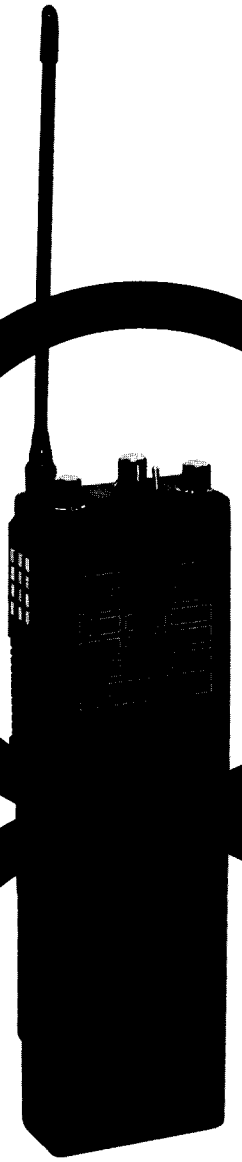
BENCH #2

MOBILE RADIO

MPR

MAINTENANCE MANUAL LBI30866E

DATAFILE FOLDER DF9047



406—512 MHz
PERSONAL
TWO-WAY FM RADIO
P2B/C COMBINATIONS

GENERAL ELECTRIC

TABLE OF CONTENTS

ILLUSTRATIONS

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SPECIFICATIONS

SYSTEM

Dimensions (H x W x D)	P2B	P2C
(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		
2 Watts	1.1 amperes	
5 Watts	2.2 amperes	

TRANSMIT

Type Numbers	KT175B/C	KT176B/C
Power Output (Adjustable)	1 to 2 Watts	1 to 5 Watts
Spurious		
Radiated	-69 dB	-69 dB
Conducted	-69 dB	-69 dB
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	24 MHz (measured at UDC Jack)	

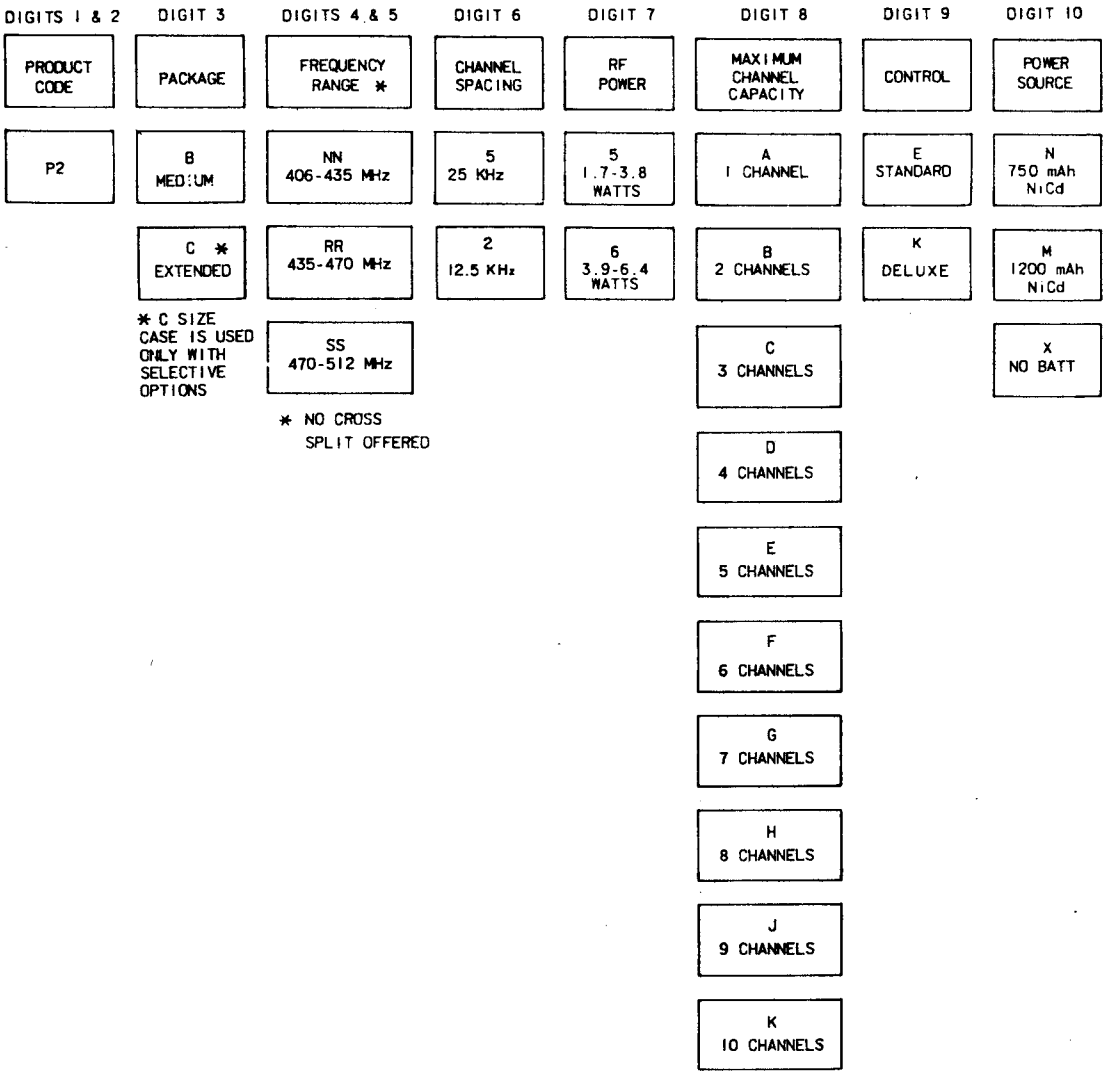
RECEIVE

Type Number	ER114B/C
Frequency Range	406-512 MHz
Sensitivity	
20 dB NQ	0.15 µV
12 dB SINAD	0.35 µV
Critical Squelch	0.25 µV
Selectivity	
20 kHz	-70 dB
25 kHz	-85 dB
30 kHz	-95 dB
Intermodulation	-75 dB
Spurious & Image	-80 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 (1000 Hz reference)
Audio Distortion	Less than 5% at 1000 Hz
Modulation Acceptance	±7 khz

BATTERY PACK

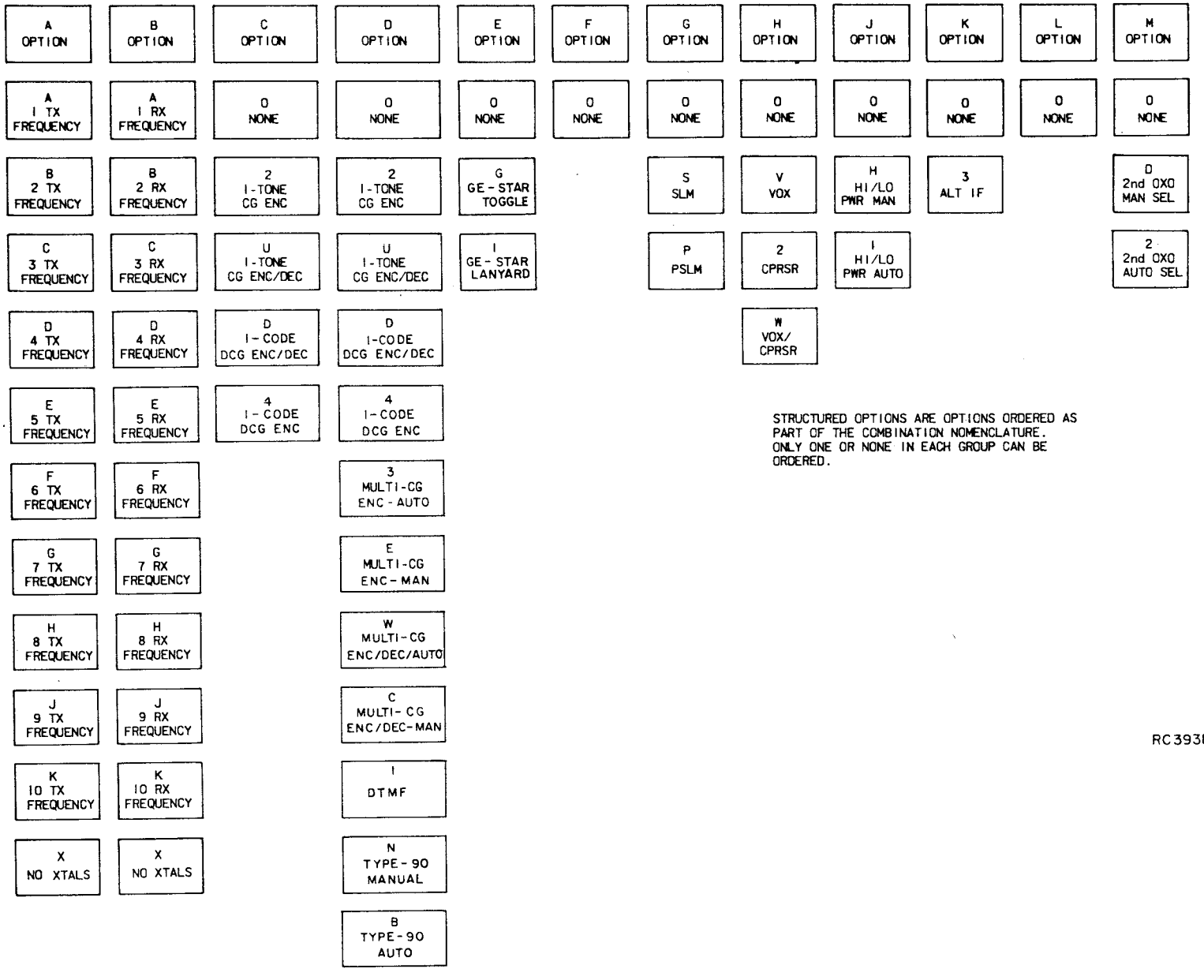
Capacities	750 & 1200 mAh
Maximum Charge Rate	1 hour
Fuse Rating	5 amperes
Charging Temperature Range	+5° to 45°C
Discharging Temperature Range	-30° to +60°C

COMBINATION NOMENCLATURE



RC3938 SH. 1, REV. A

STRUCTURED OPTIONS



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

RC3938 SH. 2, REV. A

DESCRIPTION

General Electric's MRP 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 MPR radio offers outstanding advances in reliability, Option flexibility and repairability.

Each MPR 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 MPR 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. MPR provides a 24 MHz bandwidth with no RF tuning. Practically, the transmit frequency range is limited only by the antenna VSWR.

Two power levels are available in the MPR transmit circuit and are designated by transmit type numbers, KT175B/C and KT176B/C. KT175B/C provides 1 to 2 watts output while KT176B/C provides 1 to 5 watts output.

The MPR 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 MPR and is designated by receive type number ER114B/C.

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

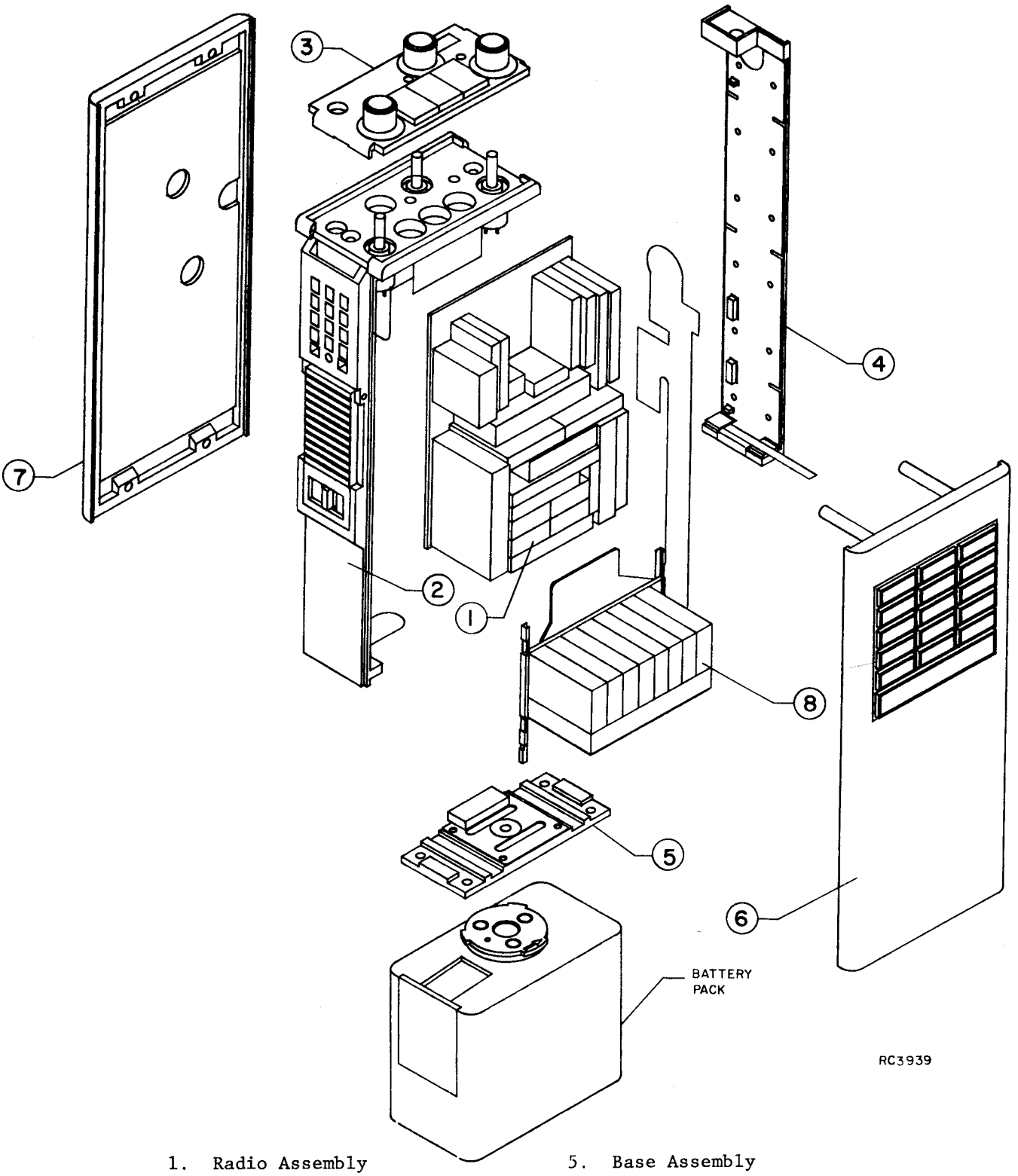
Controller Assembly

The Controller Assembly consists of a BCD channel select switch mounted on the control assembly and connected through a flexible printed wire board to a controller board. Mounted on the controller board is a simple or deluxe controller module, and 8 receive oscillator modules. The simple controller module provides ten oscillator keying leads without the ability to program repeat frequencies. Multiple tone Channel Guard and DPL functions can be programmed from the channel select switch.

The deluxe controller module provides the ultimate in system control with the ability to fully program repeat oscillators in the receive and transmit mode. Control is also provided for four system options.

Extender Assembly

The Extender Assembly consist of a printed wire board connecting the controller board to the system board and control circuits.



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

Figure 1 - MPR Assemblies

Control Assembly

The Control Assembly consists of a molded Lexan® side rail, a molded Lexan® top plate and a flexible printed wire board. 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 a red LED transmit indicator. Three toggle switches and a rotary switch are also available for option control.

The flexible printed wire board is folded around the radio assembly and makes all major interconnections between the radio assembly, UDC accessory jack and all operating controls including option controls. The flexible printed wire board does not make coax power output connections, speaker connections and the PA DC feed jumper.

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

Top Cover Assembly

The top cover is a decorative molded Lexan® top cap snapped in place over the top plate. When in place, the top cover seals the volume, squelch and option controls against water and provides the proper 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 MPR 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 MPR housing and mounts the system speaker and local microphone. The assembly consists of a die cast aluminum cover, speaker grille, speaker, microphone, a rubber boot for both the speaker and the microphone, providing isolation from vibration, a retaining clip, fastener, standoffs and Ensolite® foam shock pads.

The aluminum front cover assembly provides additional heat sinking for the transmit 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® case 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 top plate, control side rail and system board are interconnected by the flexible printed wire board. 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 is nested between shock pads in the side and base assemblies. After all modules are plugged into the system board, the front and rear covers are fastened together (after connecting the speaker and microphone) with four screws through the rear cover into the four standoffs on the front cover. The Lexan® top cover is snapped on the top of the top plate and the volume and squelch knobs are assembled. The antenna is screwed on the antenna stud and the battery pack attached. The MPR 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.

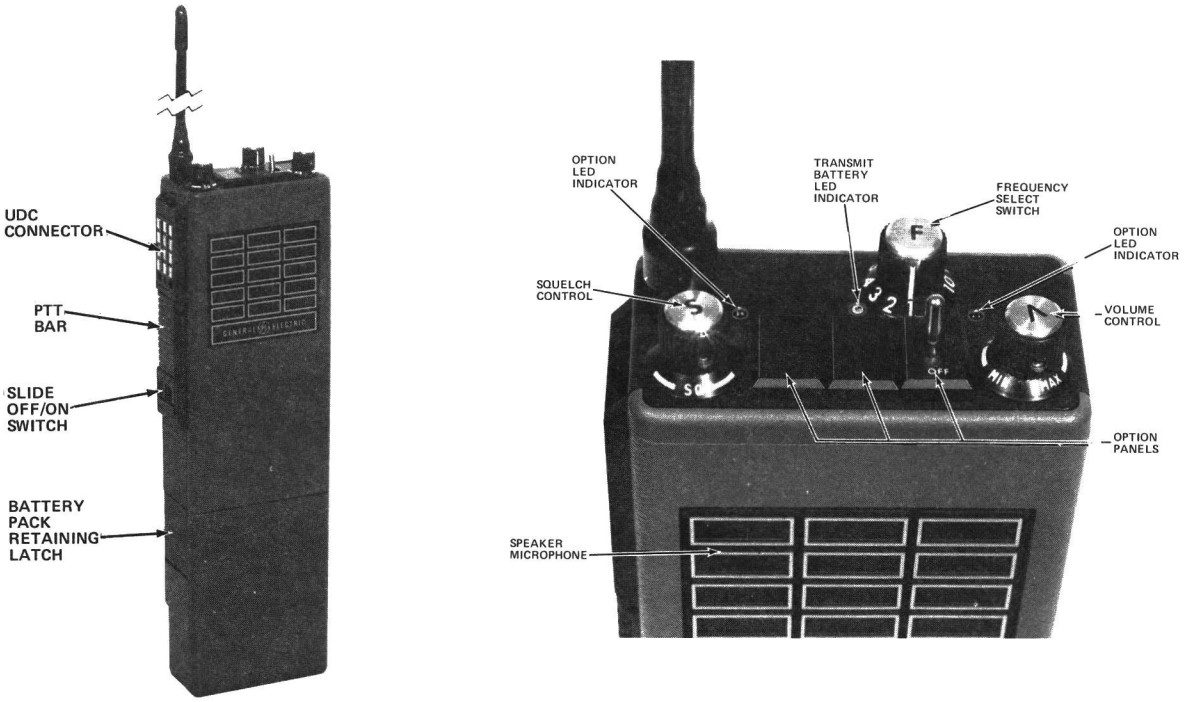


Figure 2 - Operating Controls

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 MPR receive circuit is now ready to receive messages.

