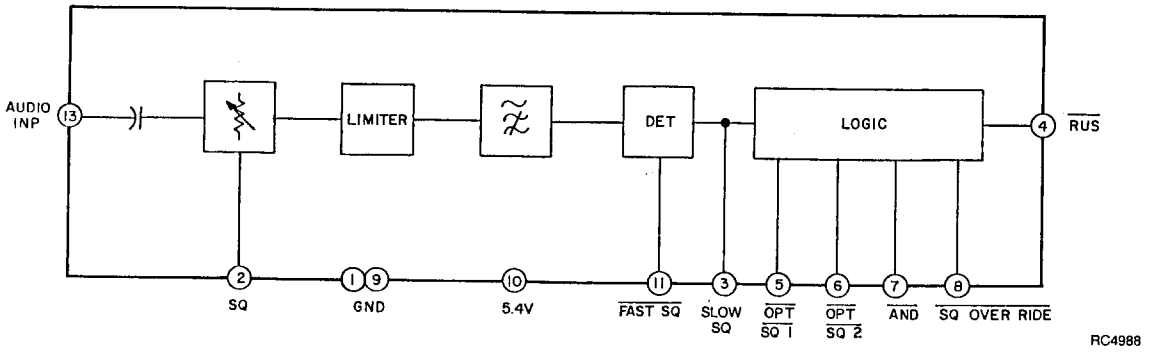


Figure 17 - Squelch

If two external tone decoders are used, the AND as well as the OR functions of these decoders may be controlled by the AND control lead. In any case, the noise squelch must be open before $\overline{\text{RUS}}$ will be pulled low.

MICROPROCESSOR CONTROLLER MODULE

This controller module consists of a logic board and a tone hybrid. The logic board provides all system controls necessary for the MPS radio. The tone hybrid works in conjunction with the logic board to provide all of the audio and tone functions.

The logic board consists of CMOS microcomputer U1, EEPROM U2, data MUX U3 and a voltage regulator circuit consisting of operational amplifier U4A, pass transistor Q1 and associated circuitry. Microcomputer U1 contains the software that performs the various tasks necessary to control the radio. It monitors the channel select switches, loads the synthesizer, performs encoding/decoding of Channel Guard and Digital Channel Guard and controls PSLM and Type 99 tone signalling.

The 2K x 8 EEPROM (U2) is programmed with all data required to "set-up" a particular RF channel. This EEPROM stores all of the channel, frequency CG/DCG and tone signalling data and is serially loaded through the microcomputer. The EEPROM is externally programmable through connector J7 on the back of the system board. The EEPROM is powered only for a short time while it is being read.

The voltage regulator circuit is controlled by the microcomputer and is used to turn on the EEPROM power supply for a read or loading of the EEPROM.

MUX (8-channel analog multiplexer) U3 is used to conserve pins on the microcomputer and allow more I/O ports to be used.

The tone hybrid consists of a switch capacitor filter (SFC), a digital tone decoder (DTD), a bilateral switch and a divide by 27 divider (See Figure 18). The SFC is used for CG/DCG encode and decode processing. The DTD is used to generate and detect higher frequency tones for Type 99. The bilateral switch is controlled by the microcomputer to mute the audio during PSLM searches. Both the DTD and the SFC require clocks to function. The DTD operates off of the 3.58 MHz oscillator from the logic board. The SFC requires a 131 kHz clock. The divide by 27 divider drops the 3.58 MHz to almost 131 kHz for the SFC.

The microcomputer responds to the manually initiated functions of push-to-talk, channel select and mode select. All other operations occur automatically and are controlled by the microcomputer.

While the radio is in the receive mode, the microcomputer reads through MUX U3, the inputs SEL A through SEL F, CPTT and PSLM OFF. Once the radio has been keyed, all switch inputs are ignored except the PTT bar.

When the PTT bar is pressed, the microcomputer immediately mutes the receiver. A delay of 10 millisecond allows the audio amplifier to be turned off before the synthesizer frequency is changed. After the delay, a switched +5 volts is generated by voltage regulator circuit U4A and pass transistor Q1. A +5 volts is applied to the negative terminal of U4A to obtain a regulated +5 volts on the collector of Q1. This switched +5 volts inhibits MUX U3 and enables EEPROM U2. The transmit bit code is then loaded in parallel from U2 into microcomputer U1 and serially loaded into the frequency, synthesizer through the clock (SYN CLK) and data (SYN DATA) input lines.

Once the bit stream is loaded into the synthesizer, an enable pulse on the syn strobe line and a 10 millisecond acquisition pulse on the acquisition line (SYN ACQ) are provided to allow the

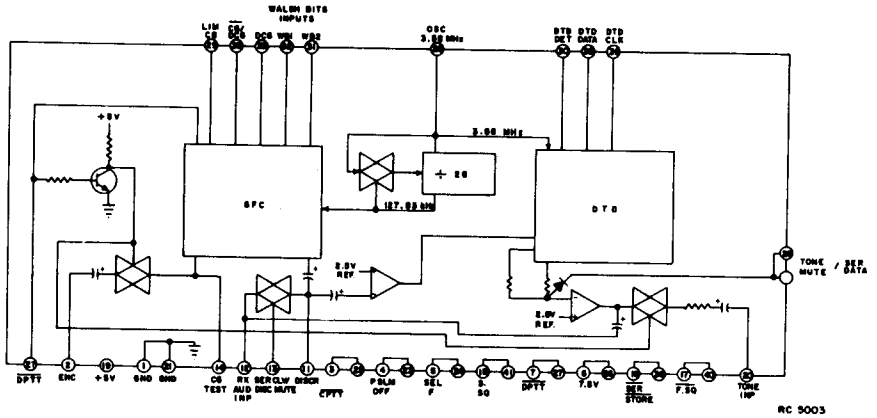


Figure 18 - Tone Hybrid

synthesizer to generate the correct RF frequency.

Microcomputer U1 immediately begins monitoring the lock detect line (LOCK) to verify the synthesizer is "on" frequency. If the synthesizer is not locked on the correct frequency, negative pulses will be present on the LOCK line. The microcomputer will reload the synthesizer and again attempt to lock it on frequency.

If the synthesizer is locked on the correct frequency, the microcomputer will key the transmit circuit by pulling the DPTT line low.

Channel Guard

Channel Guard tone or code is determined by data programmed within the EEPROM. From this data, Channel Guard and Digital Channel Guard encoding and decoding are preformed inside the microcomputer. While encoding, Walsh bits are generated by the microcomputer and limited and filtered by the SFC, in the tone hybrid, to the desired signal. The SFC filters both the encode and the decode path. While decoding, the CG tone is squared up and limited by the SFC and compared by the microcomputer to the tone data, stored in the EEPROM, for the correct operating tone. If the tone is the correct tone the microcomputer pulls the OPT SQI low to open the receive audio.

CG and DCG can be intermixed in any pattern except simultaneously. Also, any CG tone can be used and not restricted to the fixed set of EIA tones.

Type 99

Type 99 tone signalling is, like Channel Guard, formed by the microcomputer and the tone hybrid. The tone hybrid contains a digital tone decoder (DTD) to decode a preprogrammed tone. The tone signalling is preprogrammed in the EEPROM. The microcomputer reads the data from the EEPROM and loads the DTD with that data. A flag register in the EEPROM determines the different decodes allowed for Type 99. The alert tones for different decodes is generated by the controller.

The radio will respond to a decode with a series of beeps, with one pattern for individual decode and another for group and a third for super group calls. CG/DCG is compatible with tone signalling.

Priority Search Lock Monitor (PSLM)

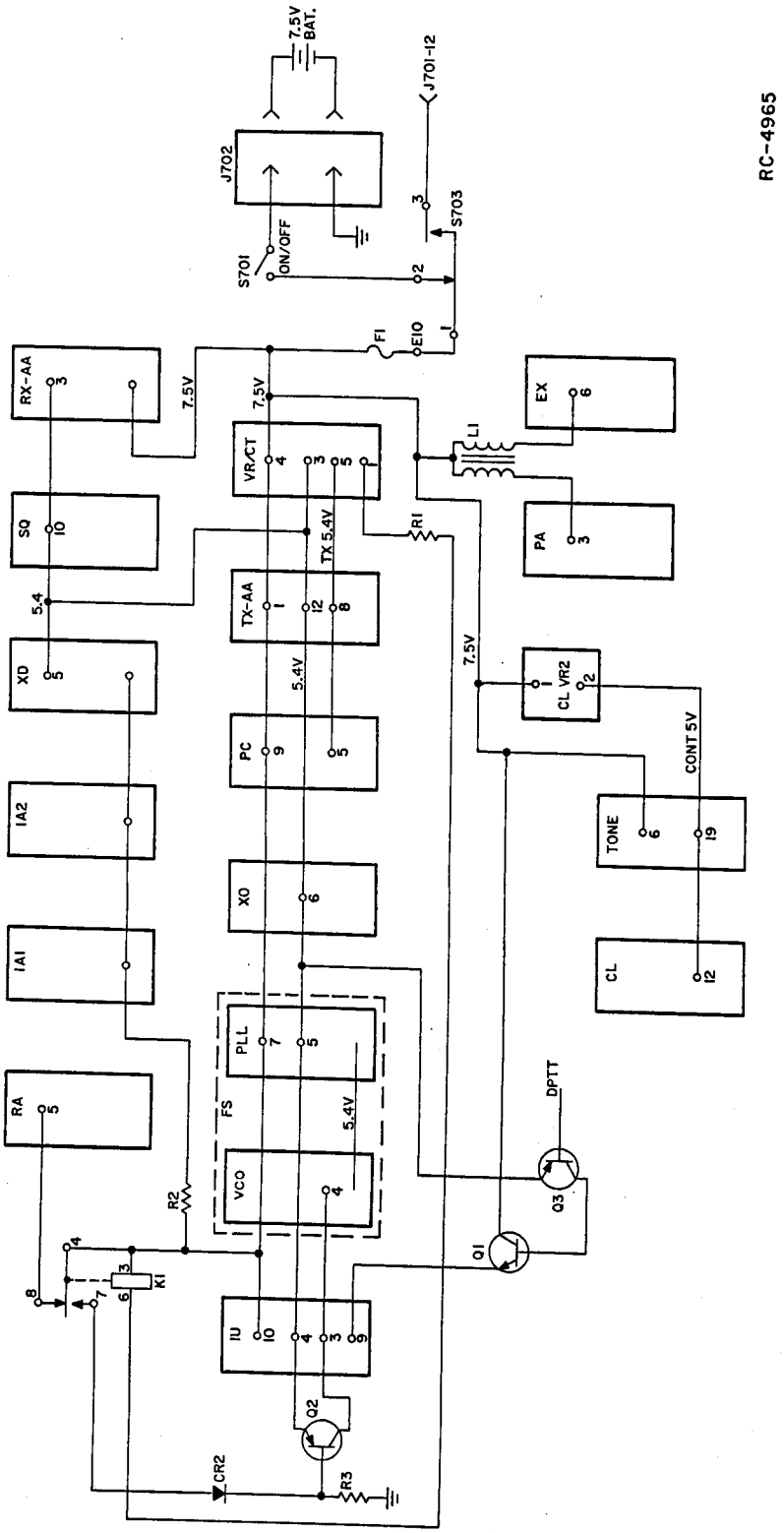
The microcomputer can perform a two channel PSLM function. The priority channel is preprogrammed into the EEPROM. The non-priority channel is always the channel that the channel select switches are set to. The radio will transmit on this channel. A toggle switch turns the PSLM on and off. The PSLM LED indicator blinks at a fast rate when the radio is searching. CG/DCG is disabled on all channels, when PSLM is on.

POWER DISTRIBUTION

Power for the MPS is supplied by a 7.5 Volt battery pack connected to connector J702 (See Figure 19). The negative terminal of the battery pack connects through the shell of connector J702 and a flexible metal strap to the system board ground pattern. The positive terminal of the battery pack connects through the system ON/OFF switch and flexible wiring harness to the system board for distribution.

Some modules on the system board operate directly from the battery voltage or through a R-C de-coupled 7.5 volt lead for noise reduction. The FS module has an internal 5.4 volt regulator to supply power to the VCO and PLL modules. A continuous and keyed 5.4 volts is also provided by voltage regulator module (VR).

The 7.5 Volts from the battery connects through relay K901 and to the receive RF amplifier module (RA).



RC-4965

Figure 19 - Power Distribution

In transmit, 7.5 volts from the battery connects through the relay contacts to the base of switching transistor Q2. Transistor Q2 switches the synthesizer interface module from receive to transmit.

There is a continuous 5 volt voltage regulator (CL VR2) which supplies 5 volts to the controller (CL) and tone modules.

Voltage Regulator Module (VR)

The voltage regulator module, powered from the 7.5 volts supply, current limited and highly stable, generates a continuous 5.4 volt output (See Figure 20). During transmit, when the DPTT lead is low, the regulator module also provides a keyed 5.4 volt output for transmit functions. When the transmit circuit is keyed the regulator module activates the system relay by saturating a keying transistor.

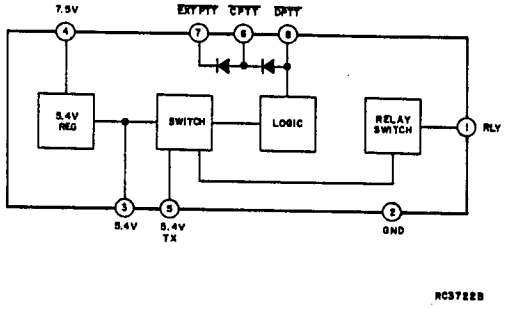


Figure 20 - Voltage Regulator

External Power

An external power source can be connected at J701-12. When Pin 12 of J701 is pressed, battery voltage is removed from the radio. The radio may now be powered by an external 7.5V source, completely bypassing ON/OFF switch S701. In vehicular chargers, the radio is turned on and off from the charger. The DC return should be the ground contact on the battery pack.

WARNING

When powering the radio from an external supply for service purposes, use a suitably fused 5 Amp supply or a 3 Amp current limited supply. DO NOT USE a PE battery pack because a system short can cause unrepairable damage to the multi-layered system board or to the flexible printed wire board.

CIRCUIT ANALYSIS

BATTERY PACK

Two battery packs, one with 750 mAh capacity and one with 1200 mAh capacity are available for use with the MPS radio. Both battery packs contain six nickel-cadmium battery cells to provide a nominal 7.5 volts DC output.

To protect the battery pack from external short circuits, the positive (+) charging contact is diode protected and the positive output terminal is fused. The fuse is replaceable.

An internal thermistor senses variations in battery pack termperature to automatically control a charger and provide a maximum charge without overheating the battery pack. Both battery packs can be recharged in one hour.

The battery pack is fully charged and shipped to the customer ready for use. If the battery pack is stored for any length of time it should be fully re-charged before placing into service.

Charger combinations for re-charging the MPS battery packs are available with charge times of 1-hour, 3-hours and 14-hours. A combination can be a single unit desk or a vehicular charger. It can also be a wall or bench mounted rack charger with a multiple of charge units.

Charge Level

The charge level of the battery packs can be measured by connecting a voltmeter across the charge contacts and measuring the voltage with the transmitter keyed.

For the rechargeable battery packs, a fully charged battery pack should provide a reading of 7.5 and 8 Volts. A fully discharged battery pack should provide a reading of no less than 6 Volts.

Battery Check

One of the best service checks for the MPS rechargeable battery packs can be easily obtained by measuring the milliampere-hour capacity. The results of the measurement can then be compared with the rated capacity of the battery pack to determine the general condition of the rechargeable batteries.

First, it is necessary to find the percentage of rated capacity. This is obtained by measuring the time it takes to discharge a fully charged battery pack until the voltage drops to 6.0 Volts. The proper load resistor for each of the battery packs is shown in Table 1.

Then use the formula T/60 = % where "T" is the time in minutes required to discharge the battery pack to 6 Volts and % is the percentage of rated capacity the battery delivered to a load. For example: assume the standard battery pack voltage dropped to 6 Volts in 50 minutes:

50/60 = .83 (percentage of capacity)

Now multiply the percentage of capacity by its rated capacity (See Table 1):

.83 x 750 mA = 622.5 mAh

The 622.5 milliampere-hours is the actual capacity of the battery pack.

NOTE

As the voltage drops very fast near the end of the discharge cycle, be very careful to avoid discharging the battery pack below 6.0 Volts.

Table 1 - Capacity Measurement Data

RECHARGEABLE BATTERY PACK	RATED CAPACITY	AVERAGE DISCHARGE RATE (for 60 minutes)	LOAD RESISTOR (R_L)	END VOLTAGE
19D429763G1 (6 cells)	750 mAh	750 mA	10 ohms 8 Watts	6 VDC
19D429777G1 (6 cells)	1200 mAh	1200 mA	6.25 ohms 12 Watts	6 VDC

CONTROL LEADS

$\overline{OR}$ - Receiver audio is heard only when the noise squelch and a tone option open simultaneously. When two tone options are present, the tone option can use the AND function and the noise squelch can use an OR function.

$\overline{CPTT}$ - This is an OR function of $\overline{PTT}$ and $\overline{EXT\ PTT}$.

$\overline{DEC\ OFF}$ - A low on this lead turns a Channel Guard decoder off. The DEC OFF lead is grounded by a switch on the Control panel, placed in the MONITOR position.

$\overline{DPTT}$ - Delayed PTT control lead from a tone module used for squelch tail elimination.

$\overline{EXT - PTT}$ - External PTT lead from VDC connector.

$\overline{FAST\ SQ}$ - A low on this lead indicates the priority fast squelch has not detected a carrier.

$\overline{LOW\ POWER}$ - A low on this lead, with the low power option, indicates the transmit circuit is in the low power condition.

$\overline{MIC\ MUTE}$ - A low on this lead mutes all transmit microphone inputs. This enables data to be transmitted through the tone input signal lead with the microphone muted.

$\overline{OPT\ SQ1}$ - This lead is normally high on a noise squelch only unit; meaning, an external tone option has not caused the squelch to close. This lead is pulled low by a tone option when it is installed and has not decoded.

$\overline{OPT\ SQ2}$ - This lead is the same as OPT SQ1 except for a second tone option.

$\overline{PTT}$ - Internal Push-to-talk; a low on this lead indicates the unit has been keyed by the side PTT bar.

$\overline{RUS}$ - Receiver Unsquelch Signal goes low when the receive audio amplifier is on.

$\overline{RX-AA-MUTE}$ - A low on this lead turns off the receiver audio amplifier.

$\overline{SQUELCH\ OVERRIDE}$ - A low on this lead forces the audio to open regardless of the noise squelch or tone decoder condition.

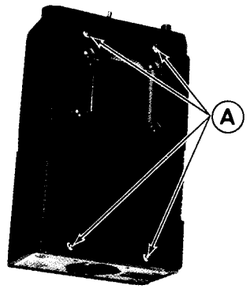
$\overline{UNLOCK}$ - A low on this lead occurs when phase lock has not been achieved, holding the transmit PA stages in an off condition.

DISASSEMBLY PROCEDURE

Caution: Always remove the battery pack before removing any component board to avoid blowing the fuse.

