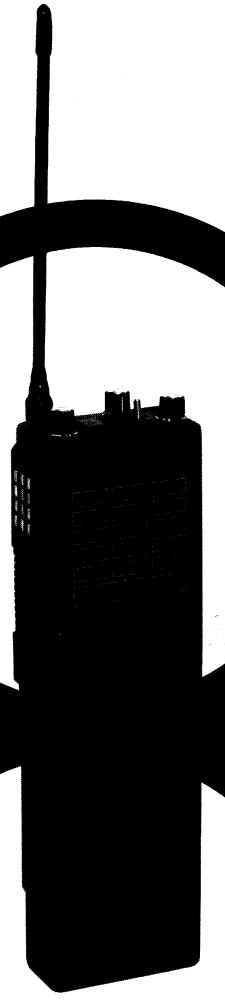
MOBILE RADIO

MPX

MAINTENANCE MANUAL LBI30990 C

DATAFILE FOLDER DF9054



406–512 MHz
PERSONAL
TWO-WAY FM RADIO
P4B/C COMBINATIONS

GENERAL ELECTRIC

TABLE OF CONTENTS

ILLUSTRATIONS

SPECIFICATIONS

SYSTEM

	P4B	P4C
Dimensions (H x W x D)		
(Less Battery Pack)	5.81" x 2.85" x 1.5" 14.76 cm x 7.24 cm x 3.81 cm	6.46" x 2.85" x 1/5" 16.41 cm x 7.24 cm x 3.81 cm
(With 750 mAh battery pack)	8.01" x 2.85" x 1.5" 20.27 cm x 7.24 cm x 3.81 cm	8.86" x 2.85" x 1.5" 21.92 cm x 7.24 cm x 3.81 cm
(With 1200 mAh battery pack)	9.36" x 2.85" x 1.5" 23.77 cm x 7.24 cm x 3.81 cm	10.01" x 2.85" x 1.5" 25.42 cm x 7.24 cm x 3.81 cm
Weight		
(Less battery pack)	20 oz.	21 oz.
(With 750 mAh battery pack)	30 oz.	31 oz.
(With 1200 mAh battery pack)	33 oz.	34 oz.
Operable Temperature Range	-30 to +60° C	
Current Drain (Less Options)		
Standby	30 milliamps	
Receive (Rated Audio)	145 milliamps	
Transmit		
1.5 Watts	1.1 amperes	
4 Watts	2.2 amperes	

TRANSMIT

Type Numbers	KT194B/C	KT195B/C
Power Output (Adjustable)	1 to 1.5 Watts	1 to 4 Watts
Spurious		
Radiated	-45 dBc or less than 50 µWatts	-50 dBc or less than 40 µWatts
Conducted	-45 dBc or less than 50 µWatts	-50 dBc or less than 40 µWatts
Multiplication	6 x RX OSC ± OFFSET OSC	
RF Load Impedance	50 ohms	
Modulation Deviation	5 kHz (Factory set at 4.5 kHz)	
Audio Sensitivity	12 millivolts at 1 kHz (typical)	
Audio Frequency Response	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz.	
Audio Distortion	Less than 3% at 300 to 3000 Hz and 3 kHz deviation.	
Maximum Frequency Spread	10 MHz (measured at UDC Jack)	

SPECIFICATIONS

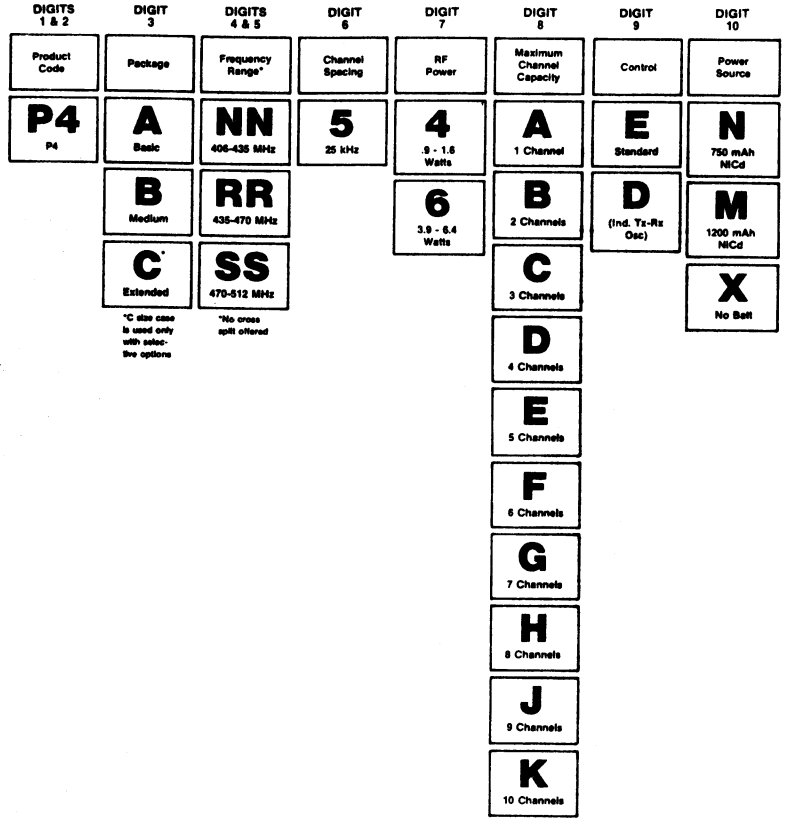
RECEIVE

Type Number	ER123B/C
Frequency Range	406-512 MHz
Sensitivity	
20 dB NQ	0.50 uV
12 dB SINAD	0.35 uV
Critical Squelch	0.25 uV
Selectivity	
20 kHz	-60 dB
25 kHz	-85 dB
Intermodulation	-75 DB
Spurious & Image	-70 dB
Maximum Frequency Spread	
Maximum Performance	2 MHz
1 dB degradation	5 MHz
3 dB degradation	7 MHz
6 dB degradation	10 MHz
Channel Spacing	25 kHz
Audio Output	500 milliwatts
Audio Frequency Response	Within +2 and -8 dB of a 6 dB/octave de-emphasis from 300 to 3000 Hz (100 Hz reference)
Audio Distortion	Less than 5% at 1000 Hz
Modulation Acceptance	±7 kHz

BATTERY PACK

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

COMBINATION NOMENCLATURE



STRUCTURED OPTIONS

DIGIT A	DIGIT B	DIGIT C	DIGIT D	DIGIT E	DIGIT F	DIGIT G	DIGIT H	DIGIT J	DIGIT K	DIGIT L	DIGIT M
A 1 Tx Frequency	**A** 1 Rx Frequency	**O** None	**O** None	**O** None	**O** None	**O** None	**O** None	**O** None	**O** None	**O** None	**O** None
B 2 Tx Frequency	**B** 2 Rx Frequency	**2** 1-Tone CG Enc	**U** 1-Tone CG Enc/Dec	**G** GE-STAR Toggle	**2** Intr Safe GPD	**A** And/Or			**3** Alt IF		**D** 2nd Oxo Man Sel
C 3 Tx Frequency	**C** 3 Rx Frequency	**U** 1-Tone CG Enc/Dec	**3** Multi-CG Enc-Auto	**1** GE-STAR Lan	**4** Intr Safe GPC	**S** SLM					**2** 2nd Oxo Auto Sel
D 4 Tx Frequency	**D** 4 Rx Frequency	**D** 1-Tone Enc/Dec DCG	**E** Multi-CG Enc-Man			**P** PSLM					
E 5 Tx Frequency	**E** 5 Rx Frequency	**4** 1-Tone Enc DCG	**W** Multi-CG Enc/Dec-Auto								
F 6 Tx Frequency	**F** 6 Rx Frequency		**C** Multi-CG Enc/Dec Man								
G 7 Tx Frequency	**G** 7 Rx Frequency		**I** DTMF								
H 8 Tx Frequency	**H** 8 Rx Frequency		**N** T99 Man								
J 9 Tx Frequency	**J** 9 Rx Frequency		**B** T99 Auto								
K 10 Tx Frequency	**K** 10 Rx Frequency		**F** Multi-DCG Enc/Dec-Auto								
O No Xtals	**O** No Xtals		**G** Multi-DCG Enc/Dec-Man								
			P DTMF w/T99 Ind & Group								
			R DTMF w/T99 Ind								
			L T99 Ind								
			M Ind/Group								

STRUCTURED OPTIONS ARE OPTIONS ORDERED AS PART OF THE COMBINATION NOMENCLATURE. ONLY ONE OR NONE IN EACH GROUP CAN BE ORDERED.

DESCRIPTION

General Electric's MPX radio is a completely modularized, two-way, FM communication system, designed to afford performance specifications equivalent or, more generally, superior to both domestic and international specification requirements. The MPX radio offers outstanding advances in reliability, Option flexibility and repairability.

Each MPX radio, depending on the combination, uses approximately 15 plug-in circuit modules. 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.

The MPX transmit circuit employs FM modulated offset oscillator modules and the highly stable Receive oscillator module to control the transmit carrier frequency. Space is provided for two offset oscillators so the transmit frequency may be on the receiver frequency for repeater talk around or further offset for repeater talk through. A phase-lock-loop module and a voltage controlled oscillator module generates the correct operating frequency. A power control module insures the correct level of power output at the antenna. The only adjustments are frequency, modulation and power level. No RF tuning of the transmit circuit is required or possible. The maximum multi-frequency switching range is limited only by the ability to control the voltage controlled oscillator frequency. MPX provides a 10 MHz bandwidth with no RF tuning. Practically, the transmit frequency range is limited only by the antenna VSWR.

The power levels are available in the MPX transmit circuit and are designated by transmit type numbers. KT194B/C and KT195B/C. KT194B/C provides 1 to 1.5 watts output while KT195B/C provides 1 to 4 watts output.

The MPX receive circuit is a single conversion circuit using fifth mode oscillator modules to reduce spurious and provide a wide frequency switching range. A 21.4 MHz IF is the standard IF. An alternate IF of 23 MHz is also available.

There are eight tuning adjustments in the receive circuit, all in the front end. Four of the adjustments are RF helical resonators tuned for maximum receive quieting. The other four adjustments are in the injection frequency multiplier chain. Three of these adjustments are helical resonators tuned for best injection signal. The other adjustment is a slug tuned coil for interstage coupling. There is one metering test point provided for this adjustment.

The receive circuit available in the MPX and is designated by receive type number ER123B/C.

The power supply for the MPX radio 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 MPX radio consists of nine assemblies plus a battery pack (see Figure 1). The nine assemblies can easily be disassembled in the field to replace any damaged or defective parts. All parts of similar MPX radios are directly interchangeable.

Radio Assembly

The radio assembly consists of a multi-layered system board and all modules for the 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 two center layers of printed wire pattern are for signal interconnections. Fifty ohm strip line is used for all high-frequency connections.

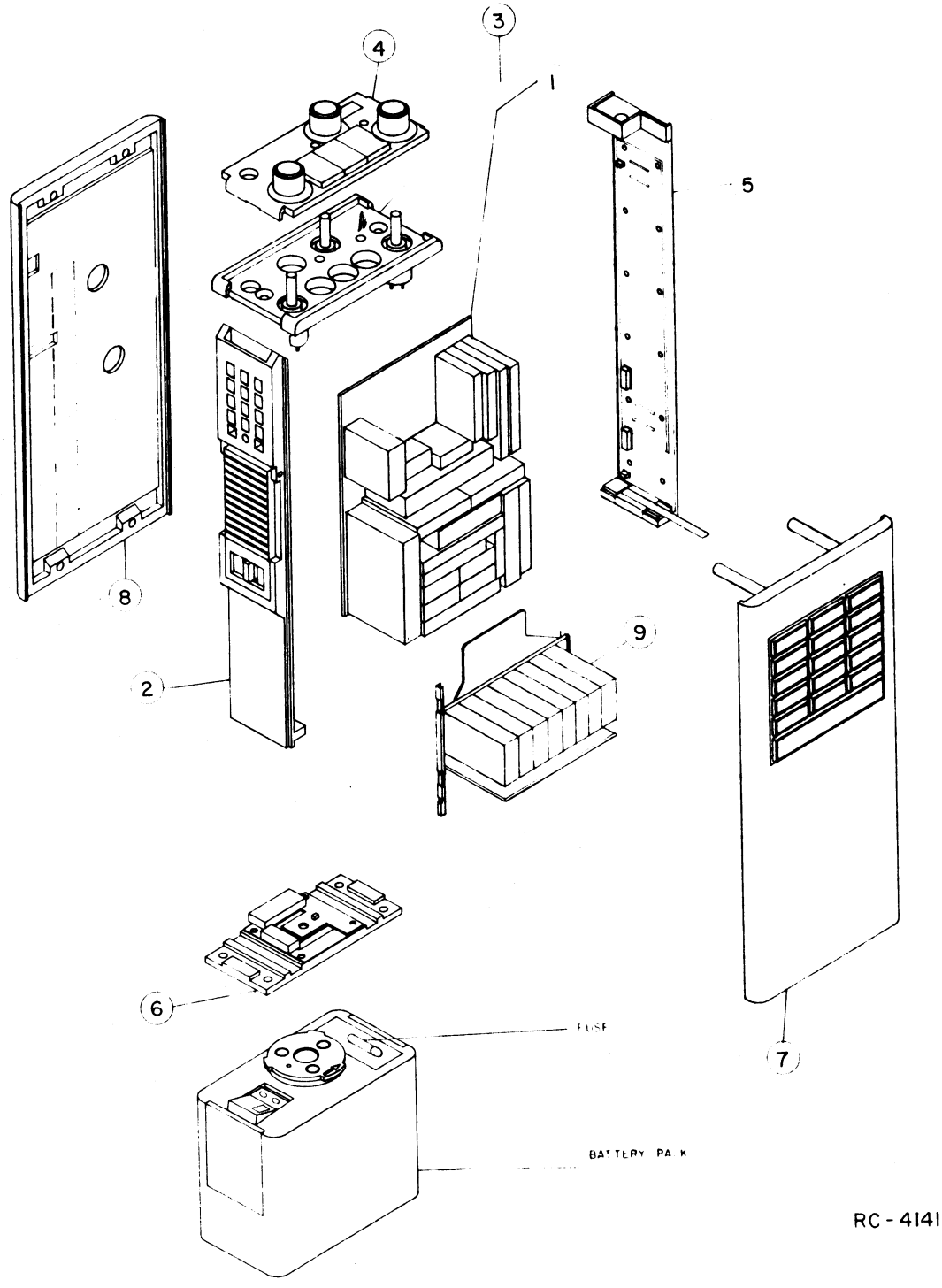
The buried layers of printed wire pattern on the system board limits circuit pattern tracing for troubleshooting, to DC distribution. A technician must rely on the schematic diagram, outline diagram and other troubleshooting aids provided in this manual.

Controller Assembly

The Controller Assembly consists of a ten position channel select switch, mounted on the control assembly, and connected through a printed wire board, mounted in the right side rail, to a diode controller board. The diode controller board plugs into an oscillator controller board and provides programming ability for repeat frequencies and option control. The oscillator controller board provides eight receive oscillator modules. The oscillator controller board is connected to the system board by a printed wire board.

Control Assembly

The Control Assembly consists of a molded Lexan® side rail, a molded Lexan® top plate and a flexible wiring harness. 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, rotary channel select switch and an Optional red LED transmit indicator. Three toggle switches and a rotary switch are also available for option control.



1. Radio Assembly
2. Control Side Rail Assembly
3. Top Plate Assembly
4. Top Cover Assembly
5. Right Side Rail Assembly
6. Base Assembly
7. Front Cover Assembly
8. Back Cover Assembly
9. Oscillator Controller Assembly

Figure 1 - MPX Assemblies

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 identification 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 MPX 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 MPX 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 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 exciter and 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 may also be present.

Battery Pack Assembly

The Battery Pack Assembly consists of a molded Lexan ease and side 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 a side slide. The side slide on the opposite side of the case is for decorative purposes only.

Assembly

The control side rail and system board are interconnected by the control side flexible wiring harness. The top plate and oscillator controller board are interconnected by a flexible wiring harness 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. The system board and oscillator controller board are nested between shock pads in the side and base assemblies. After all modules are plugged into the boards, 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 MPX 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. If the radio has two receive channels, place the channel select toggle switch into the desired position. Your MPX 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.

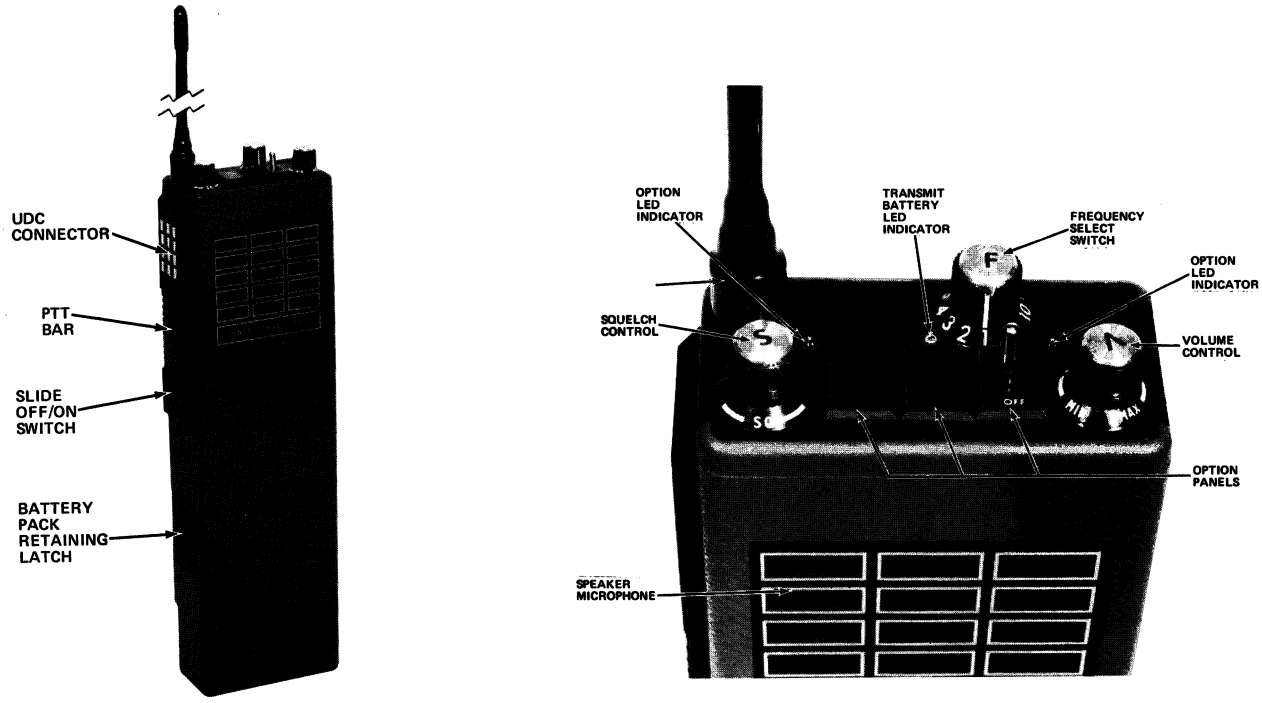


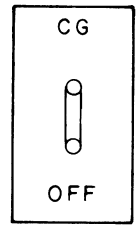
Figure 2 - Operating Controls

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.

CHANNEL GUARD OPTIONS

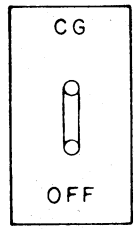
If your radio is equipped with a Channel Guard (CG) option, you have, on the control panel, a two position switch labeled CG-OFF. With the switch in the CG position the decoder permits you to hear only those calls that are tone-coded on your Channel Guard frequency. The encoder permits you to communicate 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 or observe the optional LED Carrier activity indicator to insure no one is using the channel.

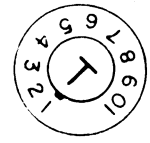


Multiple Tone Channel Guard

If your radio is equipped with a Multiple Tone Channel Guard option, you have, on the control panel, a two position switch labeled CG-OFF and possibly a rotary switch labeled T and graduated 1 through 10. 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.

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 or observe the optional LED Carrier activity indicator to insure no one is using the channel.





REPLACEMENT OF BATTERY PACKS

To remove the battery pack from the radio:

1. Turn the radio OFF.
2. Pull the battery pack retaining latch down away from 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 3.

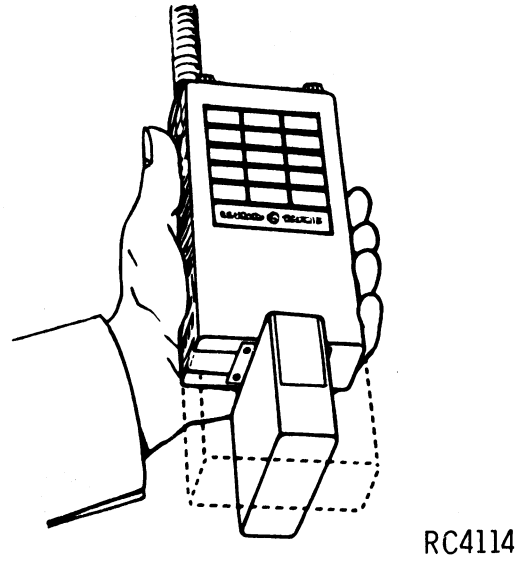


Figure 3 - Battery Pack Replacement

2. Align the large tab marked with an arrow on the battery pack connector with the large cut-out on the radio socket.
3. Press the battery pack connector into the socket on the radio and turn the battery pack one-quarter turn to the right until the latch clicks.

RE-CHARGING BATTERY PACKS

The MPX radio may be equipped with an optional battery pack transmit voltage LED indicator. This indicator blinks rapidly while transmitting with a fresh charged battery pack. If 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 MPX 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 may be obtained by insuring the antenna is vertical. Moving a few meters in another direction or moving to a higher elevation may also improve communication.

SYSTEM ANALYSIS

General Electric's MPX 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 transmit, receive, voltage regulation and option circuits. A flexible printed wire board folds around the system board to make all interconnections between the system board and radio controls.

All control leads for the MPX radio are "barred", such as $\overline{PTT}$. This means the lead is in a low voltage condition when the function name is true. For example, $\overline{PTT}$ 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.

TRANSMIT CIRCUIT

The MPX transmit circuit, as shown in Figure 4 - Block Diagram, consists of the following integrated circuit modules:

Audio Processor (TX-AA)

Offset Oscillator Module (TX-0X0)

Phase-Lock-Loop (PL)

Voltage Controlled Oscillator (VO)

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 5). Normally, audio is accepted from the external microphone unless the $\overline{PTT}$ lead is in a low voltage condition. The $\overline{PTT}$ 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. 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 $\overline{MIC\ MUTE}$ at

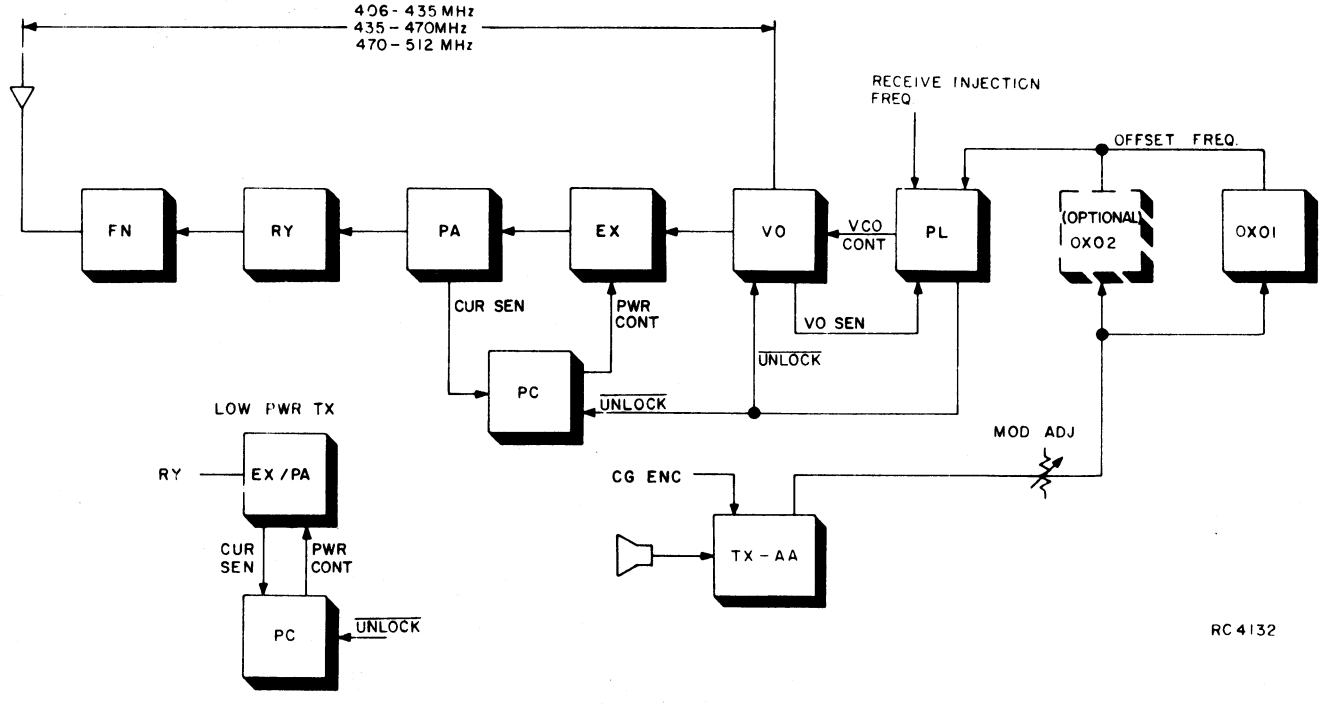


Figure 4 - Transmit Circuit Block Diagram

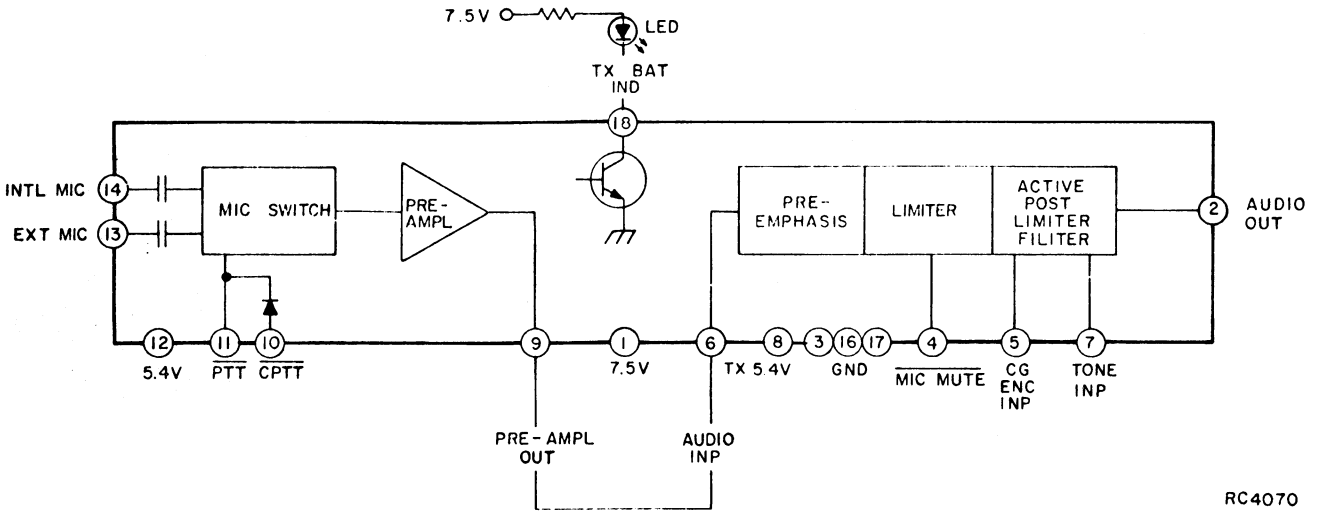


Figure 5 - Audio Processor

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 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 MOD ADJ pot R904 to the inputs of the Oscillator modules designated AUD INP at Pin 7.