TO SEND A MESSAGE

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

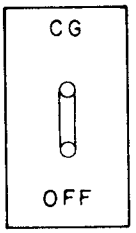
2. LISTEN to insure no one is transmitting on the selected channel. NEVER interrupt another transmission.

3. While holding the radio so the antenna is vertical, press the Push-To-Talk (PTT) bar and speak directly into the Speaker grill 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.

OPTIONS

Channel Guard

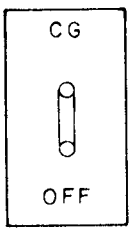
If your radio is equipped with a Channel Guard (CG) option, you have, on the control panel, a two position switch labeled CG-OFF. With the switch in the CG position the decoder permits you to hear only those calls that are tone-coded on your Channel Guard frequency. The encoder permits you to communicate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

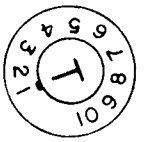


Multiple Tone Channel Guard

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.

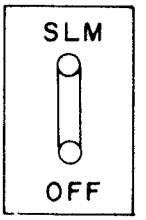




Search Lock Monitor

If your radio is equipped with a Search Lock Monitor (SLM) option, you have, on the top cover, a two-position switch labeled SLM-OFF. With the switch in the SLM position and a signal is not present, the SLM alternately searches between two receive channels and the LED indicator blinks at a fast rate. One of the receive channels is selected by the frequency select switch. The other receive channel is pre-programmed. When a signal is present, the SLM locks on the active channel and the LED indicator stops blinking. When a signal is no longer present, the SLM resumes searching. Before transmitting, the search must be defeated by placing the two-position switch in the OFF position. When the switch is in the OFF position, the radio transmits on or monitors only the channel selected by the frequency select switch.

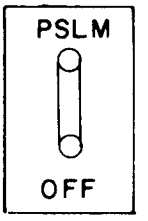
Although search should be defeated before transmitting, the transmit circuit will key on the pre-programmed channel if the two-position switch is in the SLM position.



Priority Search Lock Monitor

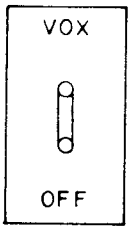
If your radio is equipped with a Priority Search Lock Monitor (PSLM) Option, you have on the top cover, a two-position switch labeled PSLM-OFF. When the switch is in the PSLM position and a signal is not present, the PSLM alternately searches between two receive channels and the LED indicator blinks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

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



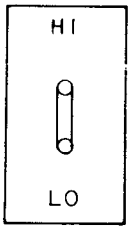
Voice Control

If your radio is equipped with a Voice Control (VC or VOX) option, you have on the top cover, a two position switch labeled VOX-OFF. With the switch in the VOX position, speaking into the external microphone keys the transmitter. When the switch is in the OFF position speaking into the external microphone will not key the transmitter.



HI/LO Power

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



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

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.
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.

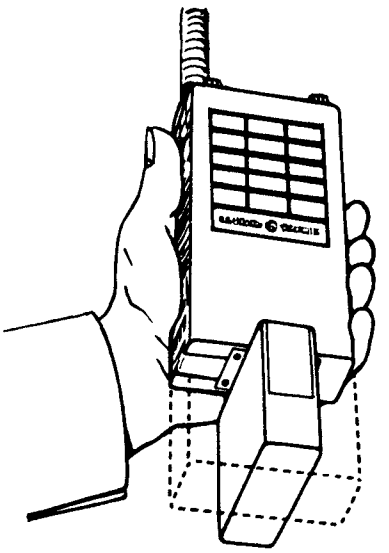


Figure 3 - Battery Pack Replacement

RE-CHARGING BATTERY PACKS

The MPR radio is equipped with a 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 MPR battery packs. For specific instructions refer to the applicable charger Operating Manual.

OPERATING TIPS

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

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

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

SYSTEM ANALYSIS

General Electric's MPR 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.

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

All control leads for the MPR radio are "barred", such as $\overline{\text{PTT}}$ or $\overline{\text{CAS}}$. This means the lead is in a low voltage condition when the function name is true. For example, $\overline{\text{PTT}}$ 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 MPR transmit circuit, as shown in Figure 4 - Block Diagram, consists of the following integrated circuit modules:

Audio Processor (TX-AA)

Optional Speech Compressor/Voice Control (SC/VC)

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 $\overline{\text{PTT}}$ lead is in a low voltage condition. The $\overline{\text{PTT}}$ 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 unless, an optional speech compressor is used. An additional 10 dB of microphone gain can be obtained by connecting a 3.6K resistor in series with a 2.2 mfd tantalum capacitor between the MIC GAIN lead and ground.

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

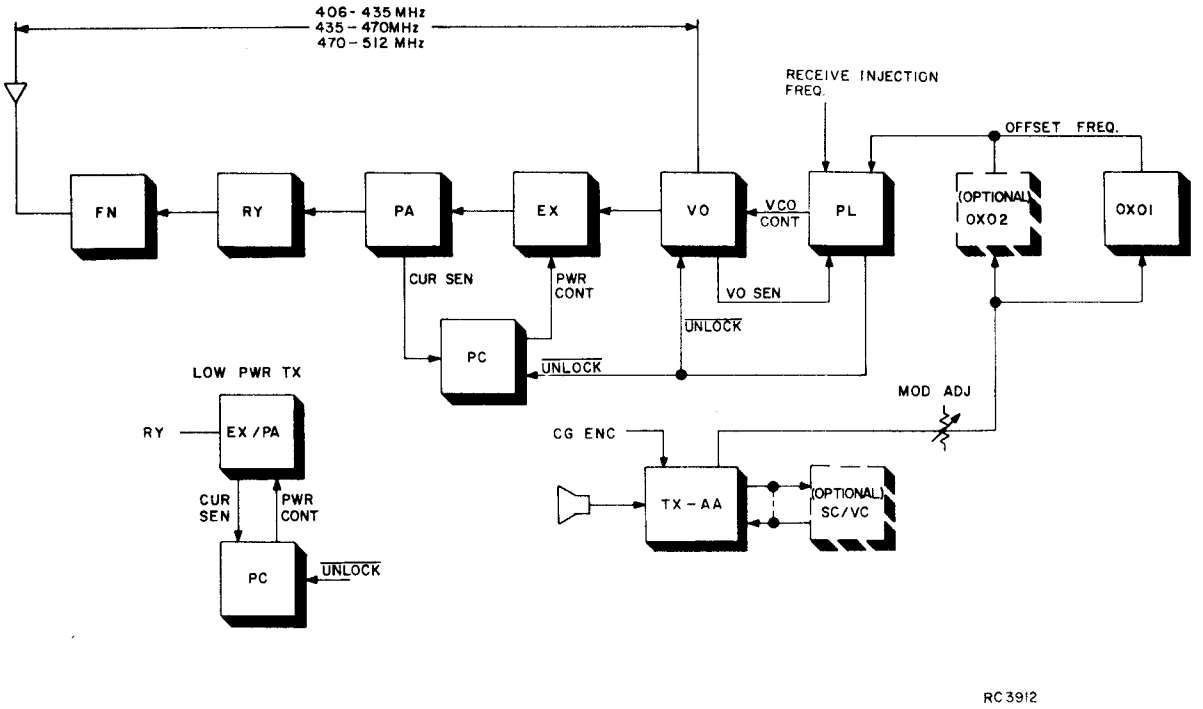


Figure 4 - Transmit Circuit Block Diagram

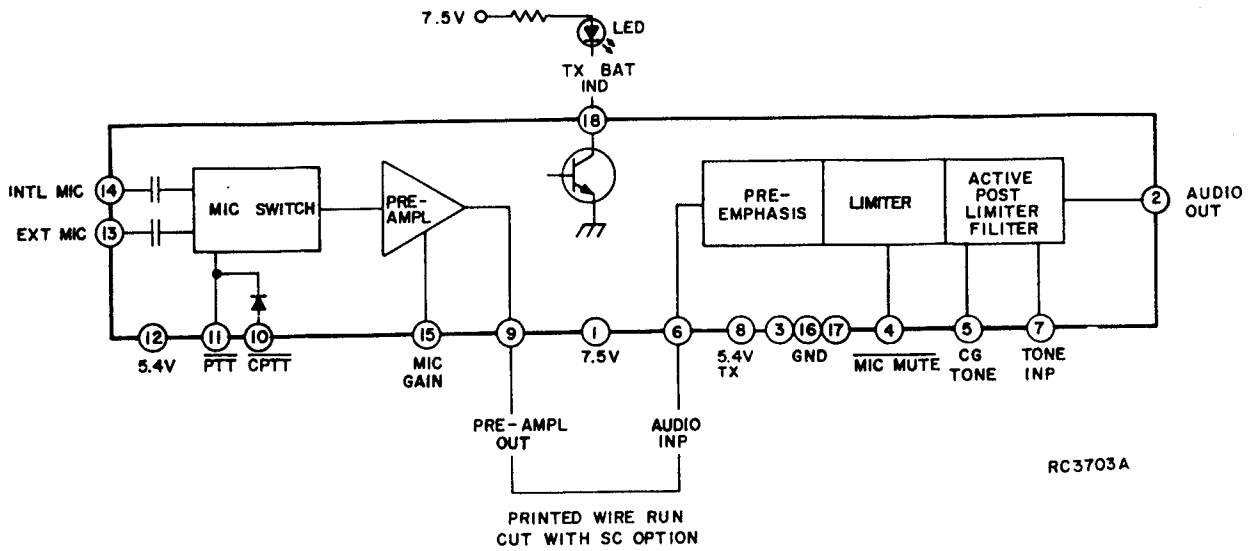


Figure 5 - Audio Processor

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.

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

Optional Speech Compressor Module (SC)

The speech compressor module provides a constant audio input level to the amplifier-limiter circuits in the audio processor module. This input level is typically, 45 millivolts at the threshold of compression, and holds the transmitter deviation approximately 2 to 3 dB into limiting; typically, 3.8 kHz of deviation. The compressor will hold the level constant over a 30 dB increase in level over threshold.

There is no discernable difference in audio quality between a radio with a speech compressor and a radio without. The frequency response of the SC module is flat from 300 to 3000 Hz. The SC module also provides 12 dB of gain below compression, for either external or internal microphones. Audio from Pin 9 of the audio processor module is connected to Pin 8 of the SC module. When the SC module is used, the printed wire run between Pin 6 and Pin 9 of the audio processor is cut (Refer to Figure 5).

Keying the transmit circuit applies 5.4 Volts to Pin 9 of the SC module (See Figure 6). Below compression, the SC circuit behaves like an amplifier with 12 dB gain. The output of the AC amplifier is insufficient to cause the DC amplifier to operate. In compression, the AC amplifier output is sufficient to cause the detector and DC amplifier to provide a gain control DC voltage to the attenuator, resulting in a constant 45 millivolt output on Pin 1. Pin 1 of the SC module is connected to Pin 6 of the audio processor module.

The recovery time for the SC is typically 800 milliseconds.

Optional Voice Control Module (VC or VOX)

The optional voice control module keys the transmit circuit when the operator speaks into the external microphone. To be operational, the VC module must have the Option Control switch in the VOX position and the $\overline{\text{RUS}}$ control lead must be in a high state indicating the receiver is in a squelched condition. This prevents the receive audio from causing the transmit circuit to key.

Audio from Pin 9 of the audio processor module is connected to Pin 8 of the VC module (see Figure 7). The audio is coupled to the input of a selective amplifier. The selective amplifier has a maximum sensitivity of 4.0 millivolts input to the MIC switch at an audio frequency of 650 Hz. This results in a deviation of a 1 kHz when a compressor is not used. The output of the selective amplifier is connected to a rectifier circuit where it is rectified and applied to a switch. If the Option Control switch is in the OFF position and the $\overline{\text{RUS}}$ control lead is high, the DC voltage is connected through the switch to the negative (-) input of a comparator amplifier. When the current flowing through the negative input of the comparator amplifier is greater than the current flowing through the positive (+) input, the output of Pin 4 will pull the $\overline{\text{CPTT}}$ lead low and key the transmit circuit.

The gain of the comparator amplifier and the sensitivity of the VC module is determined by resistor R2102 connected between Pin 7 and system ground. For optimum gain R2102 is 43K. If R2102 were larger, the gain would be greater and if R2102 were smaller, the gain would be less. An acceptable range for R2102 is from 0 ohms to 80K ohms.

The attack time for the VC module is approximately 20 milliseconds. An RC time constant in the comparator amplifier holds the release time at 1 second.

Offset Oscillator Module (TX-OXO)

The offset oscillator module is self-contained and FM modulated (see Figure 8). A high-Q Series resonant circuit oscillates at the crystal fundamental frequency (16.0 - 26.8 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.

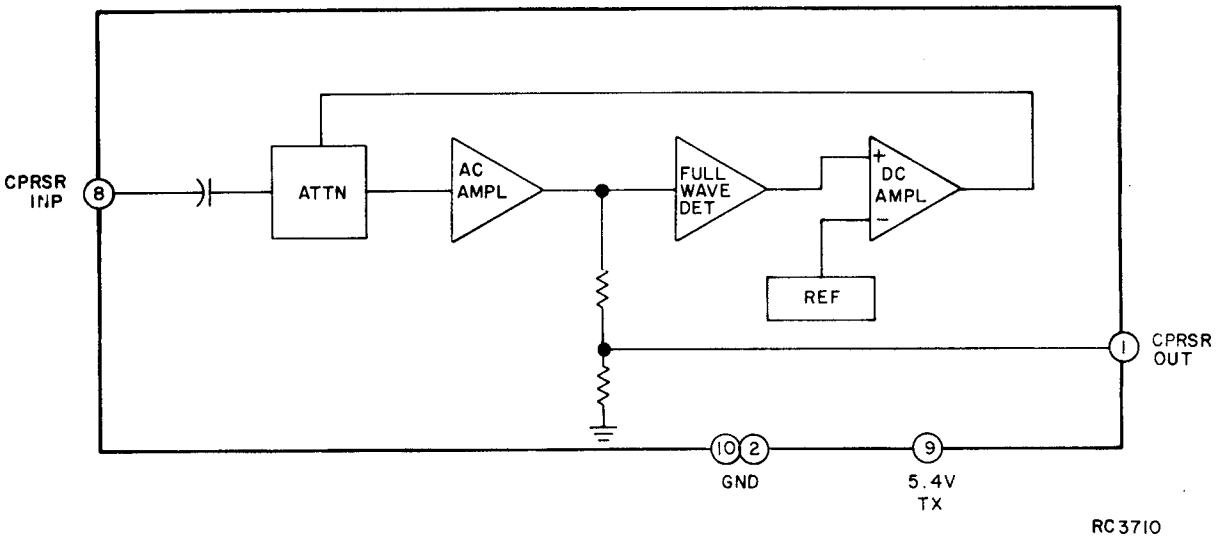


Figure 6 - Speech Compressor

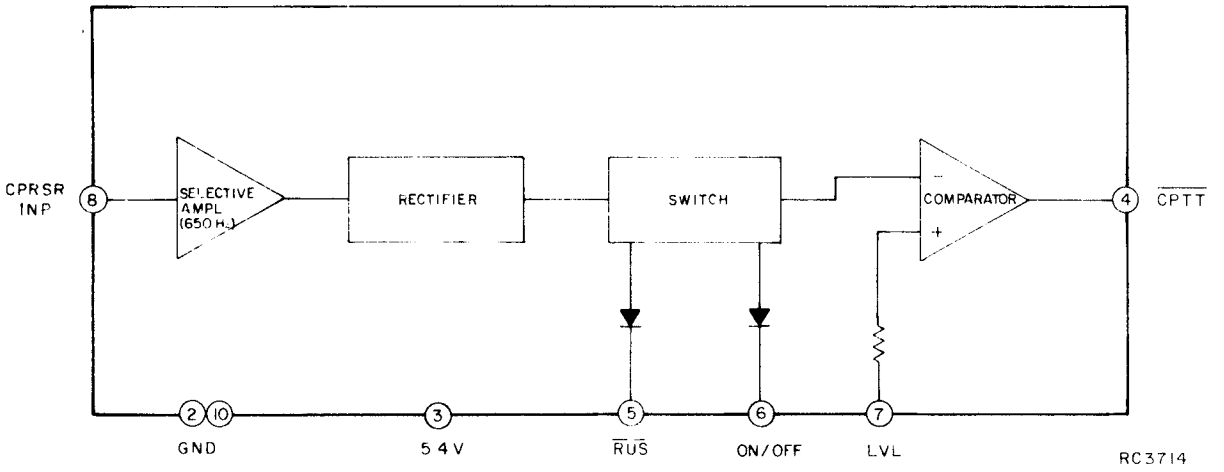


Figure 7 - Voice Control

The modulated output of the offset oscillator module is connected to Pin 10 of the phase lock loop 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 9). 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

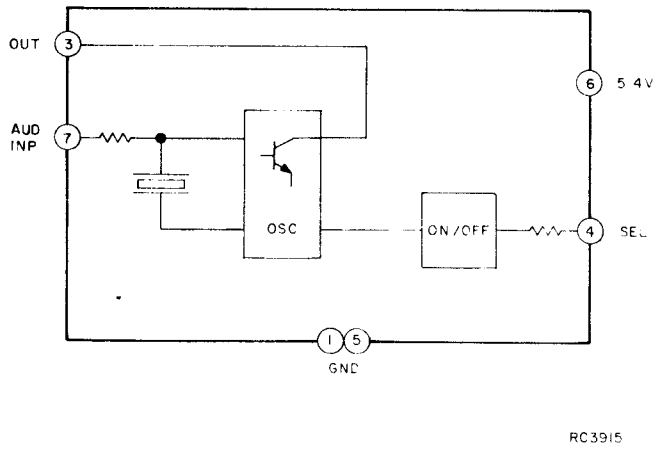


Figure 8 - Offset Oscillator Module

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.