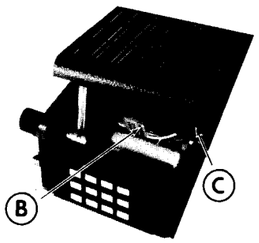
Equipment Required

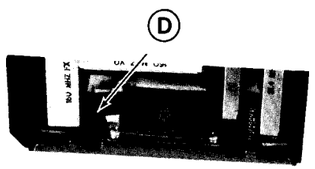
- Small Phillips-head screwdriver.
- Torx® T8 driver for back cover screws.
- Small flat-blade screwdriver.
- Module extraction tool 19B233301G2.
- Needlenose pliers.
- Allen-head wrench for removing set screws.
- Pencil-type soldering iron (40-60 watts) with a fine tip.



STEP 1.

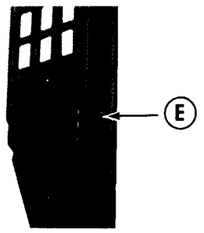
To gain access to the radio, loosen, but do not remove, the four captive screws at (A) . Carefully remove the back cover. For normal radio alignment, the back cover is all that need be removed. When tightening the captive screws, they should be no tighter than 4 ±.5 inch-pounds.





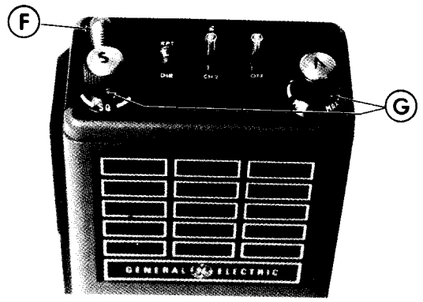
STEP 2.

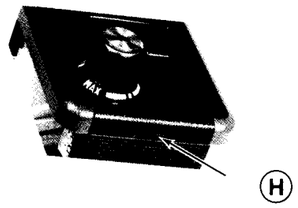
To gain access to the module side of the radio, step 1 must be completed and the radio turned over. Carefully remove the front cover and disconnect the speaker at (B) .
When replacing the front cover the speaker leads must be routed as shown. The rubber microphone cover should be pushed in at (C) to allow the cover to snap shut. Also the flexible printed wire board may require lifting at (D) to allow the standoff to fit into the slot in the housing.



STEP 3.

To remove the PTT switch, push out pin at (E)
The PTT bar should come right out.





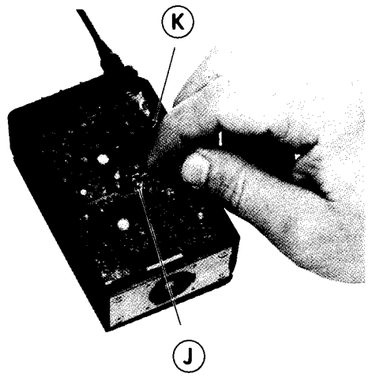
STEP 4.

To replace the speaker and microphone remove the four Phillips-head screws holding the speaker retaining plates and remove the speaker. The microphone is held in place only by the rubber mike boot and can easily be removed.

STEP 5.

To replace controls and LED indicators, remove the antenna by unscrewing the antenna at (F) and remove it from the antenna stud.

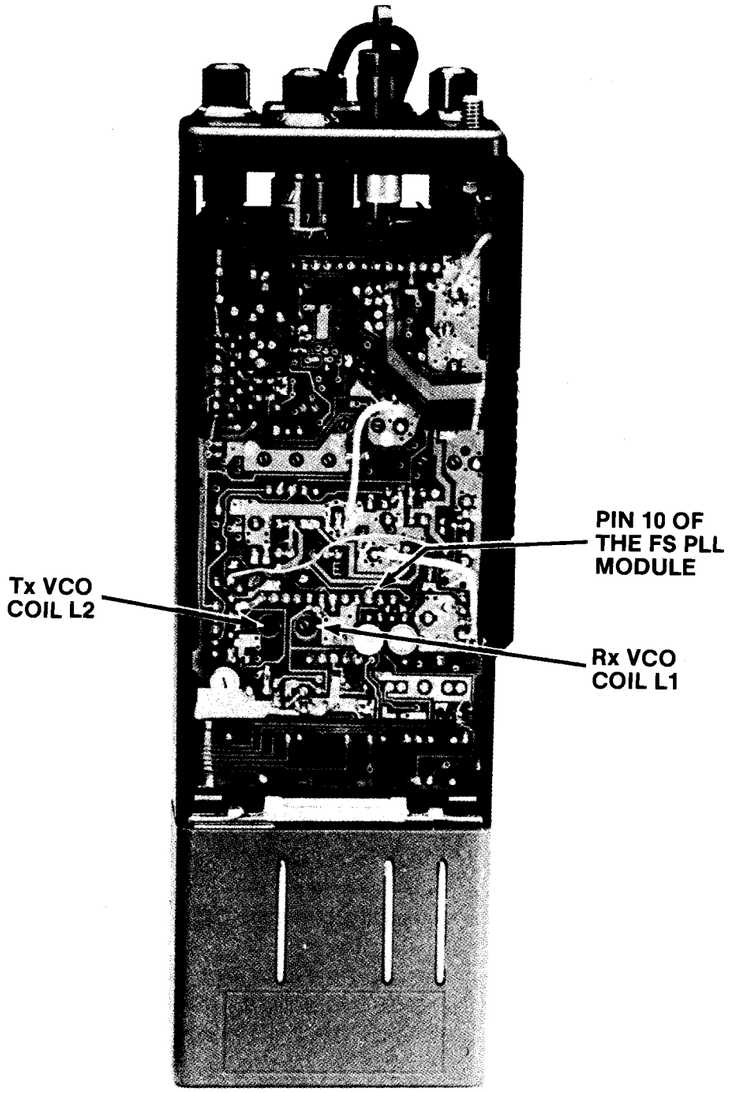
Loosen set screws at (G) and remove knobs. With a flat-blade screwdriver snap top cover off at (H) The slotted nuts holding the controls are easily accessible. When disconnecting Option controls remove the leads from the control and not the flexible printed wire. The Volume control, Squelch control and LED indicators must be unsoldered from the printed wire board.



STEP 6.

To remove modules from the system board, remove both front and back covers. Extraction tool 19B233301G2 or a simple bent paper clip can be used to push a module from the board. A number 64 drill bit in a pin vise makes a sturdier and more permanent tool.
Ground pins with knockout bottoms are present on the system board for each module except for the Ex and PA modules. To remove a module, take the extraction tool or paper clip, insert it into the ground pin of the module to be removed (J) and push the module from the board. To remove the Ex or PA module insert the extraction tool into a hole provided in the center of the board for removal of the module and push the module from the board.

Some modules have screws holding them in place. Before attempting to push a module from the board, remove any screws present (K) .



SYNTHESIZER ADJUSTMENT

EQUIPMENT:

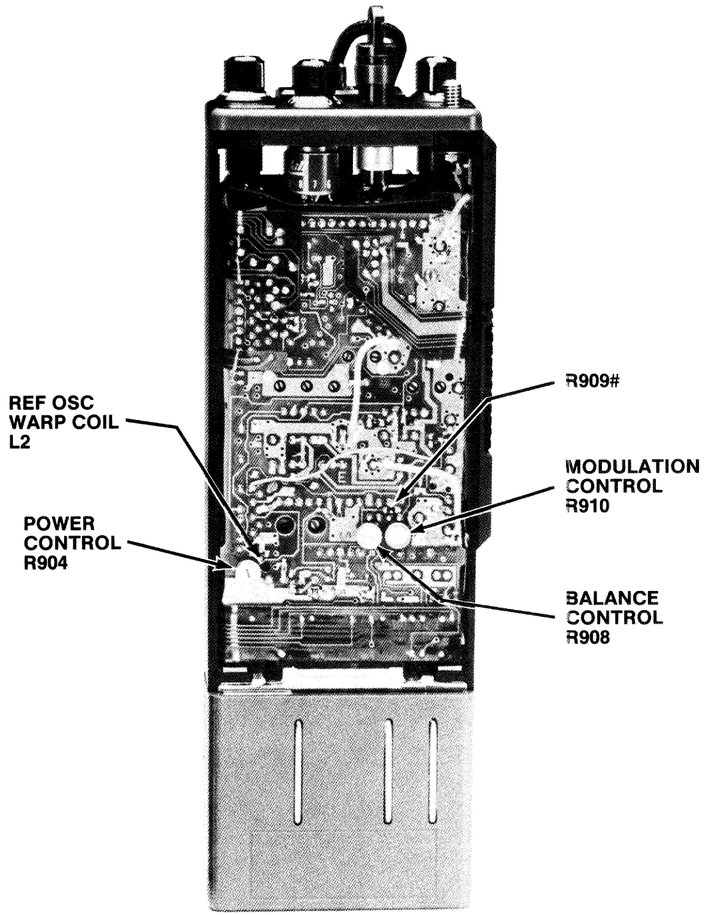
1. General Electric Battery Pack Eliminator 19C328969G1.
2. Regulated DC Power Supply set at 7.5 Volts and capable of 3 amperes connected to the Battery Pack Eliminator.
3. Ammeter, capable of 3 amperes, in series with the Power Supply and Battery Eliminator.
4. Digital Voltmeter (Input Impedance >5M ohms).
5. Oscilloscope (1 MHz and probe impedance >5M ohms).

PRELIMINARY:

1. Remove rear cover from the radio.
2. Attach Power Supply and Battery Pack Eliminator to the radio.
3. Apply power to the radio and place the radio ON/OFF switch in the ON position.
4. Connect the Digital Voltmeter and Oscilloscope to Pin 10 of the Synthesizer PLL module.

PROCEDURE:

STEP	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
1.			Set MODE/CHANNEL SELECT switches to the highest receive frequency.
2.	VCO Coil L1 (RX)	3.25 Volts DC (±0.05 Volts)	Adjust VCO coil L1 so that a pure DC signal is seen on the oscilloscope. Continue adjusting L1 until a stable reading of 3.25 VDC (±0.5 Volts) is read on the Digital Voltmeter.
NOTE: Some radios, where the highest frequency is near the lower end of the band split, cannot be adjusted for a reading of 3.25 Volts (It would be less than 3.25 Volts). On these units, leave the receive VCO coil tuning slug flush with the System Board.			
3.			Set MODE/CHANNEL SELECT switches to the lowest receive frequency.
4.	VCO Coil L1 (RX)	>1.0 Volts DC	Verify the voltage on Pin 10 is still a pure DC signal and the DC voltage is >1.0 Volt.
5.			Set MODE/CHANNEL SELECT switches to the highest transmit frequency.
6.	VCO Coil L2 (TX)	3.25 Volts DC (±0.05 Volts)	Press the PTT bar and adjust VCO coil L2 for a pure DC signal on the oscilloscope. Continue adjusting L2 for a reading of 3.25 Volts DC (±0.05 Volts) on the Digital Voltmeter.
NOTE: Some radios, where the highest transmit frquency is near the lower end of the band split, cannot be adjusted for a reading of 3.25 Volts. On these units, leave the transmit VCO coil tuning slug flush with the System Board.			
7.			Release the PTT bar and set MODE/CHANNEL SELECT switches to the lowest transmit frequency.
8.	VCO COIL L2 (TX)	>1.0 Volts DC	Press the PTT bar and verify the voltage on Pin 10 is pure DC and >1.0 Volt.



TRANSMIT CIRCUIT ALIGNMENT

EQUIPMENT:

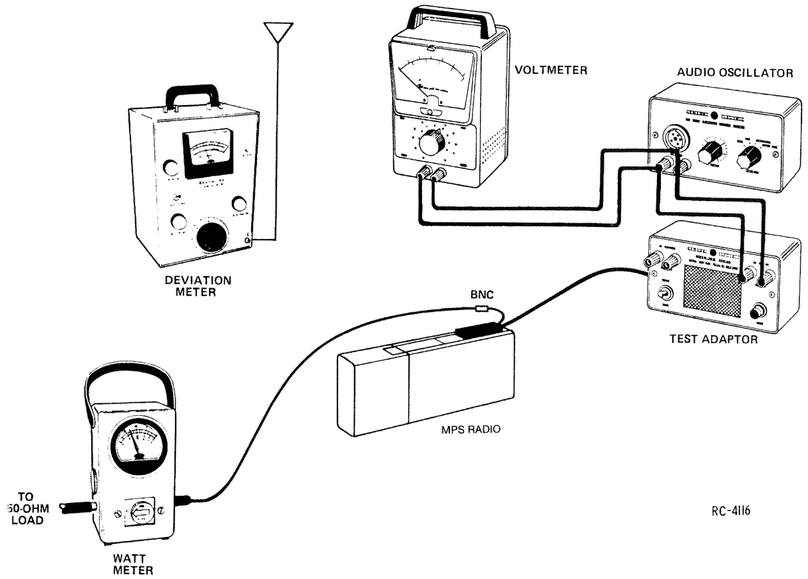
1. General Electric Test Adaptor 4EX12A12.
2. General Electric Audio Generator 4EX6A10.
3. General Electric Test Cable 19C330221G2.
4. General Electric Battery Pack Eliminator 19C328969G1.
5. Ammeter, capable of 3 amperes, in series with the Power Supply and Battery Pack Eliminator.
6. Deviation Meter with recovered audio frequency response below 5 Hz.
7. 50 ohm terminating wattmeter.
8. Frequency Counter.

PRELIMINARY:

1. Remove rear cover from the radio.
2. Connect equipment as shown.
3. Set audio oscillator for 120 millivolts rms at 1 kHz.
4. Set Power Control R904 fully counterclockwise.

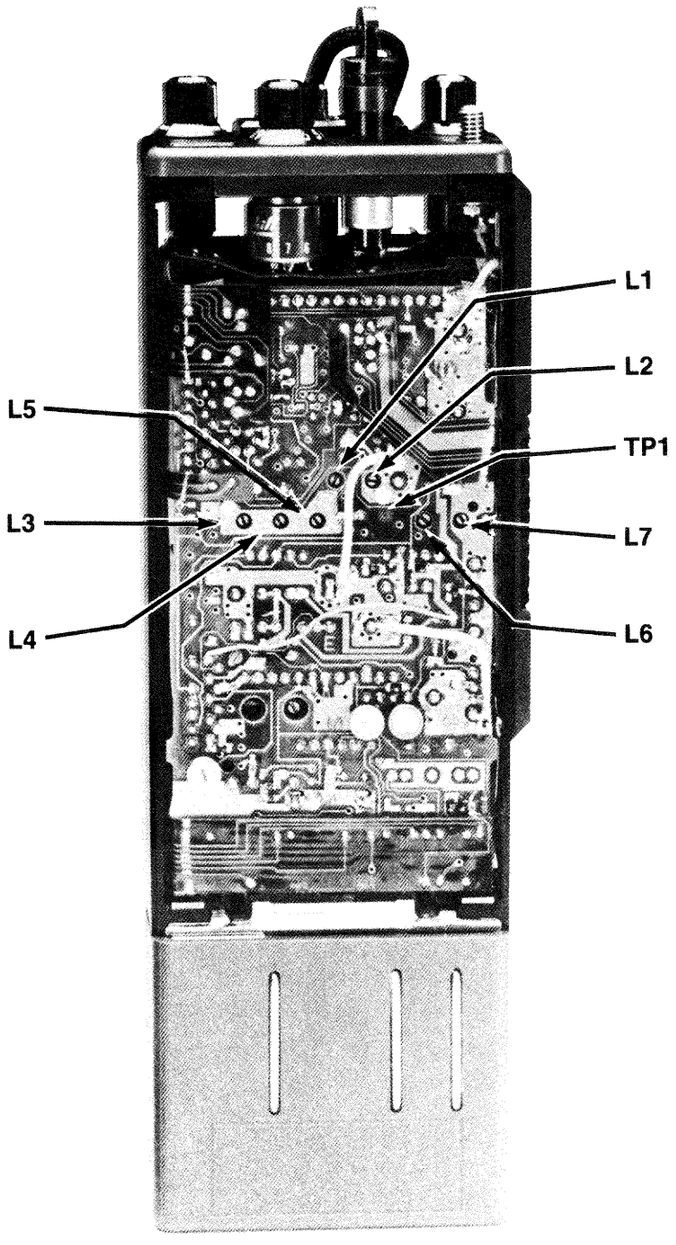
PROCEDURE:

STEP	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
1.			Set MODE/CHANNEL SELECT switches to the highest transmit frequency.
2.			On units with manual HI/LO power selection, set switch to high power.
3.	Power Control R904	1 to 2.5 Watts or 1 to 6 Watts	Press the PTT bar and adjust Power Control R904 to rated power on wattmeter.
4.	Warp Coil L2		While keying the transmit circuit adjust Reference Oscillator Warp Coil L2 for the correct operating frequency.
5.			Set MODE/CHANNEL SELECT switches to the highest transmit frequency with Channel Guard. If the unit does not have Channel Guard, set to the highest frequency.
6.			Apply 120 millivolts rms (±5 mV) of 1 kHz tone into TX audio input of Test Adaptor 4EX12A12.
7.	Modulation Control R910	4.5 kHz deviation	Press PTT bar and while monitoring transmit deviation, adjust MOD control R910 for a deviation of 4.5 kHz.
8.			Remove the 1 kHz tone.
9.			Inject a 20 Hz, 4V peak-to-peak square wave through a 100 uf coupling capacitor to the Modulation Control side of chip component R909.
10.			Monitor transmit deviation with an oscilloscope hooked to the recovered audio output of the Deviation Meter.
11.	Balance Control R908	A good square wave	Adjust Balance Control R908 for a good square wave as seen on the oscilloscope.



ALIGNMENT PROCEDURE

403-512 MHz
Transmit Circuit
Types TR-126 and TR-127



RECEIVE CIRCUIT ALIGNMENT

EQUIPMENT:

1. General Electric Test Adaptor 4EX12A12.
2. 403-512 MHz signal source.
3. RF Millivoltmeter.
4. Distortion Analyzer.

PRELIMINARY:

1. Remove back cover from radio.
2. Connect equipment as shown.
3. Set output of 403-512 MHz signal source for approximately 50 millivolts.
4. Turn SQUELCH control fully clockwise.
5. Turn all RF tuning screws out to extend approximately 1/8 inch above the System Board.
6. Set MODE/CHANNEL SELECT switches to the lowest frequency receive channel.
7. Turn all equipment on.

PROCEDURE:

STEP	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
1.	Helicals L6 & L7	Maximum RF Level	With the RF millivoltmeter connected to TP1, adjust helical resonators L6 and L7 of maximum RF level.
2.			Apply an on frequency signal through the Test Cable modulated with 1 kHz at 3 kHz deviation.
3.	Helicals L1 thru L5	Best audio SINAD	Monitoring the receive audio output on the distortion analyzer, adjust helical resonators L1 through L5 for the best audio SINAD.

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 audio, poor sensitivity, distortion, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized.

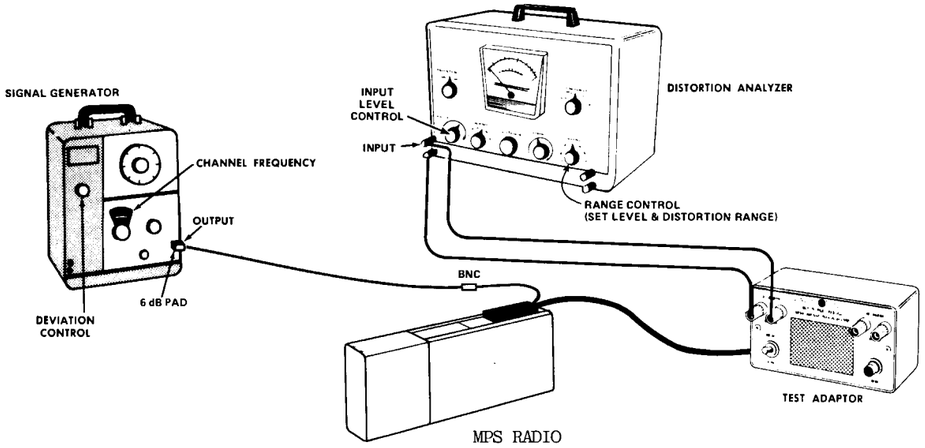
Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer
- Signal Generator
- 6 dB attenuation pad
- Test Adaptor Model 4EX12A12

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.