An Optional 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.

Offset Oscillator Module (TX-0X0)

The offset oscillator module is self-contained and FM modulated (see Figure 6). A high-Q Series resonant circuit oscillates at the crystal fundamental frequency (14.85-28.1 MHz).

A frequency stability of 15 PPM from -30 C° to +85°C is determined by the "S" shaped temperature characteristic of the crystal. Crystals are specified so the frequency error does not exceed 15 PPM throughout the temperature range.

RF output of the oscillator circuit, on Pin 3 of the module, is typically one milliwatt into a 400 ohm load.

The module frequency is trimmed to customer frequency using a slug tuned coil molded into the oscillator header.

Audio modulation from the audio processor is DC coupled to Pin 7 of the oscillator module with an input impedance of 120K ohms between Pin 7 and ground.

The modulation sensitivity is .72 volts/kHz, for the oscillator circuit.

The modulated output of the offset oscillator module is connected to Pin 10 of the phase lock loop module.

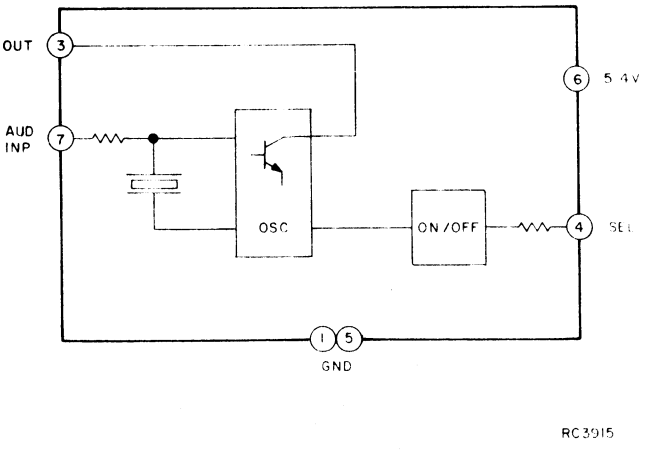


Figure 6 - Cffset Oscillator Module

Phase Lock Loop Module (PL) and Voltage Controlled Oscillator Module (VO)

The phase lock loop module and the voltage controlled oscillator module, using the offset oscillator frequency and the receive circuit injection frequency generates and controls the transmit RF carrier frequency.

Initially, when the transmit circuit is keyed, a ramp generator circuit in the PL module applies a ramp voltage from Pin 6 of the PL module to Pin 5 of the VO module (see Figure 7). This voltage causes an oscillator in the VO module to sweep across the entire frequency range of the split. The frequency output of the VO module is looped back from Pin 3 to Pin 4 of the PL module and applied to an input of a mixer circuit. The receive circuit injection frequency is connected to Pin 2 of the PL module and is also applied to an input of the mixer circuit. The difference between the VO frequency, on P4 of the PL module, and the receive circuit injection frequency, on Pin 2 of the PL module, is applied to the input of a phase detector circuit. When the offset oscillator frequency and the difference between the VO frequency and the receive circuit injection frequency are the same, the phase detector circuit shuts the ramp generator down. DC voltage from the phase detector (2 to 5 Volts DC) completes the loop back from Pin 6 of the PL module to Pin 5 of the VO module, holding the RF carrier at the desired frequency. Simultaneously, the phase detector circuit pulls the unlock lead to a high voltage state. The unlock lead is connected from Pin 7 of the PL module to Pin 6 of the VO module and Pin 1 of the Power Control Module (PC). When the $\overline{\text{UNLOCK}}$ lead goes high, a gate in the VO module opens allowing a minimum of 50 milliwatts of RF drive to be applied from Pin 9, of the VO module, to Pin 11 of the transmit Exciter module (EX).

The $\overline{\text{UNLOCK}}$ lead high, on Pin 1 of the PC module, turns on the supply voltage to enable the first stage in the EX or EX/PA.

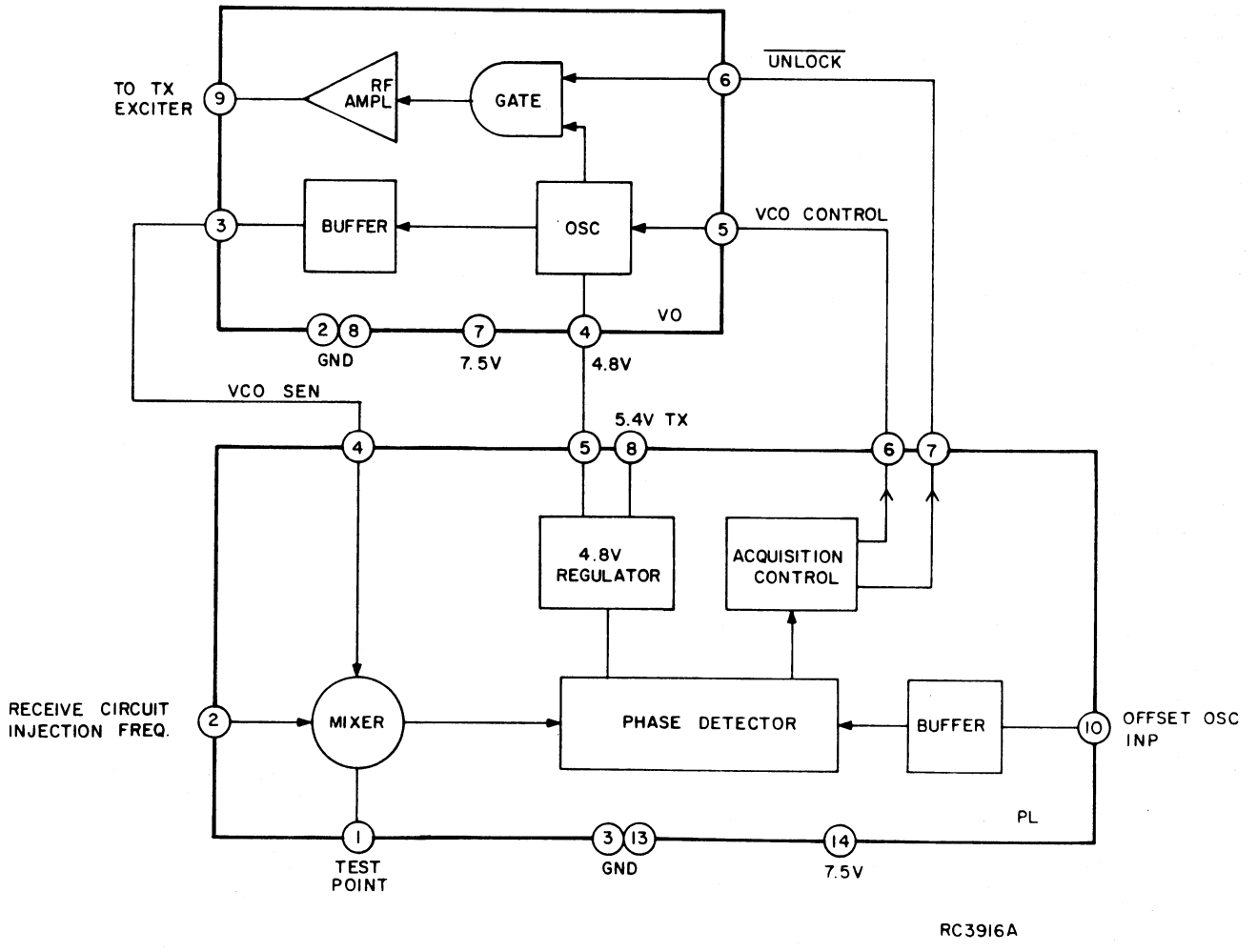


Figure 7 - Phase Lock Loop and Voltage Controlled Oscillator

The complete phase lock occurs, typically, within five milliseconds from the activation of the PTT bar.

If at any time the phase lock loop should break lock, the transmit output will immediately be inhibited by the phase detector, pulling the UNLOCK lead to a low state.

If an oscillator module should fail, the phase detector will continue sweeping the VO module, but will not enable the transmit output stages.

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 9 of the VO module to Pin 11 of the EX module is coupled to the input of the first RF amplifier stage (see Figure 8), where it is amplified to approximately 550 milliwatts. The second RF amplifier stage amplifies the 550 milliwatts to approximately 2.0 watts. The 2.0 watts output from Pin 1 of the EX module is connected to Pin 8 of the Power Amplifier Module (PA).

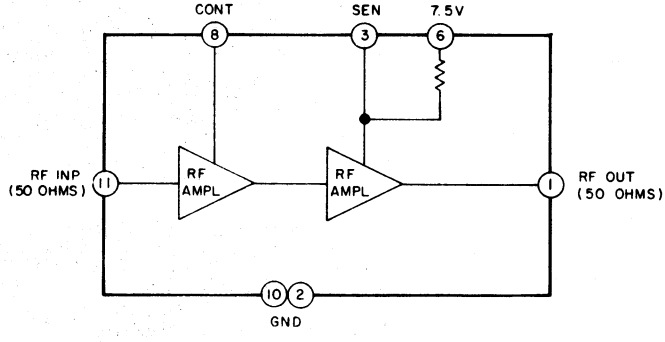


Figure 8 - Exciter

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, 2.5 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 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 9).

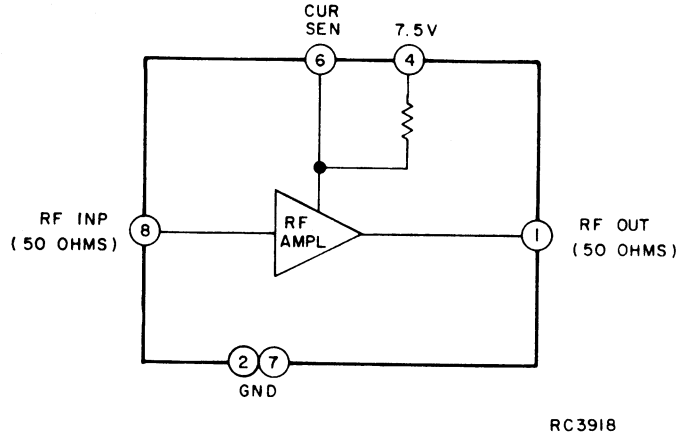


Figure 9 - Power Amplifier

The RF power amplifier stage amplifies the 2 watt input from the EX module to a minimum power output level of 4 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) for a minimum of 4 watts on the output of the FN module.

Power Control Module (PC)

The RF power output of the MPX 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 UNLOCK lead at Pin 1 of the PC module must be high, indicating that the VO is running on the correct operating frequency.

When the transmit circuit is keyed, the output of a reference generator determined by the HI PWR ADJ control, is applied to the positive (+) input of a comparator amplifier (see Figure 10). 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 UNLOCK lead goes high. Until then, the output of the amplifier is high and the series regulator is held off. When the 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.

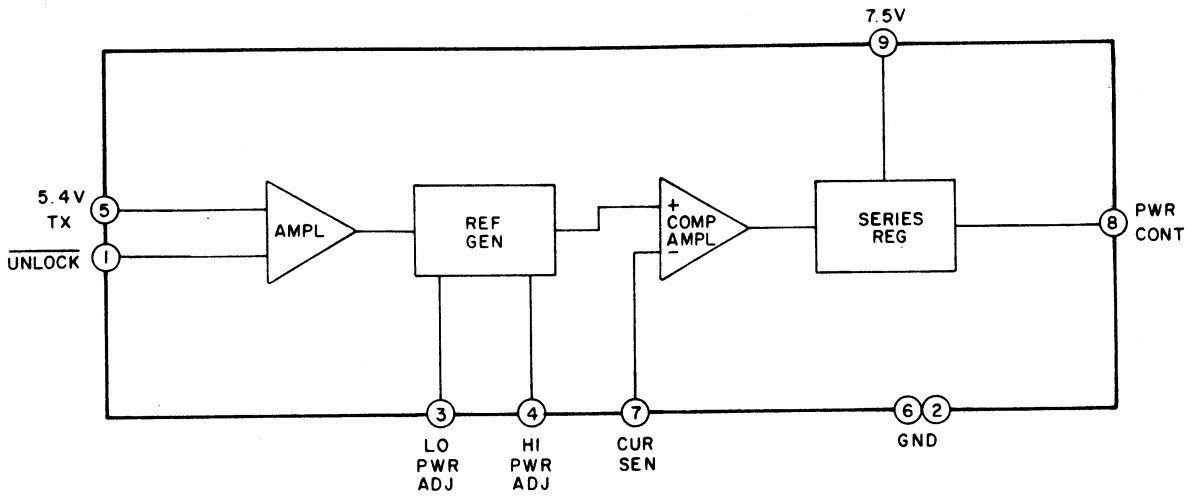


Figure 10 - Power Control

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 406 - 512 MHz. It also has a rejection of greater than 30 dB in the stop band range of 812 - 5120 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 60 or 90 seconds can be obtained by replacing the printed run between H907 and H908, on the system board, with a resistor (see Figure 11).

Keying the transmit circuit causes the $\overline{\text{PTT}}$ lead on Pin 8, of the CT module to go low and start the time-out timing sequence. When the time period for the transmit interrupt has elapsed, a time-out signal to the regulator circuit unkeys the transmit circuit. The $\overline{\text{SQ OVERRIDE}}$ 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 long as the PTT bar is pressed. A momentary release of the PTT bar resets the CT module.

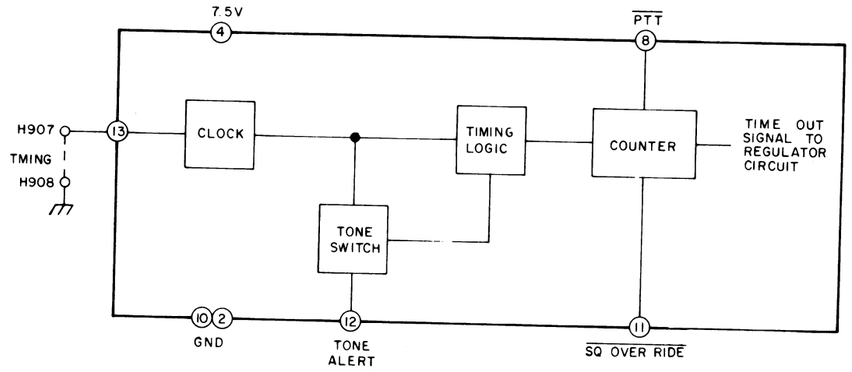
RECEIVE CIRCUIT

The MPX receive circuit, as shown in Figure 12 consist of the following integrated circuit modules:

Oscillator Module(s) (RX-XO)
Frequency Multiplier Module (FX)
Filter Network (RX-FN)
RF Amplifier/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)
Optional Channel Guard Module (CG)
Optional Search Lock Monitor Module (SP)

Oscillator Module (RX-XO)

The oscillator module is self-contained and fully temperature compensated (see Figure 13). A basic colpitts fifth mode oscillator circuit operates in the frequency



TMING	RESISTOR VALUE CONNECTED BETWEEN H907 AND H908	GE PART NO.
60 SECONDS	430K	3R151F434J
90 SECONDS	820K	3R151P824J

RC3723A

Figure 11 - Carrier Controlled Timer

range of 53 to 76 MHz. The output of the oscillator circuit is connected through a cascade common base buffer circuit to Pin 3 of the module. The output is typically 1 milliwatt.

Temperature compensation for the oscillator circuit is achieved by biasing a voltage variable capacitive diode with a correction voltage. The correction voltage is derived from a "S" shaped, correction voltage vs temperature curve.

The frequency of the oscillator module is trimmed using a slug tuned coil molded into the oscillator header providing a multiturn resolution.

The output of the oscillator module is connected to Pin 3 of the frequency multiplier module (FX).

Frequency Multiplier Module (FX)

The frequency multiplier module multiplies the oscillator frequency by six. The oscillator frequency on Pin 7 of the multiplier module is amplified and multiplied by a buffer and multiplier stage (see Figure 14). A slug tuned coil molded into the header of the module provides interstage matching. A test point is provided for this adjustment. Two helical resonators provide output filtering of the +7 dBm injection signal to the receiver converter module (RC).

During transmit, a bias current supplied from the transmit PL module, forward biases a diode in the FX module and couples a portion of the injection signal to the second output for use in controlling the transmit frequency.

RF Amplifier/Receive Converter Module (RA/RC)

The RF Amplifier/Receiver Converter module contains five helical resonators, tuned for best receive circuit quieting, an RF amplifier circuit and a passive doubly balanced, diode mixer circuit (see Figure 15).

RF from the antenna is coupled through transmit low-pass filter FN and antenna relay RY to the input of the RA/RC module. Low-pass filter FN is used in the receive circuit because of the 3rd mode response at the helical resonators in the RA/RC module. The low-pass filter also provides additional selectivity for the receive circuit.

The RF signal on the input of the RA/RC module is coupled through two helicals 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 a double balanced mixer circuit. The 406 to 512 MHz RF signal or the RF input of the RA/RC module, and the 384.6 - 480.6 MHz low side injection frequency, on the injection frequency input, provides a difference of 21.4 MHz as an IF on the output.

The RC has a typical conversion loss of 6 dB between the RF input and the IF output.

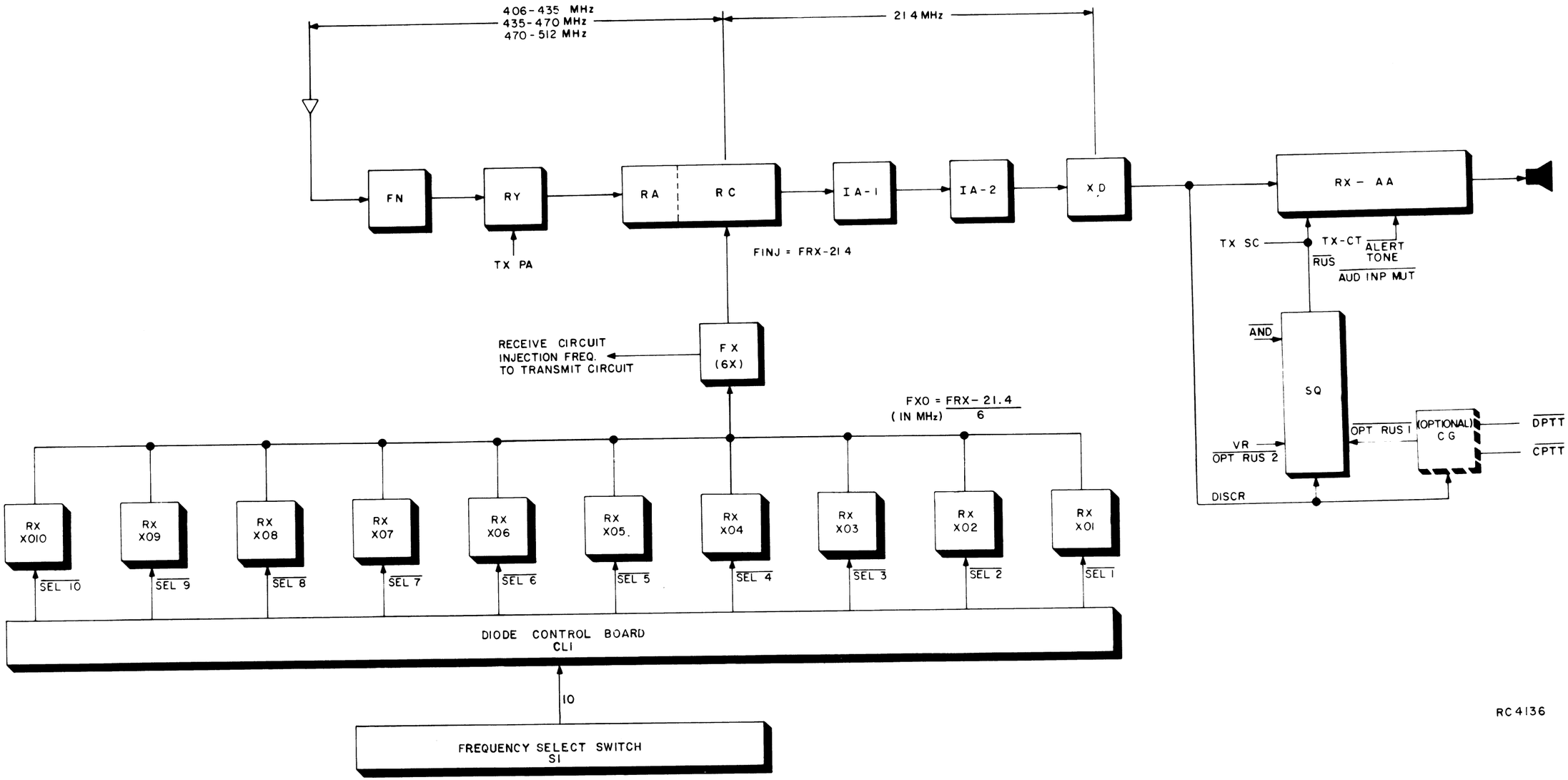


Figure 12 - Receive Circuit

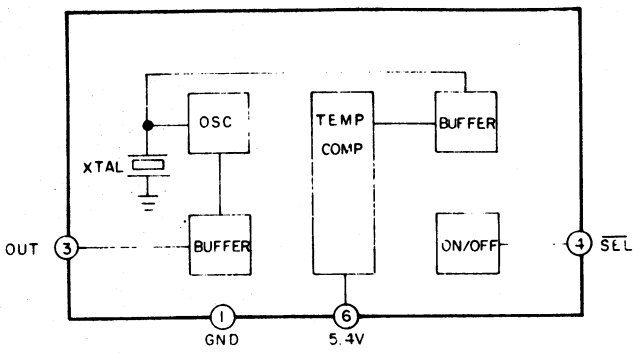


Figure 13 - RX Oscillator

All inputs and output of the RA/RC module have 50 ohm impedances. The +7 dBm injection frequency level, provided by the FX module, is connected to the injection frequency input through a 50 ohm Coax Cable.

The output of the RA/RC module is connected to the input of IF pre-amplifier (IA-1).

IF Pre-amplifier Module (IA-1)

The IF Pre-amplifier module contains an amplifier circuit and a four pole crystal filter (see Figure 16). 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.

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 80 dB gain. The discriminator module also contains a crystal resonator, audio detector circuit and audio amplifier circuit (see Figure 17). 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 and buffered to a 1K impedance 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.