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

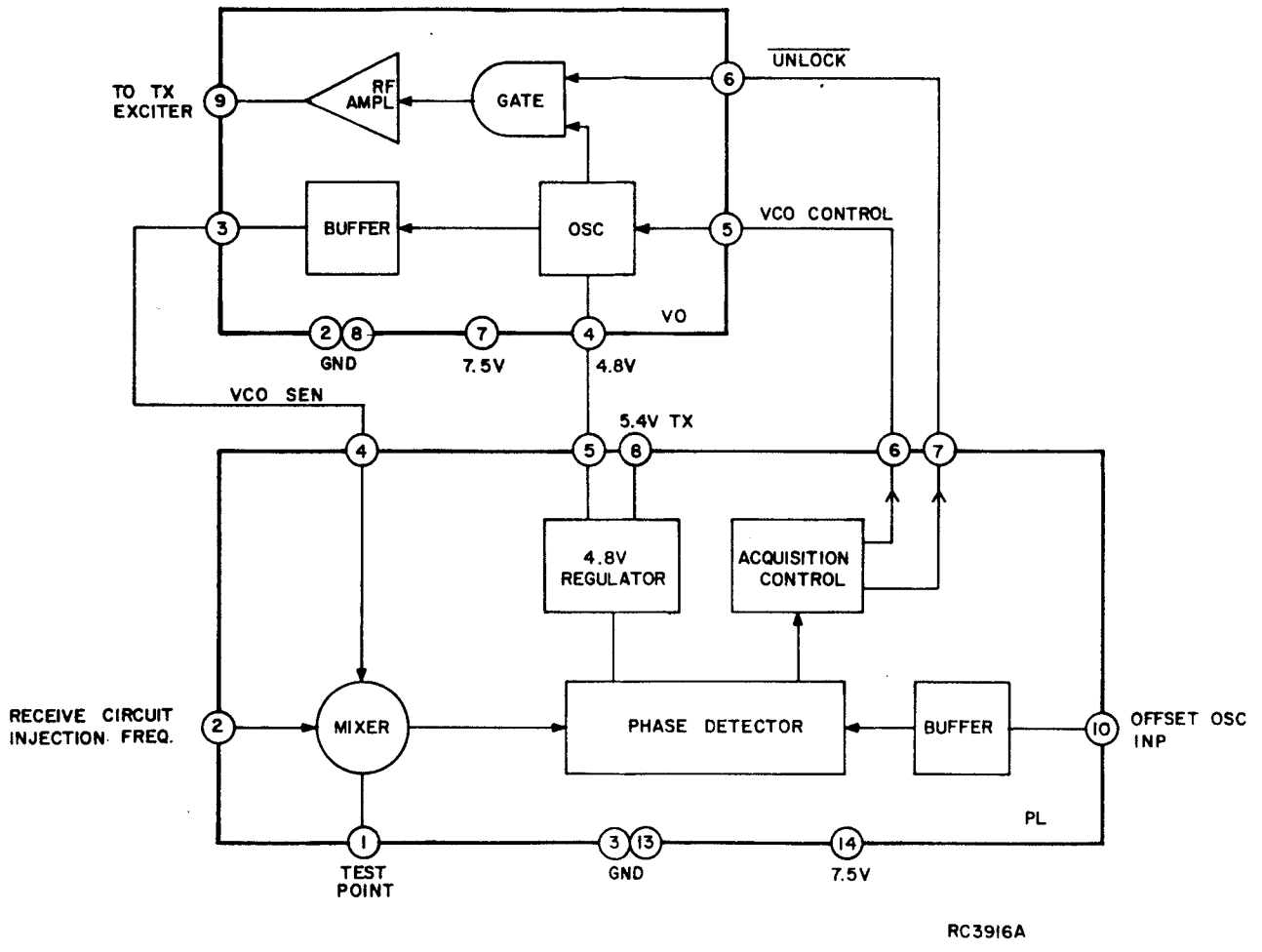


Figure 9 - Phase Lock Loop and Voltage Controlled Oscillator

If at any time the phase lock loop should break lock, the transmit output will immediately be inhibited by the phase detector, pulling the $\overline{\text{UNLOCK}}$ 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 10), 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).

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).

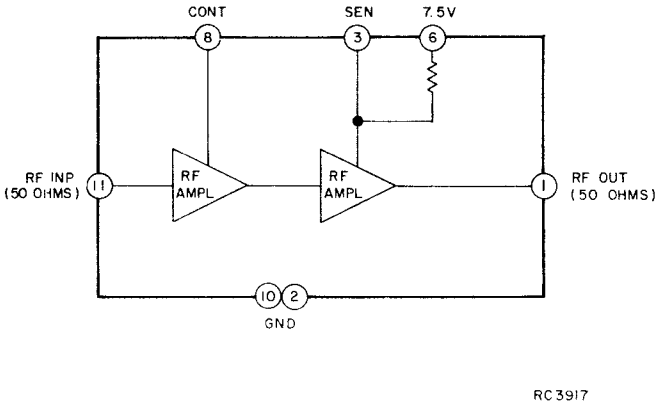


Figure 10 - Exciter

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 11).

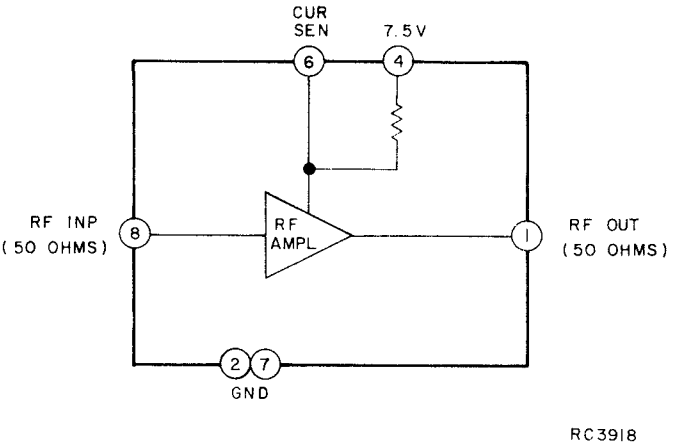


Figure 11 - Power Amplifier

The RF power amplifier stage amplifies the 2 watt input from the EX module to a minimum power output level of 5 watts at Pin 1. The output at Pin 1 is connected through the antenna relay (RY) to Pin 1 of the filter network module (FN).

Power Control Module (PC)

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

When the transmit circuit is keyed, the output of a reference generator, determined by the HI and LO power adjust controls, is applied to the positive (+) input of a comparator amplifier (See Figure 12). The current sensing element in the final PA module is connected to Pin 7 of the PC module and to the negative (-) input of the comparator amplifier. The amplifier is enabled when the $\overline{\text{UNLOCK}}$ lead goes high. Until then, the output of the amplifier is high and the series regulator is held off. When the $\overline{\text{UNLOCK}}$ lead goes high, the output of the amplifier goes low causing the series regulator to conduct and apply maximum supply voltage to the driver stage.

As the PA module begins to draw more current and the power increases, the changing voltage drop across the sensing element causes the series regulator circuit

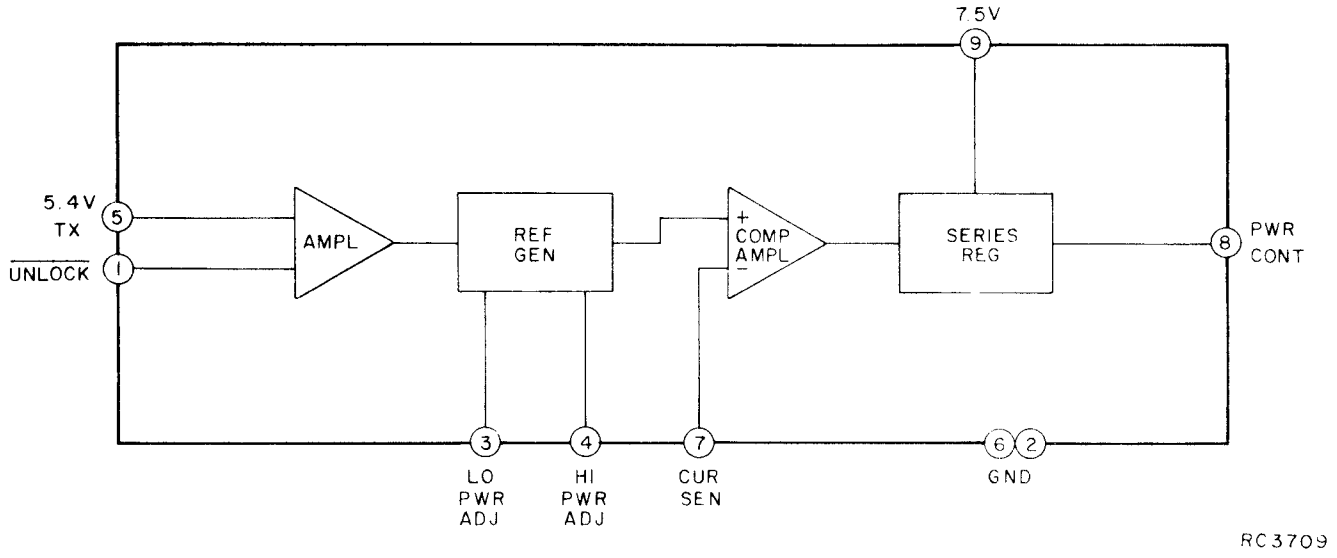


Figure 12 - Power Control

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 40 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 13).

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

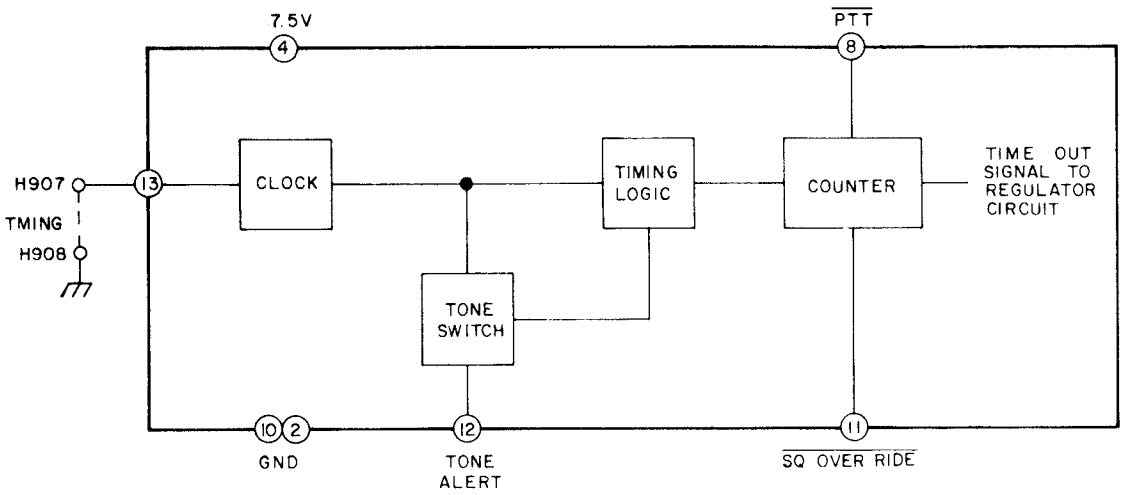
The MPR receive circuit, as shown in Figure 14 consist of the following integrated circuit modules:

- 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 15). A basic colpitts fifth mode oscillator circuit operates in the frequency 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



TMING	RESISTOR VALUE CONNECTED BETWEEN H907 AND H908	GE PART NO.
60 SECONDS	430K	3R151P434J
90 SECONDS	820K	3R151P824J

RC3723A

Figure 13 - Carrier Controlled Timer

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 multi-turn 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 16). 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 17).

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.

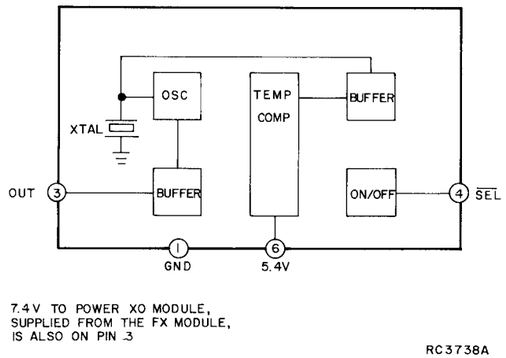


Figure 15 - RX Oscillator

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 18). 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 19). 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.

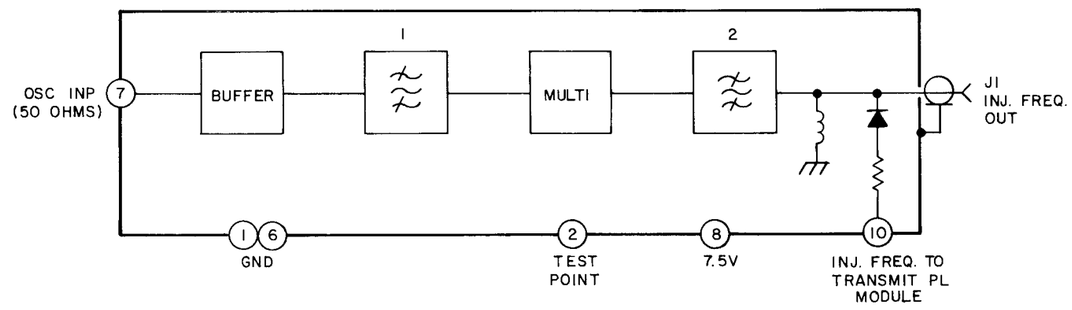


Figure 16 - Frequency Multiplier Module

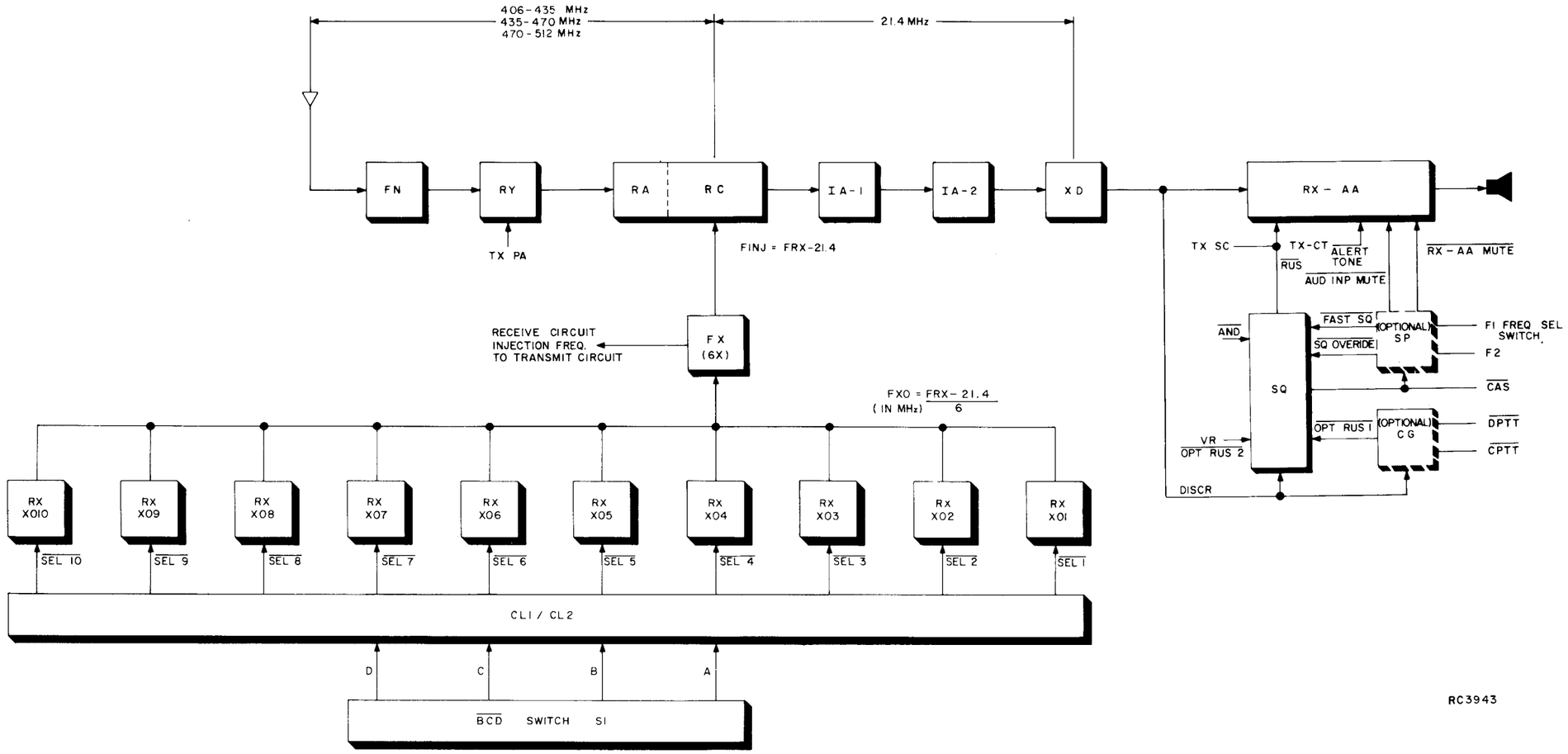


Figure 14 - Receive Circuit Block Diagram

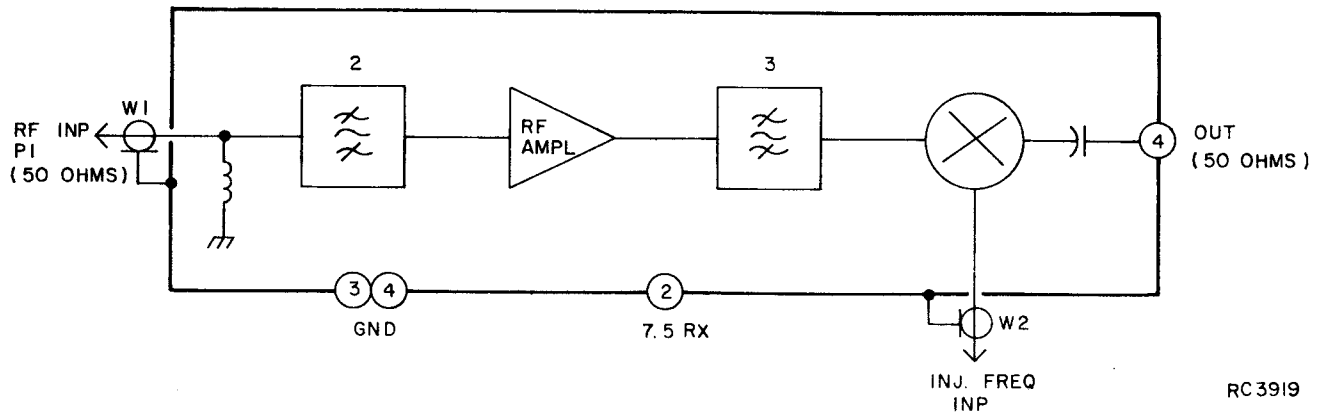


Figure 17 - RF Amplifier/Receive Converter Module

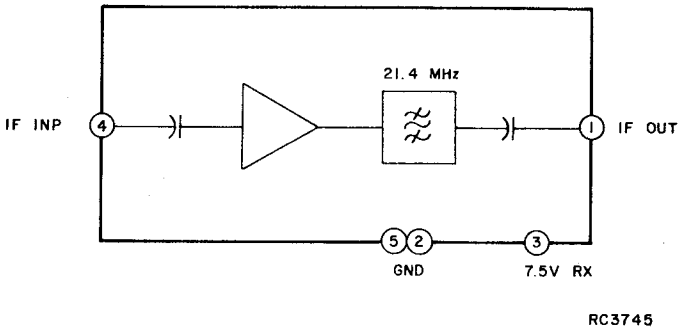


Figure 18 - IF Amplifier

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 20). 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, $\overline{\text{CAS}}$ switch and logic circuit (See Figure 21).