STEP 1

AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power output as follows:

A. Connect a 1,000 microvolt test signal modulated by 1,000 hertz ±3.0 kHz deviation.

B. Set the Volume Control for a 500 milliwatt output (2 volts RMS).

C. Make distortion measurements according to manufacturer's instructions. Reading should be less than 10% (5% is typical). 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 0.5 watt, make the following checks:

D. Battery voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)

E. Audio Gain (Refer to Receiver Troubleshooting Procedure).

STEP 2

USABLE SENSITIVITY (12 dB SINAD)

TEST PROCEDURE

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.

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. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range 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 specification with an audio output of at least 250 milliwatts.

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, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWITH (IF BANDWITH)

TEST PROCEDURE

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

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

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

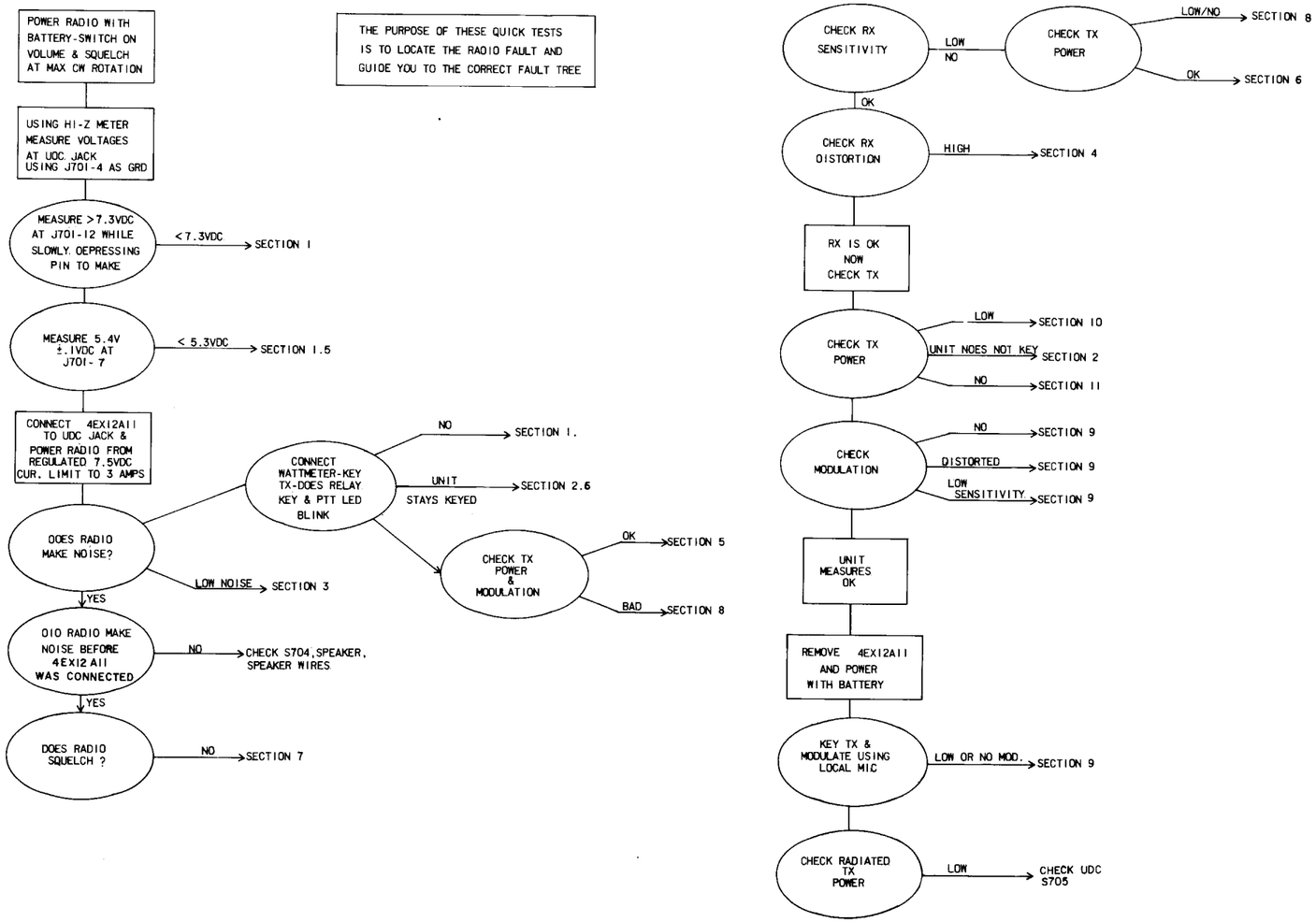
C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12 dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

D. The deviation control reading for the 12 dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7 kHz (but less than ±9 kHz).

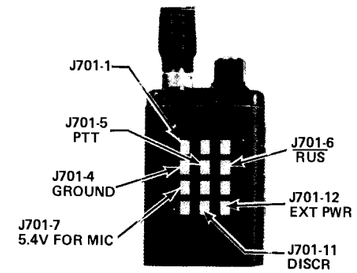
SERVICE CHECK

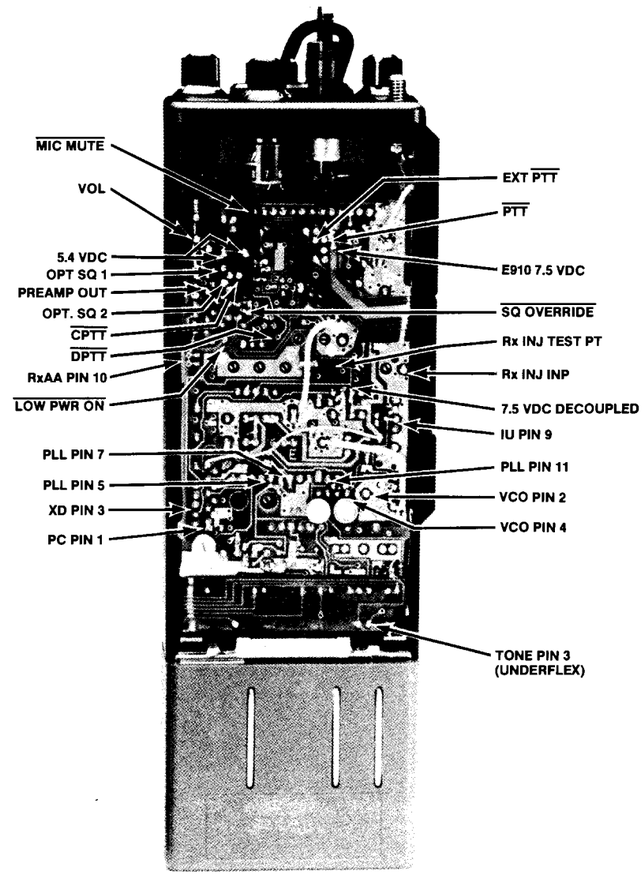
If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