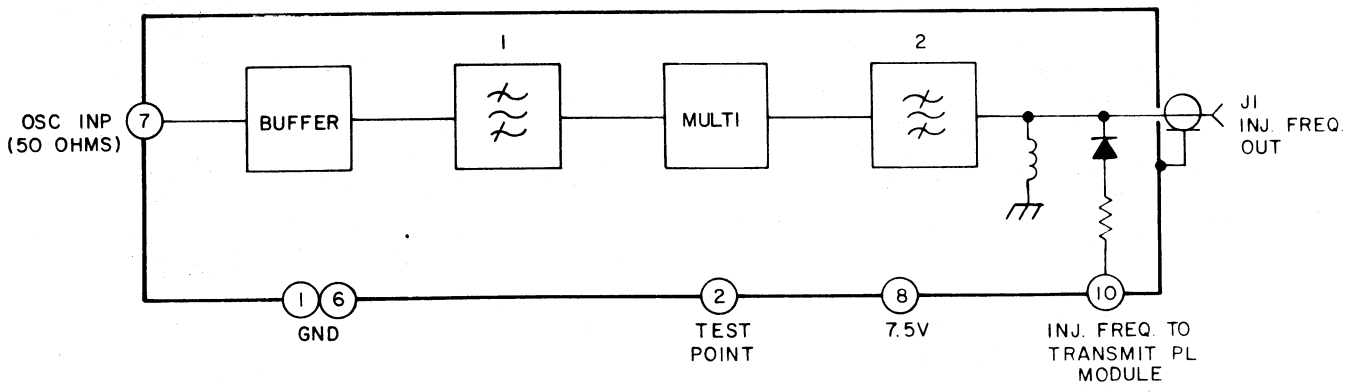


Figure 14 - Frequency Multiplier Module

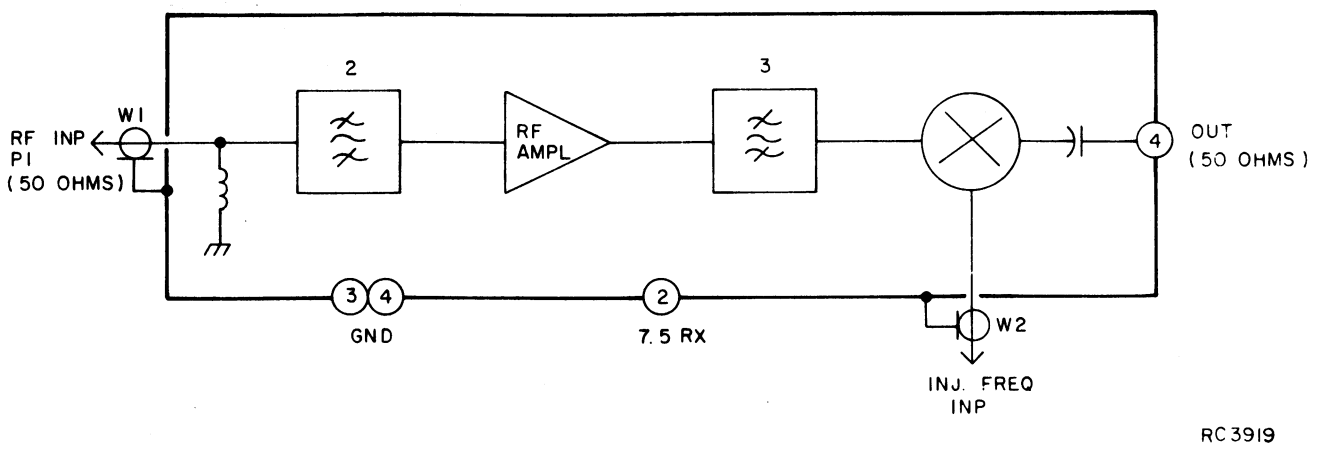


Figure 15 - RF Amplifier/Receive Converter Module

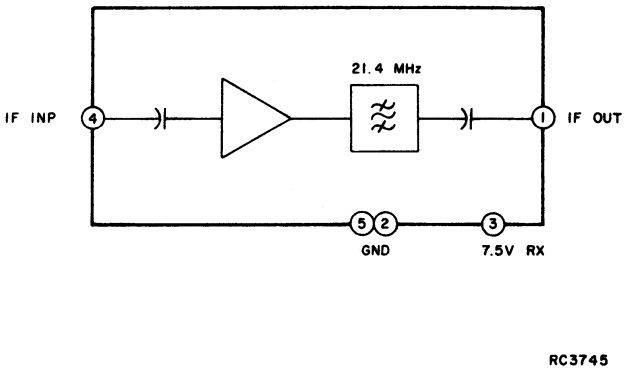


Figure 16 - IF Amplifier

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 18). Audio from the DISC 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.

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. The $\overline{\text{RX-AA MUTE}}$ lead shuts down the current to the power audio amplifier muting the audio output and is used with a priority Search Lock Monitor option (PSLM). The $\overline{\text{AUD INPT MUTE}}$ signal lead is also used with the PSLM option and mutes audio from the discriminator approximately 65 dB preventing popping during priority channel search.

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 19).

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 $\overline{\text{SQ}}$ lead. The control voltage is from 2.5 to 4.5 VDC with the $\overline{\text{SQ}}$ 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 $\overline{\text{FAST SQUELCH}}$. 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 performs 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.

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

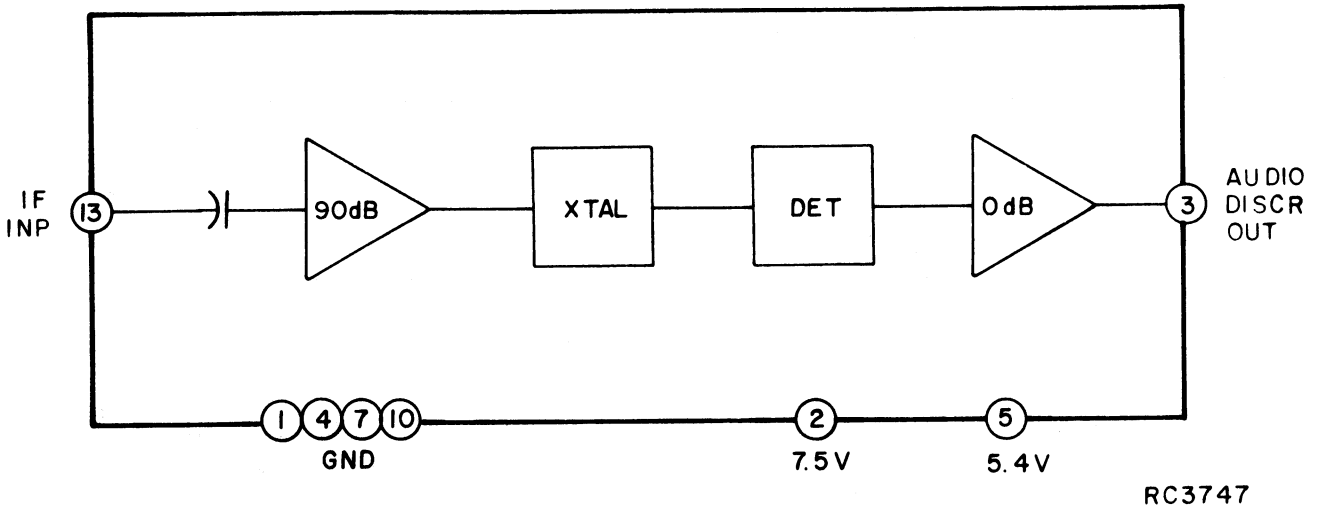


Figure 17 - Crystal Discriminator

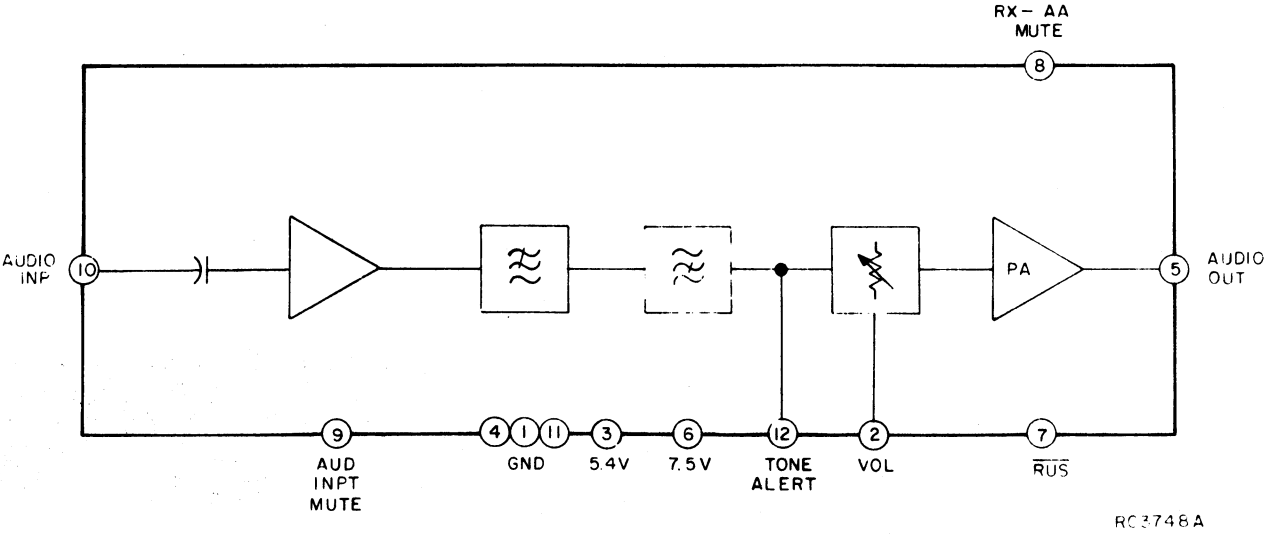


Figure 18 - Audio Amplifier

Optional Channel Guard Module (CG)

The Channel Guard module contains a tone frequency synthesizer, encoder, decoder and Squelch Tail Eliminator circuitry (see Figure 20). The synthesizer is programmable to produce Channel Guard tones from 67 to 210.7 Hz in 0.25 Hz increments. The synthesizer uses a crystal controlled 32.768 Hz reference to produce the desired clock inputs to the encoder and decoder circuits and produce digitally generated time delays for the STE circuitry.

When the transmit circuit is keyed, the $\overline{\text{CPTT}}$ lead is pulled low and the Channel Guard module responds by pulling the $\overline{\text{DPTT}}$ lead low, holding the transmit circuit in a keyed condition. The encoder circuit generates a sine wave encode tone which passes through a low pass filter to remove any clock and tone harmonics. This output tone is connected by the CG ENC lead to the transmit audio processor module (TX-AA).

When the radio is unkeyed, the $\overline{\text{CPTT}}$ lead goes high but the PTT delay circuit holds the transmit circuit in a keyed condition for an additional 160 milliseconds by holding the $\overline{\text{DPTT}}$ lead low during this time. During this 160 millisecond time, the encode circuit sends the tone with a 135° phase shift. This combination of 135° phase shift and 160 millisecond delay causes the CG decoder in other receivers to squelch the receiver audio prior to loss of RF signal. This reduces or eliminates the receiver noise burst.

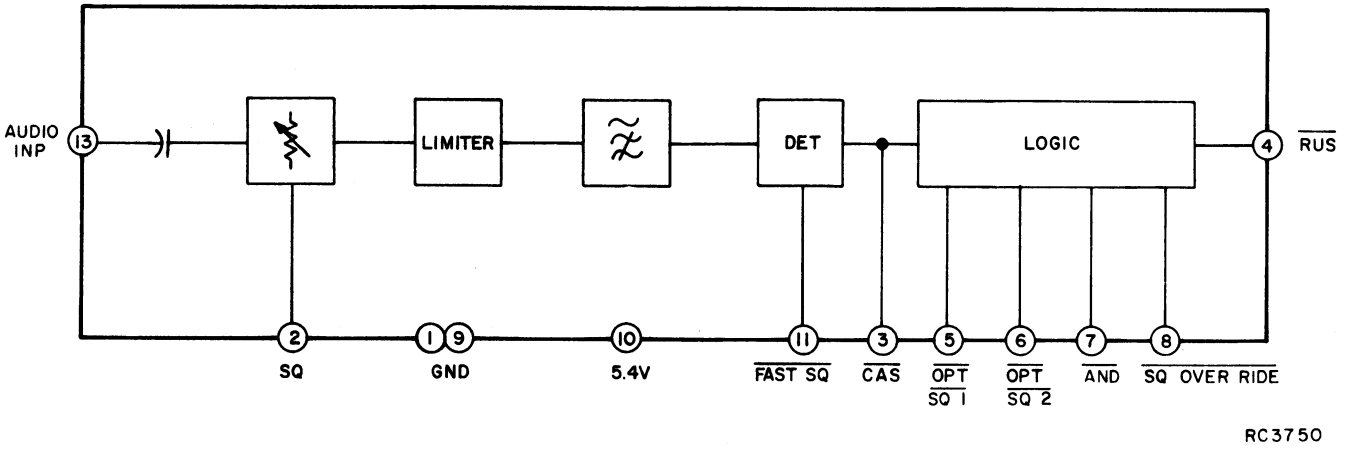


Figure 19 - Squelch

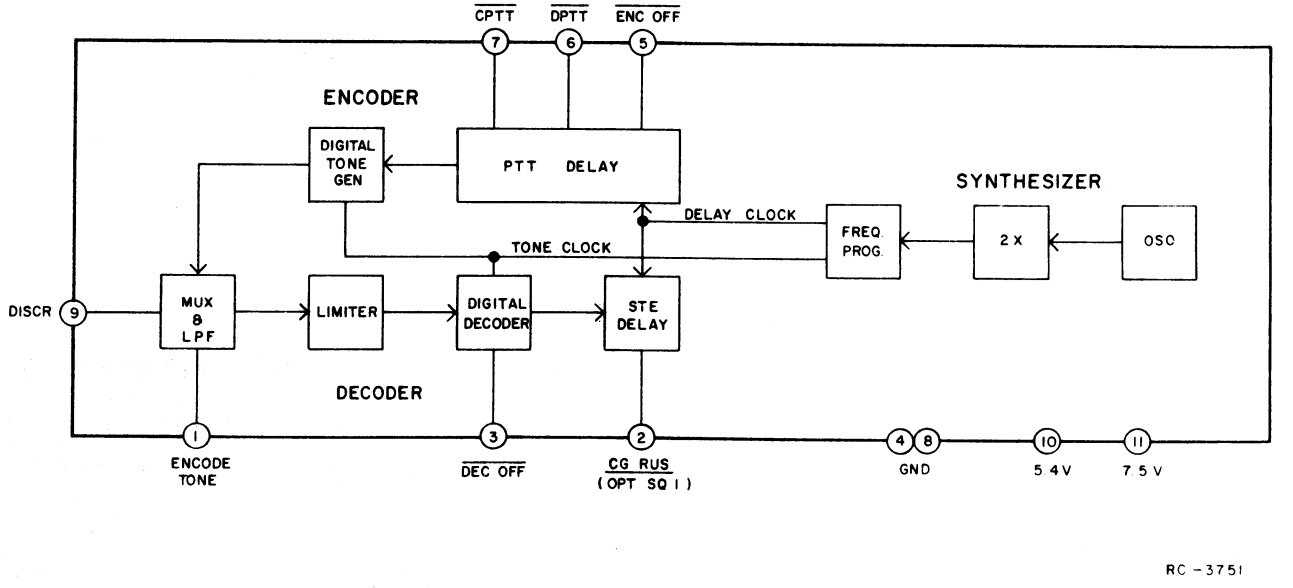


Figure 20 - Channel Guard

During receive, the receive circuit audio on the DISCR lead is fed to the CG module where it passes through a 212 Hz low pass filter to remove voice information. This prevents voice falsing or clipping in the decoder circuit. The digital decoder compares the frequency of the incoming tone to a reference clock produced by the synthesizer. If the correct tone is detected, the module responds by releasing the CG RUS lead which is normally held in a low voltage condition when the correct tone is not detected.

After decoding the tone, the decoder then looks for a phase shift to occur. If the phase shift occurs, the decoder responds by pulling CG RUS low for 200 milliseconds using the STE delay circuit. This forces the receive circuit to squelch for 200 ms during which time the received carrier should disappear.

CONTROLLER CIRCUIT

The MPX Controller Circuit consists of eight receive oscillator modules (RX-XO) and a diode controller board (CL1). Ten position channel select, rotary switch, S1, connects through a printed wire board in the right side rail to diode controller board (CL1). The input leads of S1 connect through the diode controller board to control ten oscillator module keying leads.

POWER DISTRIBUTION

Power for the MPX is supplied by a 7.5 Volt battery pack connected to connector J702 (see Figure 21). 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 printed wire board to the system board for distribution. All distribution leads are on the back side of the multi-layered system board.

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. During transmit, an additional regulated 4.8 Volts is generated by the PL module to run the VO module. 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 resistor R903 to the receive RF amplifier module (RA), frequency multiplier module (FX), IF amplifier modules (IA-1 and IA-2) and discriminator module (XD).

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 22). 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.

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 suitable 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.

BATTERY PACK

Two battery packs, one with 750 mAh capacity and one with 1200 mAh capacity are available for use with the MPX 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 temperature 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 MPX 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.

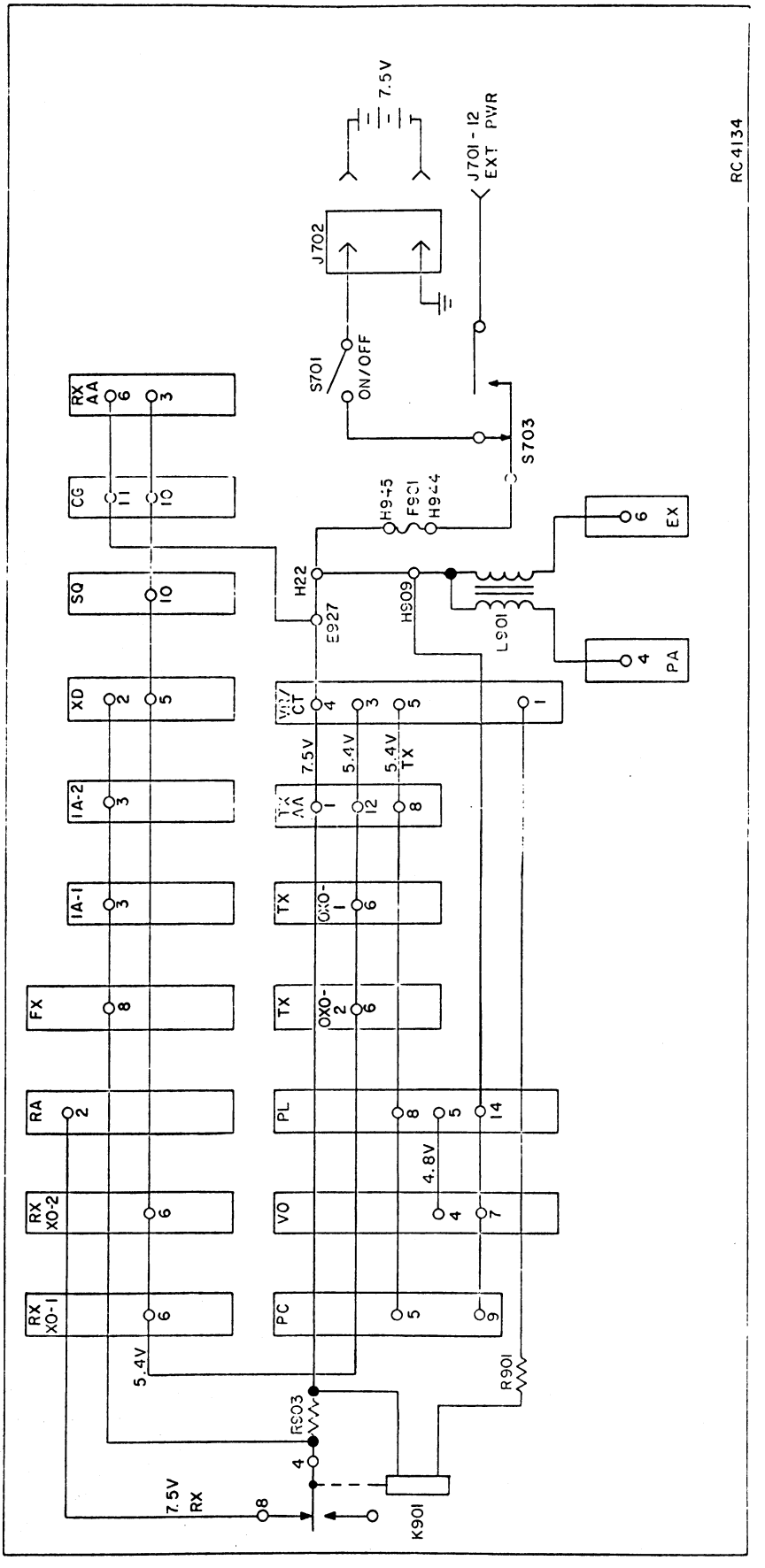


Figure 21 - Power Distribution

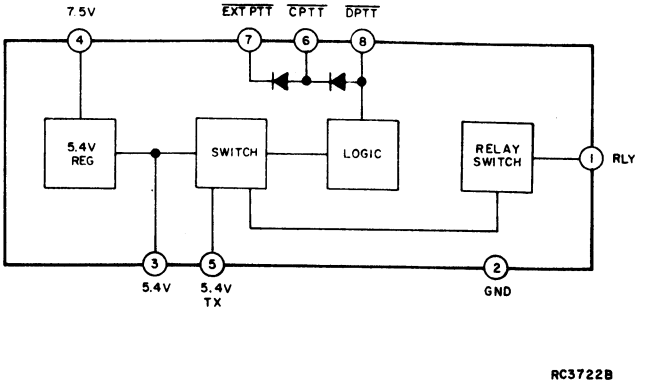


Figure 22 - Voltage Regulator

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 MPX series 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 $\frac{T}{60} = \%$ 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:

$$\frac{50}{60} = .83 \text{ (percentage of capacity)}$$

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

$$.83 \times 750 \text{ mA} = 622.5 \text{ mAh}$$

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.

GAIN MEASUREMENT

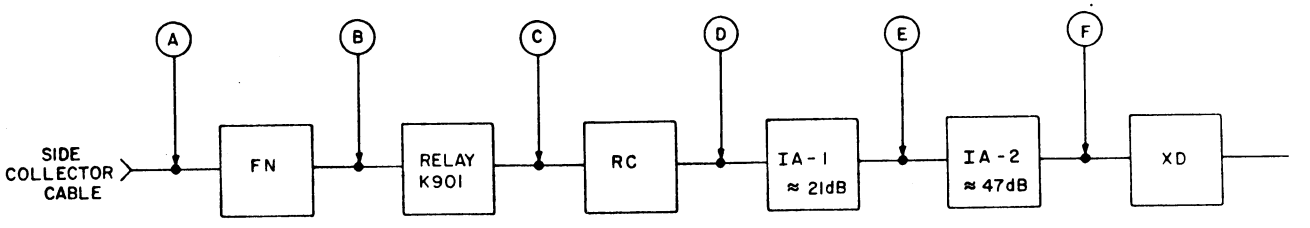
UHF AND 800 MHz

Connect an RF generator to the side connector test cable. Set the generator output for the receive frequency at 10 millivolts. Measure the level at the input to the IA-2 module with an RF voltmeter. If this voltage is good, (refer to chart below) measure the gain level at the output of the IA-2 module. If this voltage is low, replace the IA-2 module. If this voltage is good, replace the XD module.

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 mAh	10 ohms 8 Watts	6 VDC
19D429777G1 (6 cells)	1200 mAh	1200 mAh	6.25 Ohms 12 Watts	6 VDC

If the voltage at the input of IA-2 is low, check the gain of the receive front end and IA-1 as described below.



RC4238

UHF AND 800 MHz GAINS
(typical)

A. 10 millivolts
B. 10 millivolts
C. 10 millivolts
D. Can not be measured
E. 26 millivolts
F. 266 millivolts (Max ≈ 300 millivolts)

Sensitivity Check:

Unplug the receive front end modules, RC and FX. Connect a 21.4 MHz IF generator to the input of IA-1. Measure 12 dB SINAD. SINAD should be 0.11 uV @ 21.4 MHz. With the RC and FX modules plugged in and the RX-OX module removed, the SINAD should be 0.14 uV.

If these measurements are good, replace the receive front end modules RC and FX. If these measurements are not good, check the gain of IA-1 as described below.

IA-1 and IA-2 Gain Check:

With the receive front end modules, RC and FX removed and a 21.4 MHz IF generator connected to the input of IA-1, set the generator output level to 40 millivolts, as read on the RF voltmeter, at the output of IA-1. Move the voltmeter to the input of IA-1. Increase the generator output level until the voltmeter again reads 40 millivolts. The difference in the two generator settings should be approximately 21 dB. If this gain is low replace IA-1.

The gain of the IA-2 module can also be measured using the same method as with IA-1. The gain of this module should be approximately 47 dB.

CONTROL LEADS

$\overline{\text{AND}}$ - 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.

$\overline{\text{CAS}}$ - Carrier Activity Sensor goes low when the noise squelch is open. This does not mean the receiver audio can be heard.

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

$\overline{\text{DEC OFF}}$ - 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.

$\overline{\text{DLY ON}}$ - Delays the resumption of search by the SP until the radio is squelched.

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

$\overline{\text{ENC - OFF}}$ - A low on this lead turns off a Channel Guard encoder off.

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

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

$\overline{\text{FIXED PRI}}$ - When low, priority channel is fixed. When high, the priority channel is set by the channel select switch.

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

$\overline{\text{MIC MUTE}}$ - 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.

$\overline{\text{OPT SQI}}$ - 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.

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

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

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

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

$\overline{\text{SEL-1}}$ through $\overline{\text{SEL-10}}$ - A low on this lead indicates channel one has been keyed.

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

$\overline{\text{SRCH ON}}$ - A low on this lead turns the SP on.

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

$\overline{\text{VOX OFF}}$ - A low on this lead defeats VOX.

MODIFICATION KIT 19A144704

These instructions cover the installation of the 19A144704 Modification Kit when using the carrying accessory options.

The small rubber strip is provided in this accessory kit to prevent rattling or "clicking" noises in the assembly when in use as a means to carry a personal radio. Assembly of the rubber strip is optional, and will not affect the normal function of the carrying accessory. The only purpose is to prevent the impact noise when the assembly is worked by normal moving stresses during carrying of the radio unit.