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 $\overline{\text{FAST SQUELCH}}$ and

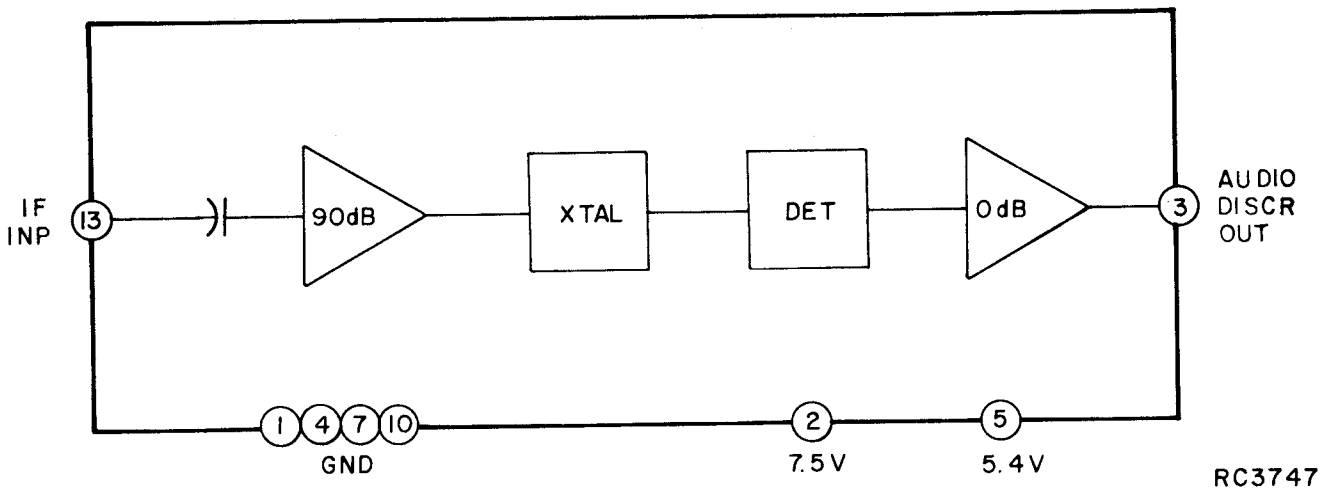


Figure 19 - Crystal Discriminator

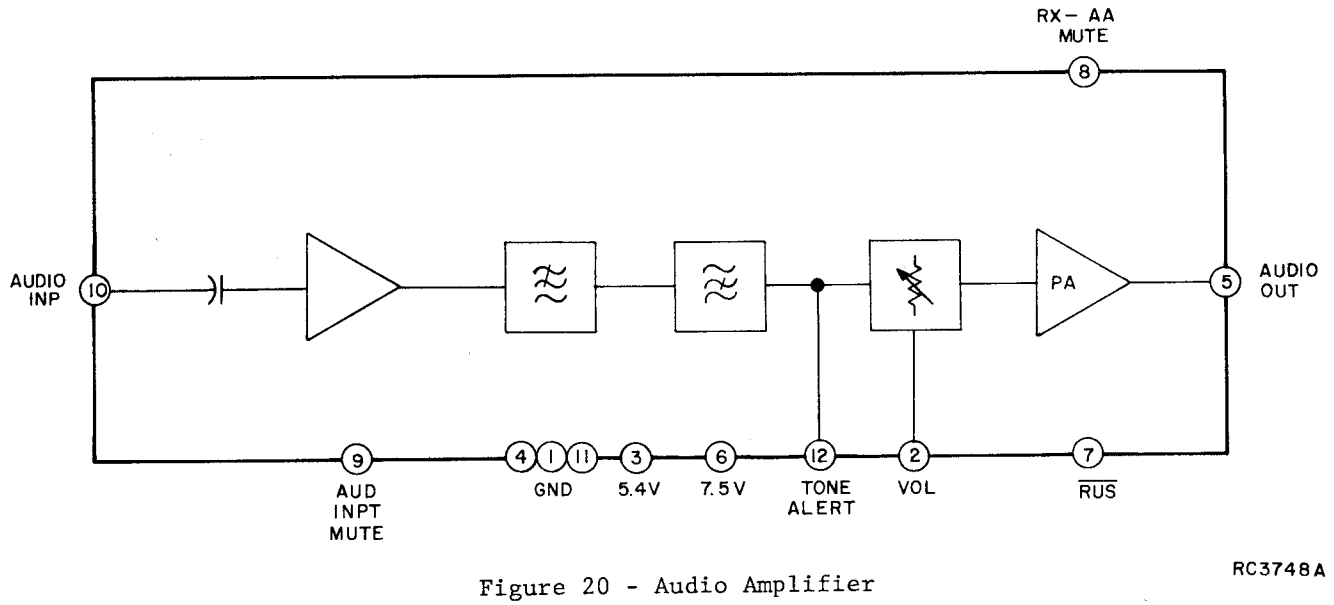


Figure 20 - Audio Amplifier

$\overline{\text{CAS}}$ outputs. When squelched the FAST SQUELCH control lead is low and the $\overline{\text{CAS}}$ control lead is high. 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 and to the carrier activity sensor ($\overline{\text{CAS}}$) output. When the input to the $\overline{\text{CAS}}$ output is low, the LED channel busy indicator lights.

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

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

If two external tone decoders are used, the AND as well as the OR functions of these

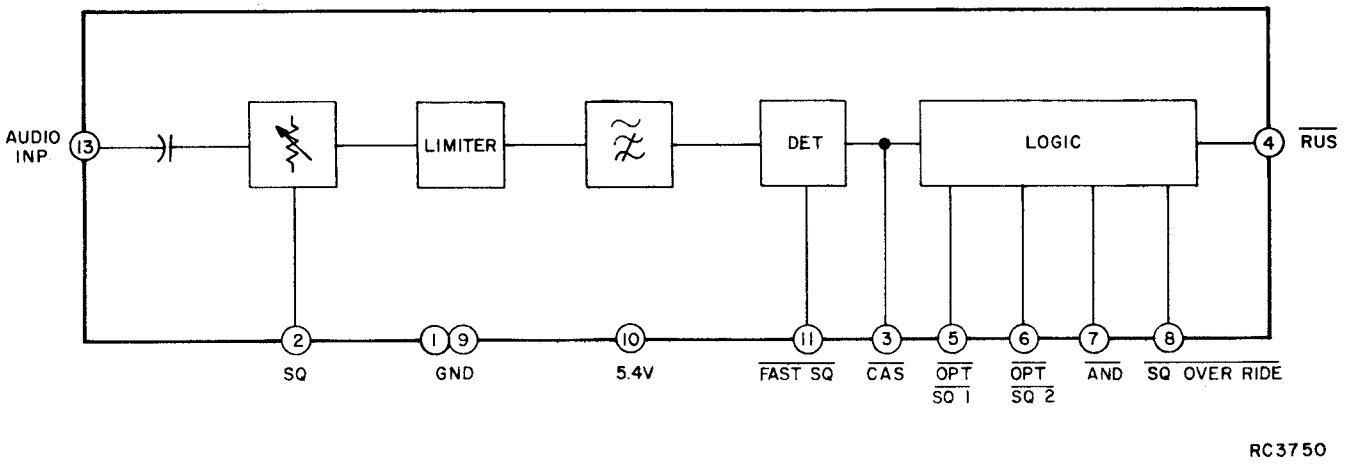


Figure 21 - Squelch

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.

Optional Channel Guard Module (CG)

The Channel Guard module contains a tone frequency synthesizer, encoder, decoder and Squelch Tail Eliminator circuitry (See Figure 22). 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.

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.

Optional Digital Channel Guard (DCG)

The DCG module contains three integrated circuits consisting of a system linear circuit, an encoder circuit and a decoder circuit (see Figure 23). The system linear circuit contains the required analog circuits, including a crystal controlled slow clock oscillator circuit, a free running fast clock oscillator circuit, a limiter circuit, for received audio, active filter components and system interfacing.

The encoder circuit is programmed to produce a repetitive, twenty-three bit binary word. This binary word can be one of 83 possible codes between 023 and 754 (see DCG Programming Procedure). The programming is accomplished by nine programming pins located on the top of the module.

When the transmit circuit is keyed, the $\overline{\text{CPTT}}$ lead is pulled low and the Digital Channel Guard module responds by pulling

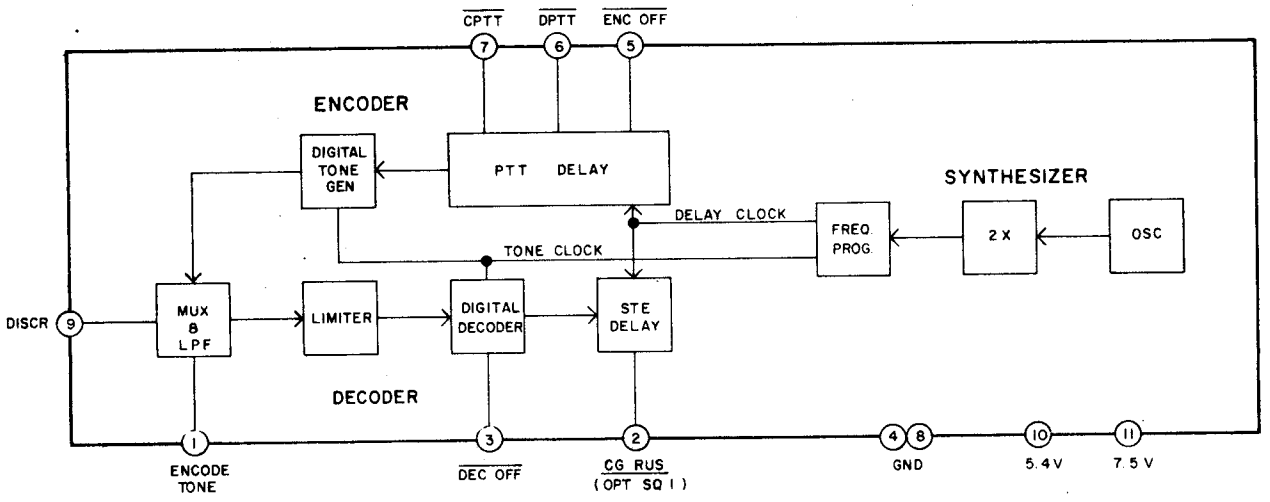


Figure 22 - Channel Guard

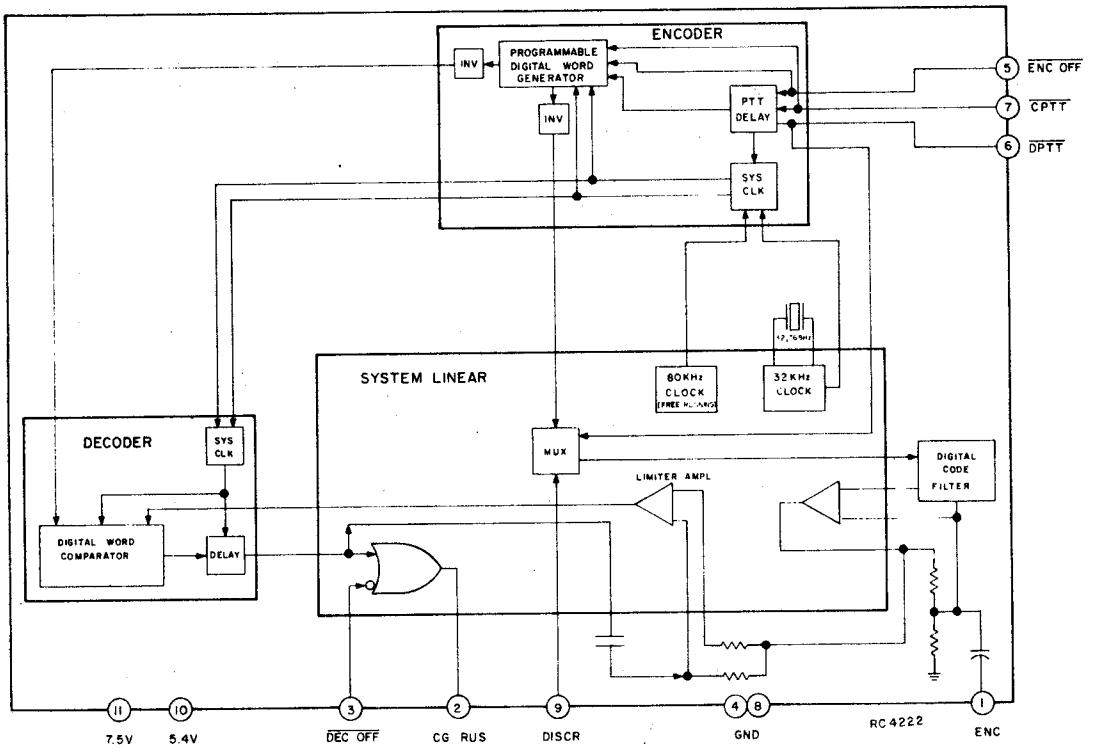


Figure 23 - Digital Channel Guard

the $\overline{\text{DPTT}}$ lead low, holding the transmit circuit in a keyed condition. The encoder circuit generates a repetitive twenty-three code word, using the slow 32 kHz clock, which passes through a low pass filter (Digital Code Filter) to remove any high frequency components. The digital output is connected by the DCG 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 addditional 180 milliseconds by holding the $\overline{\text{DPTT}}$ lead low during this time. During this 180 milliseconds delay, the digital word generator generates a 135 Hz square wave. This transmitted square wave and the 180 millisecond delay causes

the DCG decoder in other receivers to squelch the receiver circuit audio prior to loss of RF signal. This reduces or eliminates the receiver noise burst.

During receive, the receive circuit audio on the DISCR lead is fed to the DCG module where it passes through a 212 Hz low pass filter to remove voice information. This prevents interference in detecting the correct code word in the decoder circuit. The decoder circuit compares the digital code word received by the receive circuit to the digital code word generated by the digital word generator. All possible combinations of the code word are check to insure the correct code word is detected. Comparisons are made at the fast 80 kHz clock rate for a fast response time. The module responds by releasing the DCG RUS lead normally held in a low voltage condition when the correct code word is not detected. Releasing the DCG RUS lead unsquelches the receive circuit.

Optional Priority Search Lock Monitor (SP)

The priority search lock monitor allows the receive circuit to monitor each receive channel every 40 milliseconds. This is accomplished by alternately switching on each receive oscillator module (See Figure 24).

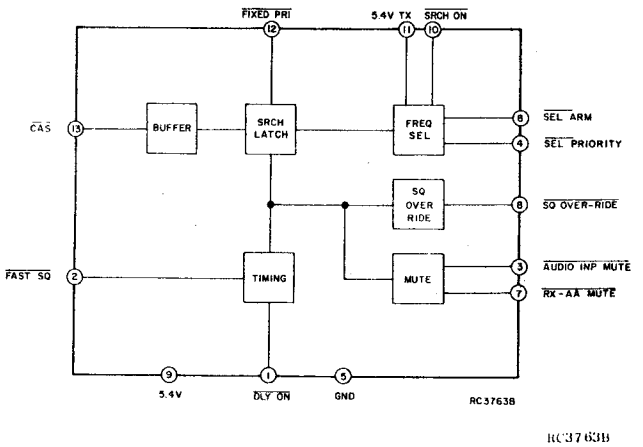


Figure 24 - Priority Search Lock Monitor

If the squelch circuit detects a carrier, the $\overline{CAS}$ control lead on Pin 13 of the SP module will go low. The $\overline{CAS}$ control lead going low causes the SP module to stop the search, locking on the active receive channel. If the active channel is the non-priority channel, the SP module will continue to search the priority channel for 8 milliseconds every 240 milliseconds. During the priority search, the $\overline{RX\text{-}AA\ MUTE}$ control lead and the AUD INP MUTE signal lead are pulled low to mute the receiver.

The $\overline{SQ\ OVERRIDE}$ control lead is also pulled low to prevent the fast squelch from closing during the search. This reduces noise during search to an almost inaudible tick.

If the active channel is a priority channel, the SP module will immediately lock on the priority channel.

Resumption of search on either channel is delayed 650 milliseconds. This delay can be defected by connecting a jumper between H6 and H7 on flexible printed wire board A701. This jumper connects 5.4 V to Pin 1 of the SP module.

The priority channel, normally channel one, can be changed to channel two by connecting a jumper between H8 and H9 on A701. This jumper connects 5.4 V to Pin 12 of the SP module.

With search on and no channels active, the search LED indicator will blink at a fast rate. If the priority channel is active, the indicator will remain on. If the active channel is non-priority, the indicator will remain off.

CONTROLLER CIRCUIT

The MPR Controller Circuit consists of 8 receive oscillator modules (RX-XO) and a simple or deluxe controller module (CL1/CL2). Twelve position BCD channel select rotary switch, S1, connects through flexible printed wire board A703 and extension board A3503 to controller board A3501. The BCD input leads of A703 connect through the controller module to control ten oscillator module keying leads.

Simple Controller Module (CL1)

The simple controller module contains a CMOS BCD to decimal decoder (See Figure 25). The BCD inputs to CL1 can select any one of 10 keying leads depending on which position the channel select switch is in. When a keying lead is selected its output goes low (See Figure 26).

Controller module CL1 is not programmable and there are no provisions for repeat oscillators or system control.

Deluxe Controller Module (CL2)

The Deluxe Controller Module contains a CMOS BCD to decimal decoder, a PROM controller and an 8X32 address PROM (See Figure 27).