MPS TROUBLESHOOTING TREE



UDC JACK (J701) CONNECTION

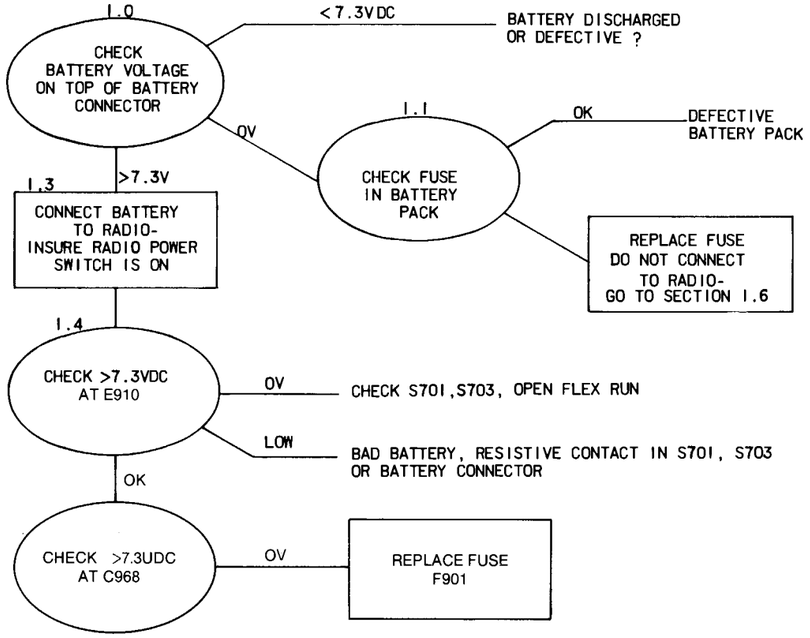




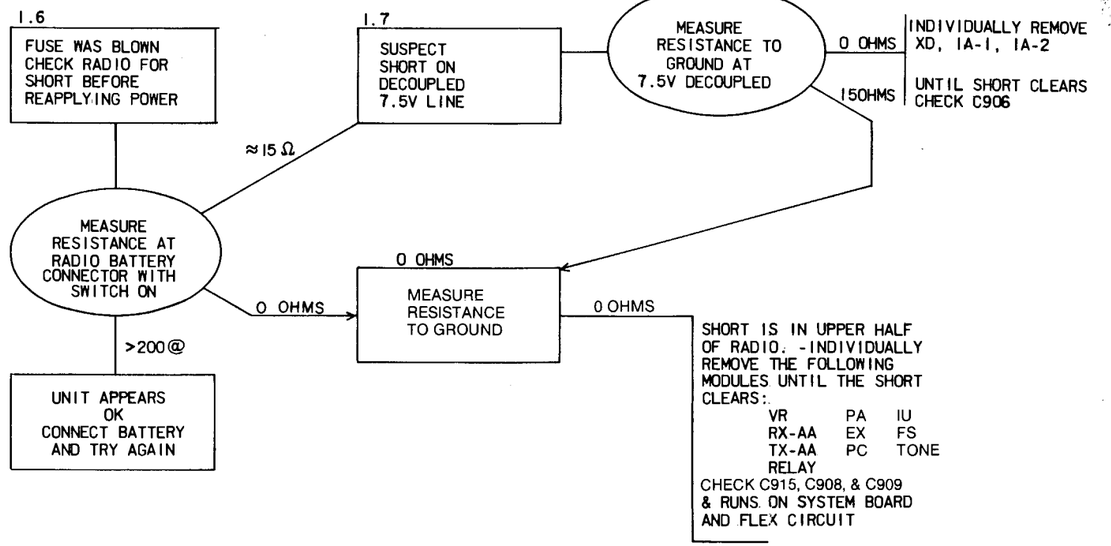
MPS TROUBLESHOOTING PROCEDURES

SHEET 1

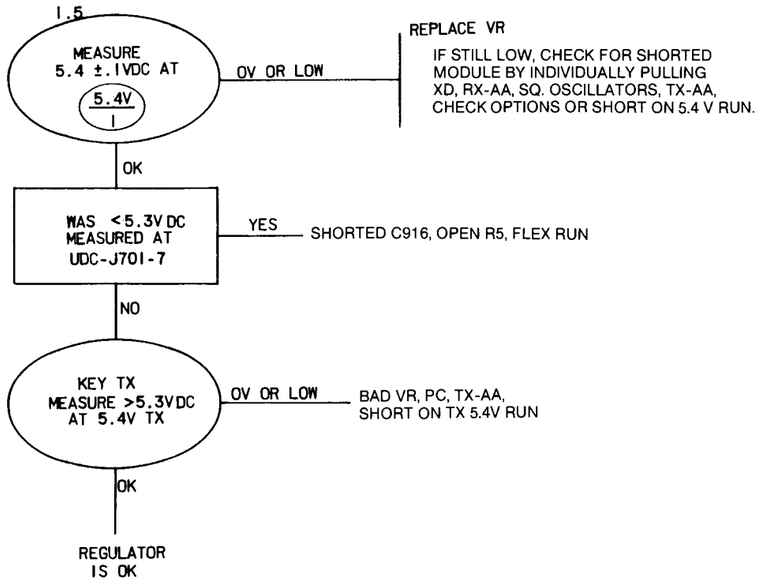
SECTION 1
POWER DISTRIBUTION FAULT



LOCATING A SHORT
SECTION 1.6

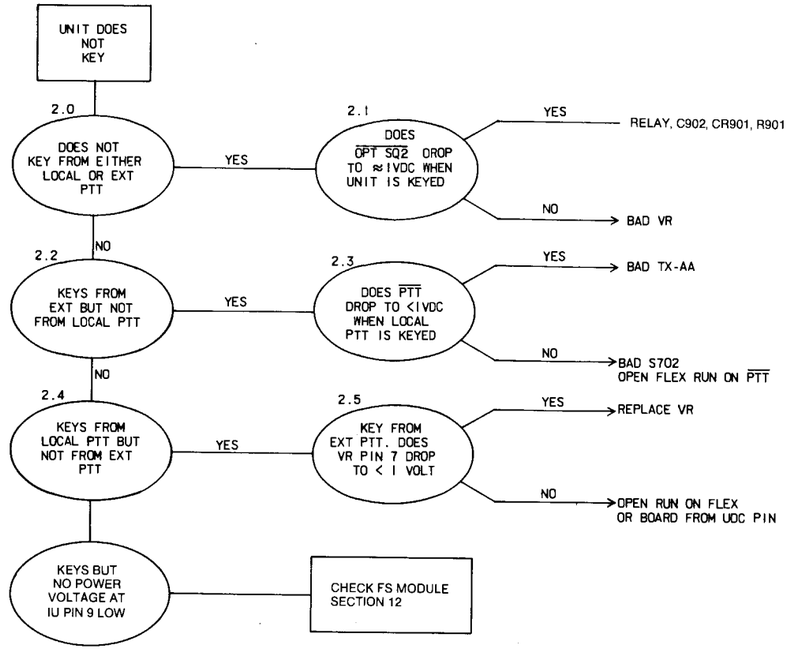


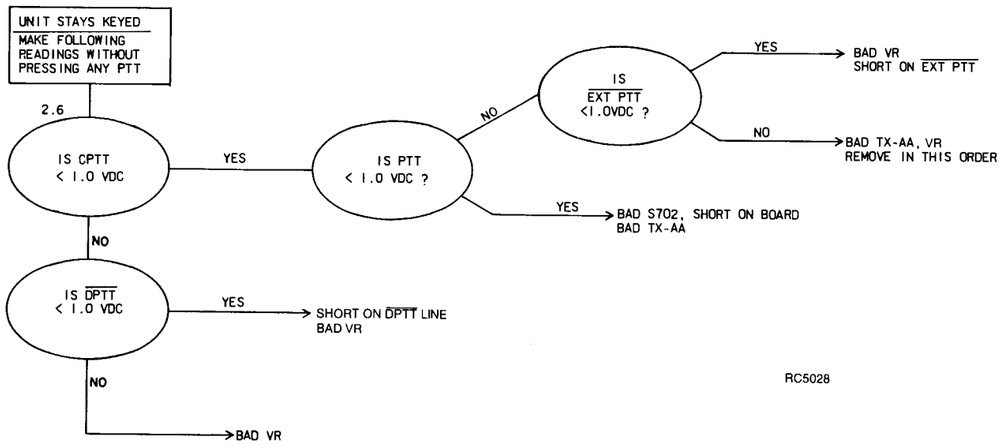
SECTION 1.5
REGULATOR FAULT



RC5027

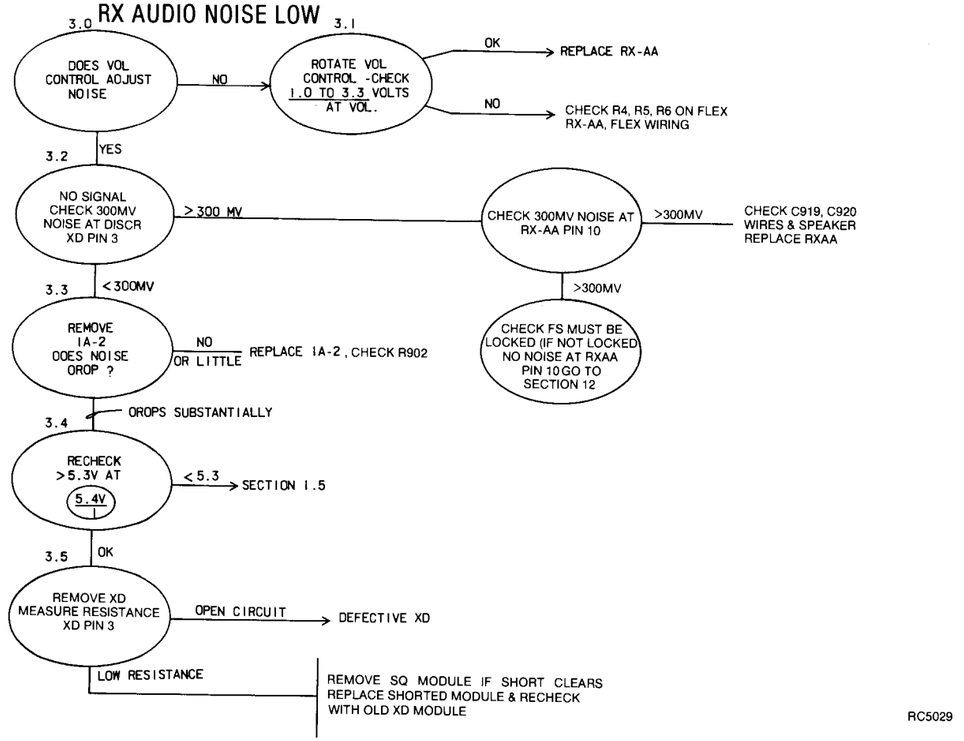
SECTION 2
TRANSMITTER KEYING FAILURE





RC5028

SECTION 3
RX AUDIO NOISE LOW

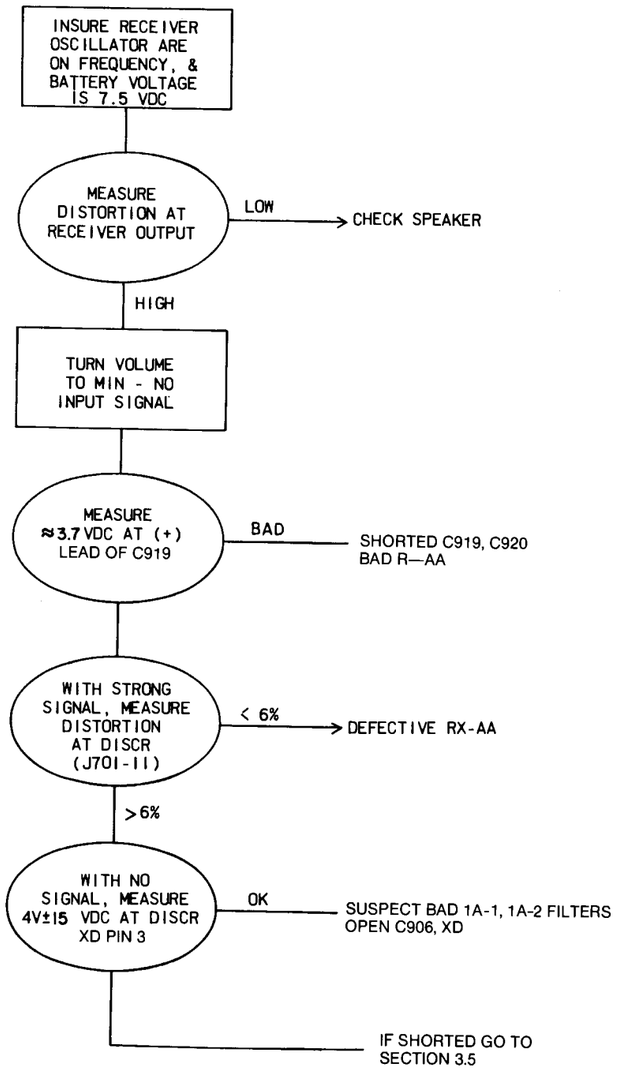


RC5029

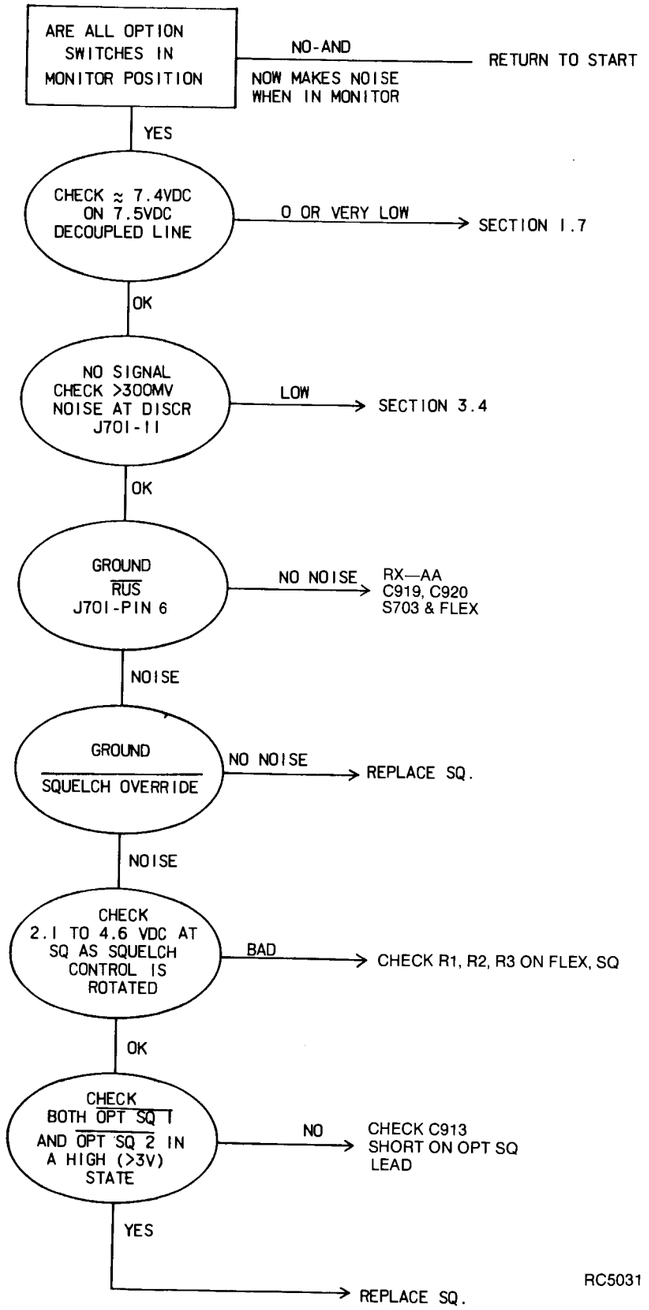
TROUBLESHOOTING PROCEDURE

SHEET 3

SECTION 4
RECEIVER AUDIO DISTORTED

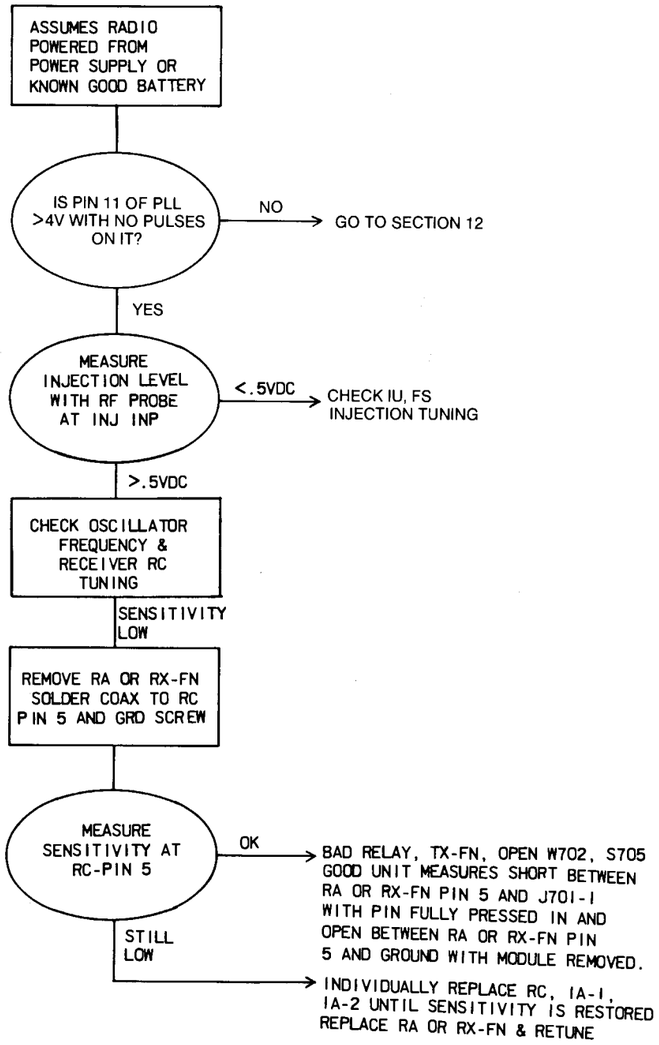


SECTION 5
NO RECEIVER AUDIO



TROUBLESHOOTING PROCEDURE

SECTION 6
LOW OR NO RECEIVER SENSITIVITY



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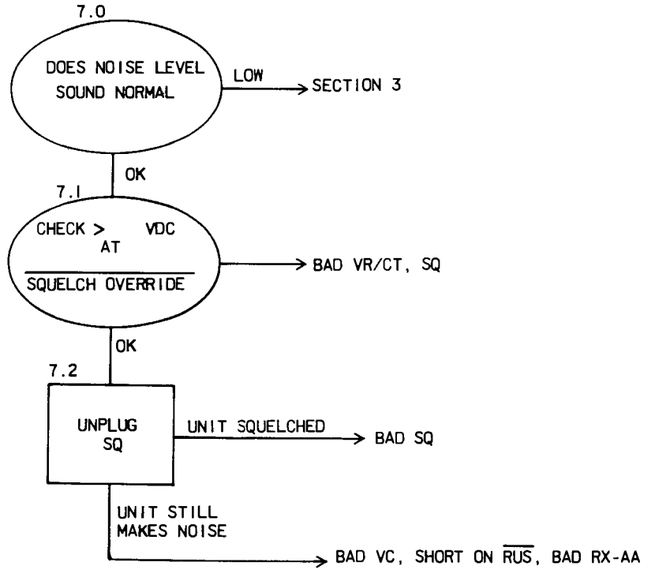
SECTION 7
UNIT DOES NOT SQUELCH



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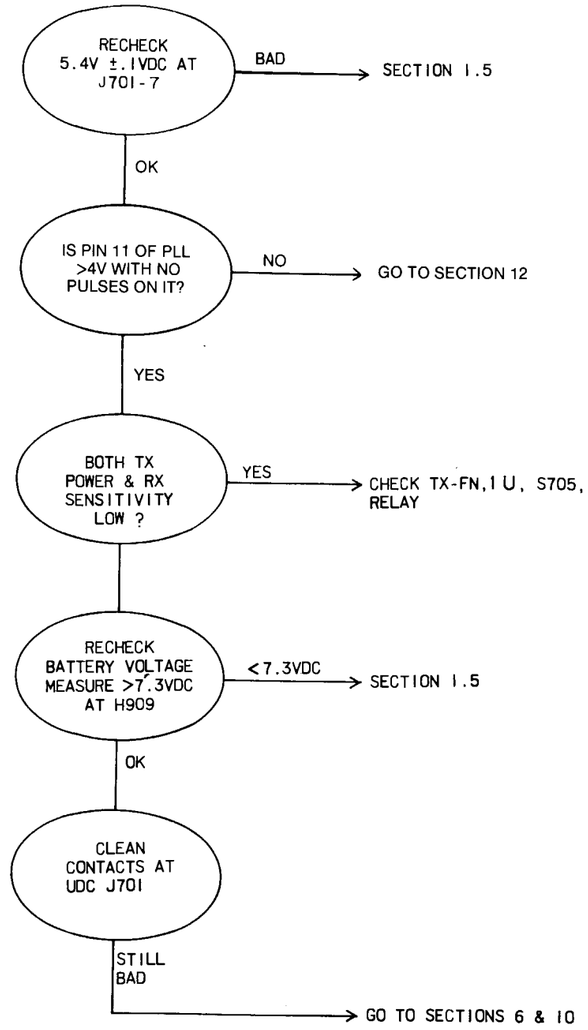
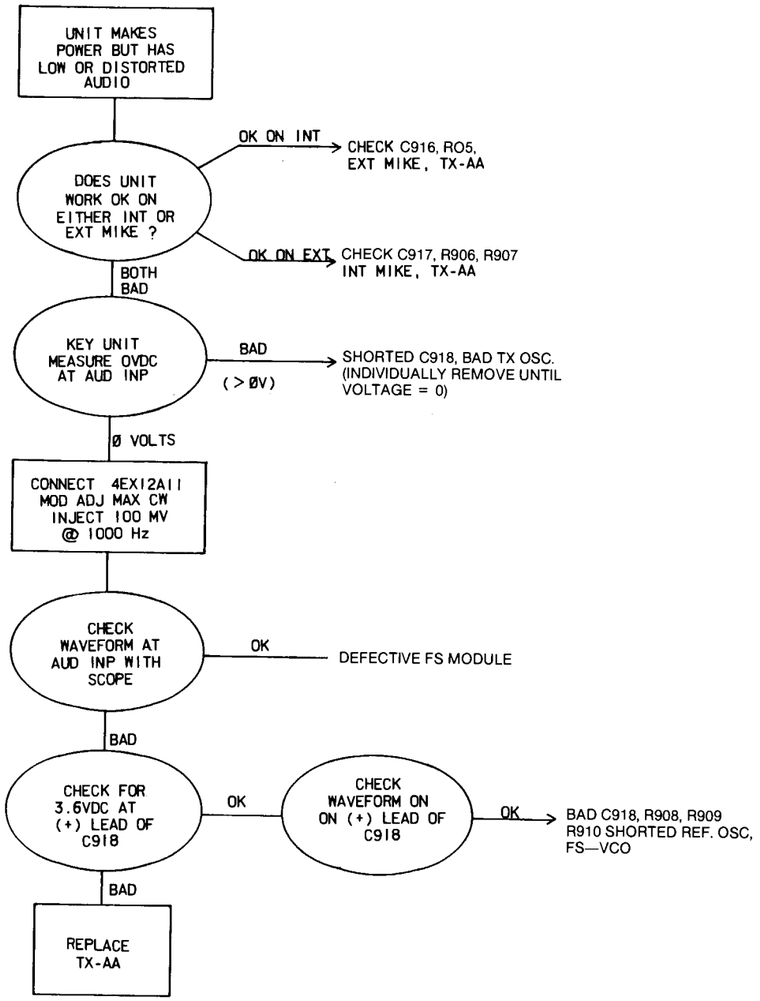
SECTION 8
BOTH RX & TX MALFUNCTION