Installation Instructions:

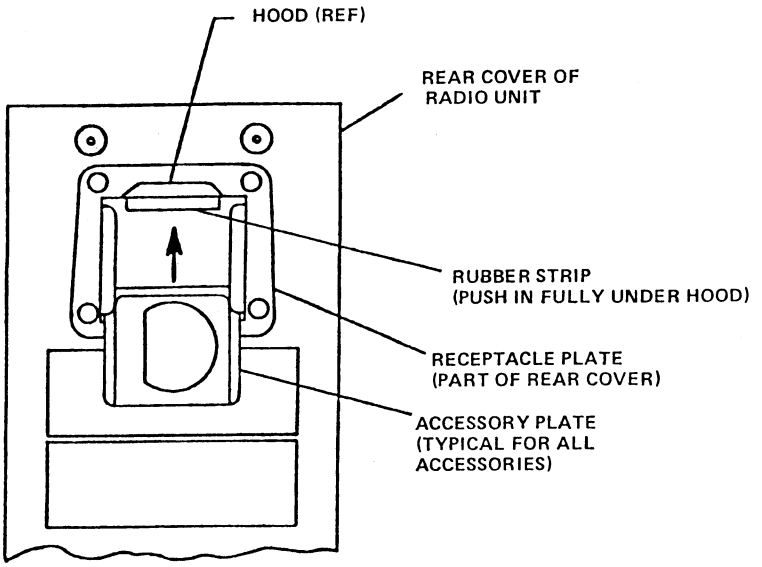
1. Force the rubber strip under the "hood" at the top of the receptacle plate mounted to the radio.

When the accessory plate (part of any of the carying accessory kits available for use with personal radios) is assembled it will compress the protruding rubber and remove the slack from the assembly. Continue to force the accessory plate against the rubber until it "snaps" in place and is securely captivated.

NOTE

If difficulty is experienced with forcing the strip under the hood it may be necessary to pry up the hood slightly, with a flat blade screwdriver, in order to flatten burrs or remove deformation which may interfere with the insertion of the rubber strip.

PARTS LOCATIONS DIAGRAM



RC 4969

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

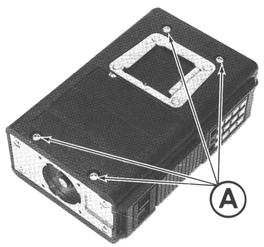
GENERAL ELECTRIC* U.S.A.

DISASSEMBLY PROCEDURE

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

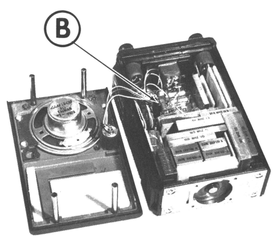
EQUIPMENT REQUIRED

- TORX® T8 Driver for back cover screws.
- Small Phillips-head screwdriver.
- Small flat-blade screwdriver.
- Needlenose pliers.
- Allen-head wrench for removing set screws.
- Pencil-type soldering iron (40-60 watts) with a fine tip.
- De-soldering tool such as a SOLDA PULLT®.



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.

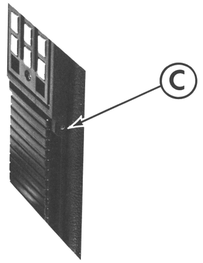


STEP 2.

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).

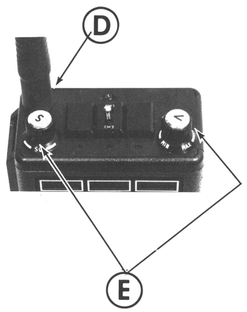
STEP 3.

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



STEP 4.

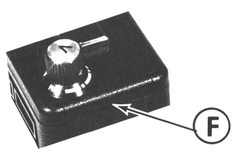
To replace the speaker and microphone remove the four screws holding the speaker retaining plates and remove the speaker. The microphone is held in place only by the rubber mike boot and can easily be removed.



STEP 5

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

Loosen set screws at (E) and remove knobs. With a flat-blade screw driver snap top cover off at (F). The slotted nuts holding the controls are easily accessible.



STEP 6

To remove modules from the system board, remove both front and back covers.

Plug-in modules can be removed by using a simple bent paper clip as a tool to push the module from the board. A number 64 drill bit in a pin vise makes a sturdier and more permanent tool. A piece of .036 steel wire can be used in place of the drill bit. 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 paper clip, insert it into the ground pin of the module to be removed (G) 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 (H).

WARNING

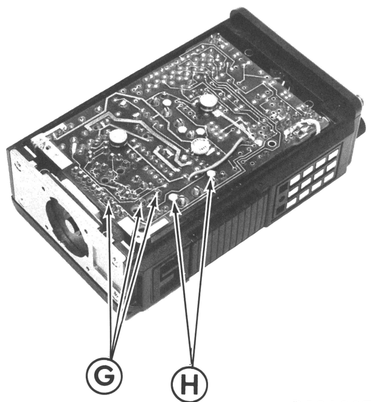
Modules are expensive and can be damaged by excessive heat or mishandling. It is recommended that extensive troubleshooting be performed before replacing any soldered-in module. Refer to the Troubleshoot Procedures listed in the Table of Contents of this publication.

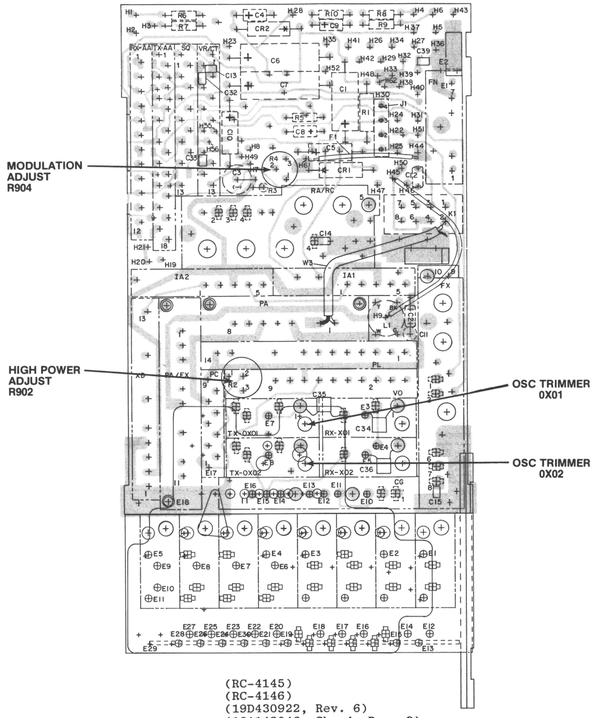
To remove a soldered-in module, hold the soldering iron against the bottom of the printed circuit board to melt the solder holding the module lead.

Remove the melted solder from the lead(s) with the de-soldering tool.

When the solder has sufficiently been removed from the lead(s), the flat blade screwdriver may be used to break loose any residual solder and remove the component from the board.

Solder in the new component on the bottom side of the board using the small pencil tip on the soldering iron.





(RC-4145)
(RC-4146)
(19D430922, Rev. 6)
(19A143046, Sh. 4, Rev. 3)

TRANSMIT CIRCUIT ALIGNMENT

EQUIPMENT

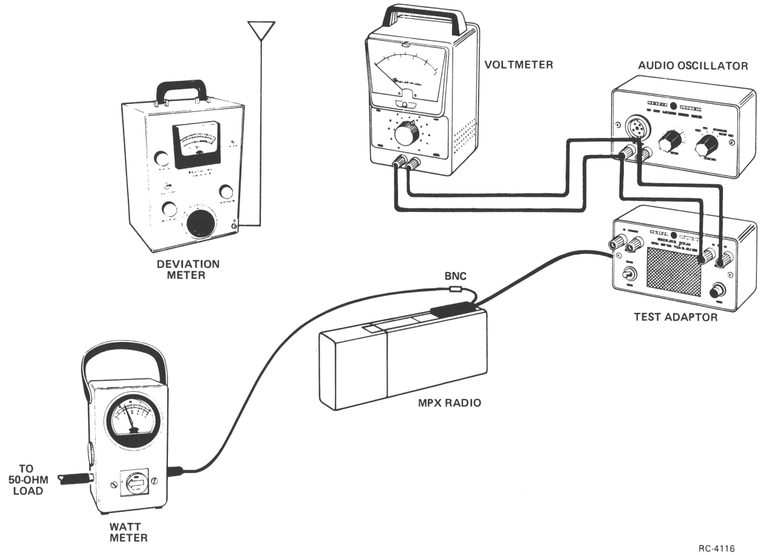
1. General Electric Test Adapter 4EX12A11.
2. General Electric Audio Generator 4EX6A10.
3. General Electric Battery Pack Eliminator 19C328969G1.
4. Regulated Power Supply, set at 7.5 VDC and capable of 3 amperes, connected to the Battery Pack Eliminator.
5. Ammeter, capable of 3 amperes, in series with the power supply and Battery Eliminator.
6. Deviation meter.
7. 50 ohm terminating wattmeter.
8. Frequency Counter.

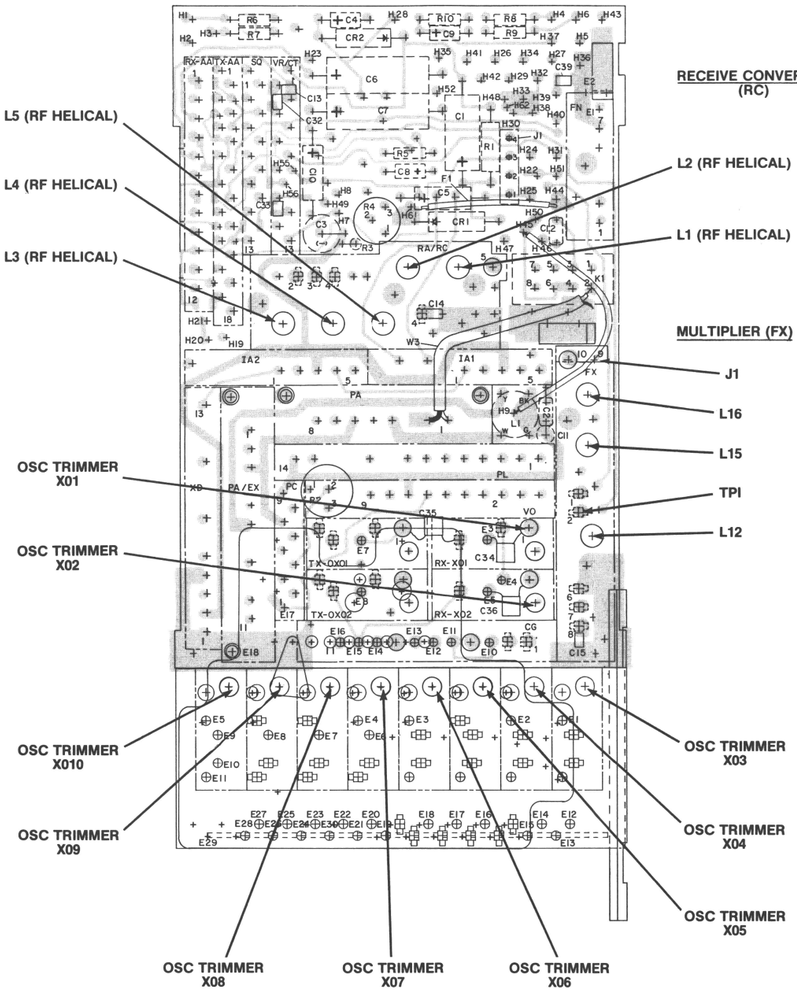
PRELIMINARY

1. Carefully remove the back cover from radio (See Disassembly Procedure).
2. Connect equipment as shown.
3. Set Audio Oscillator for 120 millivolts RMS at 1 kHz.
4. Set HI PWR adjust R902 fully counterclockwise.

ALIGNMENT PROCEDURE

STEP	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
		HIGH POWER ADJUST	FREQUENCY
1	R902	Transmit type KT194B/C - 1.5 Watts at 1.1 amperes or less.	Key transmit circuit and adjust HI PWR ADJUST R902 clockwise for rated current.
2	Multi-frequency switch	Transmit type KT195B/C - 4.0 Watts at 2.2 amperes or less.	Switch multi-frequency switch and determine which channel has the highest current.
3	R902		Re-adjust R902 until the channel with the highest current has rated current.
		FREQUENCY ADJUSTMENT	
4	0X0-1/0X0-2		After setting the receive frequency, key transmit circuit and adjust 0X0-1/0X0-2 offset oscillator trimmers for proper oscillator frequency.
		MODULATION ADJUST	
		Voice Only	
5	R904	4.5 kHz deviation	Key the transmit circuit and adjust MOD ADJ R904 until deviation meter indicates 4.5 kHz.
6	Multi-frequency switch		Switch multi-frequency switch and determine which channel has the highest deviation.
7	R904		Re-adjust R904 for 4.5 kHz deviation on the channel with the highest deviation.
		Voice and Channel Guard	
8	R904	4.5 deviation	With the multi-frequency switch on a channel guarded channel, key the transmit circuit and adjust R904 until the deviation meter indicates 4.5 kHz.
9	Multi-frequency switch		Switch the multi-frequency switch and determine which channel has the highest deviation.
10	R904		Re-adjust R904 for 4.5 kHz deviation on the channel with the channel with the highest deviation.
11	---	500 Hz to 1 kHz deviation	To check the Channel Guard output, remove the audio oscillator input. The Channel Guard deviation should be between 500 Hz and 1 kHz.





(RC-4145)
(RC-4146)
(19D430922, Rev. 6)
(19A143046, Sh. 4, Rev. 3)

RECEIVE CIRCUIT ALIGNMENT

EQUIPMENT

1. General Electric Test Adaptor 4EX12A11.
2. A 406-512 MHz signal source.
3. A 384.6 to 490.6 MHz counter.
4. Volt/Ohmmeter (20,000 ohms/volt DC).
5. RF voltmeter.
6. Distortion Analyzer.

PRELIMINARY

1. Carefully remove back cover from radio (see Disassembly Procedure).
2. Connect test equipment as shown (see Receive Circuit Test Procedures).
3. Set output of 406-512 MHz signal source for approximately 50 millivolts.
4. Turn SQUELCH control fully clockwise.
5. Turn all RF tuning screws out of the casting.
6. If multiple-frequency, place the channel select switch in the lowest frequency position.
7. Turn all equipment on.

ALIGNMENT PROCEDURE

STEP	TUNING CONTROL	PROCEDURE
	FREQUENCY MULTIPLIER (FX)	
1	L12	With volt/ohmmeter between TEST PT and ground, tune L12 for a peak indication (approximately 0.6 VDC).
2	MULTIPLIER HELICALS L15, & L16	With RF voltmeter between J1 of the FX module and ground, tune MULTIPLIER HELICALS L15 and L16 for maximum injection signal.
	RECEIVE CONVERTER (RA/RC)	
3	RF HELICALS L1, L2, L3, L4 & L5	With an on-frequency signal tune RF HELICALS L1, L2, L3, L4 and L5 for maximum quieting. Reduce the signal level as the quieting increases keeping the receive circuit out of limiting.
	FREQUENCY ADJUSTMENT	
4	X0-1 through X0-10	Measure the frequency of the injection signal at J1. Adjust the oscillator trimmers for the correct frequencies. $\frac{\text{F operating} - 21.4\ \text{MHz}}{6}$

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.

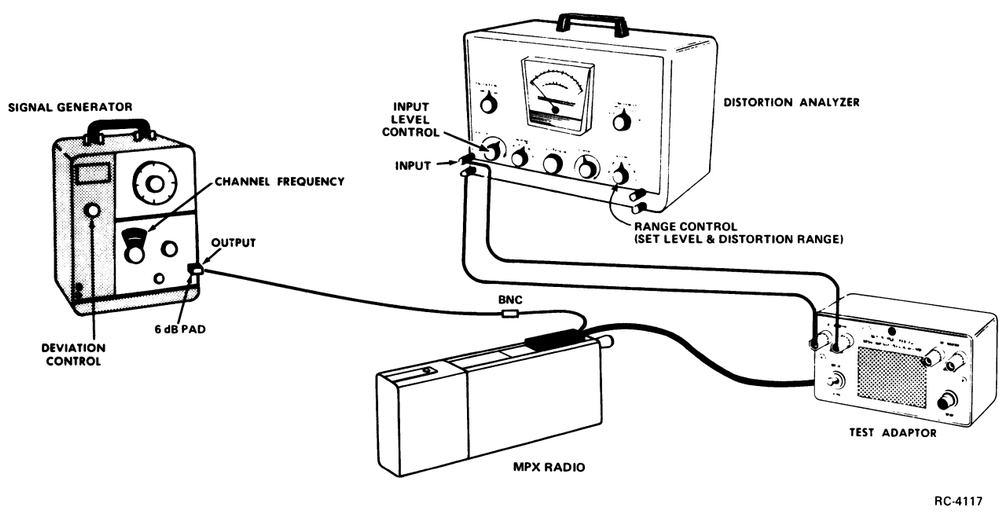
Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer
- Signal Generator
- 6 dB attenuation pad
- Test Adaptor Model 4EX12A11

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.



RECEIVE CIRCUIT TEST PROCEDURES

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

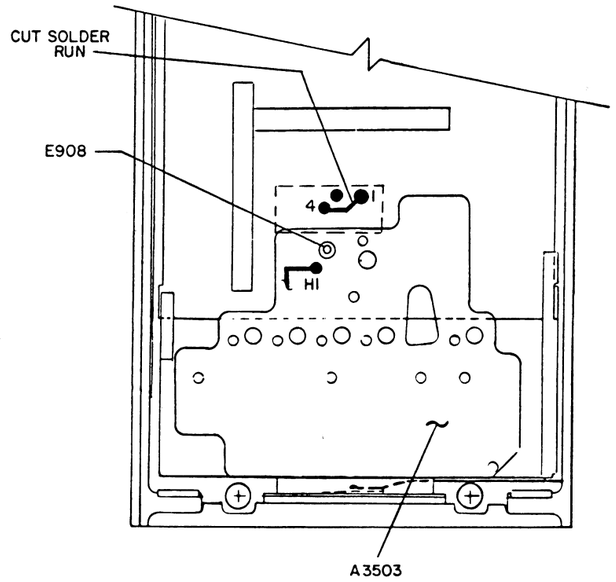
If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

THESE INSTRUCTIONS COVER THE AUTO-SELECTING OF OFFSET OSC. (OXO) TO 8 CASE MPX 450

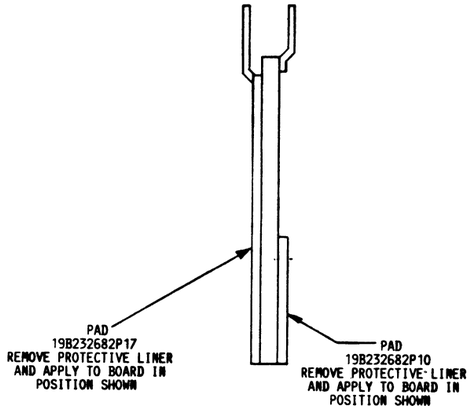
1. AUTO - SELECT OF OFFSET OSC IS ACCOMPLISHED BY PLACEMENT OF JUMPERS (T28-W) IN THE PROPER HOLES. THE ONE RESTRICTION IS THAT OXO-1 MUST GO ON CHANNEL #1 (ONE).
2. CUT RUN ON SOLDER SIDE OF SYSTEM BOARD BETWEEN OX01 PIN # 1 AND PIN #4 AS SHOWN. ADD JUMPER ON WIRE FROM A3503-H1 TO E908.
3. INSTALL JUMPERS PER PRODUCTION TAG-(REMEMBER OXO-1 MUST GO WITH CHANNEL 1 AND STARTS WITH H12, AND OXO-2 STARTS WITH H31). ASSEMBLE JUMPERS IN HOLES AS SHOWN IN CHART BELOW. HOLES ARE LARGE ENOUGH TO SOLDER TWO JUMPERS.
   EXAMPLE: IF PRODUCTION TAG SHOWS CHANNEL #1, 3, 5, 7 & 8 TO BE ON SAME OFFSET OSC. AND CHANNEL #2, 4, 6, 9 AND 10 ON THE OTHER OFFSET OSC. THEN A JUMPER WOULD GO FROM H12 TO H16, FROM H16 TO H20, FROM H20 TO H24, FROM H24 TO H26. ALSO FROM H31 TO H30, FROM H30 TO H28, FROM H28 TO H22 FROM H22 TO H18, FROM H18 TO H14.

FOR LOCATION OF HOLES SEE VIEW AT "C"

CHANNEL #	HOLE #
F1	H12
F2	H14
F3	H16
F4	H18
F5	H20
F6	H22
F7	H24
F8	H26
F9	H28
F10	H30
OX01	H12
OX02	H31



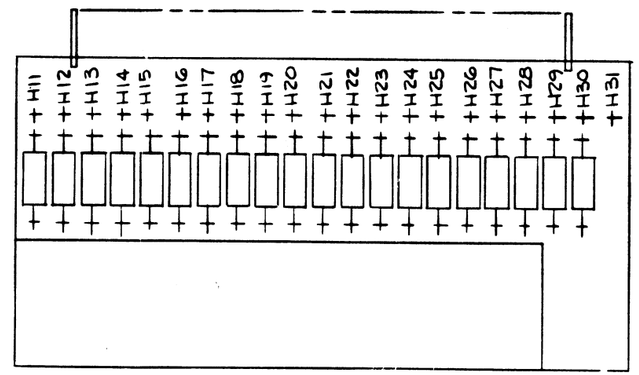
RC4148



THESE INSTRUCTION COVER THE REPEATING OF RX OSCILLAROR OX TO 8 CASE MPX 450 & 800 MHz

1. REPEATS ARE ACCOMPLISHED BY PLACEMENT OF JUMPERS (T28-W) IN THE PROPER HOLES.
2. INSTALL JUMPERS ONLY IN CHANNEL NUMBERS WHERETHE WORD "FREQ". FOLLOWED BY A CHANNEL NUMBER APPEARS ON PRODUCTION TAG IN RX FREQ. COLUMN. ASSEMBLE JUMPERS IN HOLES SHOWN IN CHART BELOW. HOLES ARE LARGE ENOUGH TO SOLDER TWO JUMPERS. FOR LOCATION OF HOLES SEE VIEW AT "C".
   EXAMPLE: IF PRODUCTION TAG SHOWS CHANNEL 3 FREQ. 1, CHANNEL 5 FREQ 1 AND CHANNEL 6 FREQ. 1, THEN A JUMPER WOULD GO FROM H11 TO H15, FROM H15 TO H19, AND FROM H19 TO H21.

CHANNEL #	HOLE #
F1	H11
F2	H13
F3	H15
F4	H17
F5	H19
F6	H21
F7	H23
F8	H25
F9	H27
F10	H29



VIEW AT "C"

HOLE IDENTIFICATION FOR CLI DIODE BOARD

(19D432062, Sh. 2, Rev. 1)

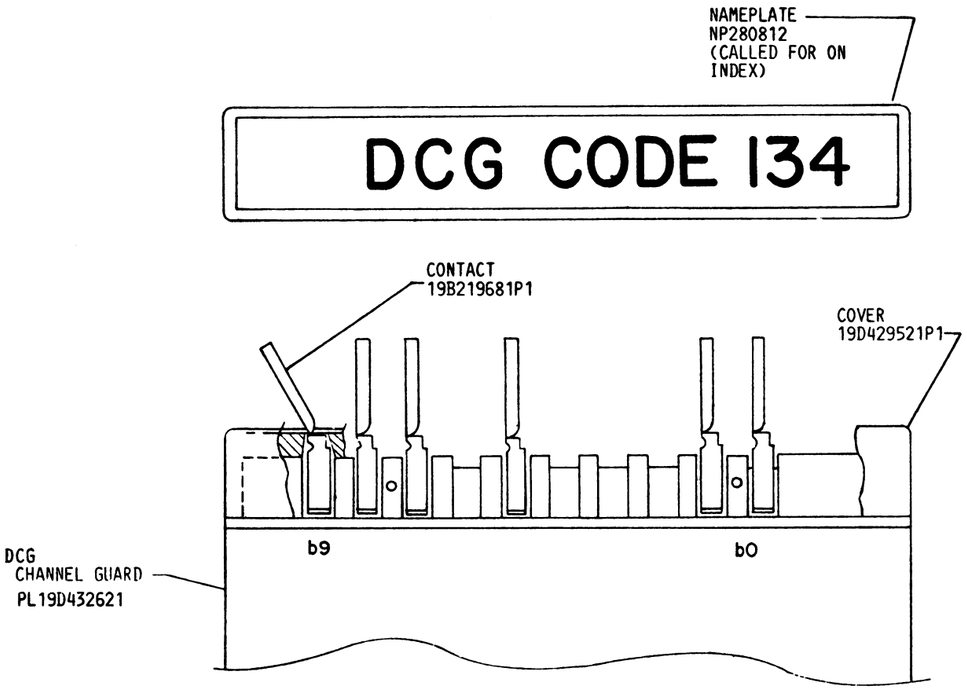


FIG. 2

CODE CHART

DCG CODE	CONTACT PIN POSITION									
	*B9	B8	B7	B6	B5	B4	B3	B2	B1	BØ
023	X	X	X	X	X		X	X		
025	X	X	X	X	X		X		X	
026	X	X	X	X	X		X			X
031	X	X	X	X	X			X	X	
032	X	X	X	X	X			X		X
043	X	X	X	X		X	X	X		
047	X	X	X	X		X	X			
051	X	X	X	X		X		X	X	
054	X	X	X	X		X			X	
065	X	X	X	X			X		X	
067	X	X	X	X			X			
071	X	X	X	X				X	X	
072	X	X	X	X				X		X
073	X	X	X	X				X		
074	X	X	X	X					X	X
114	X	X	X		X	X			X	X
115	X	X	X		X	X			X	
116	X	X	X	X			X	X	X	X
125	X	X	X		X		X		X	
131	X	X	X		X			X	X	
132	X	X	X		X			X		X
134	X	X	X		X				X	X
143	X	X	X			X	X	X		
152	X	X	X			X		X		X
155	X	X	X			X			X	
156	X	X	X			X				X
162	X	X	X				X	X		X
165	X	X	X				X		X	
172	X	X	X	X		X				
174	X	X	X			X	X	X		X
205	X	X	X		X				X	
223	X	X		X	X		X	X		
226	X	X	X		X	X	X		X	X
243	X	X		X		X	X	X		
244	X	X	X							X
245	X	X		X		X	X		X	
251	X	X		X	X					X
261	X	X		X	X		X			
263	X	X		X	X	X		X		
265	X	X	X					X	X	
271	X	X		X				X	X	
306	X	X	X			X	X			
311	X	X			X	X		X	X	
315	X	X			X	X			X	

* B9 IS LEFT OPEN IN 800 MHz RADIOS

CODE CHART(CONT.)