For any setting of channel select switch S1, CL2 can control any one of ten

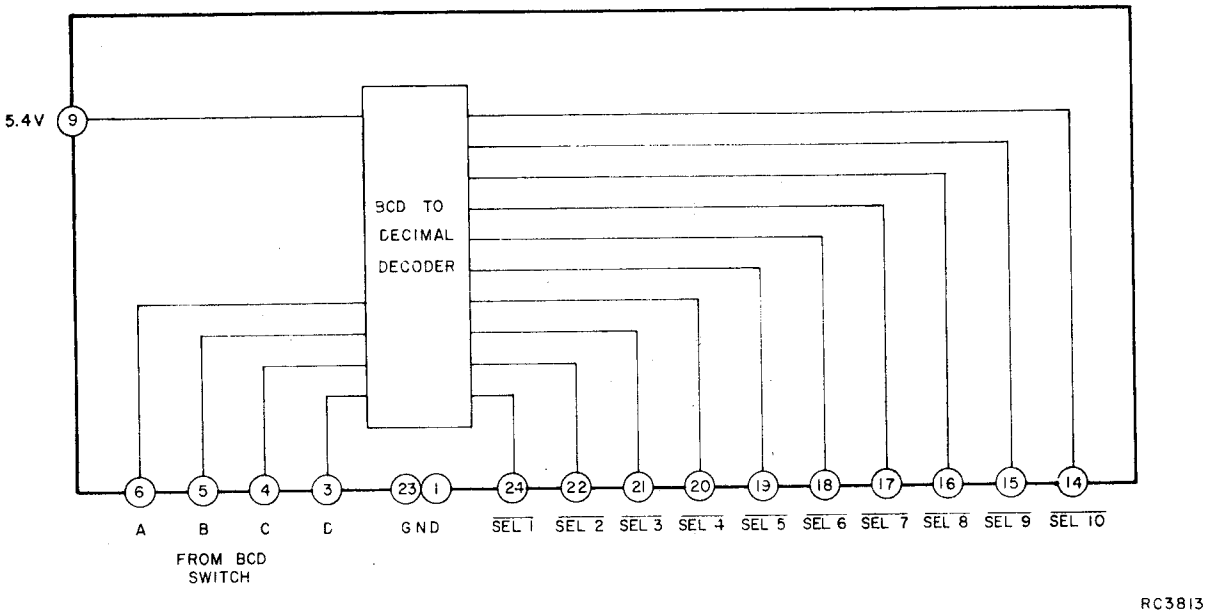


Figure 25 - Simple Controller

	BCD INPUT PIN NUMBERS				OUTPUT PIN NUMBERS									
	3	4	5	6	24	22	21	20	19	18	17	16	15	14
CHANNEL NUMBER	BCD INPUTS				CHANNEL SELECT OUTPUTS									
1	0	0	0	0	0	1	1	1	1	1	1	1	1	1
2	0	0	0	1	1	0	1	1	1	1	1	1	1	1
3	0	0	1	0	1	1	0	1	1	1	1	1	1	1
4	0	0	1	1	1	1	1	0	1	1	1	1	1	1
5	0	1	0	0	1	1	1	1	0	1	1	1	1	1
6	0	1	0	1	1	1	1	1	1	0	1	1	1	1
7	0	1	1	0	1	1	1	1	1	1	0	1	1	1
8	0	1	1	1	1	1	1	1	1	1	1	0	1	1
9	1	0	0	0	1	1	1	1	1	1	1	1	0	1
10	1	0	0	1	1	1	1	1	1	1	1	1	1	0

"0" IS ≤ 0.5 VDC
"1" IS ≥ 5 VDC

RC3861

Figure 26 - Simple Controller Logic Table

receive oscillators and the operation of four receive system functions or options. Also, for the same channel select position, the controller can control any one of ten transmit frequencies and the operation of four transmit system functions or options.

The inputs to CL2 are four BCD input leads from channel select switch S1 and the DPTT control lead connected to the T/R input. This T/R input determines transmit or receive PROM selections.

The PROM controller powers up the PROM and stores the current address and PROM outputs whenever it senses an address change. For each address, the PROM supplies eight outputs. Four of these outputs are further decoded by the BCD to decimal decoder to provide ten keying leads. Whenever a transmit or receive channel is selected by switch S1 the keying lead of CL2 corresponding to the selected channel is a logical "0". All other outputs are logical "1's". Refer to Figure 28 for a Deluxe Controller logic table. The remaining four PROM outputs are for system control. These four outputs are pre-programmed to customer specification.

Compatibility

Both Controller Modules, CL1 and CL2, are pin compatible. If it is desirable to upgrade a system by adding repeated oscillators or function control, all that is necessary is to order the appropriately programmed controller. CL2 controller PROMs are custom programmed to the customer order and will be programmed for one TX and one RX oscillator selection above the actual number ordered. This allows channel expansion above what is ordered with the restriction that oscillators may not be repeated or system functions controlled. A new controller is necessary if these functions are needed.

EXTENDER CIRCUIT

The extender circuit consists of flexible printed wire board A3503. The flexible printed wire board connects the controller circuit to the system board and circuit controls.

POWER DISTRIBUTION

Power for the MPR is supplied by a 7.5 Volt battery pack connected to connector J702 (See Figure 29). 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.

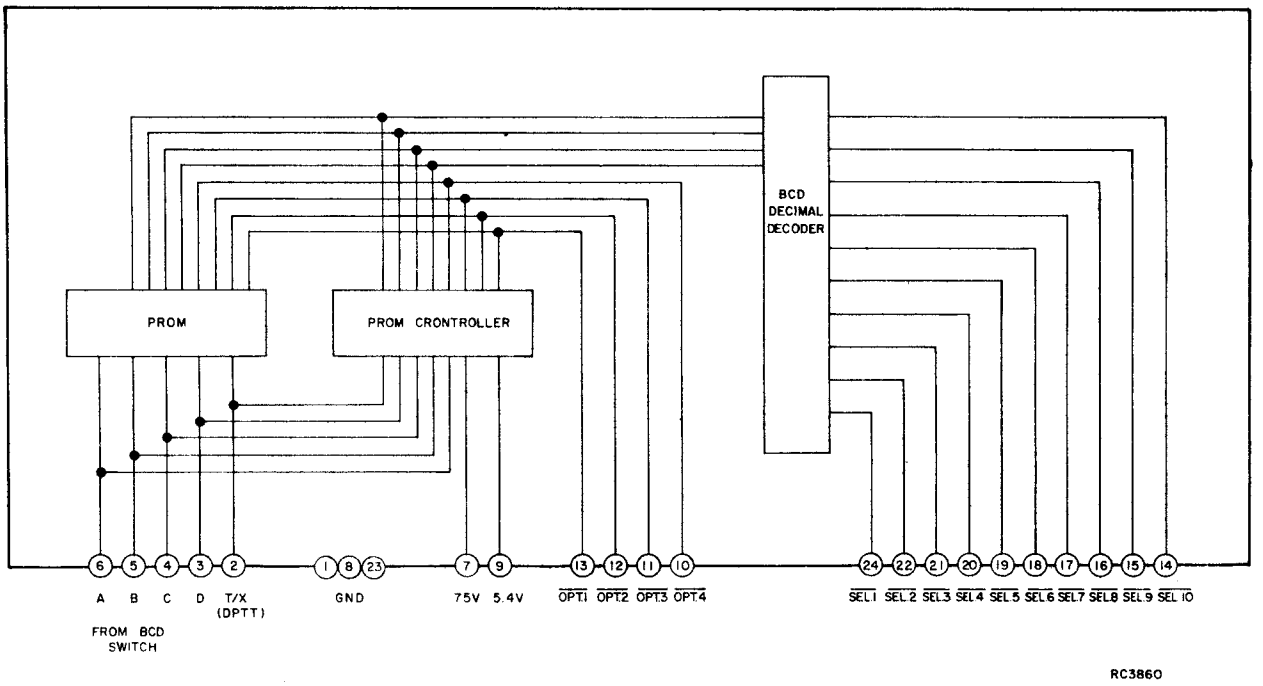


Figure 27 - Deluxe Controller Module

	T/R AND BCD INPUT PIN NUMBERS					OPTION OUTPUT PIN NUMBERS				OUTPUT PIN NUMBERS									
	2	3	4	5	6	13	12	11	10	24	22	21	20	19	18	17	16	15	14
CHANNEL NUMBER	T/R INPUT	BCD ADDRESS INPUTS				OPTION SELECT OUTPUTS				CHANNEL SELECT OUTPUTS									
TX 1	0	0	0	0	0	TX OPTIONS PRE-PROGRAMMED TO CUSTOMER SPECIFICATIONS				0	1	1	1	1	1	1	1	1	1
TX 2	0	0	0	0	1					1	0	1	1	1	1	1	1	1	1
TX 3	0	0	0	1	0					1	1	0	1	1	1	1	1	1	1
TX 4	0	0	0	1	1					1	1	1	0	1	1	1	1	1	1
TX 5	0	0	1	0	0					1	1	1	1	0	1	1	1	1	1
TX 6	0	0	1	0	1					1	1	1	1	1	0	1	1	1	1
TX 7	0	0	1	1	0					1	1	1	1	1	1	0	1	1	1
TX 8	0	0	1	1	1					1	1	1	1	1	1	1	0	1	1
TX 9	0	1	0	0	0					1	1	1	1	1	1	1	1	0	1
TX 10	0	1	0	0	1					1	1	1	1	1	1	1	1	1	0
RX 1	1	0	0	0	0	RX OPTIONS PRE-PROGRAMMED TO CUSTOMER SPECIFICATIONS				0	1	1	1	1	1	1	1	1	1
RX 2	1	0	0	0	1					1	0	1	1	1	1	1	1	1	1
RX 3	1	0	0	1	0					1	1	0	1	1	1	1	1	1	1
RX 4	1	0	0	1	1					1	1	1	0	1	1	1	1	1	1
RX 5	1	0	1	0	0					1	1	1	1	0	1	1	1	1	1
RX 6	1	0	1	0	1					1	1	1	1	1	0	1	1	1	1
RX 7	1	0	1	1	0					1	1	1	1	1	1	0	1	1	1
RX 8	1	0	1	1	1					1	1	1	1	1	1	1	0	1	1
RX 9	1	1	0	0	0					1	1	1	1	1	1	1	1	0	1
RX 10	1	1	0	0	1					1	1	1	1	1	1	1	1	1	0

"0" IS ≤ 0.5 VDC
"1" IS ≥ 5.0 VDC

RC3862

Figure 28 - Deluxe Controller Logic Table

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 30). During transmit, when the DPTT lead is low, the regulator module also provides a keyed 5.4 volt output for transmit functions. When the transmit circuit is keyed the regulator module activates the system relay by saturating a keying transistor.

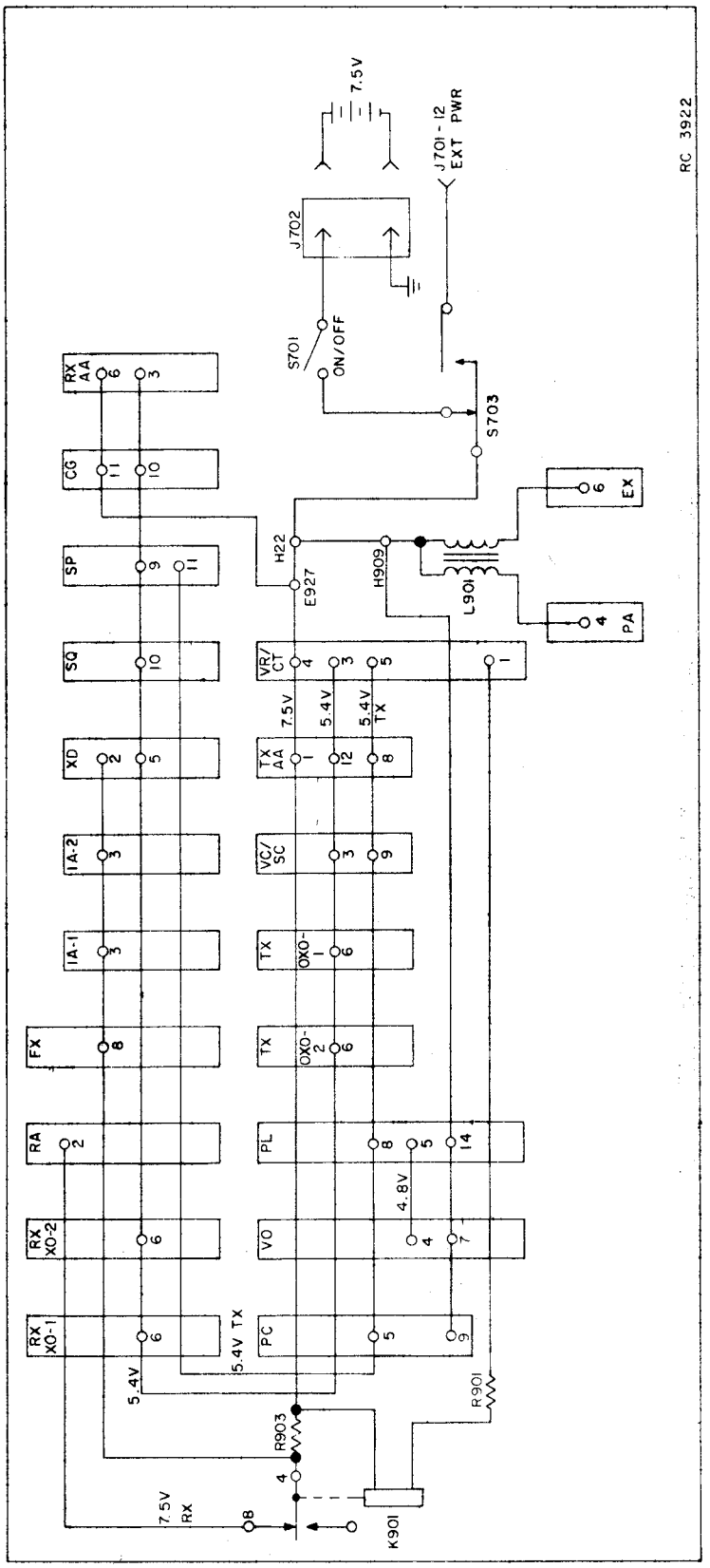


Figure 29 - Power Distribution

SYSTEM ANALYSIS

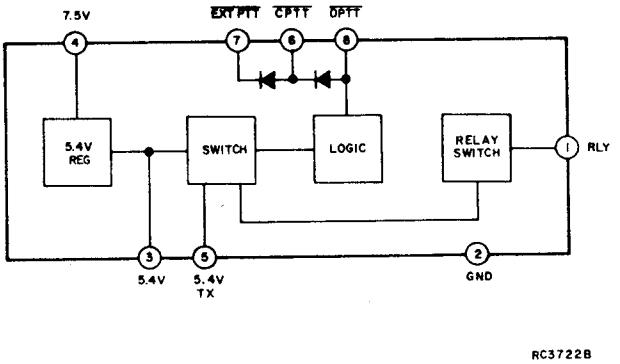


Figure 30 - Voltage Regulator

External Power

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

WARNING

When powering the radio from an external supply for service purposes, use a 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 MPR 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 MPR battery packs are available with charge times of 1-hour, 3-hours and 14-hours. A combination can be a single unit desk or a vehicular charger. It can also be a wall or bench mounted rack charger with a multiple of charge units.

Charge Level

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

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

Battery Check

One of the best service checks for the MPR 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.

Table 1 - Capacity Measurement Data

RECHARGEABLE BATTERY PACK	RATED CAPACITY	AVERAGE DISCHARGE RATE (for 60 minutes)	LOAD RESISTOR (R_L)	END VOLTAGE
19D429763G3 (6 cells)	750 mAh	750 mA	10 Ohms 8 Watts	6 VDC
19D429777G3 (6 cells)	1200 mAh	1200 mA	6.25 Ohms 12 Watts	6 VDC

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.

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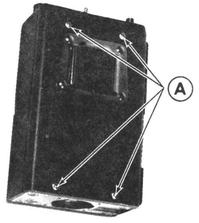
DISASSEMBLY PROCEDURE

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

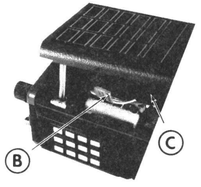
Equipment Required

- 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.



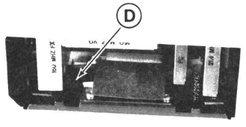
STEP 1.

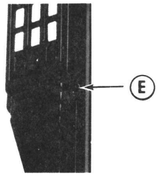
To gain access to the radio, loosen, but do not remove, the four captive screws at (A). Carefully remove the back cover. For normal radio alignment, the back cover is all that need be removed. When tightening the captive screws, they should be no tighter than 4 ±.5 inch-pounds.



STEP 2.

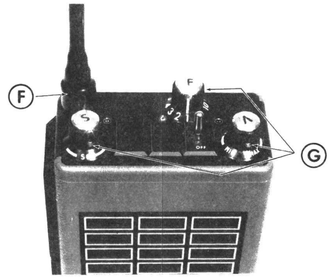
To gain access to the module side of the radio, step 1 must be completed and the radio turned over. Carefully remove the front cover and disconnect the speaker at (B). When replacing the front cover the speaker leads must be routed as shown. The rubber microphone cover should be pushed in at (C) to allow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





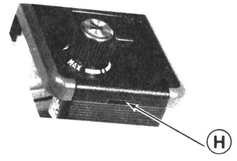
STEP 3.

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



STEP 4.

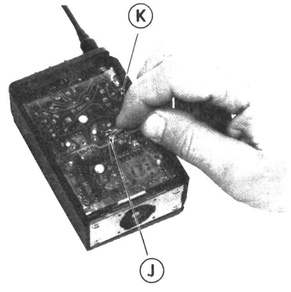
To replace the speaker and microphone remove the four Phillips-head screws holding the speaker retaining plates and remove the speaker. The microphone is held in place only by the rubber mike boot and can easily be removed.



STEP 5.