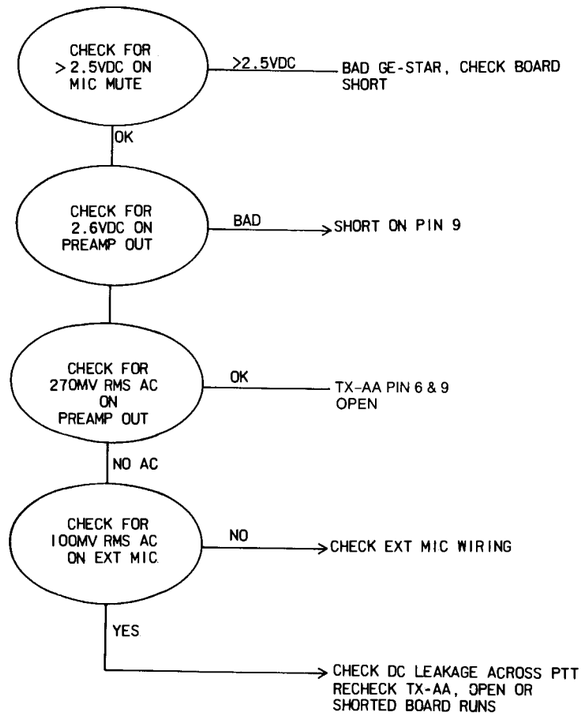


RC5034

TROUBLESHOOTING PROCEDURE

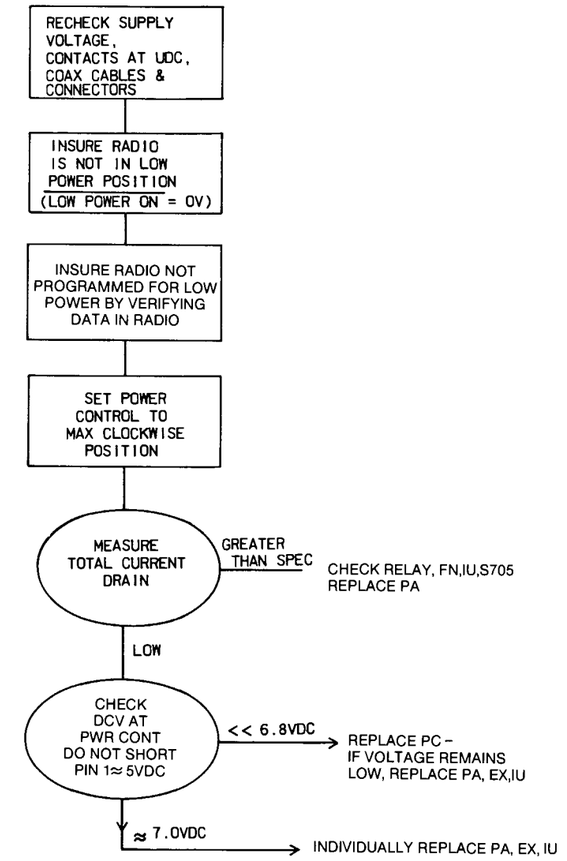
SECTION 9
NO OR DISTORTED TX AUDIO





RC5035

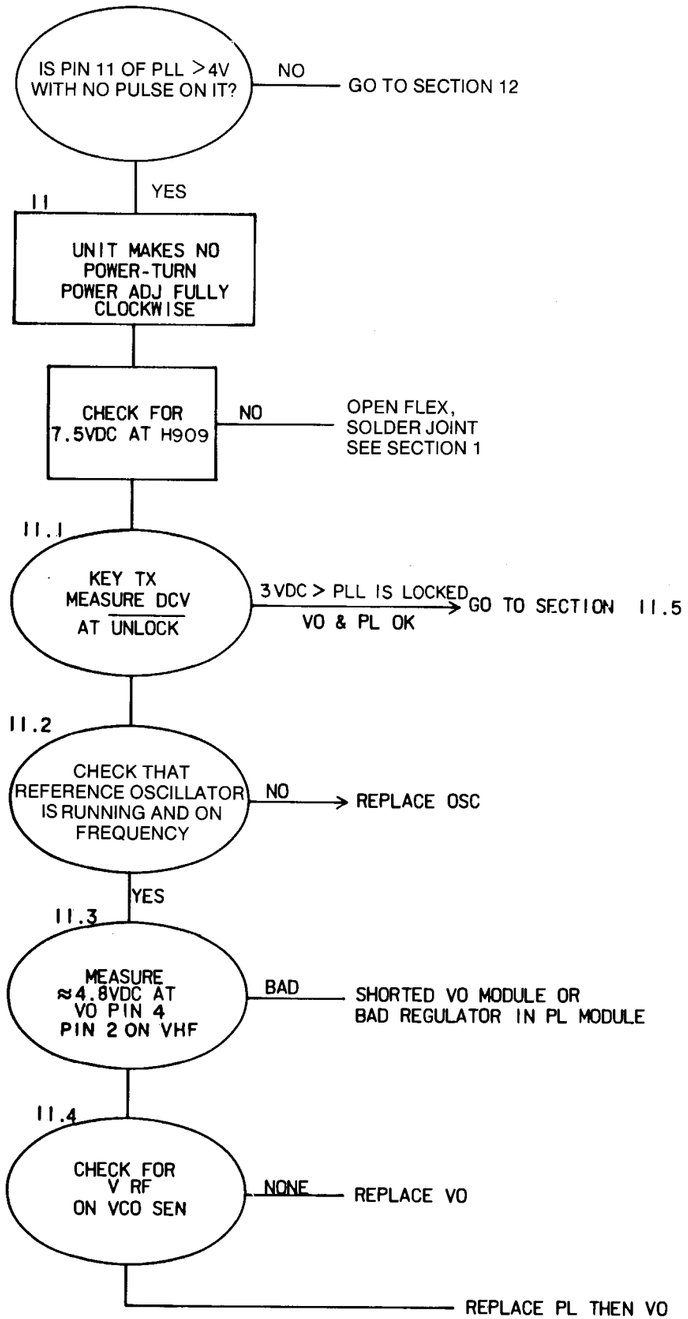
SECTION 10
LOW POWER



RC5036

TROUBLESHOOTING PROCEDURE

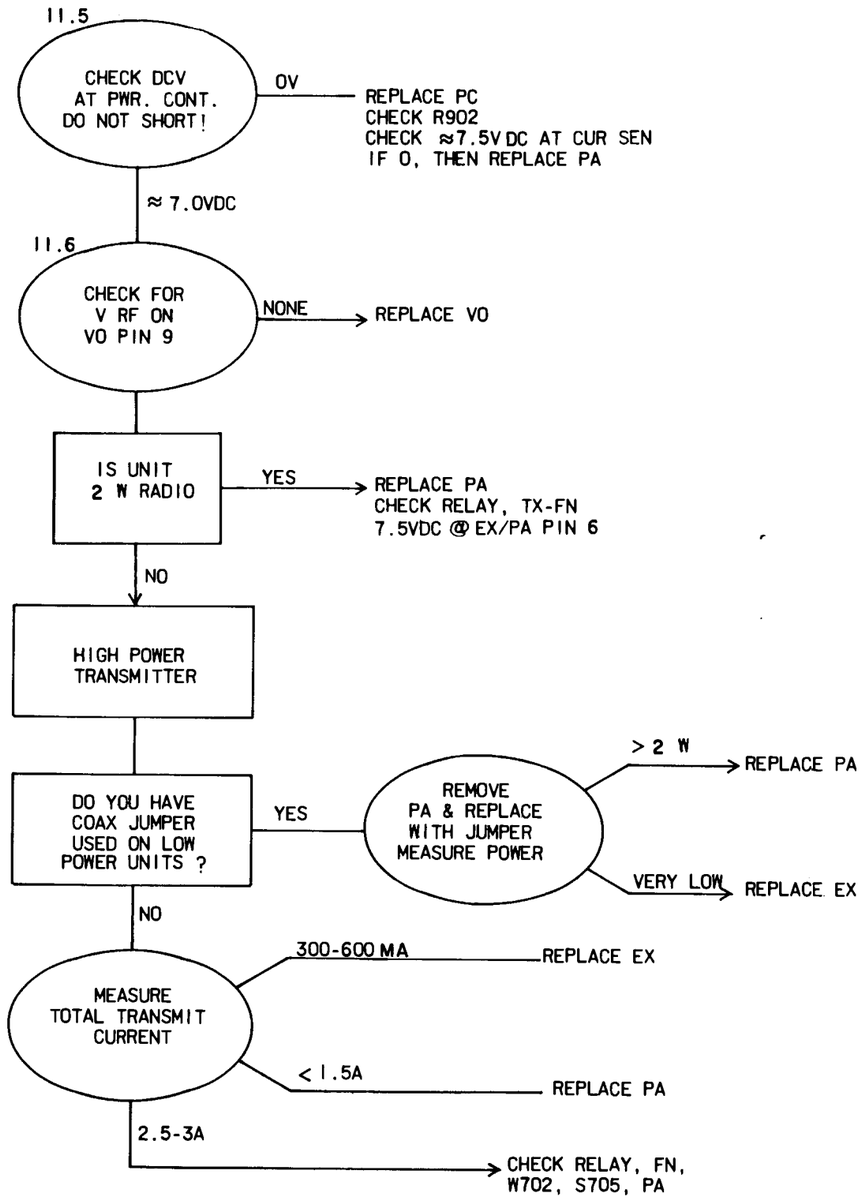
SECTION 11
NO TRANSMIT POWER



TROUBLESHOOTING PROCEDURE

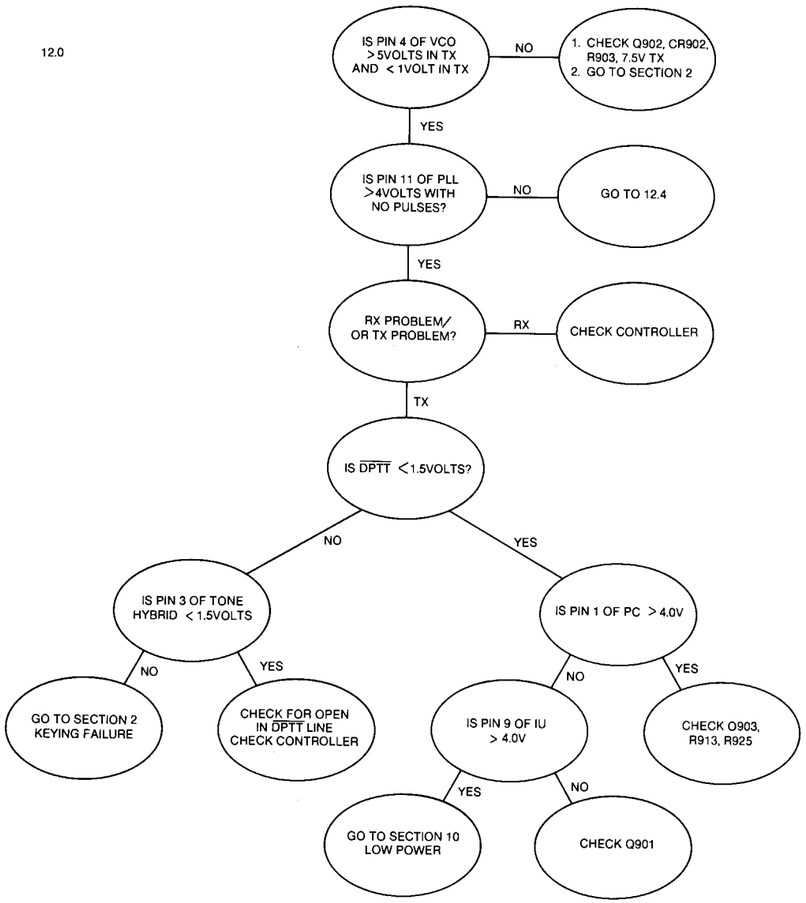
SHEET 7

SECTION 11
NO TRANSMIT POWER

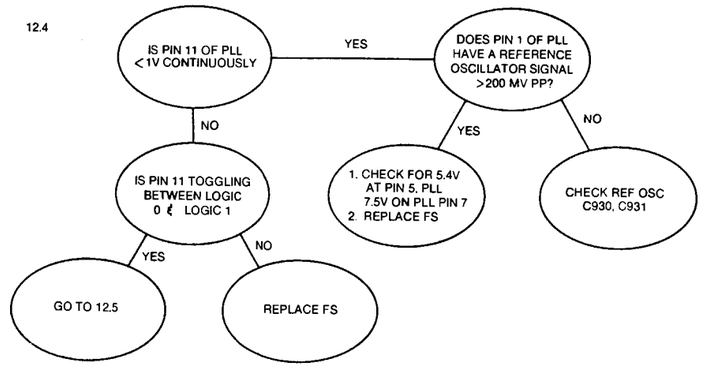


SECTION 12
SYNTHESIZER

12.0



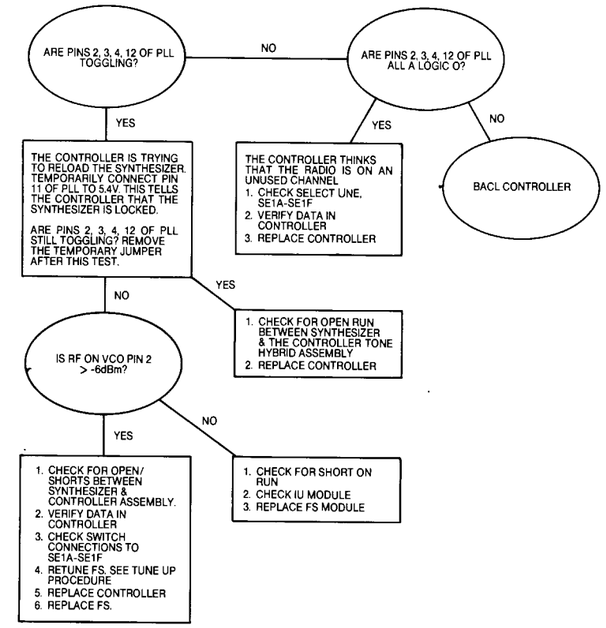
12.4



RC5038

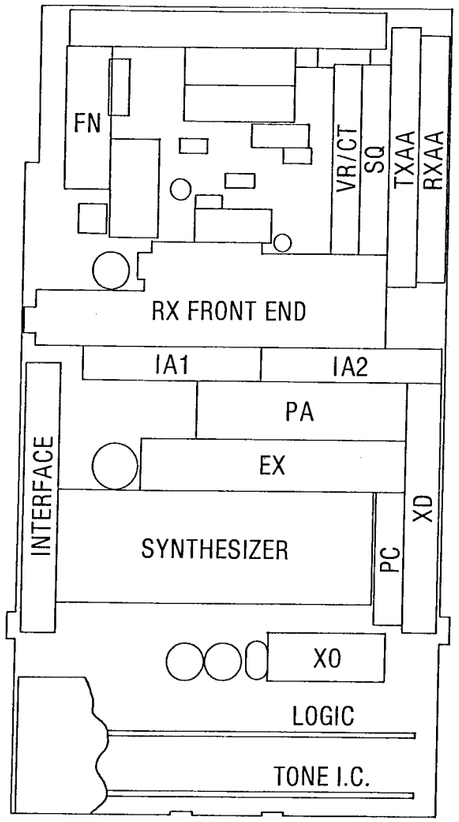
12.5

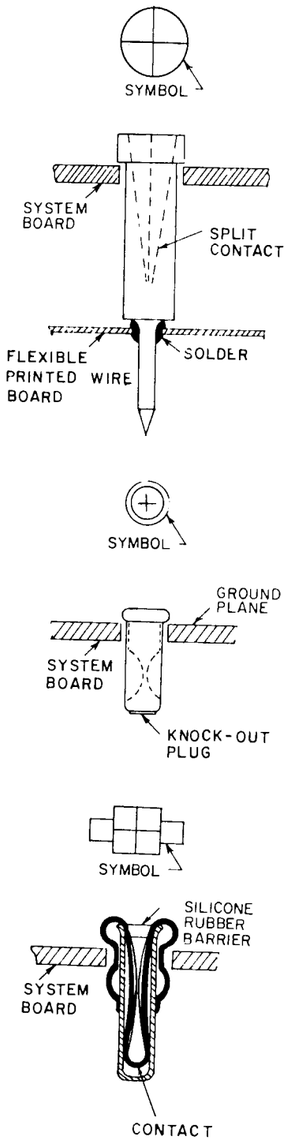
UNLOCKED SYNTHESIZER



RC5039

MODULE LAYOUT

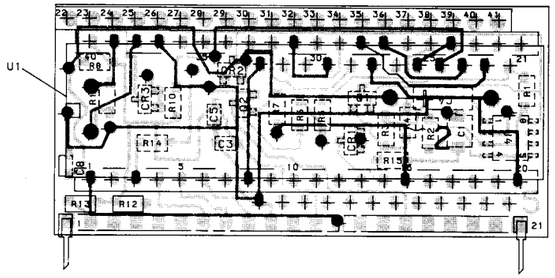




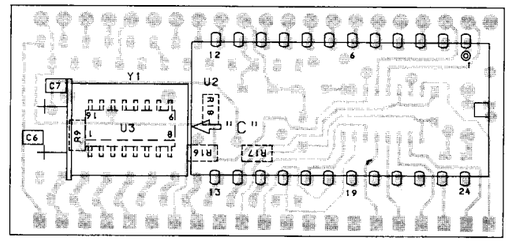
RC3776A

CONTACT IDENTIFICATION

CONTROLLER MODULE

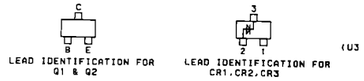


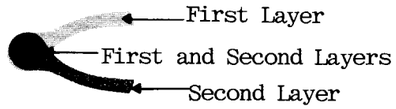
(19C336332, Sh. 1, Rev. 11)
(19A148388, Sh. 1, Rev. 5)First Layer
(19A148388, Sh. 2, Rev. 2)Second Layer



VIEW FROM SOLDER SIDE

(19C336332, Sh. 1, Rev. 11)
(19A148388, Sh. 3, Rev. 4)Third Layer

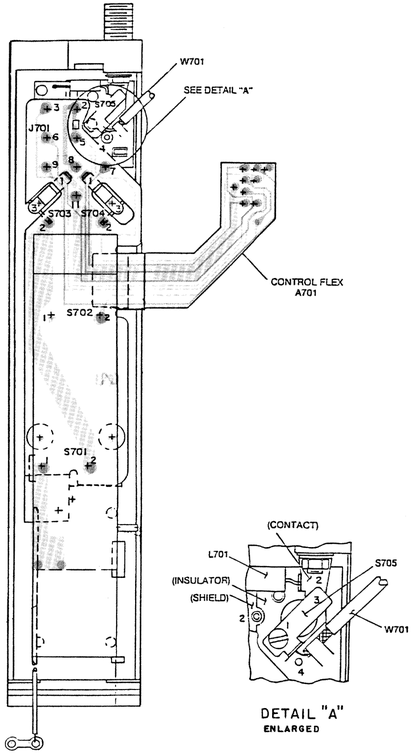




OUTLINE DIAGRAM

MODULE LAYOUT
CONTACT IDENTIFICATION
CONTROLLER MODULE

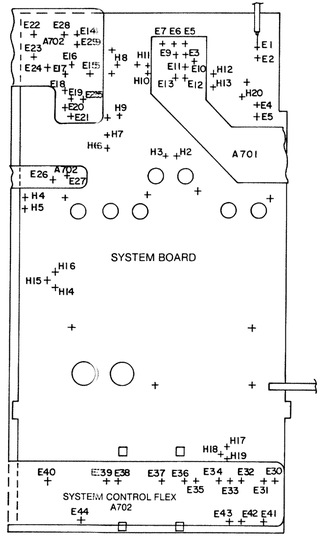
CONTROL ASSEMBLY



DETAIL "A"
ENLARGED

(19C336419, Rev. 4)RC-4993A
(19A148255, Sh. 1, Rev. 2)
(19A148255, Sh. 2, Rev. 2)

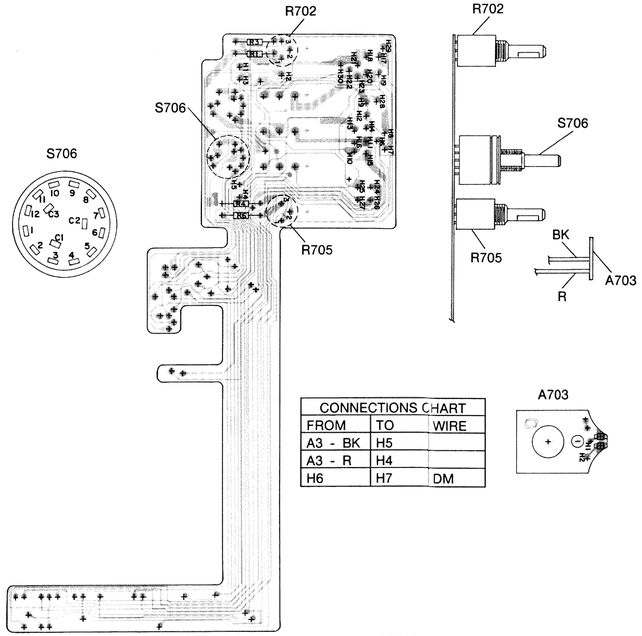
SYSTEMS BOARD FLEX CONNECTIONS



SOLDER SIDE

RC4994

SYSTEM CONTROL FLEX
A702



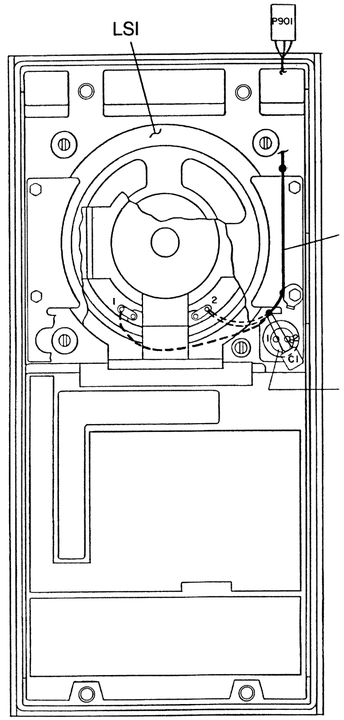
CONNECTIONS CHART		
FROM	TO	WIRE
A3 - BK	H5	
A3 - R	H4	
H6	H7	DM

RC4995

19A148216, Sh. 1, Rev. 1
19A148216, Sh. 2, Rev. 1
19A148507, Sh. 1, Rev. 0
19A148507, Sh. 2, Rev. 0

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

FRONT COVER



CONNECTION CHART		
FROM	TO	WIRE
P901	LS1-1	W
	MK1-1	0
	LS1-2	BK
LS1-2	MK1-2	T28-BK
MK1-1	MK1-2	C1

RC4996

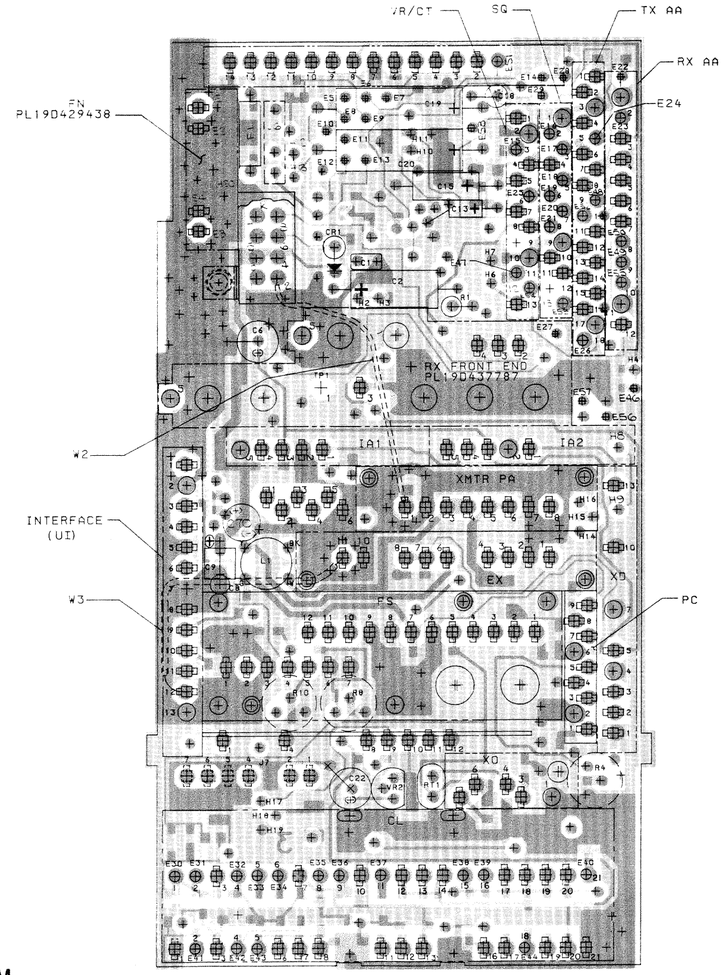
OUTLINE DIAGRAM

Control Assembly and Front Cover

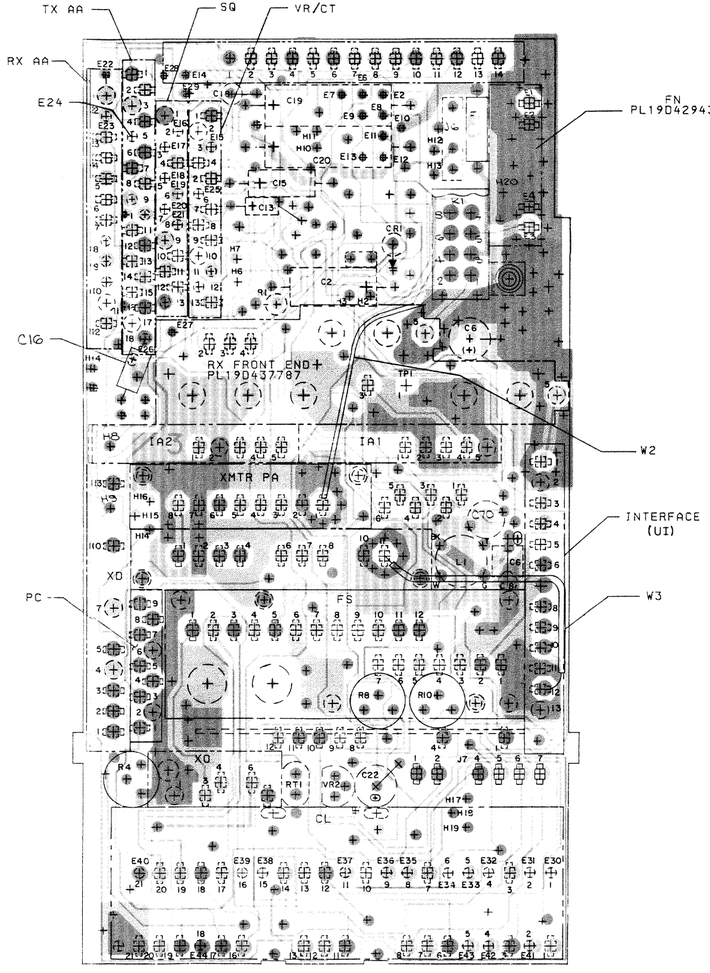
SYSTEMS BOARD

(BACK SIDE)