DCG CODE	CONTACT PIN POSITION									
	B9	B8	B7	B6	B5	B4	B3	B2	B1	BØ
331	X	X			X			X	X	
343	X	X			X		X		X	X
346	X	X				X	X			X
351	X	X				X		X	X	
364	X	X	X		X			X	X	X
365	X	X	X		X	X	X			
371	X	X		X	X	X				
411	X	X	X		X	X				
412	X	X	X		X		X			
413	X	X	X		X			X		
423	X	X		X	X				X	X
431	X	X		X			X	X		X
432	X	X		X						X
445	X	X		X	X		X	X		X
464	X	X		X	X					
465	X	X	X	X		X				X
466	X	X	X			X	X		X	X
503	X	X	X			X				
506	X	X		X	X		X		X	X
516	X	X	X	X			X			
532	X	X	X				X	X	X	
546	X	X			X	X				
565	X	X			X	X	X			
606	X	X	X			X		X		
612	X	X		X		X			X	X
624	X	X	X	X					X	
627	X	X	X	X	X					
631	X	X		X	X			X	X	
632	X	X	X		X		X	X		
654	X	X	X				X	X		
662	X	X					X			
664	X	X				X	X		X	X
703	X	X	X			X		X	X	X
712	X	X	X		X					X
723	X	X		X	X				X	
731	X	X	X	X		X		X		
732	X	X	X					X	X	X
734	X	X	X	X			X			X
743	X	X	X		X	X		X		X
754	X	X		X	X					X

THESE INSTRUCTIONS COVER THE FREQ CODING FOR DCG MODULE 19D432621 USING THE STANDARD DCG CODES.

1. INSTALL CONTACT PINS (19B219681), PER FIG. 2, IN POSITIONS INDICATED BY "X" IN CHART 1, WHICH AGREES WITH DESIRED DCG CODE. (NOTE - EXAMPLE SHOWN FOR 134).
2. ASSEMBLE SNAP ON COVER (19D429521P1).
3. BREAK OFF CONTACT TABS ABOVE COVER BY BENDING TOWARD EITHER END OF MODULE. (DO NOT BEND TAB TOWARD SIDE OF MODULE).
4. STAMP APPROPRIATE DCG CODE ON LABEL (NP280812) AND ASSEMBLE IN RECESS ON TOP OF COVER. (EXAMPLE 134).

RC4235

THESE INSTRUCTIONS COVER THE FREQ CODING FOR C. G. MODULE 19D429618 USING THE STANDARD C. G. FREQ.

1. INSTALL CONTACT PINS (19B219681), PER FIG. 1, IN POSITIONS INDICATED BY "X" IN CHART 1, WHICH AGREES WITH DESIRED CG FREQ. (NOTE - EXAMPLE SHOWN FOR 127.3Hz).
2. ASSEMBLE SNAP ON COVER (19D429521P1).
3. BREAK OFF CONTACT TABS ABOVE COVER BY BENDING TOWARD EITHER END OF MODULE. (DO NOT BEND TAB TOWARD SIDE OF MODULE).
4. STAMP APPROPRIATE CG FREQ ON LABEL (NP280529) AND ASSEMBLE IN RECESS ON TOP OF COVER. (EXAMPLE 127.3)

CHART 1

FREQ CHART										
C.G. FREQ	CONTACT PIN POSITION									
	9	8	7	6	5	4	3	2	1	0
67	X		X	X	X	X			X	X
71.9	X		X	X		X	X	X	X	X
77	X		X	X			X		X	X
82.5	X		X		X	X		X		X
88.5	X		*X			X	X	X		X
94.8	X		X					X		
100	X			X	X		X	X	X	X
103.5	X			X	X					X
107.2	X			X		X			X	
110.9	X			X					X	X
114.8	X				X	X		X		
118.8	X				X			X		
123	X					X			X	X
127.3	X								X	
131.8		X	X	X	X	X				
136.5		X	X	X		X	X	X		X
141.3		X	X	X			X		X	
146.2		X	X		X	X		X	X	
151.4		X	X		X					X
156.7		X	X				X	X		
162.2		X		X	X	X		X	X	
167.9		X		X		X	X	X	X	X
173.8		X		X			X			
179.9		X			X		X	X	X	X
186.2		X				X		X	X	
192.8			X	X	X	X	X	X		
203.5			X	X		X				X
210.7			X		X	X		X		

THESE INSTRUCTIONS COVER THE FREQ CODING FOR CG MODULE 19D429618 USING THE NON STANDARD CG FREQ.

1. USE CHART 2 TO CALCULATE THE CG FREQ DESIRED.
2. FIND THE FREQ DESIRED BY ADDING UP THE FREQ IN CHART 2. ABOVE EACH FREQ IS A CONTACT PIN POSITION NUMBER, IF THIS POSITION IS OPEN (THAT IS A PIN IS NOT INSTALLED), THE CG WILL PRODUCE THAT FREQ. IF MORE THAN ONE IS LEFT OPEN, THE OUTPUT FREQ WILL BE THE SUM OF THE OPEN POSITIONS.

   EXAMPLE: CG FREQ 128Hz THEREFORE CONTACT PIN POSITION #9 WILL BE OPEN AND CONTACT PINS WILL BE INSTALLED IN POSITION 0, 1, 2, 3, 4, 5, 6 ,7 AND 8.

   EXAMPLE: CG FREQ 132.75Hz. THEREFORE CONTACT PIN POSITION #9 WHICH IS 128, #4 WHICH IS 4, #1 WHICH IS .5, AND #0 WHICH IS .25 WILL BE OPEN. ADD THE FREQ 128 + 4 + .5 + .25 = 132.75. CONTACT PINS WILL BE INSTALLED IN POSITION #2, 3, 5, 6, 7 AND 8.
3. INSTALL CONTACT PINS, ASSEMBLE COVER AND STAMP LABEL PER INSTRUCTIONS FOR FREQ CODING THE STANDARD CG FREQ.

CHART 2

9	8	7	6	5	4	3	2	1	0	CONTACT PIN POSITION
128	64	32	16	8	4	2	1	.5	.25	FREQ IN Hz

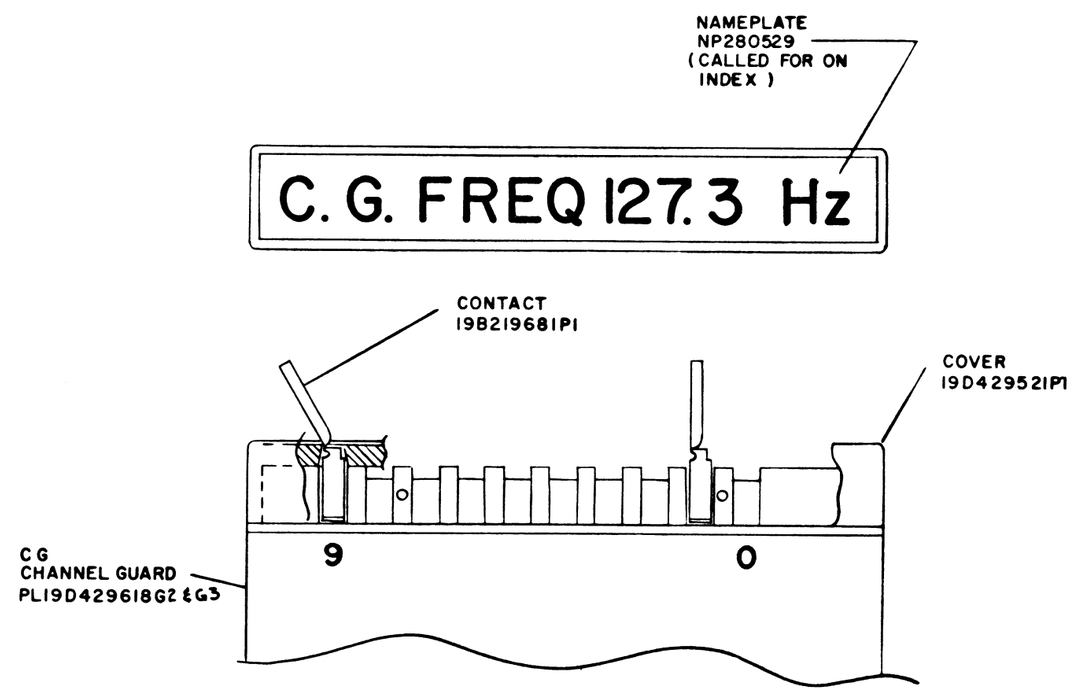
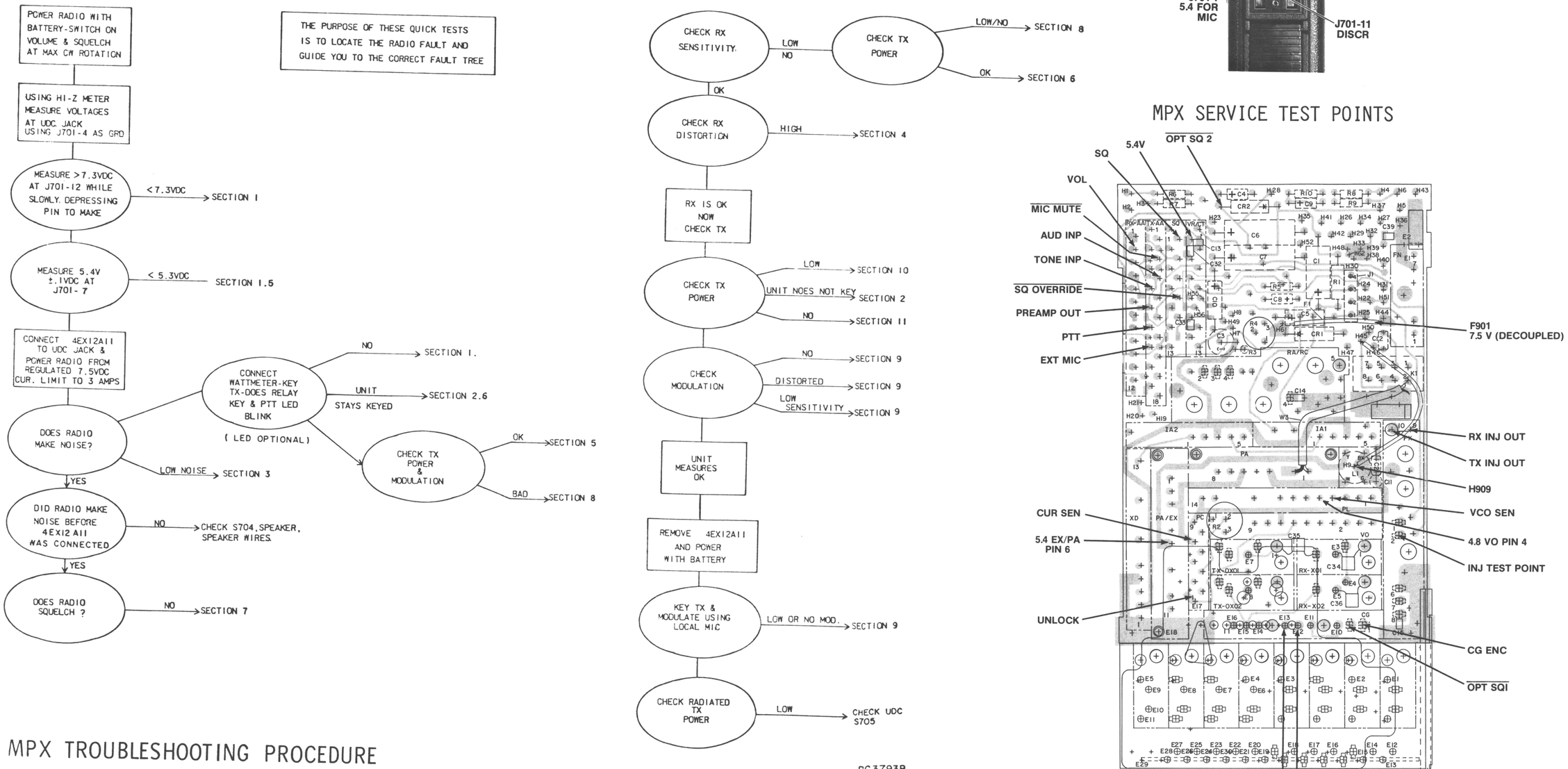


FIG. 1

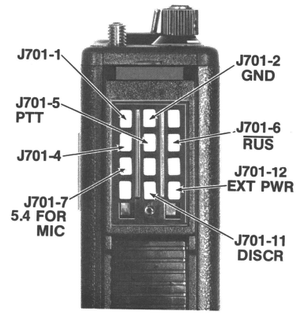
MPX TROUBLESHOOTING TREE



MPX TROUBLESHOOTING PROCEDURE

Sheet 1

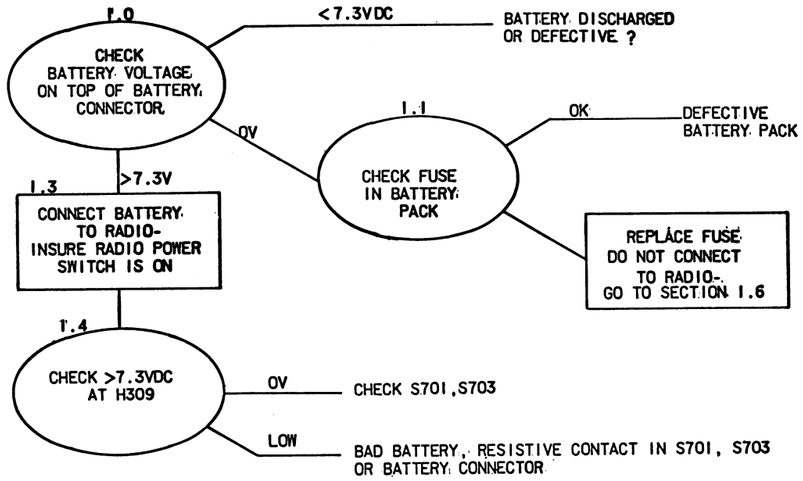
UDC JACK (J701) CONNECTION



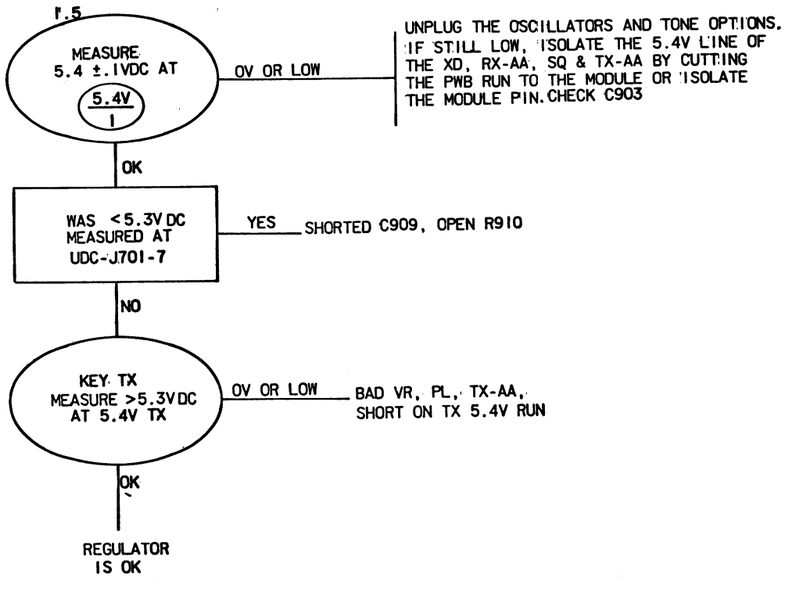
MPX SERVICE TEST POINTS

(RC-4145)
(RC-4146)
(19D430922, Rev. 6)
(19A143046, Sh. 4, Rev. 3)