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

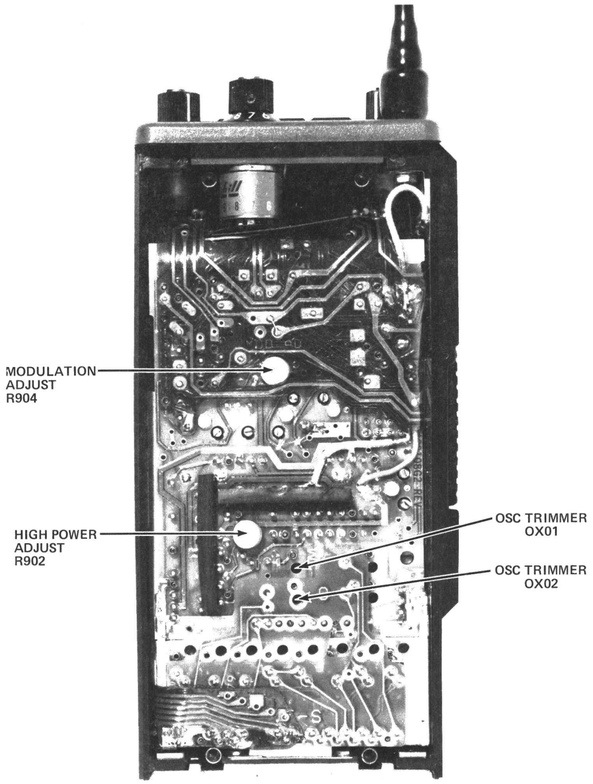
Loosen set screws at (G) and remove knobs. With a flat-blade screwdriver snap top cover off at (H). The slotted nuts holding the controls are easily accessible. When disconnecting Option controls remove the leads from the control and not the flexible printed wire. The Volume control, Squelch control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



STEP 6.

To remove modules from the system board, remove both front and back covers. A simple bent paper clip can be used as a tool to push a 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 (J) and push the module from the board. To remove the Ex or PA module insert the paper clip into a hole provided in the center of the board for removal of the module and push the module from the board.

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



TRANSMIT CIRCUIT

ALIGNMENT AND TEST PROCEDURE

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 watt meter.
8. Frequency Counter.

PRELIMINARY

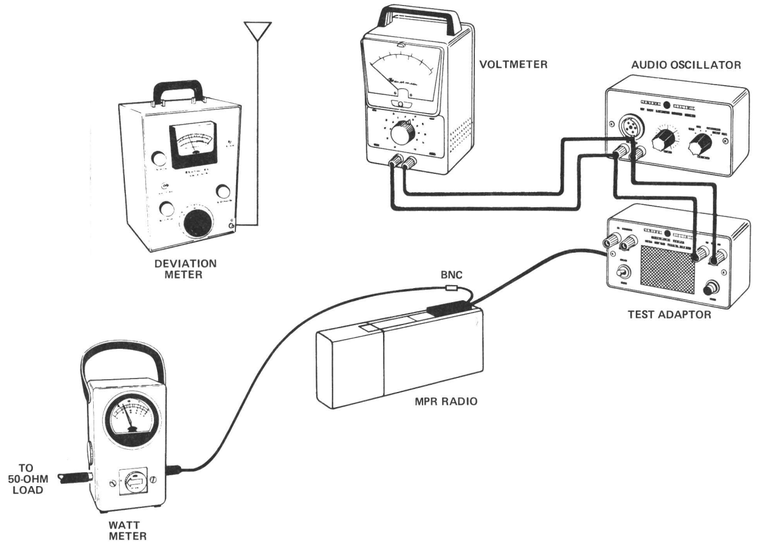
1. Carefully remove the back cover from radio (See Disassembly Procedure).
2. Connect equipment as shown.
3. Set Audio Oscillator for 120 millivolts RMS at 1 kHz.
4. Set HI PWR adjust R902 fully counterclockwise.
5. If present, set LOW POWER ADJ R2101 fully counterclockwise.

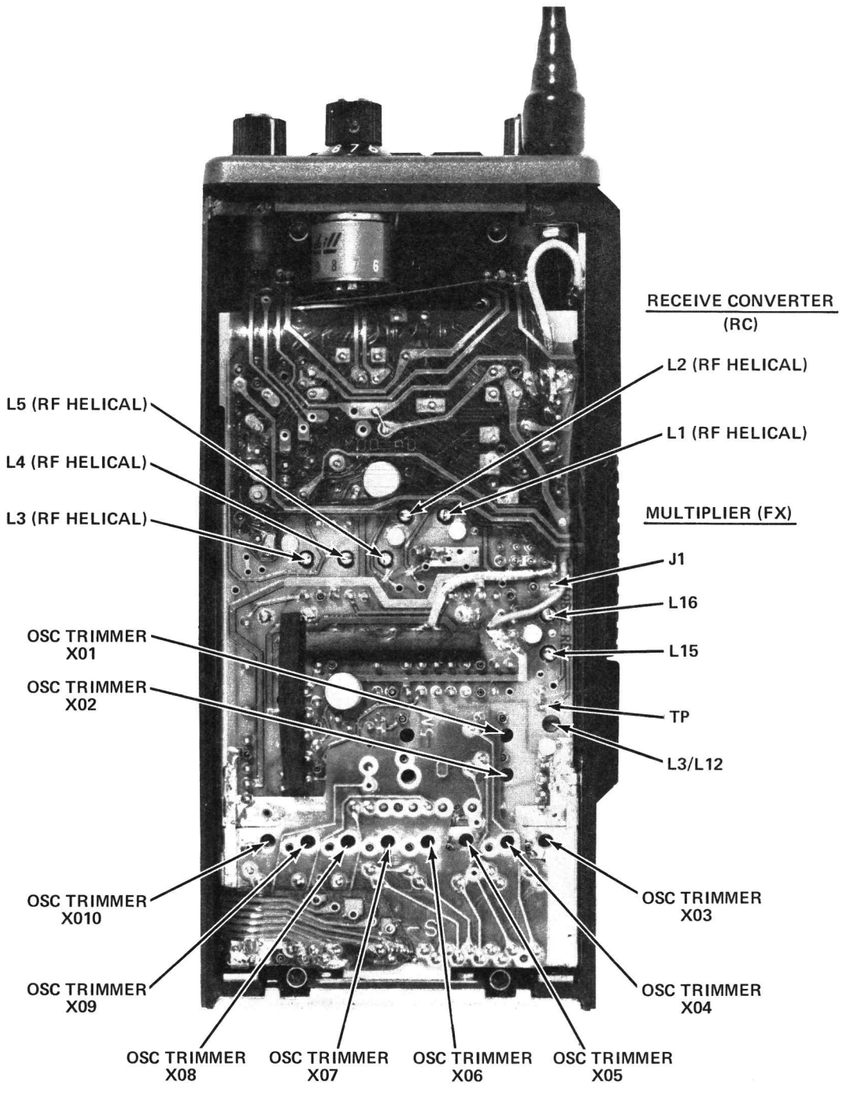
NOTE

In units equipped with the HI/LO power option, the HI/LO power may be slaved to the channel select switch. When making power adjustments insure the channel select switch is in a position where HI power is enabled for HI power out. In the case of LO power adjustments, insure the channel select switch is in a position where LO power is enabled for LO power out.

ALIGNMENT PROCEDURE

STEP	TUNING CONTROL	TYPICAL METER READING	
		HIGH POWER ADJUST	FREQUENCY
1	R902	Transmit type KT175B/C - 2.0 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 KT176B/C - 5.0 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.
		LOW POWER ADJUST	
4	R2101	Transmit type KT175B/C - 1 to 2.0 Watts.	Key transmit circuit and adjust LOW PWR ADJ R2101 clockwise to rated power output.
5	Multi-frequency switch	Transmit type KT176B/C - 1 to 5 Watts.	Switch multi-frequency switch and determine which channel has the highest current.
6	R2101		Re-adjust R2101 until the channel with the highest current has rated power output.
		FREQUENCY ADJUSTMENT	
7	OX0-1/OX0-2		After setting the receive frequency, key transmit circuit and adjust OX0-1/OX0-2 offset oscillator trimmers for proper oscillator frequency.
		MODULATION ADJUST	
		Voice Only	
8	R904	4.5 kHz deviation	Key the transmit circuit and adjust MOD ADJ R904 until deviation meter indicates 4.5 kHz.
9	Multi-frequency switch		Switch 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 highest deviation.
		Voice and Channel Guard	
11	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.
12	Multi-frequency switch		Switch the multi-frequency switch and determine which channel has the highest deviation.
13	R904		Re-adjust R904 for 4.5 kHz deviation on the channel with the highest deviation
14	--	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.
		Voice and Compressor	
15	--	35 millivolt RMS at 1 kHz	Set audio oscillator for 35 millivolts RMS at 1 kHz.
16	R904	3.8 kHz deviation	Key transmit circuit and adjust R904 until deviation meter indicates 3.8 kHz.
17	Multi-frequency switch		Switch the multi-frequency switch and determine which channel has the highest deviation.
18	R904		Re-adjust R904 for 3.8 kHz deviation on the channel with the highest deviation.
		Voice, Channel Guard and Compressor	
19	--	3.5 millivolt RMS at 1 kHz	Set audio oscillator for 35 millivolts RMS at 1 kHz.
20	R904	3.8 kHz deviation	Key transmit circuit and adjust R904 until deviation meter indicates 3.8 kHz.
21	Multi-frequency		Switch multi-frequency switch and determine which channel has the highest deviation.
22	R904		Re-adjust R904 for 3.8 kHz deviation on the channel with the highest deviation.





EQUIPMENT

1. General Electric Test Adaptor 4EX12A11.
2. A 406-512 MHz signal source.
3. A 21.4 MHz signal source (Used in setting frequency).
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	L3/L12	With volt/ohmmeter between TEST PT and ground, tune L3/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 (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	While applying an on-frequency signal, loosely couple a 21.4 MHz signal to the converter. Adjust the oscillator trimmer(s) for a zero beat frequency between the two signals.

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.

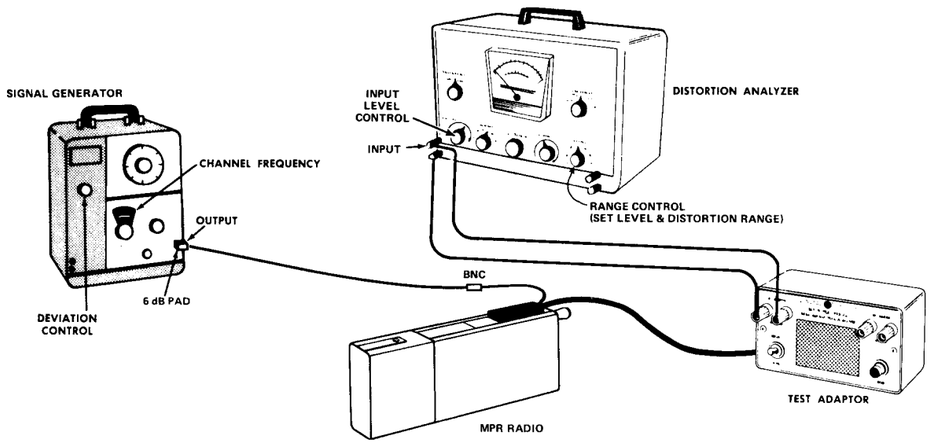
Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

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 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

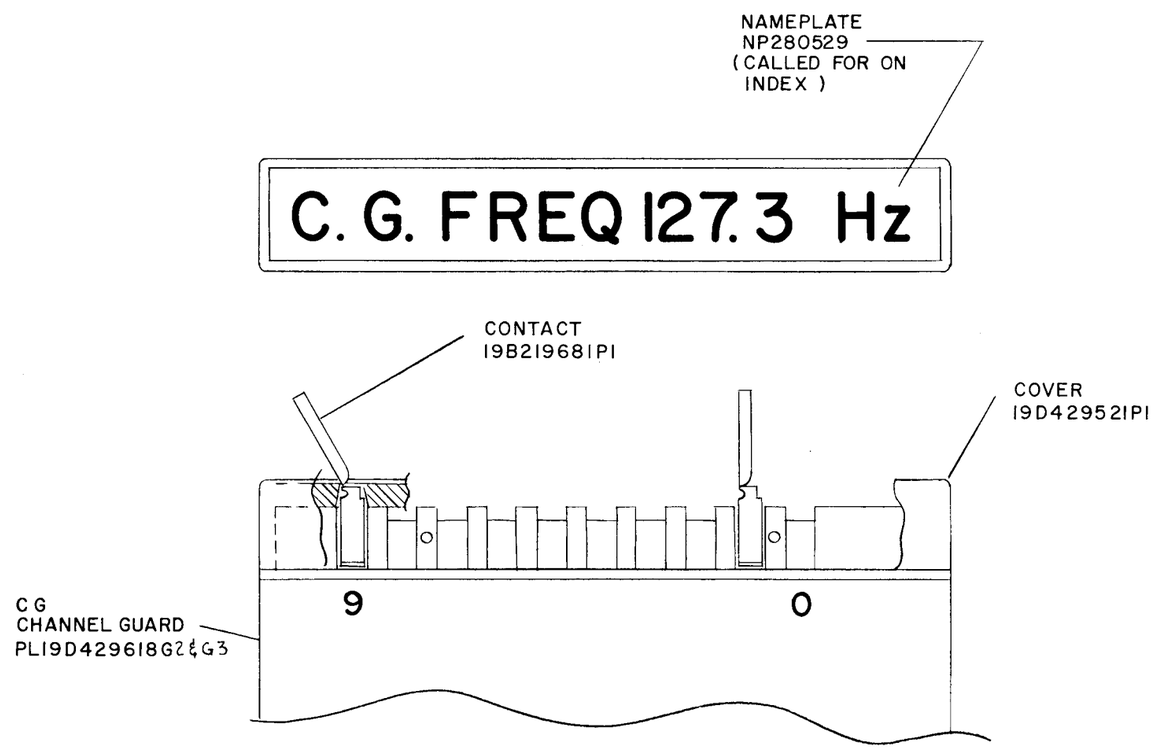


FIG. 1

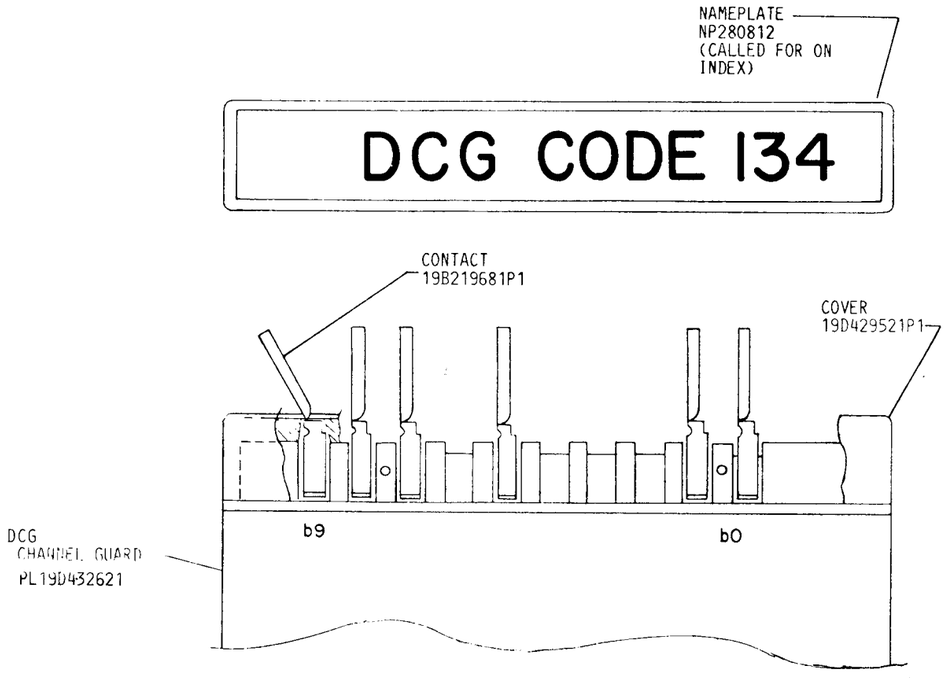


FIG. 2

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.)

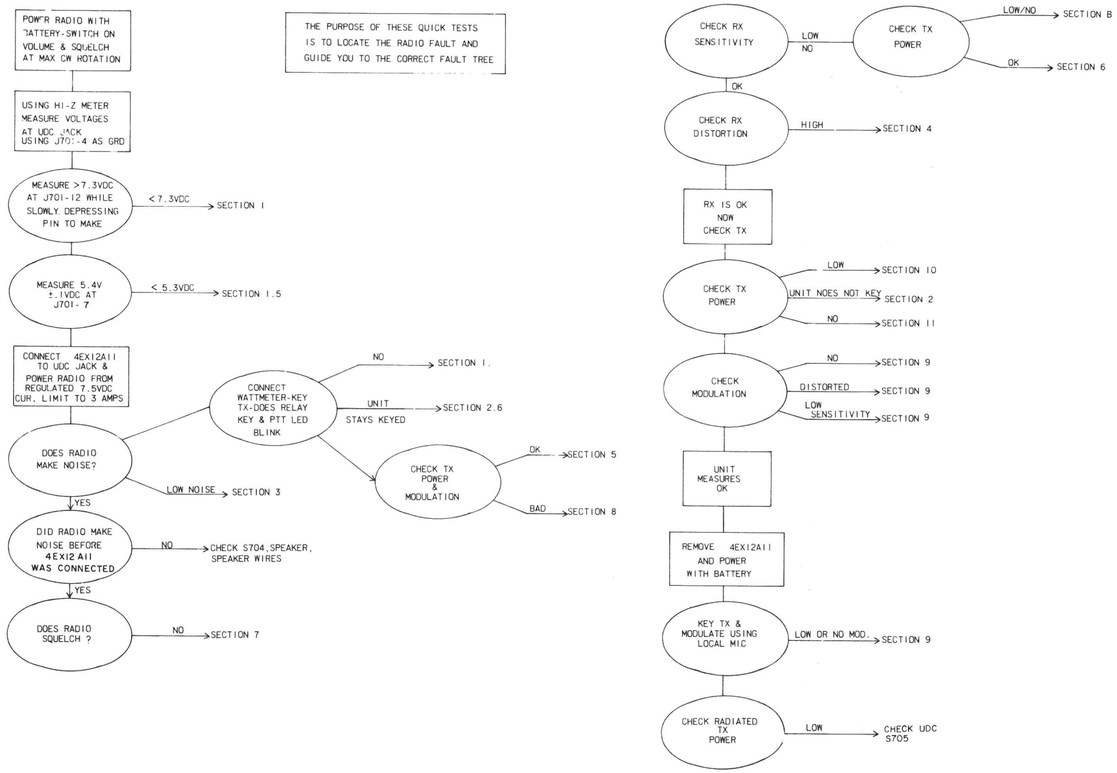
DCG CODE	CONTACT PIN POSITION									
	B9	B8	B7	B6	B5	B4	B3	B2	B1	BØ
331	X	X			X			X	X	
343	X	X			X		X		X	X
346	X	X				X	X			X
351	X	X				X		X	X	
364	X	X	X		X			X	X	X
365	X	X	X		X	X	X			
371	X	X		X	X	X				
411	X	X	X		X	X				
412	X	X	X		X		X			
413	X	X	X		X			X		
423	X	X		X	X				X	X
431	X	X		X			X	X		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
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).