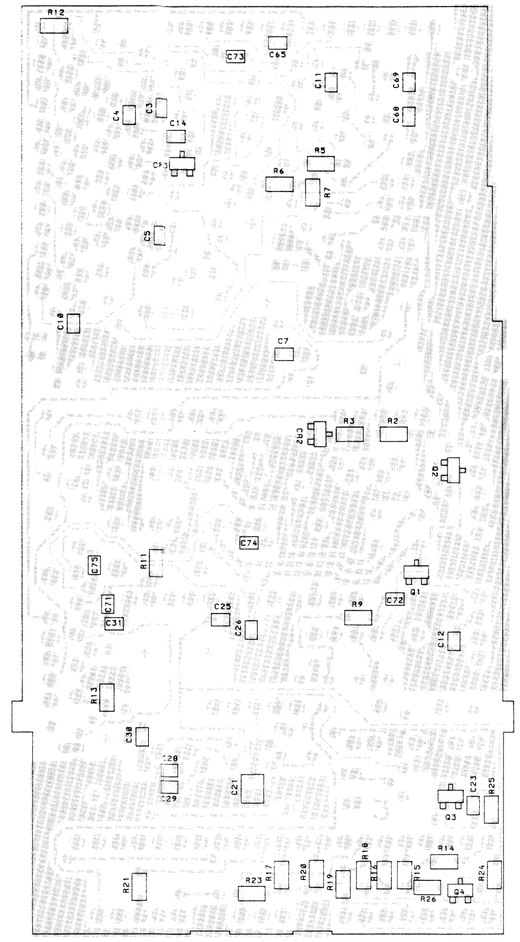
PARTIAL REFERENCE DESIGNATIONS ARE SHOWN ALL DESIGNATIONS ARE 900 SERIES, EXAMPLE C1 - C901



FRONT VIEW

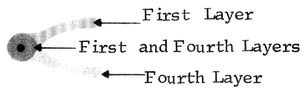


REAR VIEW

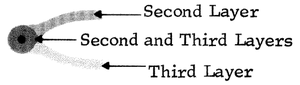


OUTLINE DIAGRAM

SYSTEM BOARD
SHEET 2

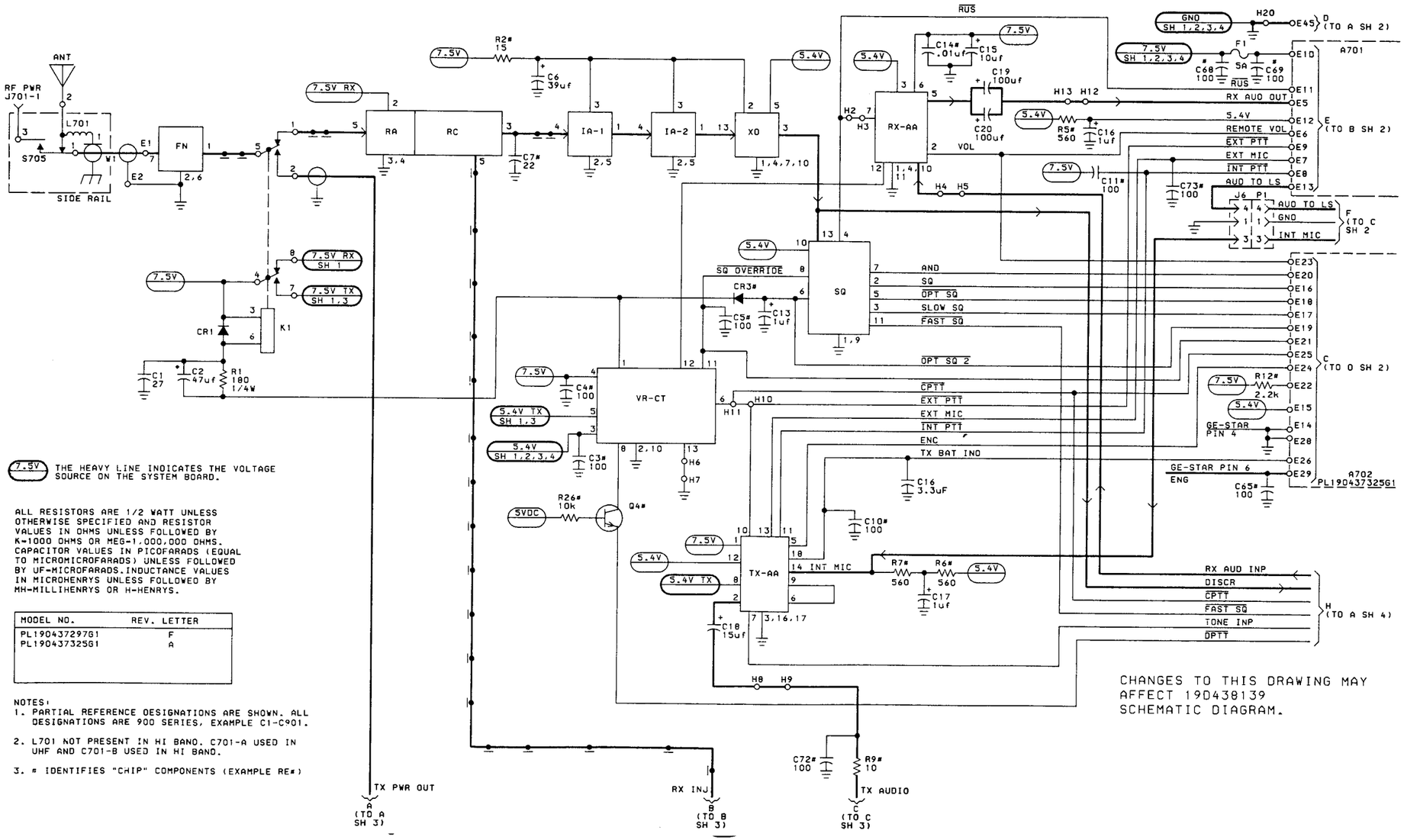


(19D437299, Sh. 1, Rev. 9)
(19A14816B, Sh. 3, Rev. 3)Third Layer
(19A14816B, Sh. 2, Rev. 3)Second Layer



(19D437299, Sh. 1, Rev. 9)
(19A14816B, Sh. 4, Rev. 3)Fourth Layer
(19A14816B, Sh. 1, Rev. 3)First Layer

(19D437297, Sh. 3, Rev. 5)
(19A14816B, Sh. 4, Rev. 3)Fourth Layer



7.5V THE HEAVY LINE INDICATES THE VOLTAGE SOURCE ON THE SYSTEM BOARD.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

MODEL NO.	REV. LETTER
PL19043729G1	F
PL19043732G1	A

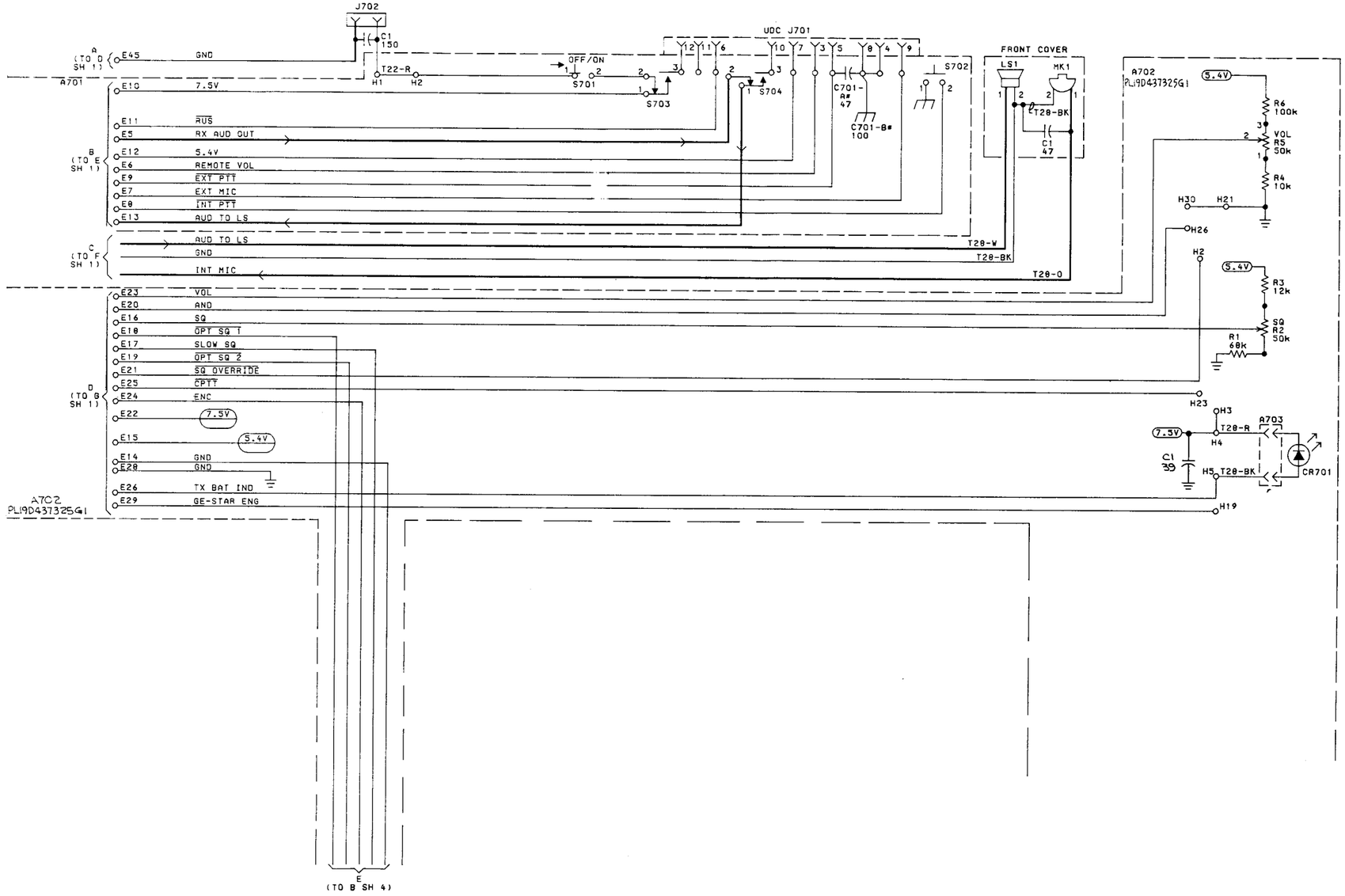
NOTES:
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. ALL DESIGNATIONS ARE 900 SERIES, EXAMPLE C1-C901.
2. L701 NOT PRESENT IN HI BAND. C701-A USED IN UHF AND C701-B USED IN HI BAND.
3. # IDENTIFIES "CHIP" COMPONENTS (EXAMPLE RE#)

CHANGES TO THIS DRAWING MAY AFFECT 19D438139 SCHEMATIC DIAGRAM.

(19D437704, Sh. 1, Rev. 10)

SCHEMATIC DIAGRAM

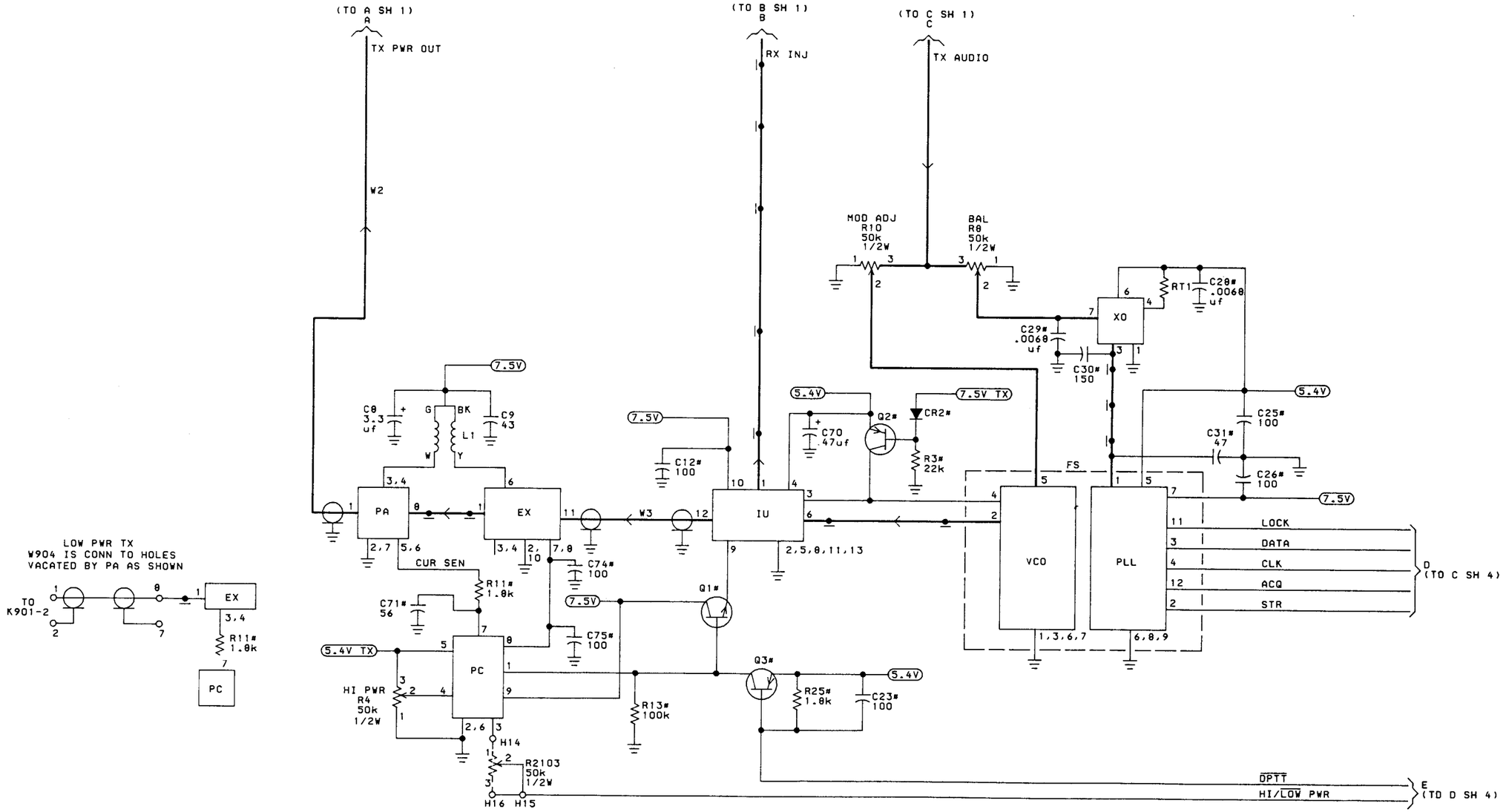
403-512 MHz
TWO-WAY RADIO
SHEET 1



SCHEMATIC DIAGRAM

(19D437704, Sh. 2, Rev. 4)

403-512 MHz
MPS TWO-WAY RADIO
SHEET 2

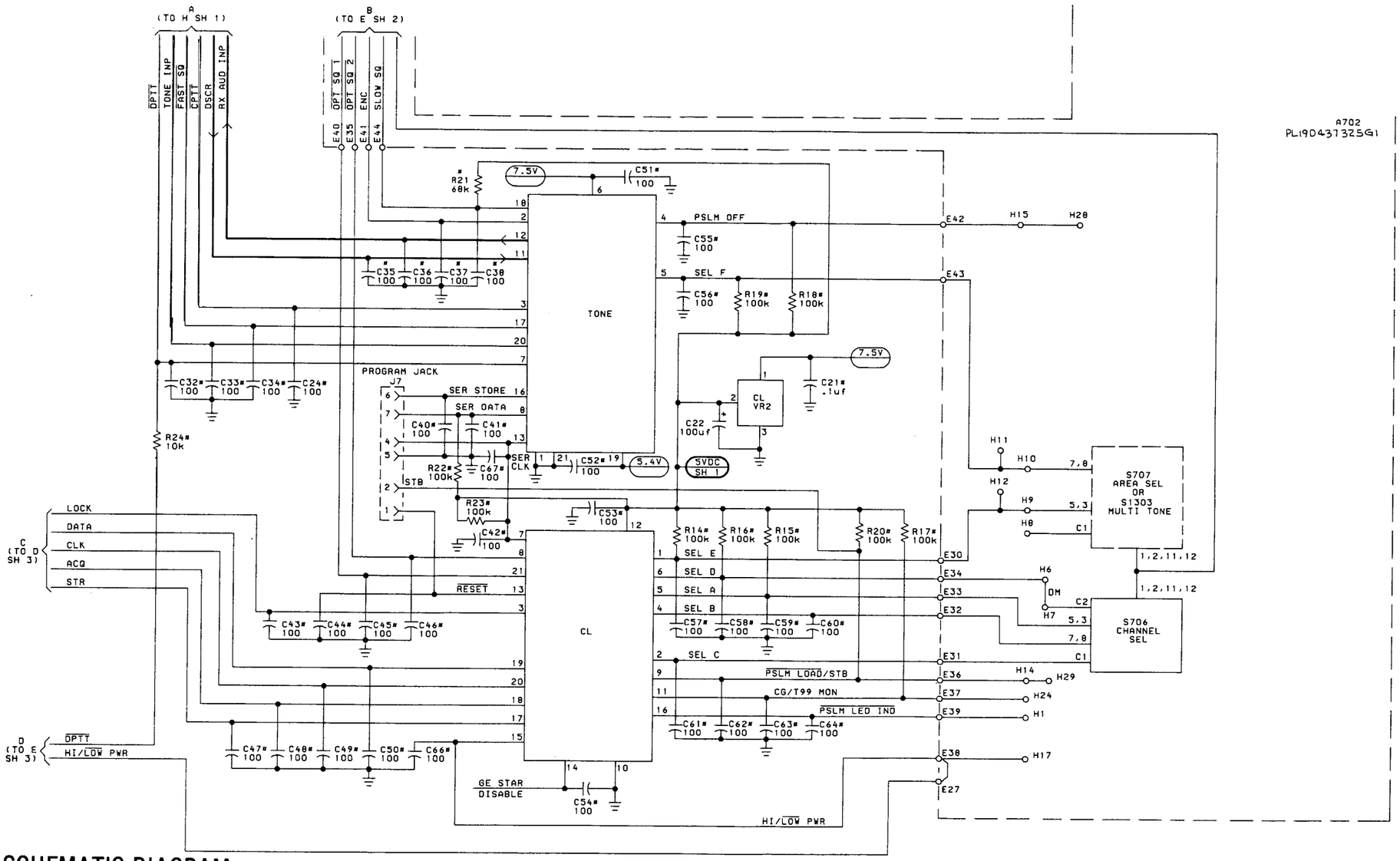


LOW PWR TX
W904 IS CONN TO HOLES
VACATED BY PA AS SHOWN

(19D437704, Sh. 3, Rev. 4)