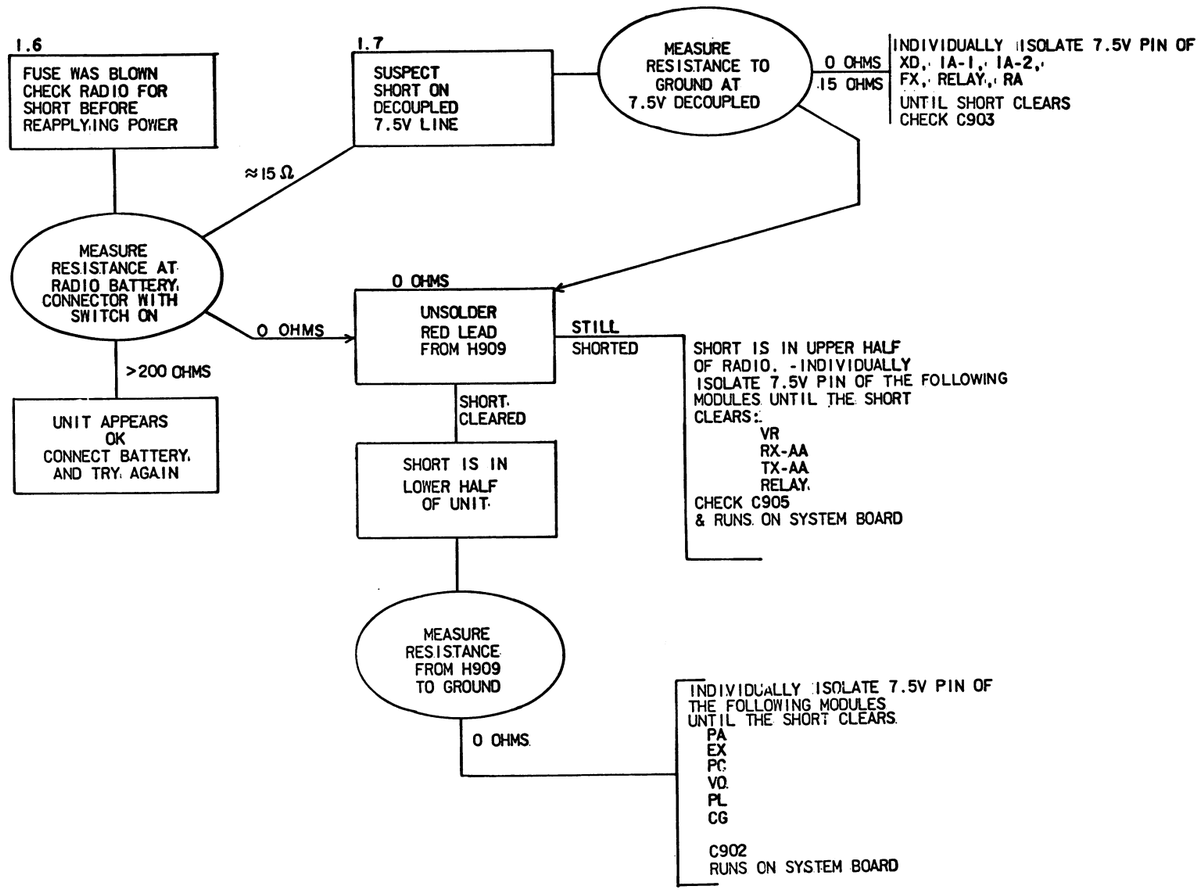
SECTION #1
POWER DISTRIBUTION FAULT



REGULATOR FAULT
SECTION 1.5

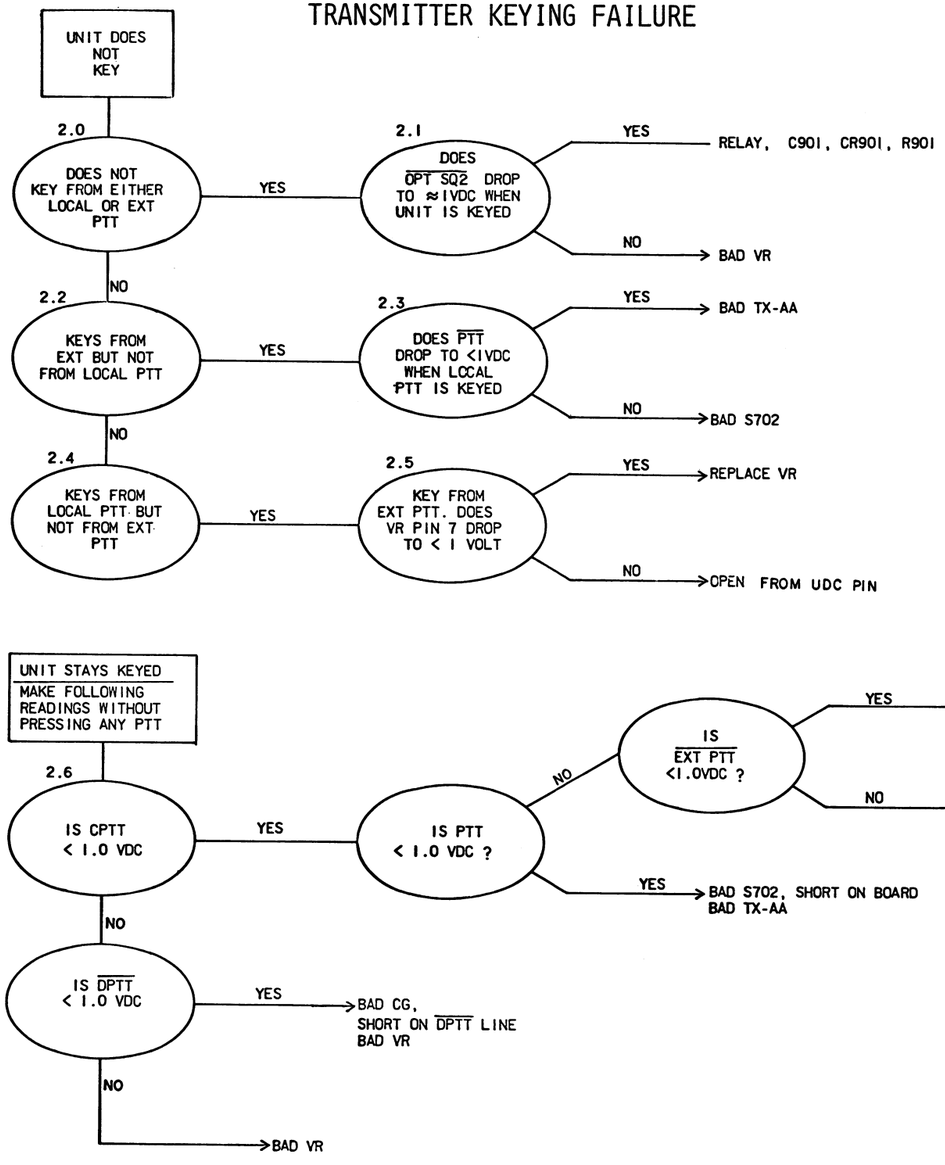


LOCATING A SHORT
SECTION 1.6



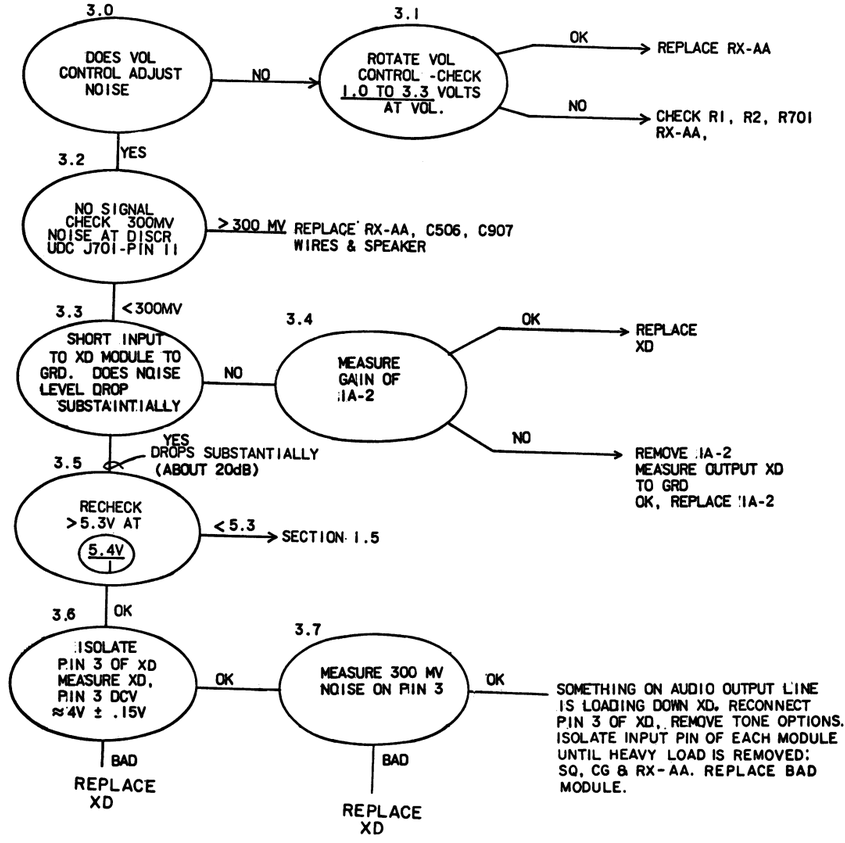
RC4095A

SECTION 2
TRANSMITTER KEYING FAILURE



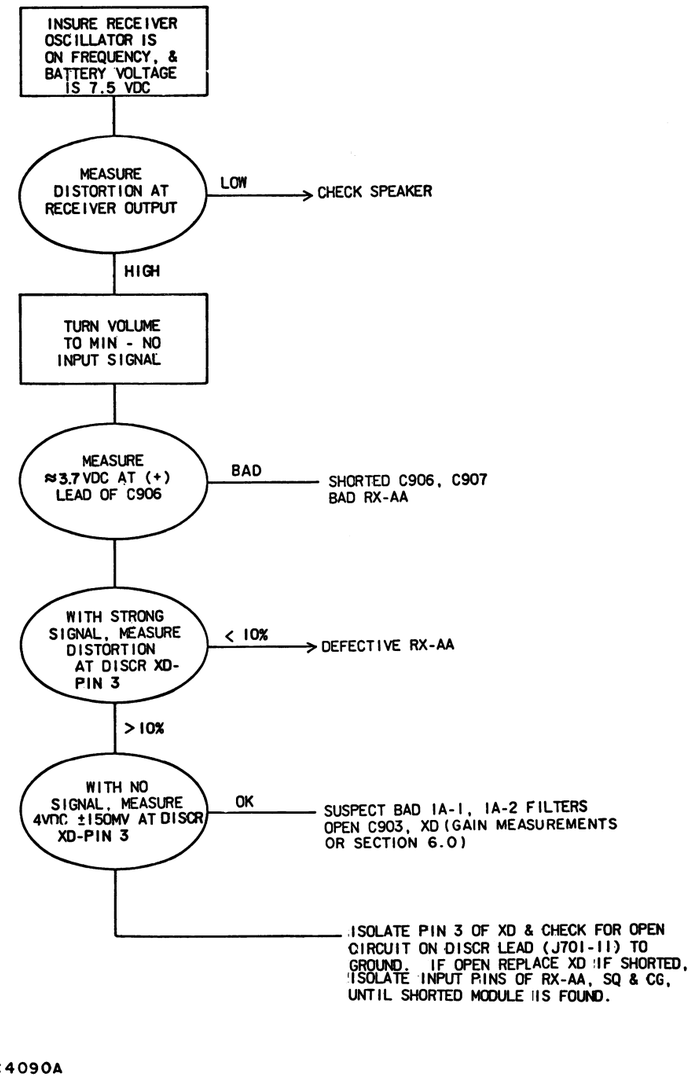
RC4087

SECTION 3
RX AUDIO NOISE LOW



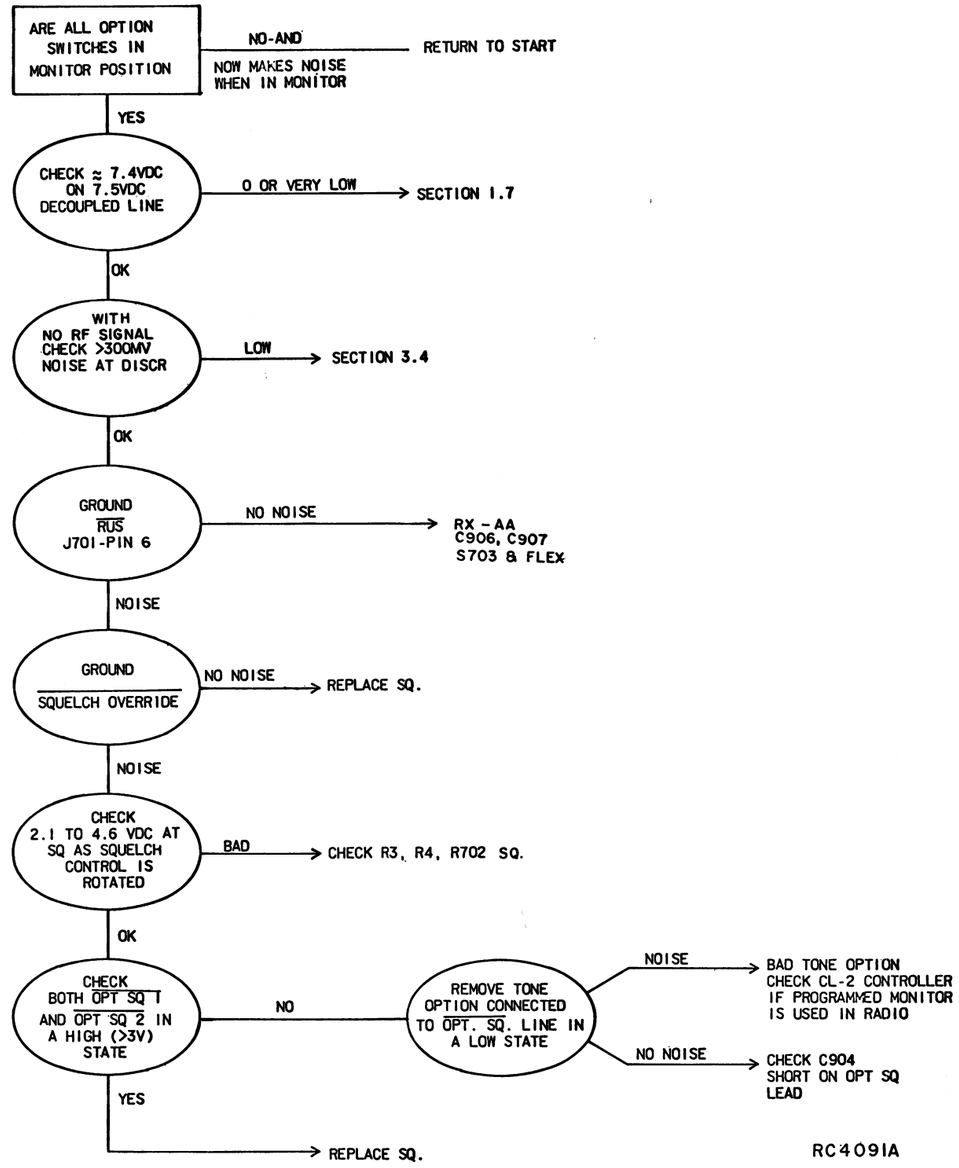
RC4089A

SECTION 4
RECEIVER AUDIO DISTORTED



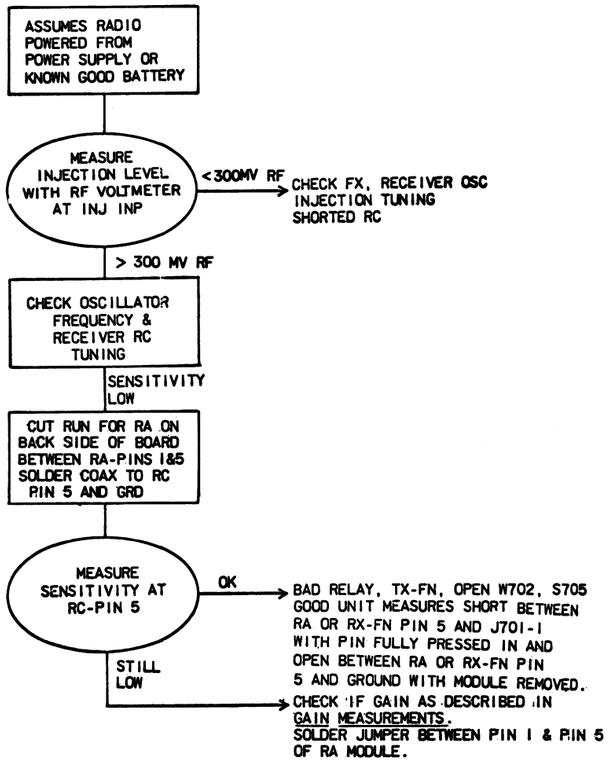
RC4090A

SECTION 5
NO RECEIVER AUDIO



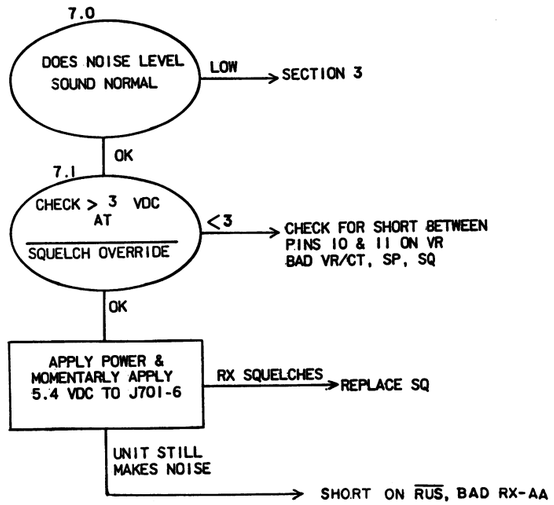
RC4091A

SECTION 6
LOW OR NO RECEIVER SENSITIVITY



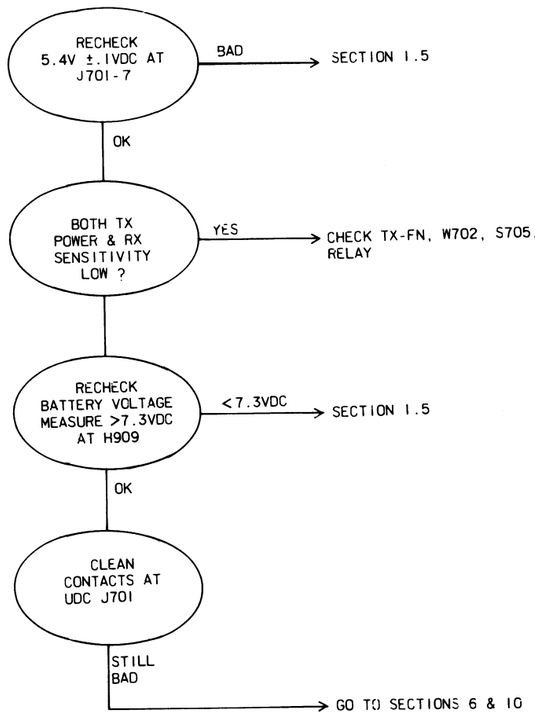
RC4231

SECTION 7
UNIT DOES NOT SQUELCH



RC4088A

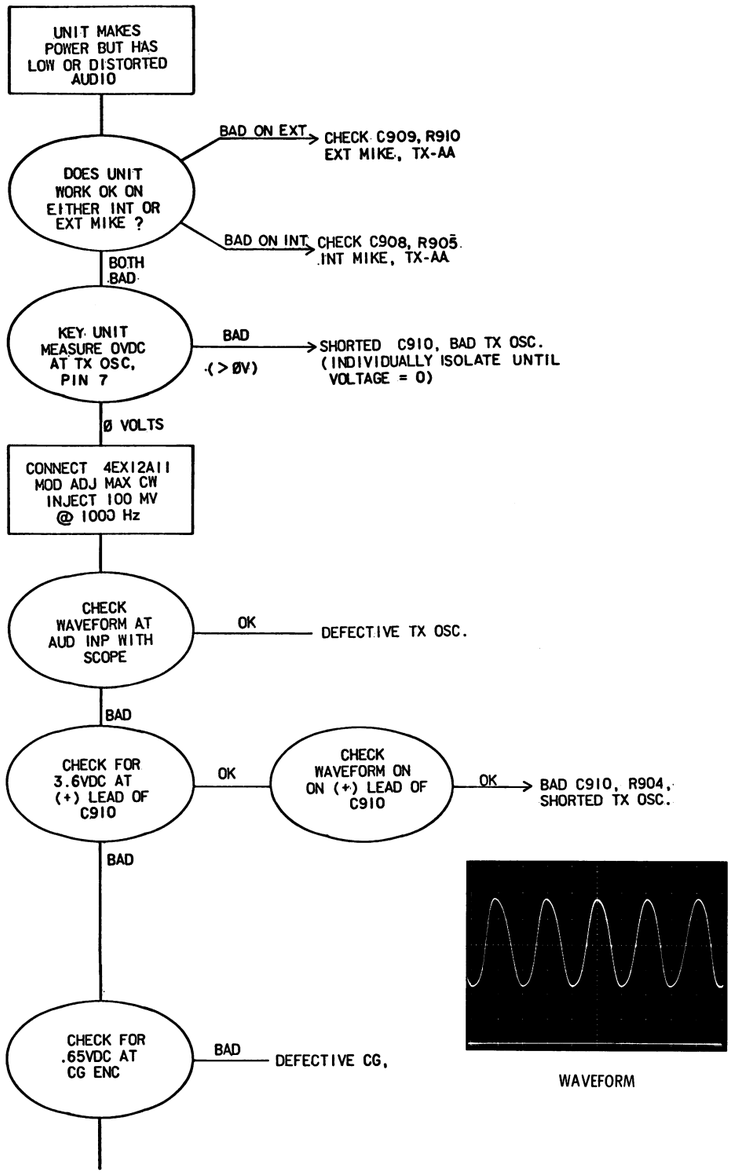
SECTION 8
BOTH RX & TX MALFUNCTION



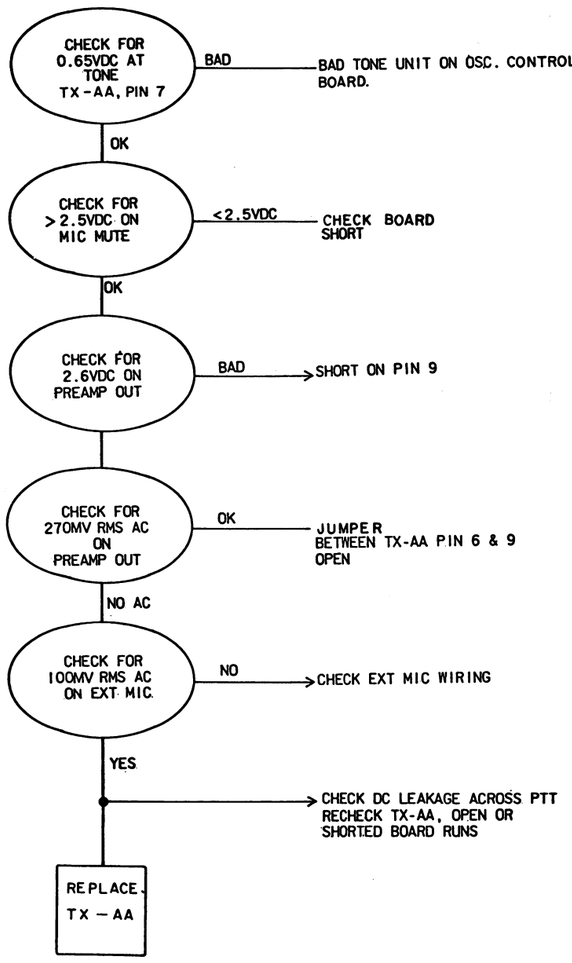
RC3803A

TROUBLESHOOTING PROCEDURE

SECTION 9
NO OR DISTORTED TX AUDIO

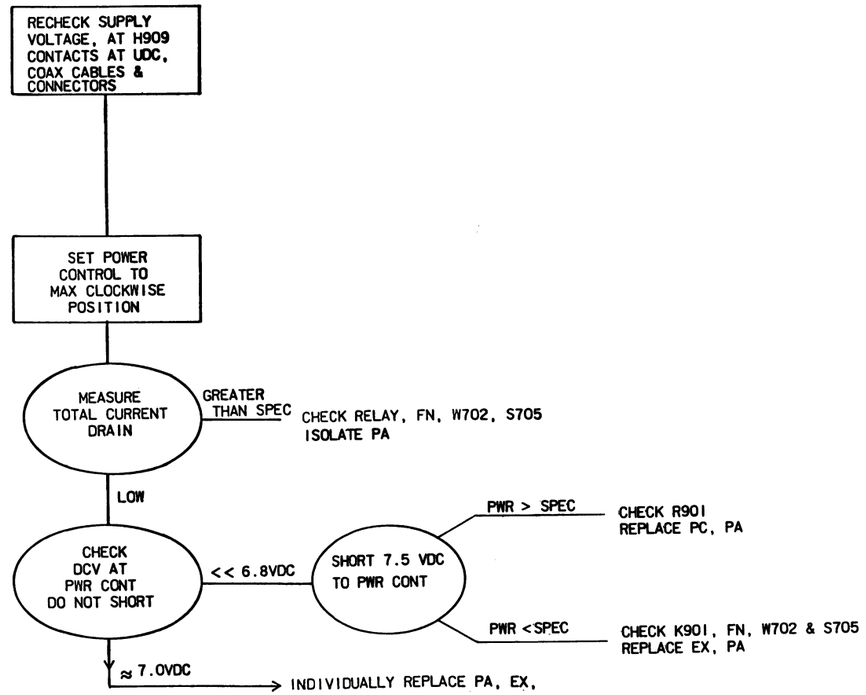


WAVEFORM



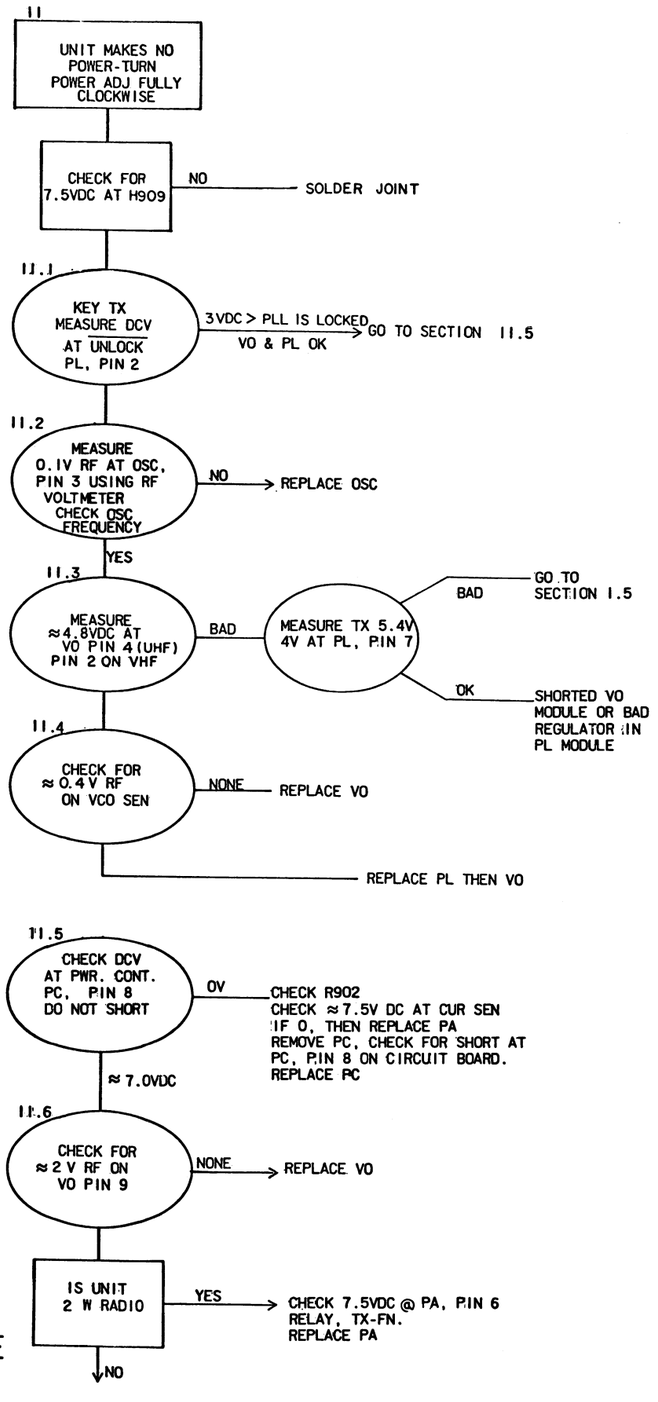
RC4092A

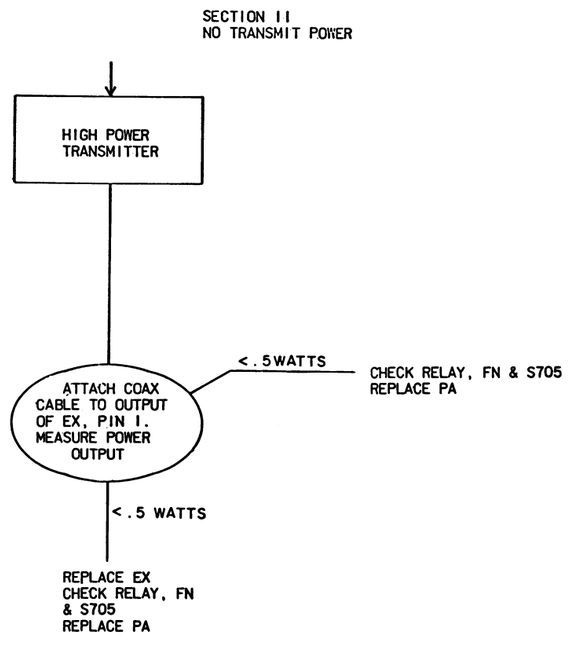
SECTION 10
LOW POWER



RC4093A

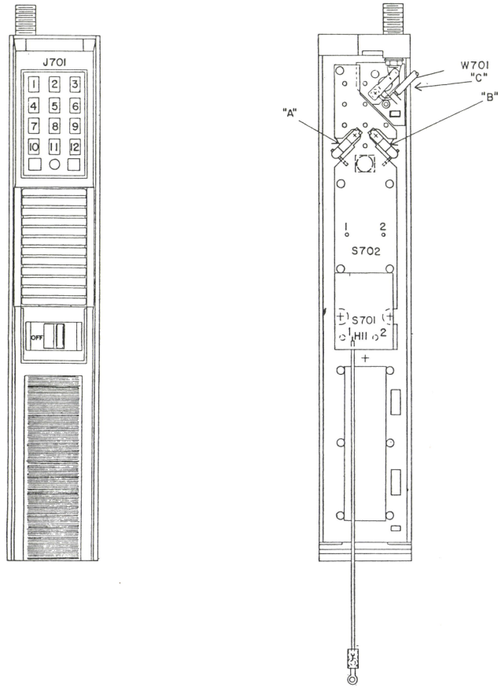
SECTION 11
NO TRANSMIT POWER





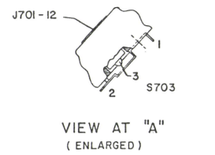
RC4094B

CONTROL SIDE RAIL

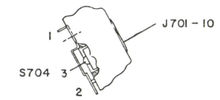


(19D437310, Rev. 0)

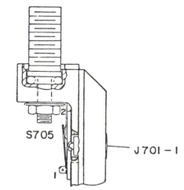
(19A142980, Sh. 1, Rev. 3)
(19A142980, Sh. 2, Rev. 3)



VIEW AT "A"
(ENLARGED)

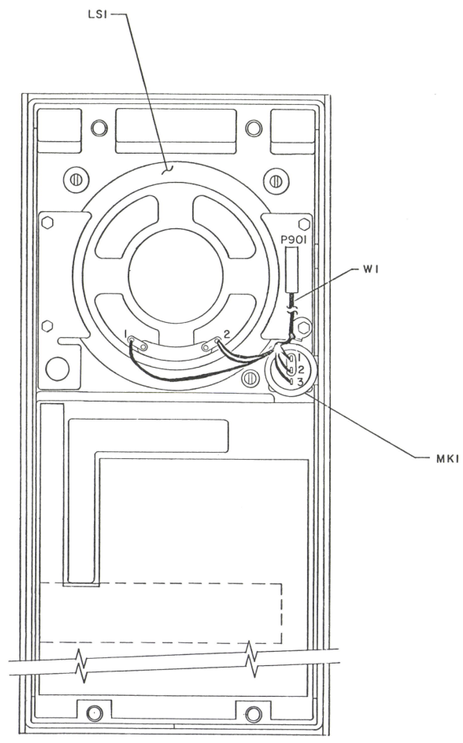


VIEW AT "B"
(ENLARGED)



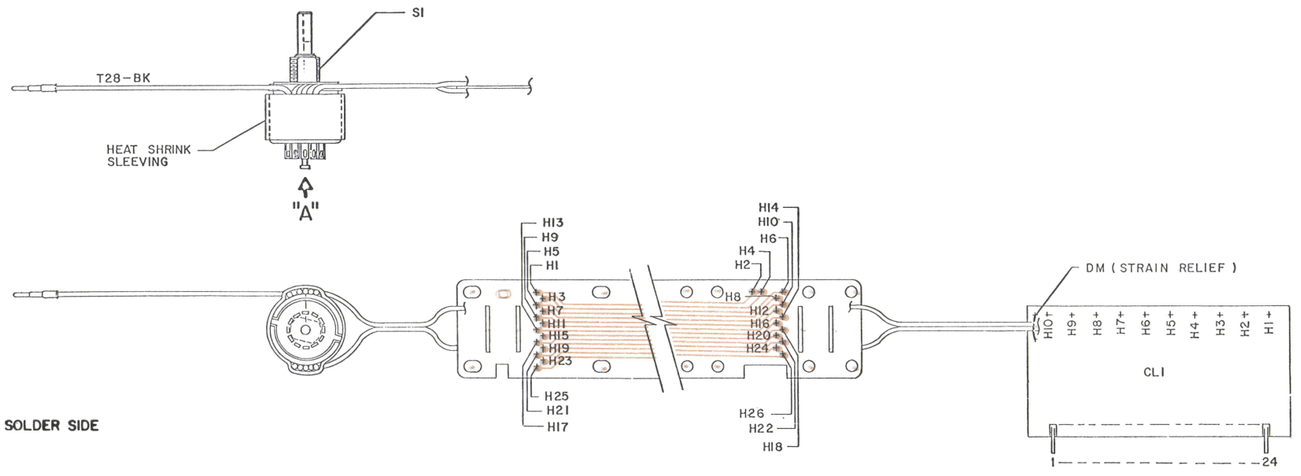
VIEW AT "C"
(ENLARGED)