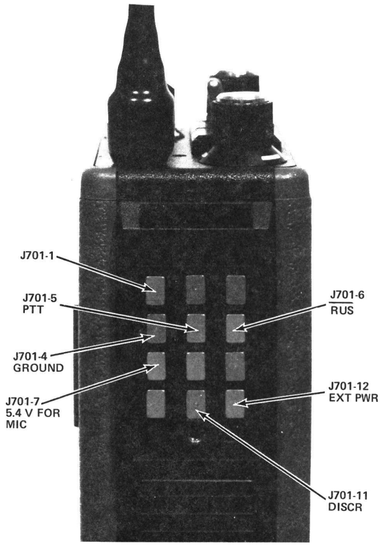
RC4235

MPR TROUBLESHOOTING TREE

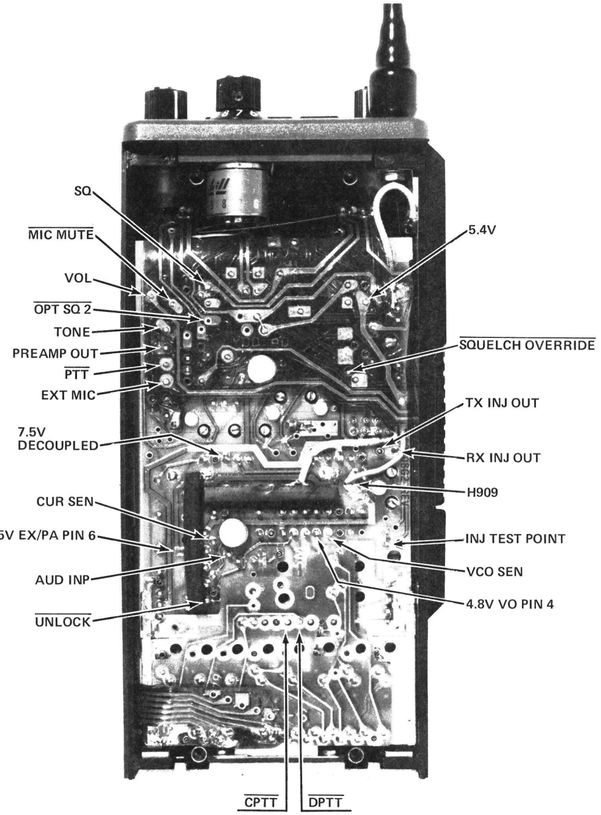


RC3793A

UDC JACK (J701) CONNECTION

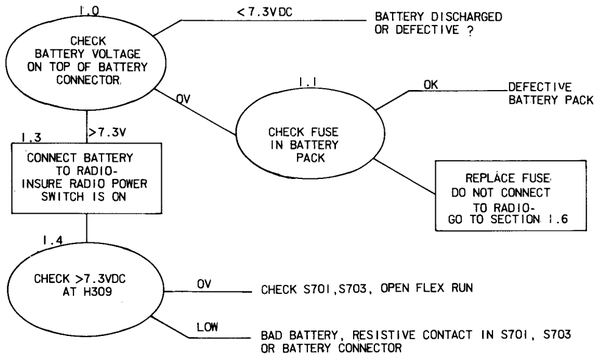


MPR SERVICE TEST POINTS

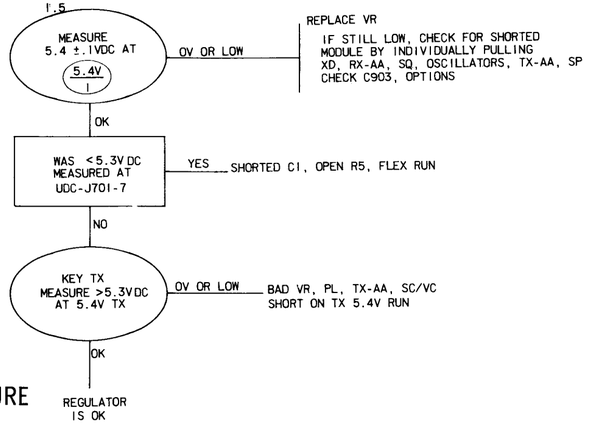


MPR TROUBLESHOOTING PROCEDURE

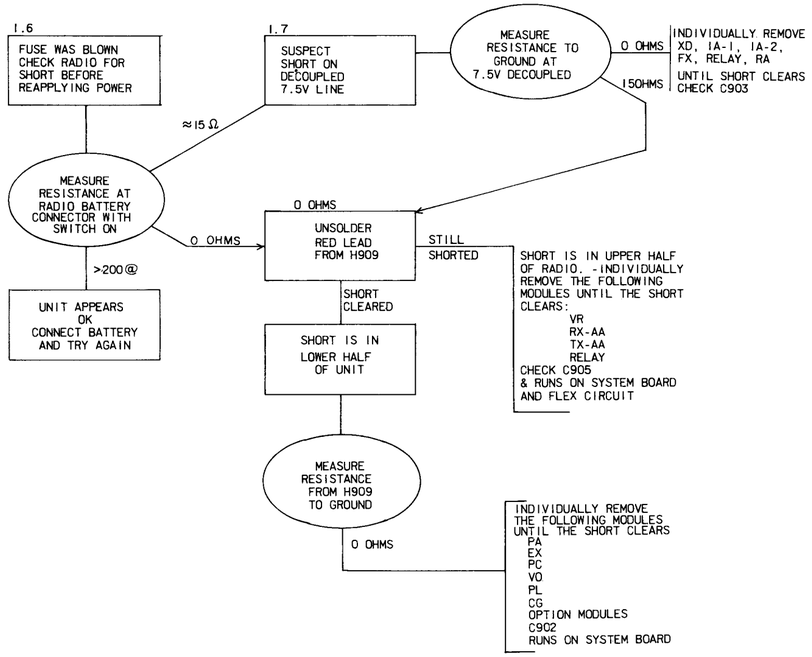
SECTION #1
POWER DISTRIBUTION FAULT



REGULATOR FAULT
SECTION 1.5

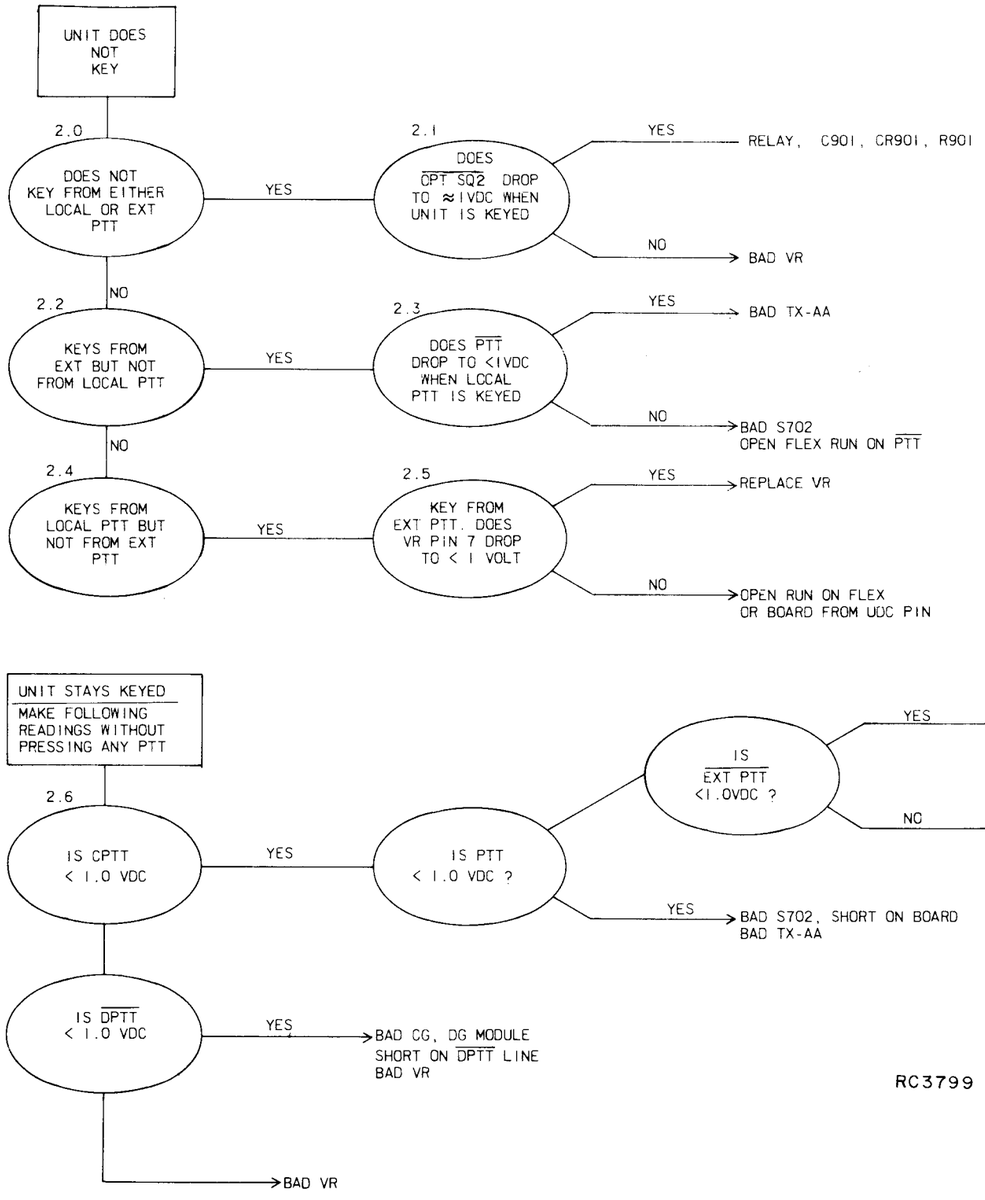


LOCATING A SHORT
SECTION 1.6



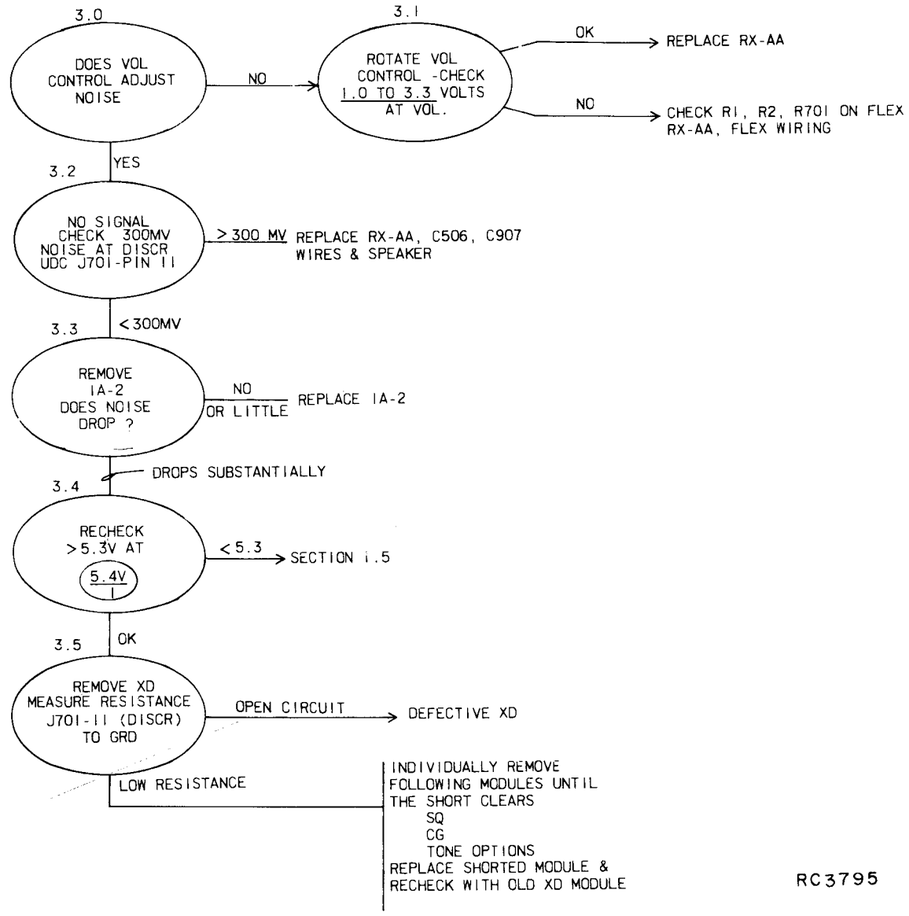
RC3794A

SECTION 2
TRANSMITTER KEYING FAILURE



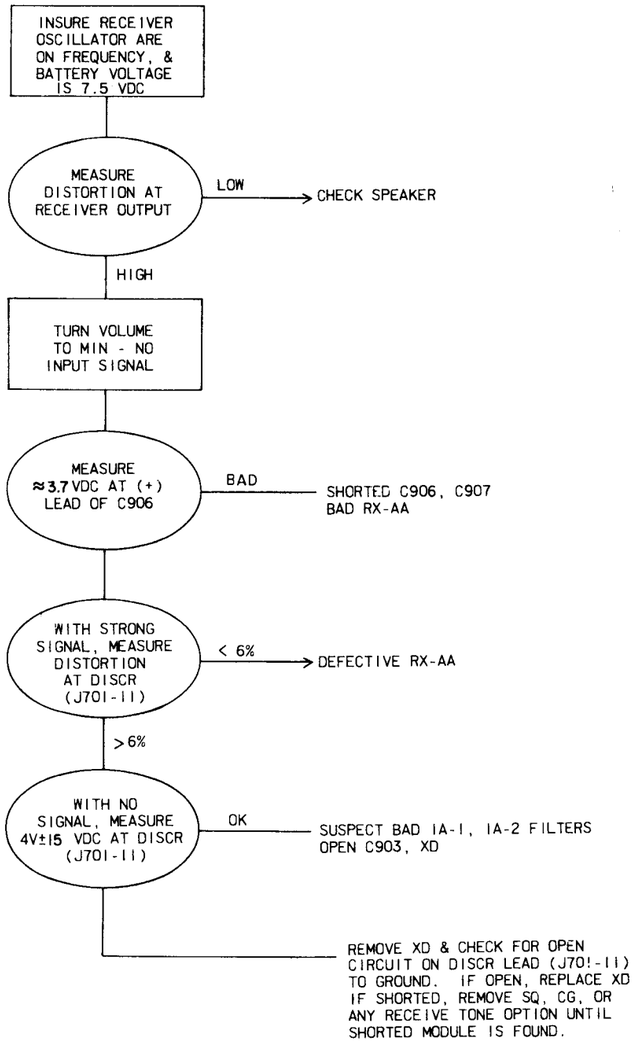
RC3799

SECTION 3
RX AUDIO NOISE LOW

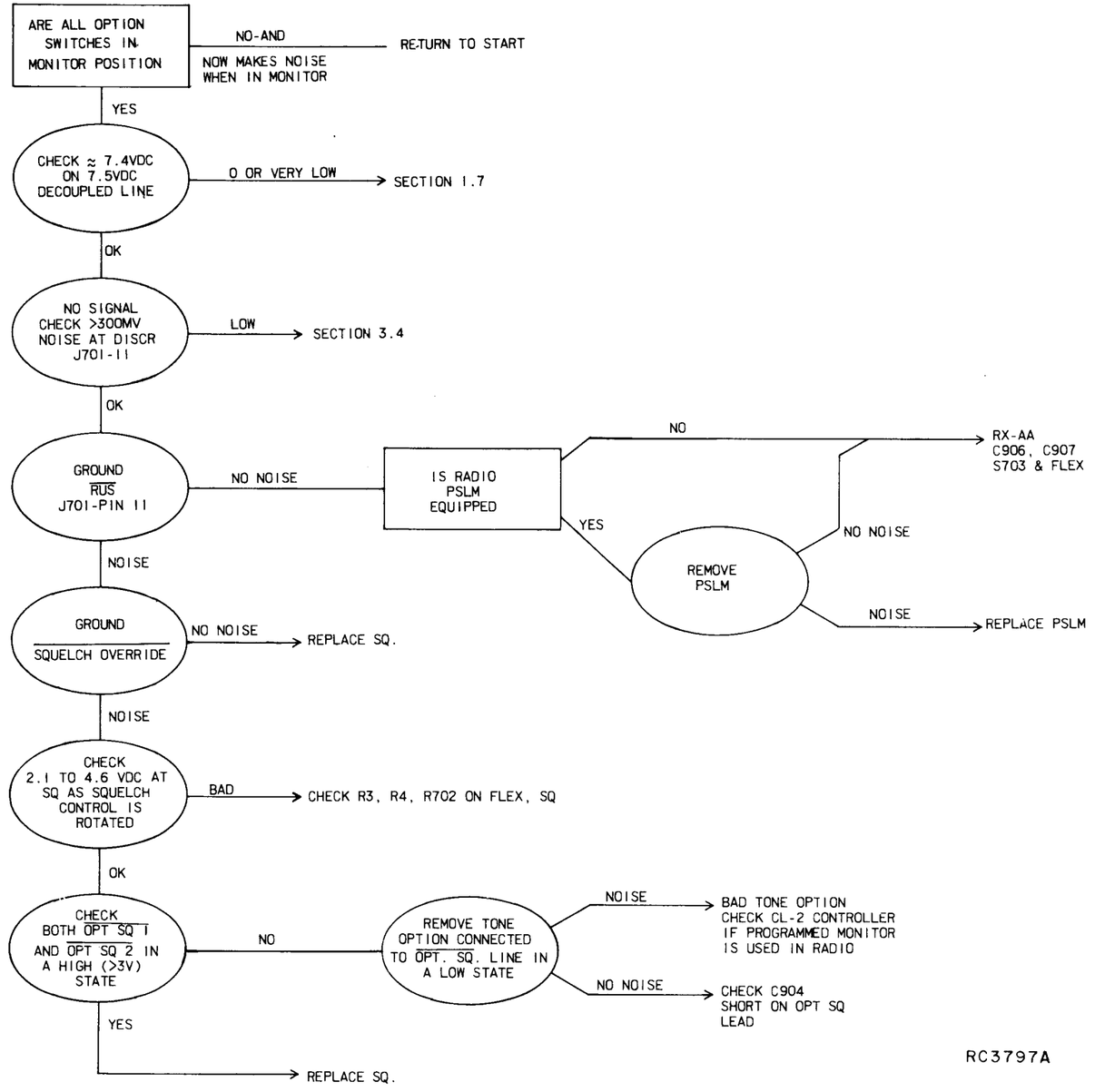


RC3795

SECTION 4
RECEIVER AUDIO DISTORTED



SECTION 5
NO RECEIVER AUDIO

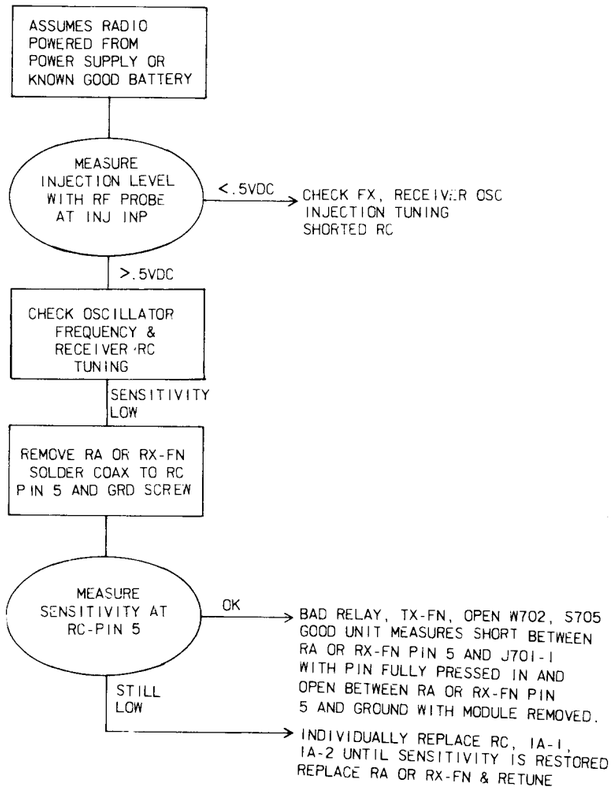


RC3797A

TROUBLESHOOTING PROCEDURE

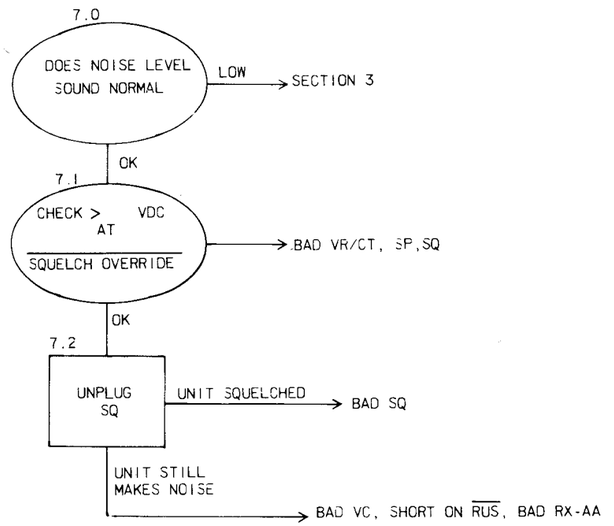
RC3796A

SECTION 6
LOW OR NO RECEIVER SENSITIVITY