SCHEMATIC DIAGRAM

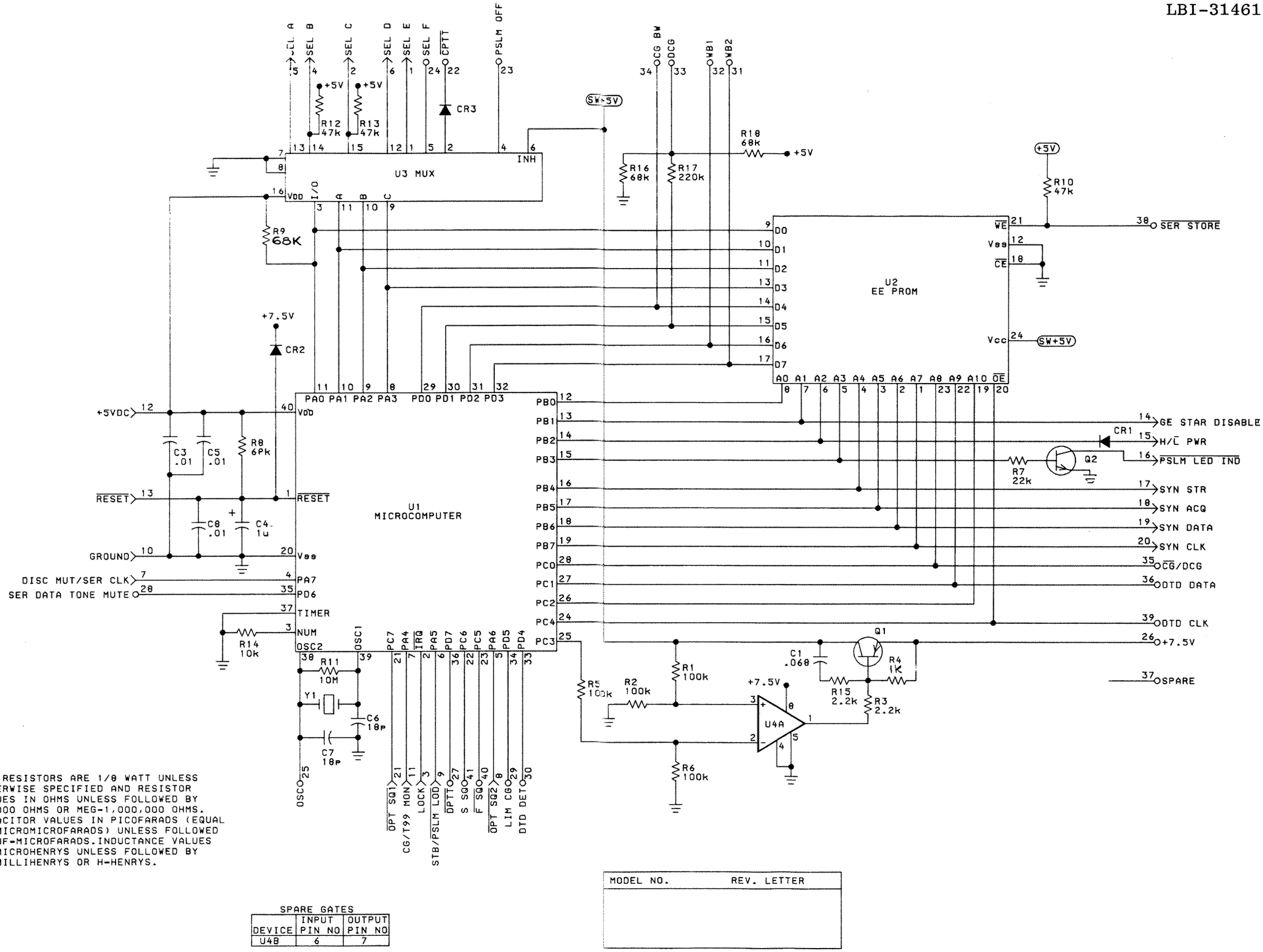
403-512 MHz
MPS TWO-WAY RADIO
SHEET 3



SCHEMATIC DIAGRAM

403-512 MHz
MPS TWO-WAY RADIO
SHEET 4

(19D437704, Sh. 4, Rev. 6)



ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH-MILLIHENRYS OR H-HENRYS.

SPARE GATES

DEVICE	INPUT PIN NO	OUTPUT PIN NO
U4B	6	7

MODEL NO.	REV. LETTER

(19D437664, Sh. 1, Rev. 10)

SCHEMATIC DIAGRAM

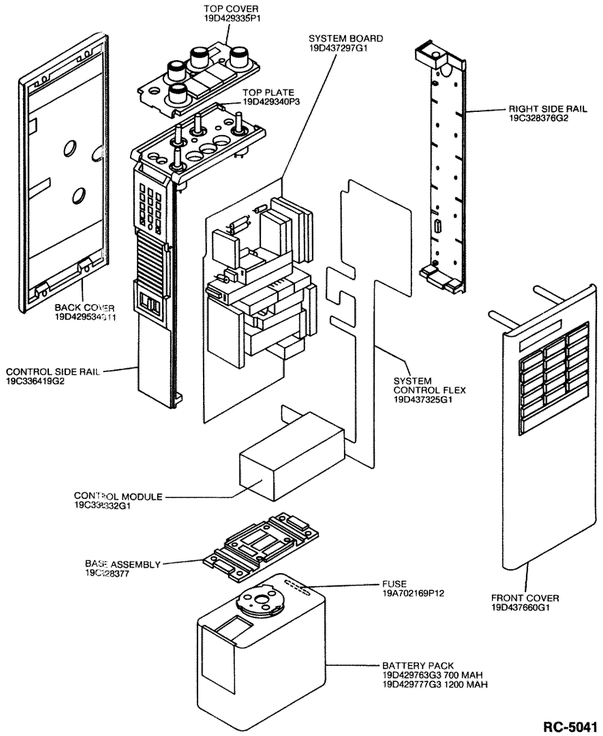
403-512 MHz
MPS Logic Board
SHEET 1

PARTS LIST

SYSTEM BOARD
19D437297G6 490-512 MHz
19D437297G7 490-512 MHz
19D437297G15 490-512 MHz
19D437297G16 490-512 MHz
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U1C	19D437611G1	Interface Board (Group 6).
U1D	19D437611G3	Interface Board (Group 7).
U1E	19D437611G4	Interface Board (Group 15).
U1F	19D437611G5	Interface Board (Group 16).
U2	19D429420G2	Receive Audio Amplifier (All Groups).
U4	19C336332G3	Control Module (Groups 15 & 16 only).
U5	19D437671G3	Tone Hybrid (Groups 15 & 16 only).
U11	19D429538G1	Power Control. (All Groups).
U12C	19D429965G1	Low Pass Filter. (All Groups).
U13E	19D437567G1	Receiver Front End (Group 6).
U13F	19D437567G2	Receiver Front End (Group 7).
U13G	19D437567G3	Receiver Front End (Groups 15 & 16).
U14C	19D429854G1	RF Power Amplifier. (Group 6).
U14D	19D429854G2	RF Power Amplifier. (Group 7).
U14E	19D429854G3	RF Power Amplifier. (Groups 15 & 16).
U15C	19D429888G12	Exciter and PA (Group 6) Hi Power.
U15D	19D429888G13	Exciter and PA (Group 7) Hi Power.
U15E	19D429888G14	Exciter and PA (Groups 15 & 16) Hi Power.
U17D	19D437544G1	Frequency Synthesizer (Group 6).
U17E	19D437544G3	Frequency Synthesizer (Group 7).
U17F	19D437544G4	Frequency Synthesizer (Group 15).
U17G	19D437544G5	Frequency Synthesizer (Group 16).
		COMPONENT BOARD 19D437297G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C901	19A700221P44	Ceramic: 27 pF + or - 5%, 100 VDCW, temp coef -80 PPM.
C902	5491674P42	Tantalum: 47 uF + or -20%, 6 VDCW; sim to Sprague Type 162D.
C903 thru C905	19A702061P61	Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C906	5491674P30	Tantalum: 39 uF + or - 20%, 10 VDCW; sim to Sprague Type 162D.
C907	19A702061P29	Ceramic: 22 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C908	5491674P36	Tantalum: 3.3 uF + or - 20%, 10 VDCW; sim to Sprague Type 162D.
C909	19A700221P51	Ceramic: 43 pF + or - 5%, 100 VDCW, temp coef -80 PPM.
C910	19A700007P61	Ceramic: 100 pF + or - 5%, 50 VDCW; temp coef 0 + or - 30 PPM.
C911 and C912	19A702061P61	Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C913	5491674P1	Tantalum: 1 uF +40-20%, 10 VDCW; sim to Sprague Type 162D.
C914	19A702052P14	Ceramic: 0.01 uF + or - 10%, 50 VDCW.
C915	5491674P37	Tantalum: 10 uF + or -20%, 10 VDCW; sim to Sprague Type 162D.
C916	19B800650P15	Tantalum: 3.3 uF + or - 20%, 10 VDCW.
C918	5491674P34	Tantalum: 15 uF + or -20%, 6 VDCW; sim to Sprague Type 162D.
C919 and C920	19B200240P19	Tantalum: 100 uF + or -20%, 6 VDCW.
C921	19A7020352P26	Ceramic: 0.1 uF + or - 10%, 50 VDCW.
C922	19B200240P19	Tantalum: 100 uF + or -20%, 6 VDCW.
C923 thru C926	19A702061P61	Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C928 and C929	19A7020352P12	Ceramic: 6800 pF + or - 10%, 50 VDCW.
C930	19A7022336P54	Ceramic: 150 pF + or -5%, 500 VDCW, temp coef 0 + or -30 PPM/°C.
C931	19A7022336P42	Ceramic: 47 pF + or -5%, 50 VDCW, temp coef 0 + or -30 PPM.
C932 thru C938	19A702061P61	Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C940 thru C969	19A702061P61	Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C970	19A7015334P9	Tantalum: 47 uF + or -20%, 6.3 VDCW.
C971	19A702061P49	Ceramic: 56 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C972 thru C975	19A702061P61	Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
		- - - - - - - - - - RECTIFIERS - - - - - - - - - -
CR901	5494922P1	Silicon: sim to Hughes 1N456.
CR902	19A7025126P1	Silicon. (Schottky Barrier); sim to BAT 17.
CR903	19A7025125P2	Silicon.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1 thru E4	19B209648P1	Contact, electrical.
E5 thru E14	19A7013129P1	Contact, electrical: rated @ 3 amps; sim to Berg 75404-001.
E15 thru E21	19A1345591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
E22	19A7013129P1	Contact, electrical: rated @ 3 amps; sim to Berg 75404-001.
E23 thru E26	19A1345591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
E27 thru E29	19A7013129P1	Contact, electrical: rated @ 3 amps; sim to Berg 75404-001.
E30 thru E44	19A1345591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
		- - - - - - - - - - FUSES - - - - - - - - - -
F901	19A7021069P11	Enclosed link; rated 5 amps @ 125 v; sim to Littelfuse 255003.
		- - - - - - - - - - JACKS - - - - - - - - - -
J906	19A7013129P1	Contact, electrical: rated @ 3 amps; sim to Berg 75404-001. (Quantity 3).
J907	19B209648P1	Contact, electrical. (Quantity 6).
		- - - - - - - - - - RELAYS - - - - - - - - - -
K901	19B800721P1	Sensitive Hermectic sealed: 90 ohms + or - 10% coil res, 5.75 to 9.0 nominal v, 2 form contacts C; sim to C.P. Clare MP1401G03.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L901	19B232664G1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q901	19A700076P2	Silicon, NPN.
Q902	19A700059P1	Silicon, PNP.
Q903	19A700059P2	Silicon, PNP.
Q904	19A700076P2	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R901	19A700106P45	Composition: 180 ohms + or - 5%, 1/4 w.
R902	19B800607P150	Metal film: 15 ohms + or - 5%, 200 VDCW, 1/8 w.
R903	19B800607P223	Metal film: 22K ohms + or - 5%, 200 VDCW, 1/8 w.
R904	19A134512P8	Variable: 50K ohms + or -5%, 1/2 w.
R905	19B800607P561	Metal film: 560 ohms + or - 5%, 200 VDCW, 1/8 w.
R906	19B800607P122	Metal film: 1.2K ohms + or -5%, 200 VDCW, 1/8 w.
R907	19B800607P561	Metal film: 560 ohms + or - 5%, 200 VDCW, 1/8 w.
R908	19A134512P8	Variable: 50K ohms + or -5%, 1/2 w.
R909	19B800607P100	Metal film: 10 ohms + or -5%, 200 VDCW, 1/8 w.
R910	19A134512P8	Variable: 50K ohms + or -5%, 1/2 w.
R911	19B800607P182	Metal film: 1.8K ohms + or - 5%, 200 VDCW, 1/8 w.
R912	19B800607P222	Metal film: 2.2K ohms + or - 5%, 200 VDCW, 1/8 w.
R913 thru R920	19B800607P104	Metal film: 100K ohms + or - 5%, 200 VDCW, 1/8 w.
R921	19B800607P683	Metal film: 68K ohms + or - 5%, 200 VDCW, 1/8 w.
R922 and R923	19B800607P104	Metal film: 100K ohms + or - 5%, 200 VDCW, 1/8 w.
R924	19B800607P103	Metal film: 10K ohms + or - 5%, 200 VDCW, 1/8 w.
R925	19B800607P182	Metal film: 1.8K ohms + or - 5%, 200 VDCW, 1/8 w.
R926	19B800607P103	Metal film: 10K ohms + or - 5%, 200 VDCW, 1/8 w.
		- - - - - - - - - - THERMISTOR - - - - - - - - - -
RT1	19A701828P1	Thermistor: 3.3K ohms + or -5%; sim to Philips 2322-642-63332/
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR902	19A702536P1	Linear positive voltage regulator; sim to LM2931AZ-5.
		- - - - - - - - - - CABLES - - - - - - - - - -
W902	19A137417G1	Cable wire: approx 2 inches long.
W903	19A137417G6	RF Cable.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A115834P9	Contact, electrical: sim to AMP 3-332070-4. (Quantity 19).
	19B232662P1	Support. (Used with K901).
	19A115834P6	Contact, electrical. (Used with K901).
	19B800608P2	Rivet, tubular. (Secures K901 support).
	19A121175P44	Insulator. (Used with C19 & C20).
	19A149126P1	Insulator. (Used with K901).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



RC-5041

PARTS LIST

LBI31465B

MPS MODULE LIST
403-512 MHz

SYMBOL	GE PART NO.	DESCRIPTION
CT	19D433436G5	Carrier Control Timer. (Includes Voltage Regulator.)
IA-1	19D429542G1	IF Preamplifier. (21.4 MHz IF).
	19D429542G2	IF Preamplifier. (23.0 MHz IF).
IA-2	19D429482G1	IF Preamplifier. (21.4 MHz IF).
	19D429482G2	IF Preamplifier. (23.0 MHz IF).
SQ	19D429426G1	Squelch.
	19D429426G2	12.5 kHz Spacing.
TX-A#	19D429486G2	Transmit Audio Processor.
	19D432210G1	12.5 kHz Spacing.
VR	19D433436G1	Voltage Regulator. (Does not include CCT.)
XD	19D429422G1	Receiver Discriminator. (21.4 MHz IF).
	19D429422G2	Receiver Discriminator. (23.0 MHz IF).
XO	19D437530G1	Reference Oscillator. (13.2 MHz IF).
	19D437530G2	Reference Oscillator. (13.8 MHz IF).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

LBI31464
UHF ANTENNA

SYMBOL	GE PART NO.	DESCRIPTION
	19B209548P4	Antenna, spring whip. (406-435 MHz).
	19B209548P5	Antenna, spring whip. (430-470 MHz).
	19B209548P6	Antenna, spring whip. (470-512 MHz).

PARTS LIST

RIGHT SIDE RAIL
19C328376G2
(SEE RC4971)
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
1	19D429242P2	Side rail.
2	19A137410P1	Bushing. (Secures base assembly and top plate to right side rail - not included with side rail).
3	19C328322P2	Shield.
4	19A137609G1	Strap.

PARTS LIST

LOGIC BOARD
19C336332G1
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A702052P24	Ceramic: 0.068 uF + or - 10%, 50 VDCW.
C3	19A702052P14	Ceramic: 0.01 uF + or - 10%, 50 VDCW.
C4	19B800650P13	Tantalum: 1 uF -20+40%, 10 VDCW.
C5	19A702052P14	Ceramic: 0.01 uF + or - 10%, 50 VDCW.
C6 and C7	19A702061P25	Ceramic: 18 pF + or -5%, 50 VDCW, temp coef 0 + or -30 PPM/^C.
C8	19A702052P14	Ceramic: 0.01 uF + or - 10%, 50 VDCW.
		- - - - - - - - - - RECTIFIERS - - - - - - - - - -
CR1 thru CR3	19A702525P1	Silicon, sim to MMBV3401.
		- - - - - - - - - - JACKS - - - - - - - - - -
J1	19B801236P1	Socket, strip, 20 contacts rated at 1 amp.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A700059P1	Silicon, PNP.
Q2	19A700076P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	19B800607P104	Metal film: 100K ohms + or - 5%, 200 VDCW, 1/8 w.
R3	19B800607P222	Metal film: 2.2K ohms + or - 5%, 200 VDCW, 1/8 w.
R4	19B800607P102	Metal film: 1K ohms + or - 5%, 200 VDCW, 1/8 w.
R5 and R6	19B800607P104	Metal film: 100K ohms + or - 5%, 200 VDCW, 1/8 w.
R7	19B800607P223	Metal film: 22K ohms + or - 5%, 200 VDCW, 1/8 w.
R8 and R9	19B800607P683	Metal film: 68K ohms + or - 5%, 200 VDCW, 1/8 w.
R10	19B800607P473	Metal film: 47K ohms + or - 5%, 200 VDCW, 1/8 w.
R11	19B800607P106	Metal film: 10 megohms + or -10%, 200 VDCW, 1/8 w.
R12 and R13	19B800607P473	Metal film: 47K ohms + or - 5%, 200 VDCW, 1/8 w.
R14	19B800607P103	Metal film: 10K ohms + or - 5%, 200 VDCW, 1/8 w.
R15	19B800607P222	Metal film: 2.2K ohms + or - 5%, 200 VDCW, 1/8 w.
R16	19B800607P683	Metal film: 68K ohms + or - 5%, 200 VDCW, 1/8 w.
R17	19B800607P224	Metal film: 220K ohms + or - 5%, 200 VDCW, 1/8 w.
R18	19B800607P683	Metal film: 68K ohms + or - 5%, 200 VDCW, 1/8 w.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1	19A702872P30	Integrated Circuit.
U2	19A703952P1	MEMORY. (2K X 8 5 VOLT ONLY EEPROM).
U3	19A702705P3	Digital: 8 CHANNEL ANAGOL MPX; sim to 4051BM.
U4	19A702293P2	Operational Amplifier Dual Op Amp; sim to LM358D.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

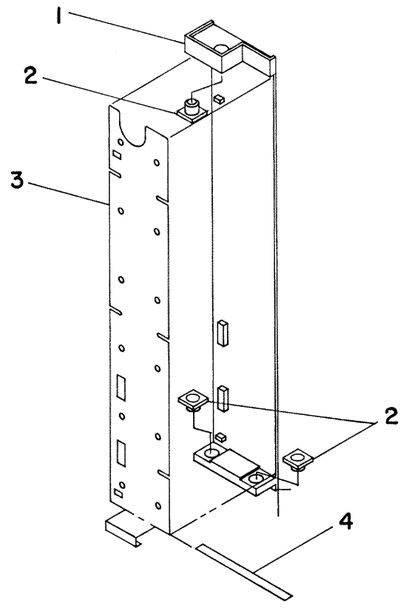
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XU1	19B801236P2	Socket, strip, 20 contacts rated at 1 amp; sim to Santec SL-120-TP-12.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	19A702511G1	Quartz: Frequency 3.579545 MHz.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19C328104P3	Clip contact. (Quantity 21).
	19C328103P1	Lead. (Quantity 21 - mates with clip contact 19C328104P3).