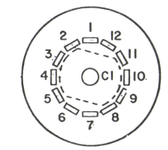
FRONT COVER



(19C331216, Rev. 0)

CONTROL ASSEMBLY A703





VIEW AT "A"

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

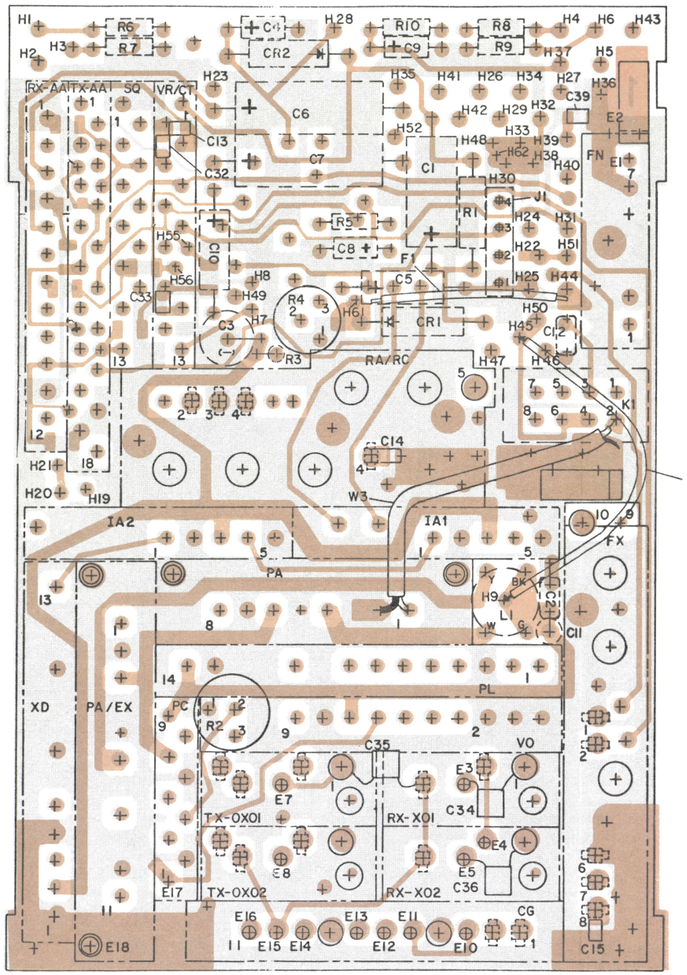
(19C331200, Rev. 0)
(19A143104, Sh. 1, Rev. 0)
(19A143104, Sh. 2, Rev. 0)

OUTLINE DIAGRAM

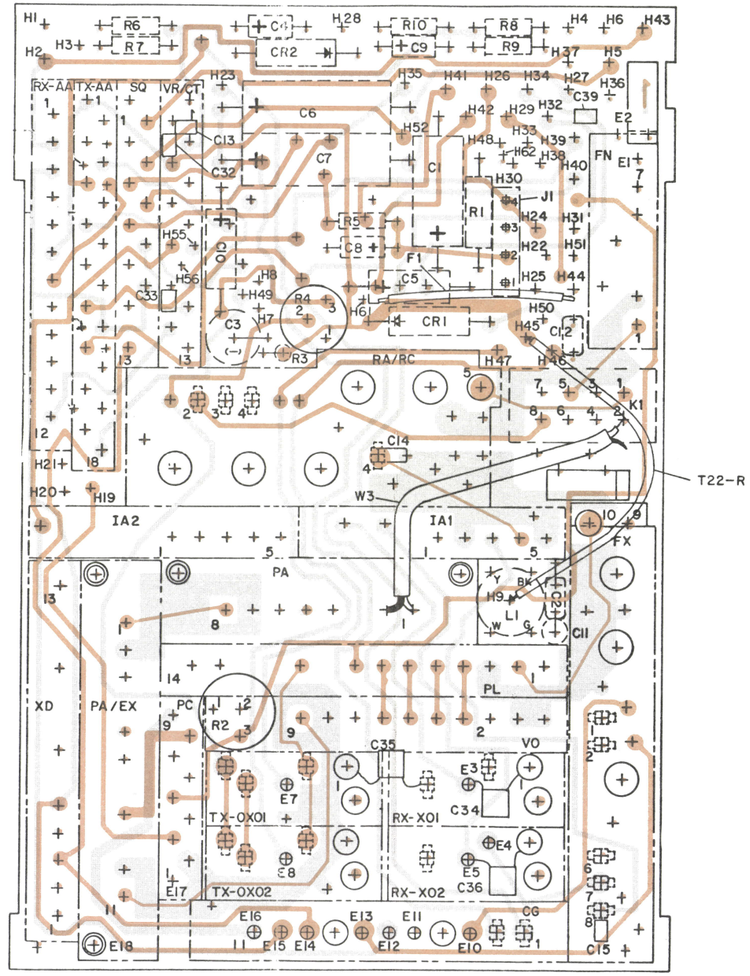
CONTROL ASSEMBLIES
AND FRONT COVER

SYSTEM BOARD

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

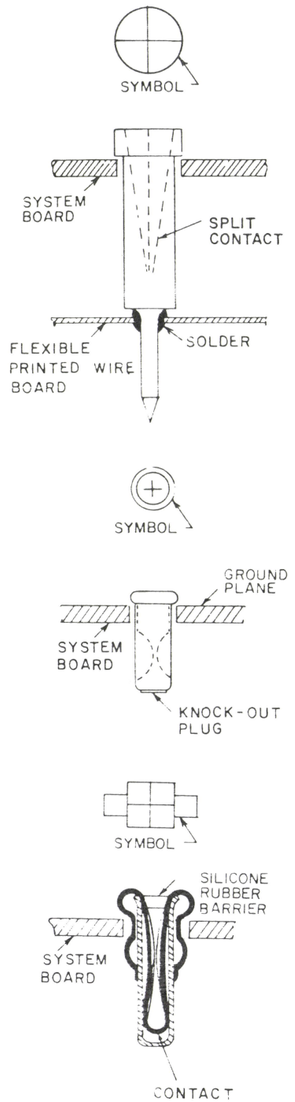


(19A143046, Sh. 1, Rev, 1) 1st Layer - GROUND
(19A143046, Sh. 4, Rev. 3) 4th Layer - PWR. DISTRIBUTION



(19A143046, Sh. 2, Rev. 1) 2nd Layer - RF SIG. FLOW
(19A143046, Sh. 3, Rev. 1) 3rd Layer - RF SIG. FLOW

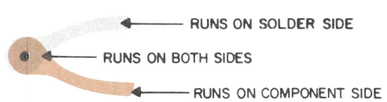
(19D430922, Rev. 6)



RC3776A

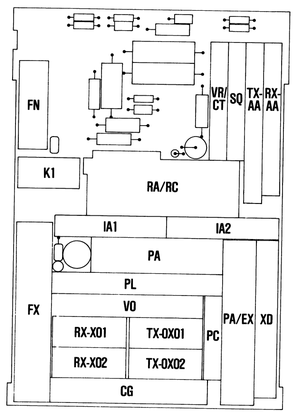
OUTLINE DIAGRAM

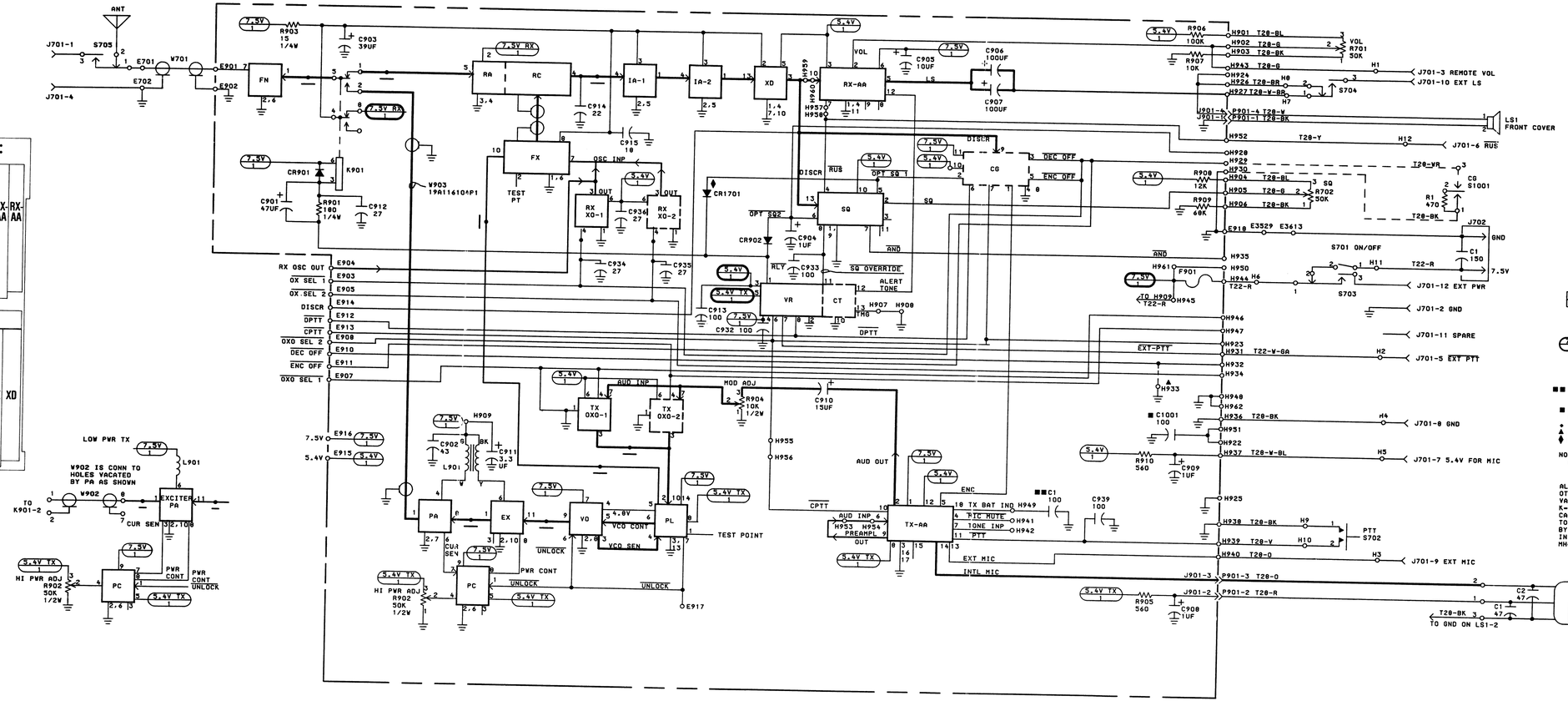
SYSTEM BOARD
(Sheet 2)



CONTACT IDENTIFICATION

MODULE LAYOUT





MODEL NO	REV LTR
PL19043075092	B

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

■■ C1 IS ADDED WHEN USING THE TX LED OPTION ONLY. SUPPLIED AS PART OF 19A143169 KIT.

■ PRESENT IN GE-STAR UNITS ONLY SUPPLIED AS PART OF 19A143198 KIT.

* THIS RUN CUT WITH SC OPTION

▲ PRESENT IN SINGLE FREQ UNITS ONLY

♦ PRESENT WITH AND GATE ONLY

NOTES:

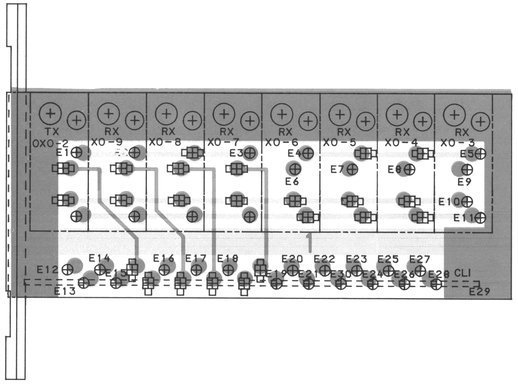
1. RUNS ARE CUT HERE IN A THREE (3) OR MORE FREQ UNITS.

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.

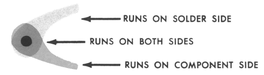
(19B622444, Rev. 6)

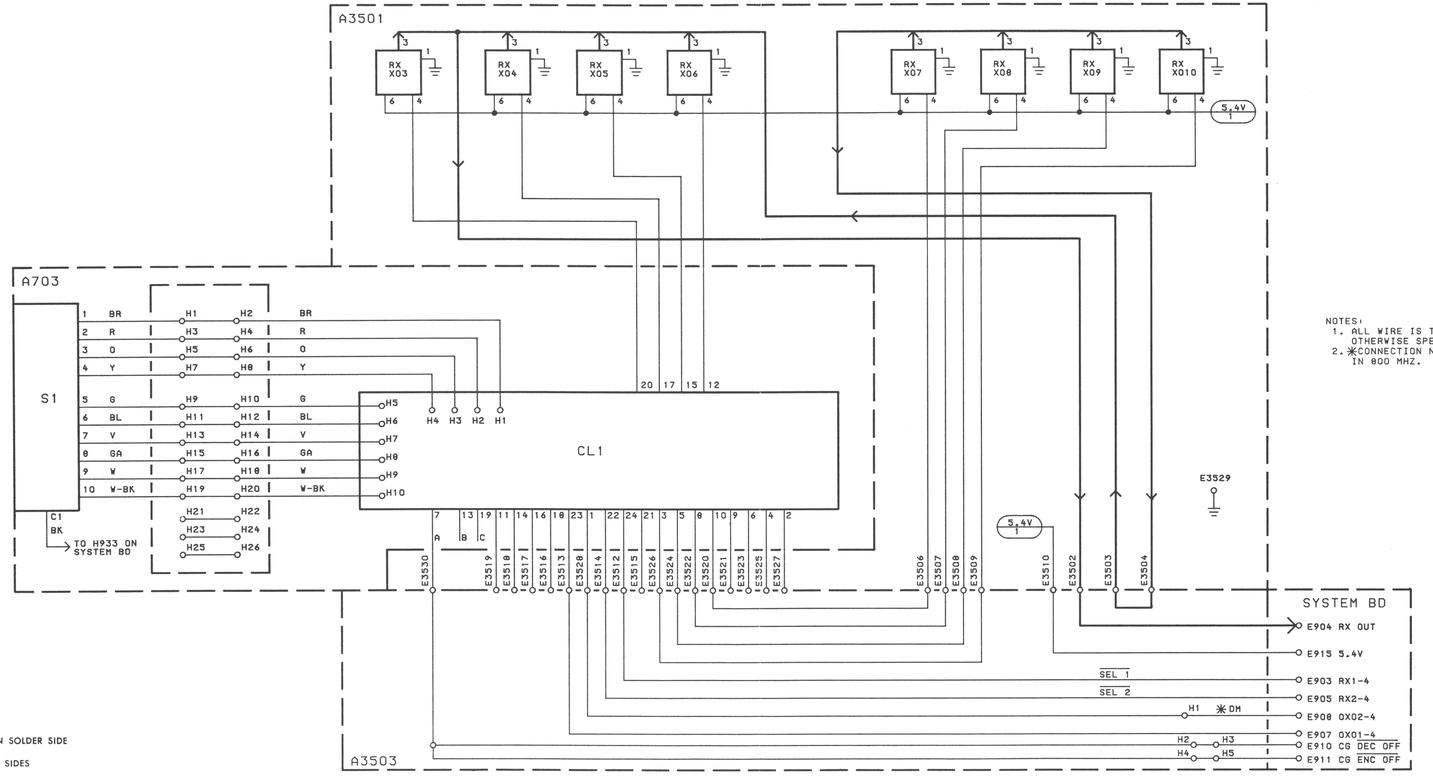
SCHEMATIC DIAGRAM

406-512 MHz MPX TWO-WAY FM RADIO



(RC-4144A)
(19C330541, Rev. 2)
(19A142974, Sh. 1, Rev. 1)
(19A142974, Sh. 2, Rev. 1)



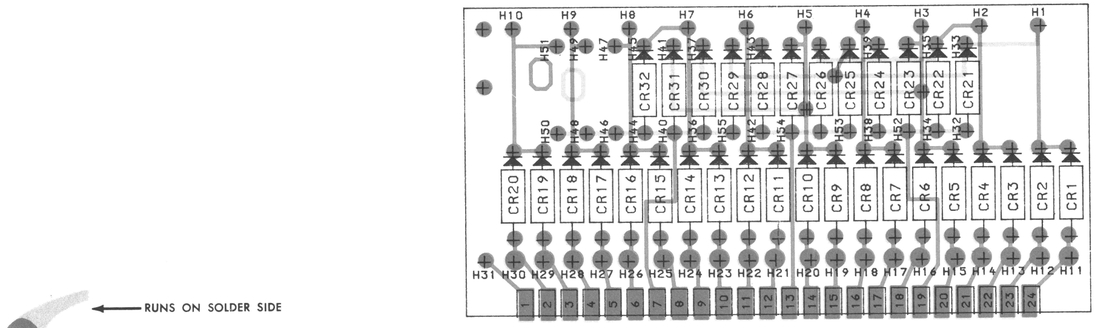


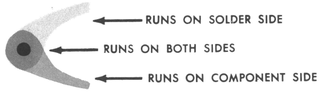
NOTES:
1. ALL WIRE IS T20 UNLESS OTHERWISE SPECIFIED.
2. ✳CONNECTION NOT PRESENT IN 800 MHZ.

(19D432125, Rev. 2)

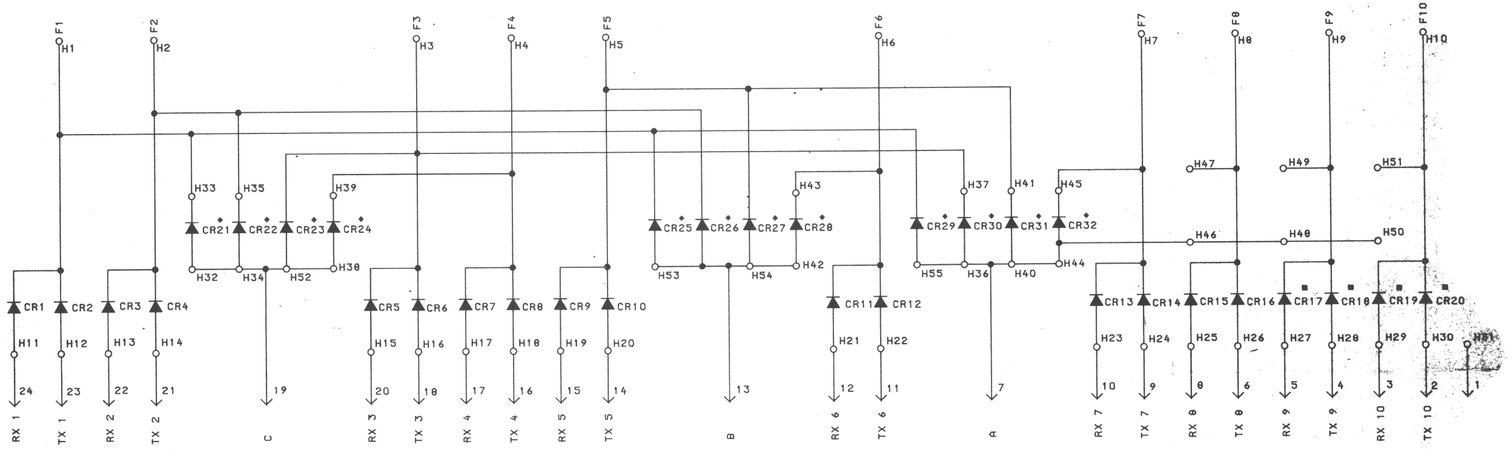
OUTLINE & SCHEMATIC DIAGRAM

MULTI-FREQUENCY KIT
19A143173G1





(19C330809, Rev. 0)
(19A142944, Sh. 1, Rev. 0)
(19A142944, Sh. 2, Rev. 0)



NOTES:
◆ NOT PRESENT IN GROUP 1 AND 3
■ NOT PRESENT IN GROUP 2 AND 3

(19D432124, Rev. 1)

OUTLINE & SCHEMATIC DIAGRAM

DIODE BOARD CL1

PARTS LIST

LBI31282A

MPX MODULE LIST
P4B/C COMBINATIONS
(406-512 MHz)

SYMBOL	GE PART NO.	DESCRIPTION
CG	19D429618G1	Channel Guard Encode/Decode Module. (Earlier Models)
	19D429618G2	Channel Guard. (Encode only).
	19D429618G3	Channel Guard. (Encode/Decode).
CT	19D433436G6	Carrier Controlled Timer. (Includes voltage regulator).
	19D430867G1	Carrier Controlled Timer. (Includes voltage regulator). (Earlier Models).
EX/PA	19D430902G1	(406-435 MHz) Exciter & Power Amplifier for 1.7 to 3.8 watt transmit.
	19D430902G2	(435-470 MHz) Exciter & Power Amplifier for 1.7 to 3.8 watt transmit.
	19D430902G3	(470-512 MHz) Exciter & Power Amplifier for 1.7 to 3.8 watt transmit.
EX	19D430902G4	(406-435 MHz) Exciter for 3.9 to 6.4 watt transmit.
	19D430902G5	(435-470 MHz) Exciter for 3.9 to 6.4 watt transmit.
	19D430902G6	(470-512 MHz) Exciter for 3.9 to 6.4 watt transmit.
Fx	19D430185G1	(406-435 MHz) Frequency Multiplier.
	19D430185G2	(435-470 MHz) Frequency Multiplier.
	19D430185G3	(470-512 MHz) Frequency Multiplier.
IA-1	19D430889G1	IF Preamplifier, 25 KHz Channel spacing.
	19D430889G2	IF Preamplifier, 25 KHz Channel spacing. (Alternate IF).
	19D430889G4	IF Preamplifier, 12.5 KHz Channel spacing.
IA-2	19D430890G1	IF Amplifier, 25 KHz Channel spacing.
	19D430890G2	IF Amplifier, 25 KHz Channel spacing. (Alternate IF).
	19D430890G4	IF Amplifier, 12.5 KHz Channel spacing.
PA	19D430907G1	(406-435 MHz) RF Power Amplifier.
	19D430907G2	(435-470 MHz) RF Power Amplifier.
	19D430907G3	(470-512 MHz) RF Power Amplifier.
PC	19D430871G2	Power Control.
PL	19D430884G1	(406-435 MHz) Phase-Lock-Loop.
	19D430884G2	(435-470 MHz) Phase-Lock-Loop.
	19D430884G3	(470-512 MHz) Phase-Lock-Loop.
RA/RC	19D429928G1	(406-435 MHz) Receiver Front End.
	19D429928G2	(435-470 MHz) Receiver Front End.
	19D429928G3	(470-512 MHz) Receiver Front End.
RX-AA	19D430878G1	Receive Audio Amplifier. (Earlier Models).
	19D430878G2	Receive Audio Amplifier.
RX-XO	19A137645G7	Receive Oscillator.
SQ	19D430867G1	Squelch, 25 KHz Channel spacing.
	19D430867G2	Squelch, 12.5 KHz Channel spacing.
TX-AA	19D430878G1	Transmit Audio Processor, 25 KHz Channel spacing. (Earlier Models).
	19D430877G2	Transmit Audio Processor, 25 KHz Channel spacing.
	19D432212G1	Transmit Audio Processor, 12.5 KHz Channel spacing. (Earlier Models).
	19D432212G2	Transmit Audio Processor, 12.5 KHz Channel spacing.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
TX-OXO	19D429739G1	Transmit Offset Oscillator.
	19D429739G2	Transmit Offset Oscillator. (2nd OXO Manual Select).
	19D429739G11	Transmit Offset Oscillator. (Used with Alternate IF).
	19D429739G12	Transmit Offset Oscillator. (Used with Alternate IF, 2nd OXO Manual Select).
VO	19D430879G1	(406-435 MHz) Voltage Controlled Oscillator.
	19D430879G2	(435-470 MHz) Voltage Controlled Oscillator.
	19D430879G3	(470-512 MHz) Voltage Controlled Oscillator.
VR	19D433436G3	Voltage Regulator (Does not include Carrier Controlled Timer).
	19D430873G1	Voltage Regulator. (Includes Carrier Controlled Timer). (Earlier Models).
XD	19D430880G1	Receive Discriminator, 25 KHz Channel spacing.
	19D430880G2	Receive Discriminator, 25 KHz Channel spacing. (Alternate IF).
	19D430880G4	Receive Discriminator, 12.5 KHz Channel spacing.

PARTS LIST

SYSTEM BOARD
19D430750G2 - REV. B
ISSUE 4

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C901	5491674P42	Tantalum: 47 uF ±20%, 6 VDCW; sim to Sprague Type 162D.
C902	19A700221P51	Ceramic: 43 pF ±5%, 100 VDCW, temp coef -80 PPM.
C903	5491674P30	Tantalum: 39 uF ±20%, 10 VDCW; sim to Sprague Type 162D.
C904	5491674P1	Tantalum: 1 uF +40-20%, 10 VDCW; sim to Sprague Type 162D.
C905	5491674P37	Tantalum: 10 uF ±20%, 10 VDCW; sim to Sprague Type 162D.
C906 and C907	19B200240P19	Tantalum: 100 uF ±20%, 6 VDCW.
C908 and C909	5491674P1	Tantalum: 1 uF +40-20%, 10 VDCW; sim to Sprague Type 162D.
C910	5491674P34	Tantalum: 15 uF ±20%, 6 VDCW; sim to Sprague Type 162D.
C911	5491674P36	Tantalum: 3.3 uF ±20%, 10 VDCW; sim to Sprague Type 162D.
C912	19A700221P44	Ceramic: 27 pF ±5%, 100 VDCW, temp coef -80 PPM.
C913	19A700007P61	Ceramic: 100 pF ±5%, 50 VDCW; temp coef 0 ±30 PPM.
C914	19A700007P29	Ceramic: 22 pF ±5%, temp coef 0 ±30 PPM.
C915	19A700007P25	Ceramic: 18 pF ±5%, 50 VDCW; temp coef 0 ±30 PPM.
C932 and C933	19A700007P61	Ceramic: 100 pF ±5%, 50 VDCW; temp coef 0 ±30 PPM.
C934 thru C936	19A700229P44	Ceramic: 27 pF ±5%, 100 VDCW, temp coef -3300 PPM.
C939	19A700007P61	Ceramic: 100 pF ±5%, 50 VDCW; temp coef 0 ±30 PPM.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR901 and CR902	5494922P1	Silicon: sim to Hughes 1N456.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	19A701329P1	Contact, electrical: rated @ 3 amps; sim to Berg 75404-001.
E3 thru E5	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
E7 and E8	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
E10 thru E16	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
		- - - - - - - - - - FUSES - - - - - - - - - -
F901	19A127884G1	Fuse Kit.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K901	19B209666P1	Sensitive, hermetic sealed: 90 ohms ±10%, 5.75 to 9.0 VDC nominal, 2 form C contact; sim to C.P. Clare MP14016003.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L901	19B232664G1	Coil.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R901	19A700106P45	Composition: 180 ohms ±5%, 1/4 w.
R902	19A134512P8	Variable: 50K ohms ±5%, 1/2 w.
R903	19A134564P1	Metal film: 15 ohms ±5%, 1/4 w.
R904	19A134512P7	Variable, cermet: 50K ohms ±10%, 1/2 w; sim to A-B A2A503.
R905	3R151P561J	Composition: 560 ohms ±5%, 1/8 w.
R906	3R151P104J	Composition: 100K ohms ±5%, 1/8 w.
R907	3R151P103J	Composition: 10K ohms ±5%, 1/8 w.
R908	3R151P123J	Composition: 12K ohms ±5%, 1/8 w.
R909	3R151P683J	Composition: 68K ohms ±5%, 1/8 w.
R910	3R151P561J	Composition: 560 ohms ±5%, 1/8 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W903	19A137417G2	Cable, RF. (Specify length).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A121175P13	Insulator, plate. (Used with K901).
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108. (Located on printed board).
	19A701329P1	Contact, electrical: rated @ 3 amps; sim to Berg 75404-001. (E1).
		HARDWARE KIT 19A143144G1
	19B232678P1	Support.
	19A134793P1805	Screw, thd. forming: No. 1-64 x 7/32. (Quantity 5 - Secures system board).
	19A134582P1	Washer, non-metallic.
	19C328742P1	Ground clip.

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.

PARTS LIST

MULTI FREQUENCY KIT
19A143173G1
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
A703		CONTROLLER 19D432096G1
CL1		DIODE BOARD 19C330513G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 thru CR20	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19A134040P4	Rotary: 2-12 positions, contacts rated .002 amps @ 6 VDC; sim to Grayhill 51MY23450.
A3501		CONTROLLER BOARD 19C330539G1
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1 thru E28	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
E29	19C330540P1	Printed wire board.
E30	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
A3503	19D430827P1	Printed Wire Board.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19C328108P3	Knob. (S1).
	19C328193P1	Knob, scaled dial.
	19A143453P1	Set screw, self locking: 3-48 x 1/8. (Secures 19C328108P3 Knob).
	19A702460P1	Contact, electrical. (Hung in wiring from S1).
	19A115834P6	Contact, electrical. (Used with A3501).
	19A115834P9	Contact, electrical: sim to AMP 3-332070-4. (Used with A3501).
	19A127319P2	Nut: No. thd. size 1/4-28. (Secures S1).
	19A134285P1	Tape, pressure sensitive. (Located under CL1 diode board).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

CHANNEL GUARD ENCODE/DECODE KIT
19A143171G1 ENCODE
19A143171G2 ENCODE/DECODE
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1001	19B232691G1	Toggle: SPDT; sim to C&K Components 7101SDG.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19B219681P1	Contact, electrical. (Quantity 9).
	19B232508P1	Seal.
	19A127319P6	Nut: No. thd. size 1/4-40.
	19B232996G3	Decorative Module. (Channel Guard).

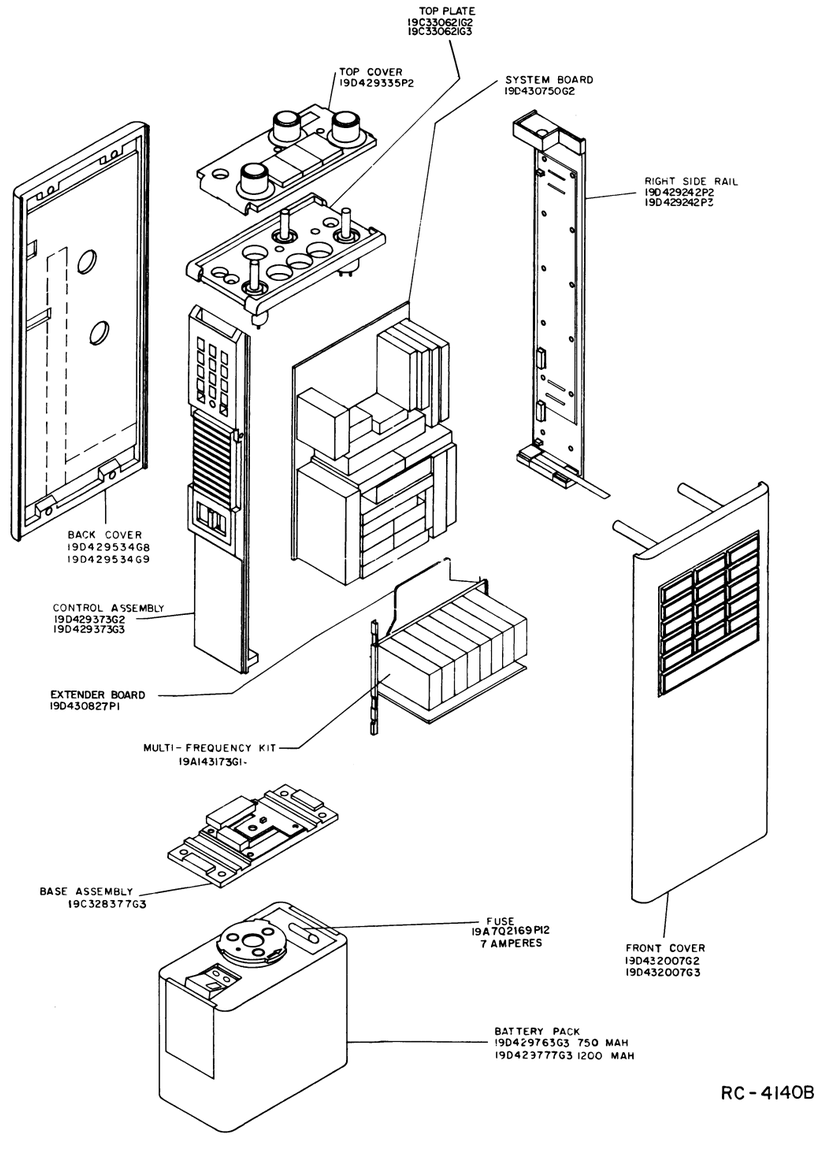
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

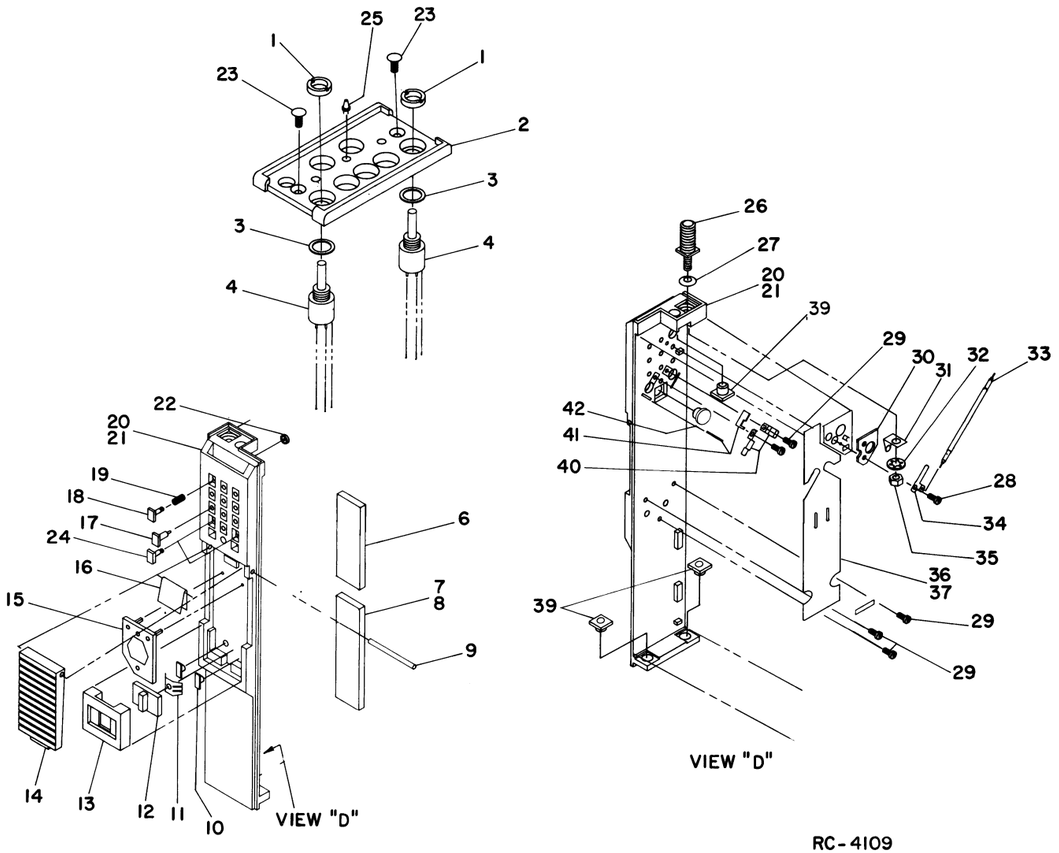
TWO FREQUENCY KIT
19A143168G1 VHF & UHF
19A143168G2 UHF W 2 OXO AUTO SELECT
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S706		SWITCH ASSEMBLY 19B232691G4
	19A116648P7	Toggle: DPDT, contacts rated 5 amps at 28 VDC or 115 VAC; sim to C & K 7201SDG.
	19A702460P1	Contact, electrical. (Quantity 3).
S707		SWITCH ASSEMBLY 19B232691G5
	19A116648P7	Toggle: DPDT, contacts rated 5 amps at 28 VDC or 115 VAC; sim to C & K 7201SDG.
	19A702460P1	Contact, electrical. (Quantity 5).
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19B232508P1	Seal.
	19A127319P6	Nut: No. thd. size 1/4-40.
	19B232996G1	Decorative module.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



RC-4140B



RC-4109

PARTS LISTS

Sheet 3

PARTS LIST

SIDE RAIL
19D429373G2 "B" CASE
19D429373G3 "C" CASE
ISSUE 5

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J701		(See items 17-19, 22, 24 on RC4109).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701		(See items 10-13 on RC4109).
S702		(See items 9, 14-16 on RC4109).
S703 and S704		(See items 19, 22, 24, 29, 40 on RC4109).
S705		(See items 18, 19, 22, 28, 30, 31, 34 on RC4109).
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W701	19A137417G1	Cable wire: approx 1 inches long.
		MECHANICAL PARTS (SEE RC4109)
6	19B232682P16	Pad.
7	19B232682P9	Pad. ("B" Case).
8	19B232682P10	Pad. ("C" Case).
9	19A134585P1	Pin, spring. (Part of S702).
10	19B234407G3	Contact. (Part of S701).
11	19B232560P1	Spring. (Part of S701).
12	19A137826G1	Slide. (Part of S701).
13	19C328373P1	Plate. (Part of S701).
14	19C328176P1	Button. (Part of S702).
15	19B800847P1	Switch, push: contacts rated 25 mA @ 9 VDC; sim to Bomar KB3256-ID. (Part of S702).
16	19A137414P1	Spring. (Part of S702).
17	19B234407G1	Contact. (J701-2 thru J701-9, J701-11).
18	19B234407G4	Contact. (Part of S705).
19	4035235P13	Spring, helical. (Part of S703-S705).
20	19D429241P2	Left side rail. ("B" Case).
21	19D429241P3	Left side rail. ("C" Case).
22	19A137413P1	Seal. (Part of S703-S705).
24	19B234407G2	Contact. (Part of S703 & S704).
26	19A137411P1	Antenna stud.
27	19A115983P13	Packing.
28	19A134588P4	Screw, panhead: size 0-40. (Part of S705).
29	19A134588P1	Drive screw. (Part of S703 & S704).
30	19B232672P1	Insulator. (Part of S705).
31	19B232671P1	Contact. (Part of S705).
32	19A702593P1	Lockwasher, internal tooth: Metric, M2.2.
33		(NOT USED).
34	19B232670P1	Contact. (Part of S705).
35	19A700034P3	Hex nut, metric: M2.5 x 0.45.
36	19D432008G1	Interconnect Board.
37		(NOT USED).
40	19A144581G1	Contact. (Part of S703 & S704).
41	19B234407G5	Contact. (Part of S703 & S704).
42	19B232415P1	Bushing.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

TOP PLATE
19C330621G2
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R701 and R702	19B232886G1	Variable, cermet: 50K ohms ±10%, 1 w.
		MECHANICAL PARTS (RC4109)
1	19A127319P1	Nut: No. thd. size 1/4-32.
2	19D429340P4	Top plate.
3	4037064P25	Washer, non-metallic.
4	19B232886G1	Resistor. (R701 & R702).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

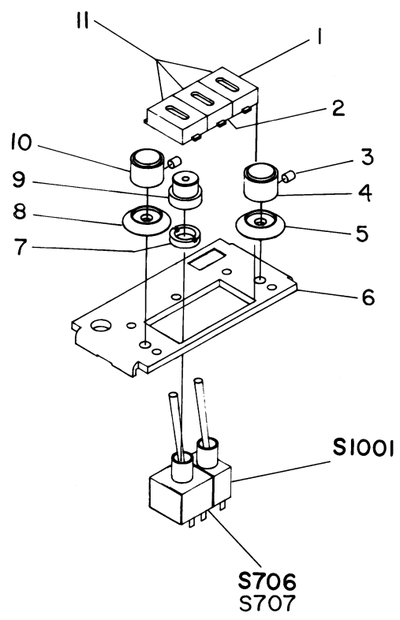
PARTS LIST

LBI31184A

TOP COVER ASSEMBLY
(Cannot be ordered as an assembly)
(SEE RC4113)

SYMBOL	GE PART NO.	DESCRIPTION
1	19B232996G3	Decorative Module. (Channel Guard).
2		(Not Used).
3	N70P702C6	Set screw: No. 3-48 x 1/8.
4	19C328108P1	Knob. (Volume).
5	19C328193P2	Knob, scaled. (Min - Max).
6	19D429335P2	Top plate.
7	19A127319P6	Nut: No. thd. size 1/4-40. (Used with 2 frequency switch S706).
8	19C328193P3	Dial, scale.
9	19B232508P1	Seal. (Used with S706, S707, S1001 switches).
10	19C328108P2	Knob. (Squelch).
11	19B232517P1	Dummy cap.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



RC-4113

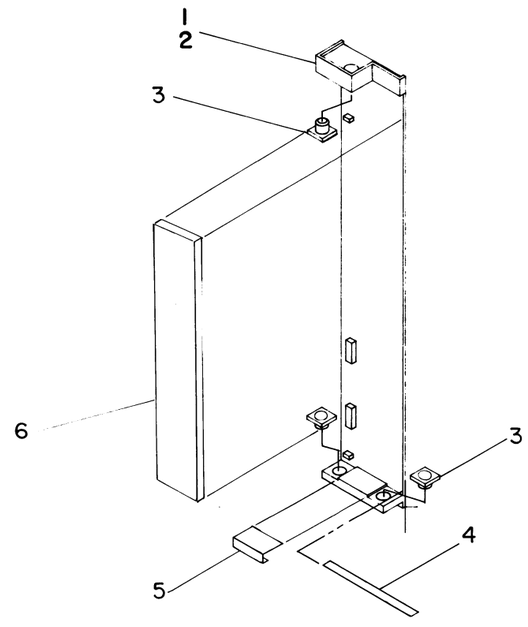
PARTS LIST

LBI31185A

RIGHT SIDE RAIL
(Cannot be ordered as an assembly)
(SEE RC4108)

SYMBOL	GE PART NO.	DESCRIPTION
1	19D429242P2	Right Side Rail. ("B" Case).
2	19D429242P3	Right Side Rail. ("C" Case).
3	19A137410P1	Bushing.
4	19B232795G1	Strap.
5	19A121175P3	Insulator plate. (Not Used).
6	19B232682P6	Pad.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



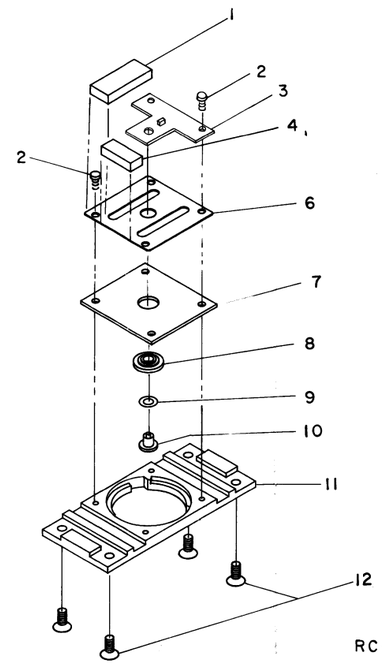
RC-4108

PARTS LIST

BASE ASSEMBLY
19C328377G1
(SEE RC3779)
ISSUE 5

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A700007P65	Ceramic: 150 pF ±5%, 50 VDCW; temp coef 0 ±30 PPM.
		MECHANICAL PARTS
2	N530P203C	Drive screw, type U: No. 0 x 3/16. (Metric).
3	19C330619P1	Printed board.
4	19C232682P11	Pad. (Not Used).
6	19B232497P1	Spring.
7	19B232706P1	Pad.
8	19A137490P1	Insulator.
9	4035306P70	Washer, non-metallic.
10	19A137531P1	Contact.
11	19D429248P1	Base.
12	19A134586P2506	Machine screw: M2.5-.45 x 6. (Not Included With Base Assembly).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



RC-3779A

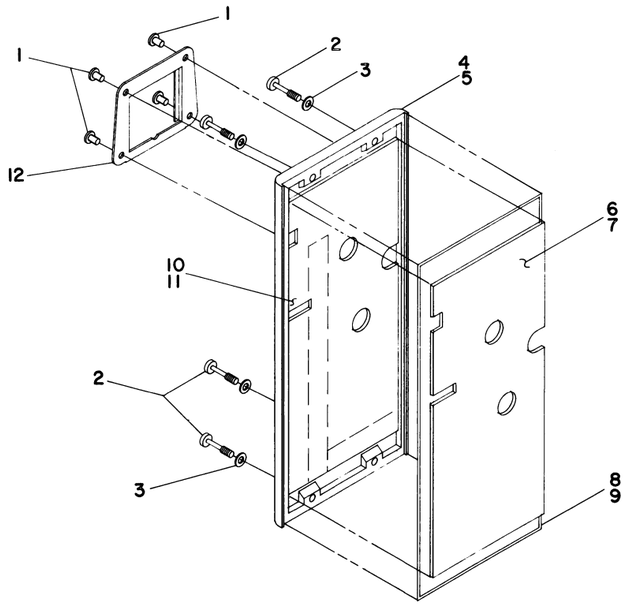
PARTS LIST

REAR COVER

19D429534G8 "B" CASE
19D429534G9 "C" CASE
(SEE RC4105)
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
1	N327P9010E	Rivet, tubular.
2	19A702863P1	Machine screw: M2.5-.45 x 13.
3	19A700032P3	Lockwasher, tooth, steel, metric: 2.5.
4	19C328374G8	Rear Cover. ("B" CASE).
5	19C328374G9	Rear Cover. ("C" CASE).
6	19B233545P5	Insulator. ("B" CASE).
7	19B233545P6	Insulator. ("C" CASE).
8	19A134583P2	Cover seal, rubber. ("B" CASE).
9	19A134583P3	Cover seal, rubber. ("C" CASE).
10	19B232524P1	Pad. ("B" CASE).
11	19B232524P5	Pad. ("C" CASE).
12	19B233216P1	Option, receptacle.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



RC-4105

PARTS LIST

FRONT COVER
19D432007G2 "B" CASE
19D432007G3 "C" CASE
ISSUE 5

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A700226P53	Ceramic: 47 pF ±5%, 100 VDCW, temp coef -750 PPM.
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - - -
LS1	19A134460P1	Permanent magnet: 2 inches, 8 ohms ±10%, imp 500 mW, 450 ±100 Hz resonant freq; sim to Pioneer 850∠P1301F.
		- - - - - - - - - - MICROPHONES - - - - - - - - - -
MK1	19A134461P1	Cartridge: 200-850 ohms imp, 1.5-10 VDC; sim to PRINO EM-60-PM12.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P901		(Part of W1).
		- - - - - - - - - - CABLES - - - - - - - - - -
W1		CABLE 19B233023G1
		- - - - - - - - - - PLUGS - - - - - - - - - -
P901		Connector. Includes:
	19A702405P4	Shell.
	19A702405P27	Contact, electrical; sim to Berg 47650. (Quantity 4).
		MECHANICAL PARTS (SEE RC4101)
1	19A134583P2	Cover seal, rubber. ("B" CASE).
2	19A134583P3	Cover seal, rubber. ("C" CASE).
3	4033714P14	Solderless terminal.
4	19A702405P4	Shell. (P901).
	19A702405P27	Contact, electrical. (Quantity 4 - P901).
5	19A134793P1804	Screw, thd. forming: No. 1-64 x 5/32.
6	19B232496P1	Speaker retaining plate.
7	19A134460P1	Speaker, permanent magnet. (LS1).
8	19A137709P1	Spacer. (Quantity 4).
9	19C328382G7	RF Cover. ("B" CASE).
10	19C328382G8	RF Cover. ("C" CASE).
11	19D429300P1	Grille.
12	19B232816P6	Pad. ("B" CASE).
13	19B232816P6	Pad. ("C CASE).
14	19B232498P1	Microphone boot.
15	19A134461P1	Microphone. (MK1).
16	19A121175P15	Insulator, plate. ("C" CASE).
17	19B232682P18	Pad. ("C" CASE).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

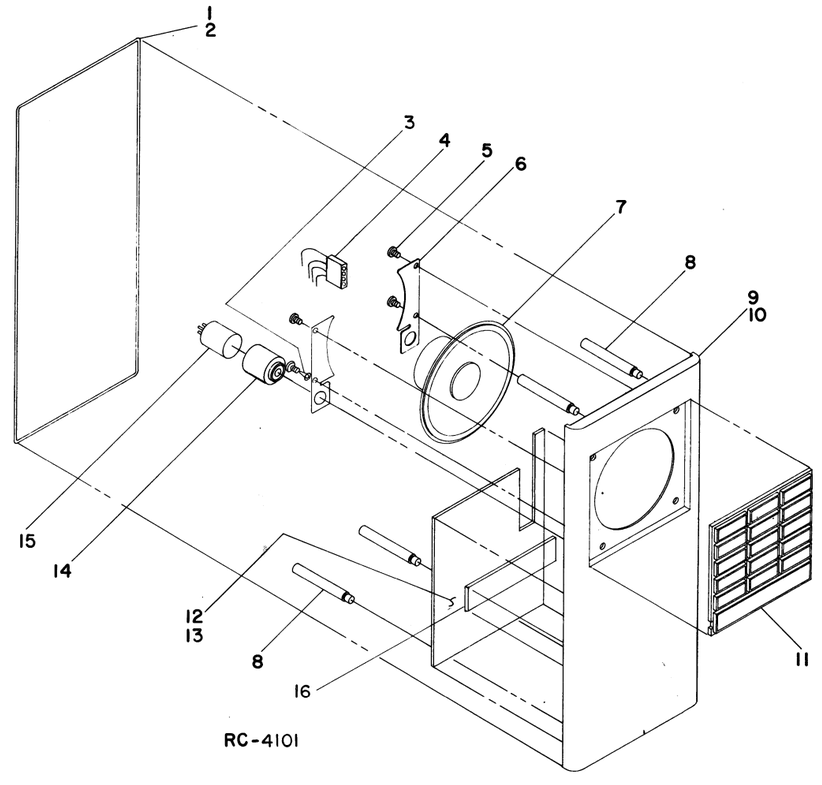
PARTS LIST

REAR COVER

19D429534G8 "B" CASE
19D429534G9 "C" CASE
(SEE RC4105)
ISSUE 4

SYMBOL	GE PART NO.	DESCRIPTION
1	N327P9010Y6	Rivet, tubular.
2	19A702863P1	Machine screw: M2.5-.45 x 13.
3	19A700032P3	Lockwasher, tooth, steel, metric: 2.5.
4	19C328374G12	Rear Cover. ("B" CASE).
5	19C328374G9	Rear Cover. ("C" CASE).
6	19B233545P5	Insulator. ("B" CASE).
7	19B233545P6	Insulator. ("C" CASE).
8	19A134583P2	Cover seal, rubber. ("B" CASE).
9	19A134583P3	Cover seal, rubber. ("C" CASE).
10	19B232524P1	Pad. ("B" CASE).
11	19B232524P1	Pad. ("C" CASE).
12	19C850865P1	Option, receptacle.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



RC-4101