PARTS LIST

BATTERY PACKS
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
	19D429763G1	Battery pack, 750 mAh
	19D429777G1	Battery pack, 1200 mAh.
	19D429763G2	Intrinsically safe battery Group D; 750 mAh.
	19D429777G2	Intrinsically safe battery Group D; 1200 mAh.
	19D429763G8	Intrinsically safe battery Group C; 750 mAh.
	19D429777G8	Intrinsically safe battery Group C; 1200 mAh.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



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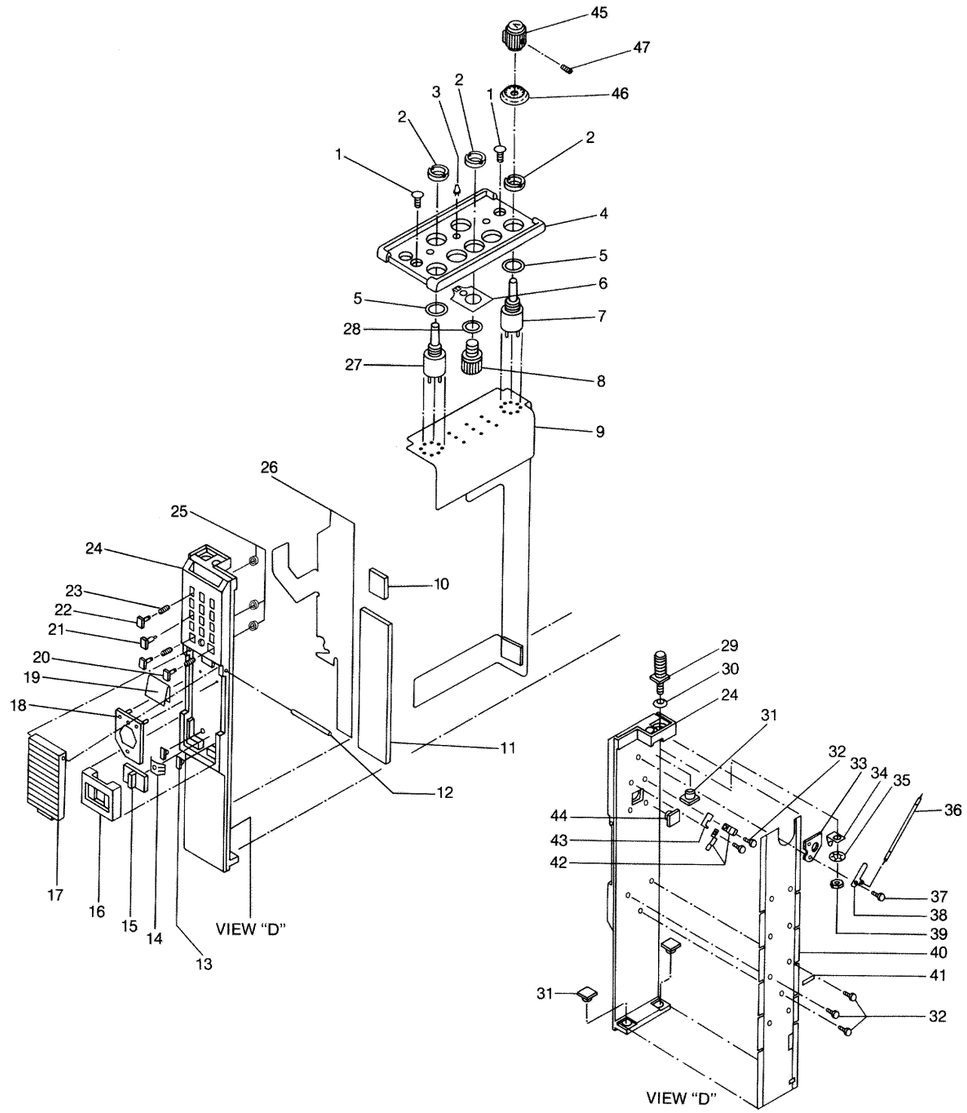


RC-5040A

PARTS LIST

CONTROL SIDE RAIL
19C336419G1

ISSUE 2

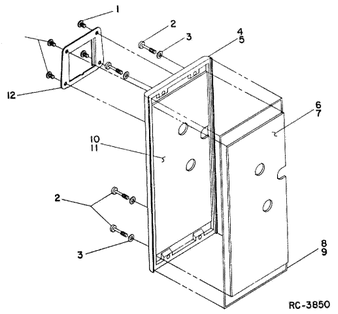
SYMBOL	GE PART NO.	DESCRIPTION
A701		FLEX BOARD 19C336414G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C701	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
		- - - - - - - - - - COILS - - - - - - - - - -
L701	19A700024P1	Coil, RF: 100 nH ±10%, 0.08 ohms DC res max, 100 v.
		- - - - - - - - - - CABLES - - - - - - - - - -
W701	19A137417G3	Cable, RF: approx 2 inches long.
		SIDE RAIL 19D429564G4
		- - - - - - - - - - JACKS - - - - - - - - - -
J701		(See Items 20-23 & 25 on RC 5040).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701		(See Items 13-16 on RC 5040).
S702		(See Items 12 & 17-19 on RC 5040).
S703		(See Items 20,23,25,32 & 42-44 on RC 5040).
S704		(See Items 20,23,25,32 & 42-44 on RC 5040).
S705		(See Items 22,23,25,30-35 & 37-39 on RC 5040).
		ASSOCIATED ASSEMBLIES
A702		SYSTEM FLEX BOARD 19D437325G1
A703	19C336413G1	Display Board. (See Item 6 on RC 5040).
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R701	3R151P683J	Composition: 68K ohms ±5%, 1/8 w.
R702	19A134528P3	Variable, cermet: 50K ohms ±10%, 1 w. (See Item 26 on RC 5040).
R703	3R151P123J	Composition: 12K ohms ±5%, 1/8 w.
R704	3R151P103J	Composition: 10K ohms ±5%, 1/8 w.
R705	19A134528P3	Variable, cermet: 50K ohms ±10%, 1 w. (See Item 7 on RC 5040).
R706	3R151P104J	Composition: 100K ohms ±5%, 1/8 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S706	19A134781P2	Rotary: 1 section, 1 pole, 2-12 position, non-shorting contacts; sim to Grayhill 51MY2326.
		MECHANICAL PARTS (SEE RC 5040)
1.	19A134586P2506E	Machine screw, metric: 2.5-0.45 x 6MM. (Secures Top Plate and Base Assemly to side rail).
2.	19A127319P1	Nut: No. thd. size 1/4-32. (Used with R702 and R705, Squelch and Volume).
3.	19A134323P1	Optoelectronic: red, sim to Opcoa LLL-7A.
4.	19D429340P3	Top plate.
5.	4037064P25	Washer, non-metallic. (Used with R702 and R705).
6.	19C336413G1	Display board. (A703).
7.	19A134528P3	Variable, cermet: 50K ohms ±10%, 1 w (R702 - Squelch).
8.	N170P21004C6	Screw.
9.	19D437325G1	System Flex Board. (A702).
10.	19B232682P8	Pad.
11.	19B232682P20	Pad.
12.	19A134585P1	Pin, spring. (Part of S702).
13.	19B234407G3	Contact. (Part of S701).
14.	19B232560P1	Spring. (Part of S701).
15.	19A137826G1	Slide. (Part of S701).
16.	19C328373P1	Plate. (Part of S701).
17.	19C328176P1	Button. (Part of S702).
18.	19B800847P1	Push switch: contacts rated 25 mA @ ± VDC; sim to Bowmar KB3256-1D. (Part of S702).
19.	19A137414P1	Spring. (Part of S702).
20.	19B234407G2	Contact. (Part of S703 & S704).
21.	19B234407G1	Contact. (J701-2 thru J701-9, J701-1.).
22.	19B234407G2	Contact. (Part of S705).
23.	4035235P13	Spring. (Part of S703-S705).
24.	19D429241P2	Left side rail.
25.	19A137413P1	Seal. (Part of S703-S705).
26.	19C336414G2	Flex board.
27.	19A134528P3	Variable, cermet: 50K ohms ±10%, 1 w (R705 - Volume).
28.	4037064P14	Washer, non-metallic: 9/32. (Used with A703).
29.	19A137411P1	Antenna stud.
30.	19A700127P3	Packing.
31.	19A137410P1	Bushing. (Secure Top Plate to left side rail).
32.	19A134588P1	Drive screw, pan head: 0-40 x 5/32. (Part of S701, S703 and S704).
33.	19B232672P1	Insulator. (Part of S705).
34.	19B234497P1	Contact. (Part of S705).
35.	19A702593P1	Lockwasher, internal tooth: Metric, #2.2.
36.	19A137417G3	Cable, RF: approx 2 inches long. (W701).
37.	19A134588P4	Screw, panhead: size 0-40. (Part of S705).
38.	19B232670P1	Contact. (Part of S705).
39.	19A700034P3	Hex nut, metric: M2.5 x 0.45.
40.	19C328385P2	Shield.
41.	19A137609G2	Strap.
42.	19A144581G1	Contact. (Part of S703 & S704).
43.	19B234407G5	Contact. (Part of S703 & S704).
44.	19B232415P1	Bushing.
45.	19C328108P1 19C328108P13 19C328108P2	Volume Knob. Frequency Knob. Squelch Knob.
46.	19C328193P2 19C328193P9 19C328193P3	Volume Dial. Frequency Dial. Squelch Dial.
47.	19A148453P1	Set Screw (for knobs).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

REAR COVER
19D429534G11
(SEE RC3850)
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
1	N327P9010Y6	Rivet, tubular.
2	19A702863P1	Machine screw: TORX®Drive. M2 - .45 x 13.
3	19A700032P3	Lockwasher, internal tooth. M2.5.
4	19C328374G11	Rear cover.
6	19B232524P1	Pad.
8	19A134583P2	Cover seal, rubber.
10	19C336406P1	Pad. (Adheres to item 4).
11	19C336405P1	Pad. (Adheres to item 10).
12	19C850865P1	Option receptacle.
13	19A134285P1	Tape, pressure sensitive.



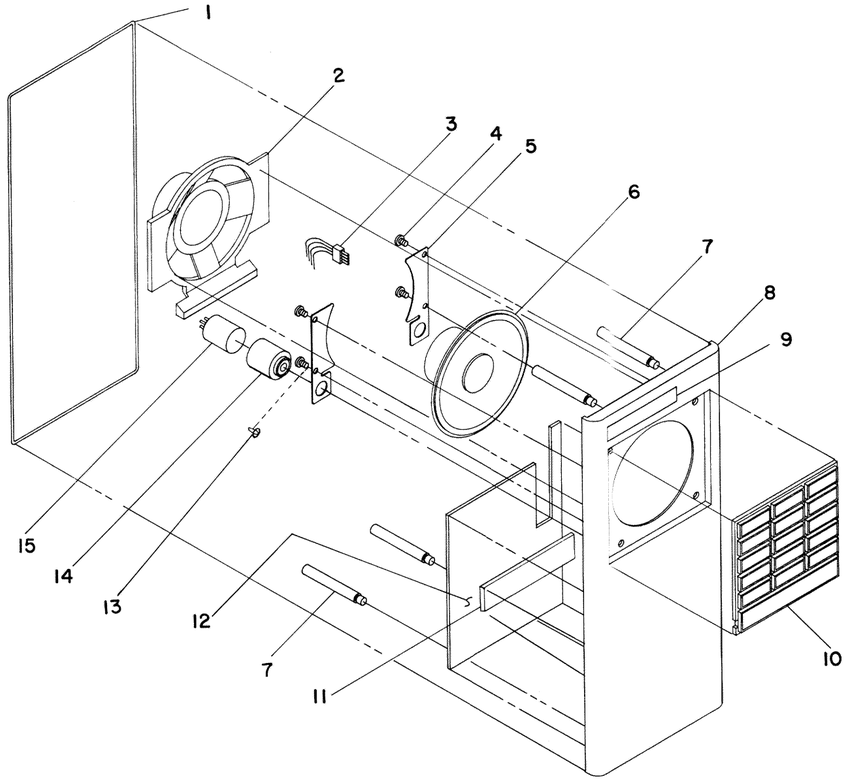
RC-3850

PARTS LIST

FRONT COVER ASSEMBLY
19D437660G1
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A700226P53	Ceramic: 47 pF ±5%, 100 VDCW, temp coef -750 PPM.
		- - - - - - - - - - SPEAKERS - - - - - - - - - -
LS1	19A134460P1	Permanent magnet: 2 inches, 8 ohms ±10%, imp 500 mW, 450 ±100 Hz resonant freq; sim to Pioneer A50AP13-01F.
		- - - - - - - - - - MICROPHONES - - - - - - - - - -
MK1	19A701301P2	Microphone cartridge: 1800 ±30% ohms imp, 1.1 - 10 VDC; sim to Primo EM-78.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P901		Connector. Includes:
	19A702405P4	Shell
	19A702405P27	Contact, electrical. (Quantity 3).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19C851212P2	Pushbutton; sim to Amp Keyword Technology CP83-41190.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19B233023G3	Cable assembly.
		MECHANICAL PARTS (SEE RC4973)
1	19A134583P2	Cover seal, rubber.
2	19D429314P1	Speaker boot.
3		Connector plug. (P901). Consists of 19A702405P4 Shell and three 19A702405P27 contacts.
4	19A134793P1804	Screw, thread forming: No. 1-64 x 5/32.
5	19B234460P1	Speaker retaining plate.
6	19A134460P1	Speaker, permanent magnet: 2 inch, 8 ohms ±10% imp, 500 mW, 450 ±100 Hz resonant frequency; sim to Pioneer 850AP1301F. (LS1).
7	19A137709P1	Spacer.
8	19C328382G12	RF Cover.
9	19A148345P1	Nameplate. (SYNTHESIZED).
10	19D429300P1	Grille.
11	19A121175P15	Insulator, plate.
12	19B232816P6	Pad.
13	4033714P14	Solderless terminal.
14	19B234459P1	Microphone boot.
15	19A701301P2	Microphone. (MK1).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

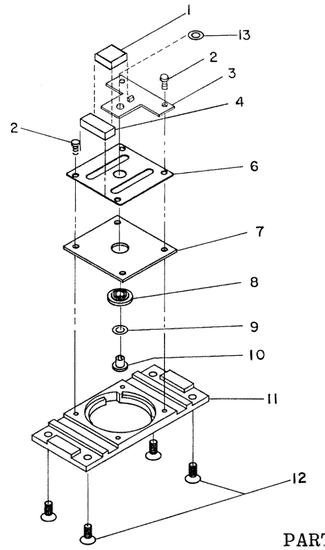


RC-4973

PARTS LIST

BASE ASSEMBLY
19C328377G3
(SEE RC3779)
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A700007P65	Ceramic: 150 pf ±5%, 50 VDCW; temp coef 0 ±30 PPM.
		MECHANICAL PARTS
1	19A121175P39	Insulated plate.
2	N530P203C	Drive screw, type U: No. 0 x 3/16.
3	19C331904P1	Printed board.
4	19B232682P11	Pad.
6	19B232497P2	Spring.
7	19B237706P2	Pad.
8	19A137490P3	Insulator.
9	4035306P70	Washer, non-metallic.
10	19A137531P5	Contact.
11	19D429248P2	Base.
12	19A134586P2506	Machine screw: 2.5 with 0.45 thd. pitch, 6MM long. (Not included with base assembly).
13	19A134455P3	Flat washer.



RC-3779B

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 - System Board 19D437297G1

To prevent noise on 5.4 volt supply causing an unlock condition when transmitting with low battery voltage. Add Capacitor C970 from 5.4V line of synthesizer interface module to ground.

C970: 315A6047P476M; Tantalum, 47 uF ±20%, 10 VDCW.

REV. B - System Board 19D437297G1

To revise PWB to include changes required for 470-512 MHz splits. Deleted CR904. Added C971, C972, C973, C974, R926 and Q904. Also relocated SPKR/MIC Connector. See Revised Drawings and Schematics.

END OF DOCUMENT

ADDENDUM NO 1 TO LBI31461B
(PCP9)

This addendum adds information about programming the radio to the DESCRIPTION section, adds the CMOS caution block to the DESCRIPTION section and replaces Table 1 in the CIRCUIT ANALYSIS section.

Programming

The EEPROM in the microprocessor controller module can be programmmed or reprogrammed to allow the radio to be adapted to changing system requirements. RF frequencies, Channel Guard tones, digital codes, Type 99 tones, PSLM and the GE STAR functions can be programmed.

The EEPROM is externally programmable through J7 on the back of the system board using General Electric Universal PROM Programmer Model TQ2310. This programmer allows all information to be loaded simultaneously.

Programming instructions are provided in the Programmers Manual (LBI31415) for the MPS radio.

CMOS Caution

CAUTION

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

Table 1 - Capacity Measurement Data

RECHARGEABLE BATTERY PACK	RATED CAPACITY (mAh)	AVERAGE DISCHARGE RATE FOR 60 MINUTES (mAh)	LOAD RESISTOR R_L	END VOLTAGE (VDC)
19D429763G1 (STD. OPTION PA10) (6 cells)	750	750	10 ohms 8 watts	6
19D429777G9 (STD. OPTION PA11) (6 cells)	1200	1200	6.25 ohms 12 watts	6
19D429763G8 (IS GPC OPT. PA14) (6 cells)	750	750	10 ohms 8 watts	6
19D429777G8 (IS GPC OPT. PA15) (6 cells)	1200	1200	6.25 ohms 12 watts	6

This addendum provides production changes unintentionally left out of this publication.

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 the descriptions of parts affected by these revisions.

REV. A - SYSTEM FLEX BOARD 19D437325G1
To simplify setting of rotary switch S706. Incorporated switch stop by changing S706.

S706 was 19A134781P1 - Rotary switch.

REV. A - SYSTEM BOARD 19D437297G1
To prevent noise on 5.4 volt supply causing an unlock condition when transmitting with low battery voltage. Add capacitor C970 from 5.4V line of synthesizer interface module to ground.

REV. B - SYSTEM BOARD 19D437297G1
To revise PWB to include changes required for 470-512 MHz splits. Deleted CR904. Added C971, C972, C973, C974, R926 and Q904. Also relocated SPKR/MIC Connector.

REV. C - SYSTEM BOARD 19D437297G1
To improve operation. Deleted C927.

REV. D - SYSTEM BOARD 19D437297G1
To add new Voice Guard option and to facilitate manufacturing. Changed part number of CR903, changed quantity of three terminals: 19B209648P1 (from 170 to 161), 19A134591P1 (from 26 to 35), and 19A701329P1 (from 17 to 22).

CR903 was 19A700155 - Silicon, switching: sim to BAT 18.

REV. E - SYSTEM BOARD 19D437297G1
To increase microphone sensitivity. Deleted C916 and C917, changed R906.

C916 and C917 were 5491674P1 - Tantalum: 1 uF +40-20%, 10 VDCW; sim to Sprague type 162D.

R906 was 19B800607P561 - Metal film: 560 ohms ±5%, 100 VDCW, 1/8 w.

REV. F - SYSTEM BOARD 19D437297G1
To correct an RFI problem, added C916.