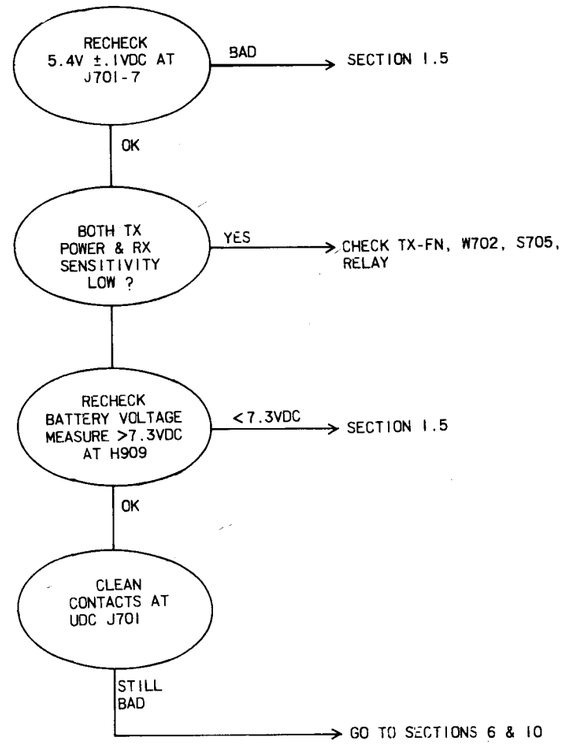
RC3798

SECTION 7
UNIT DOES NOT SQUELCH



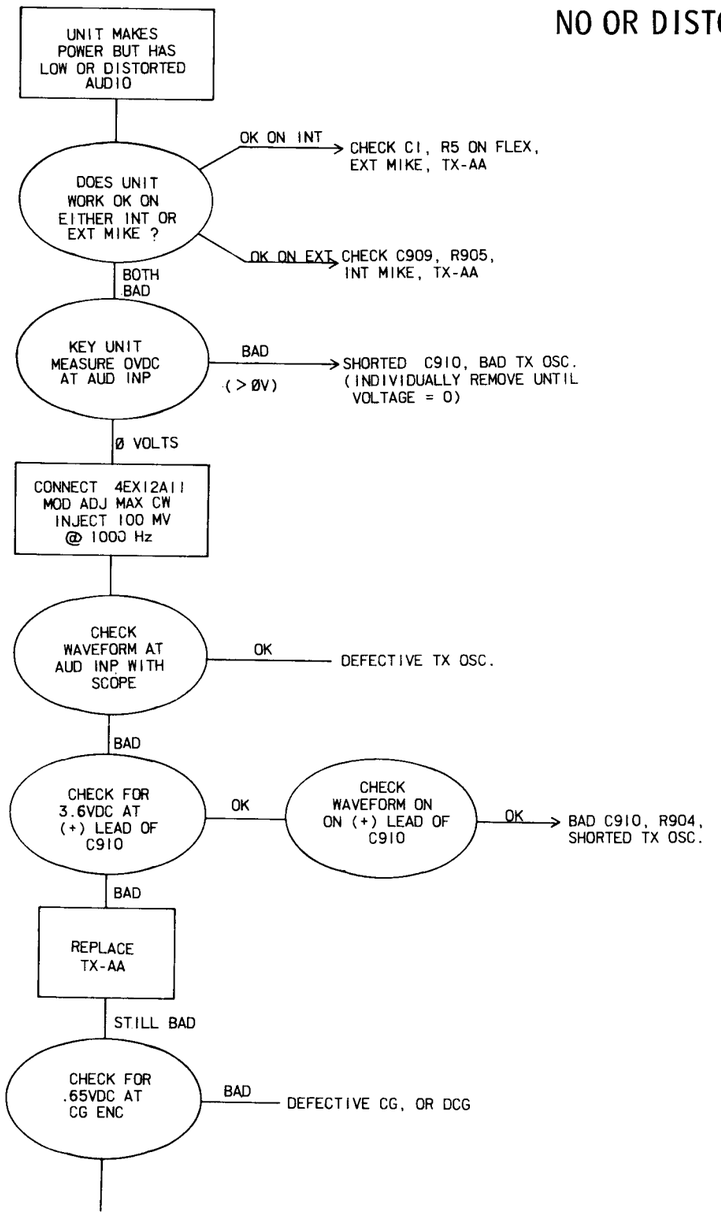
RC3800

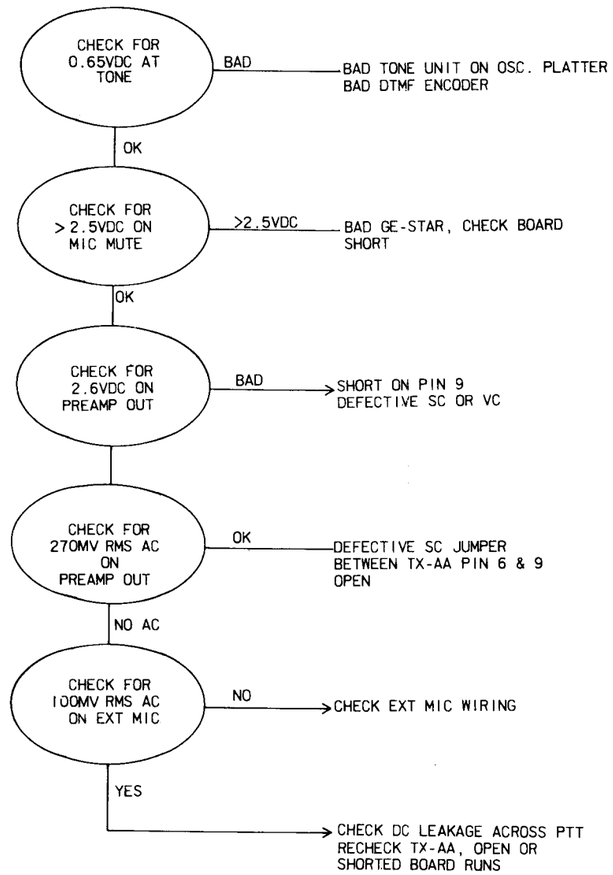
SECTION 8
BOTH RX & TX MALFUNCTION



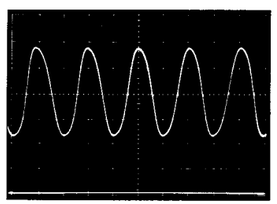
RC3803A

SECTION 9
NO OR DISTORTED TX AUDIO

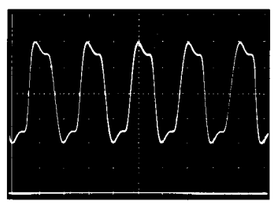




RC3802A

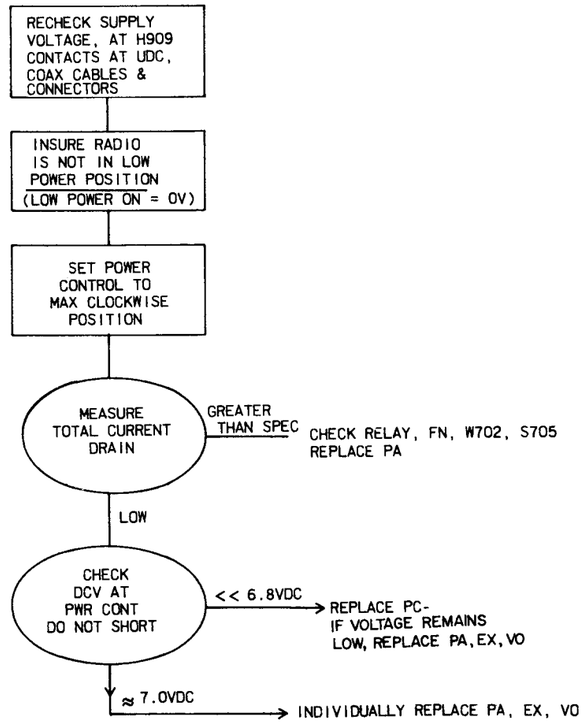


WAVEFORM WITH COMPRESSOR



WAVEFORM WITHOUT COMPRESSOR

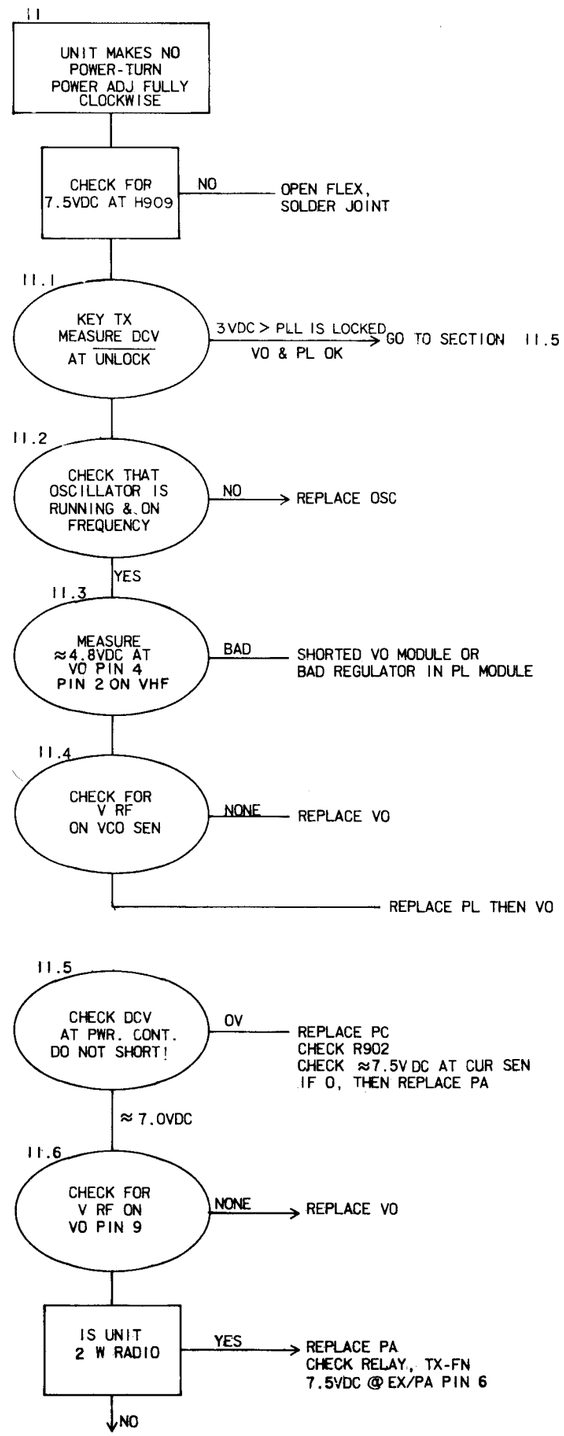
SECTION 10
LOW POWER

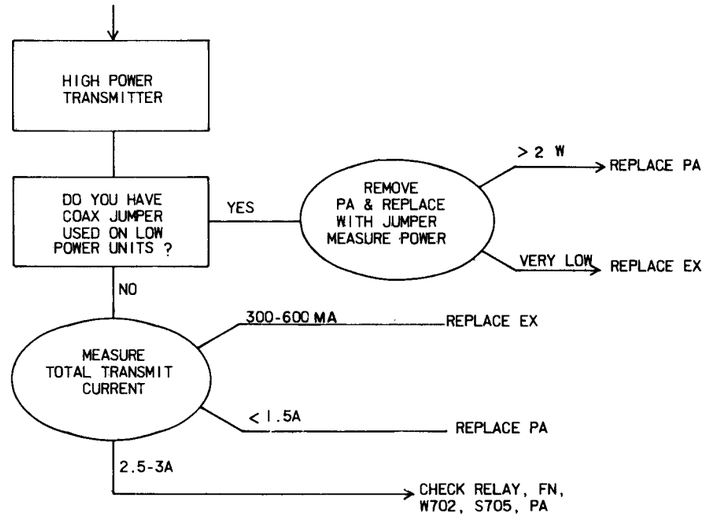


RC3804

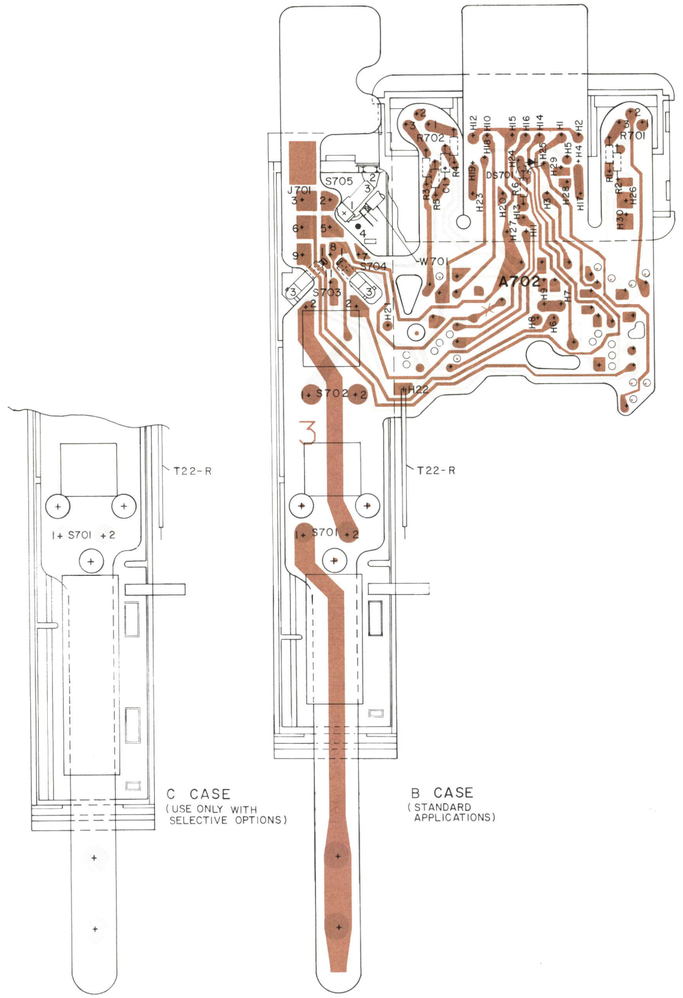
TROUBLESHOOTING PROCEDURE

SECTION 11
NO TRANSMIT POWER

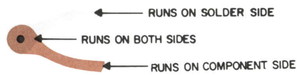




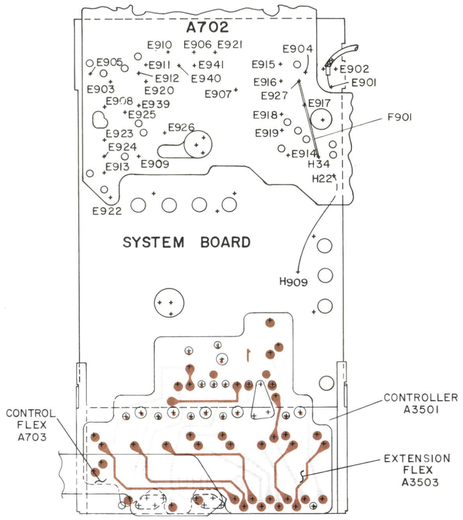
RC3801A



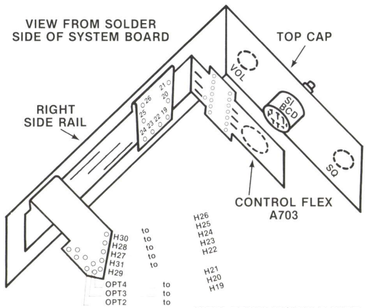
(19A138178, Sh. 1, Rev. 3)
(19A138178, Sh. 2, Rev. 3)

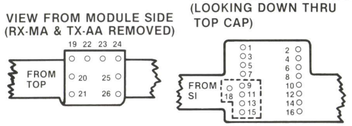


CONTROL ASSEMBLY

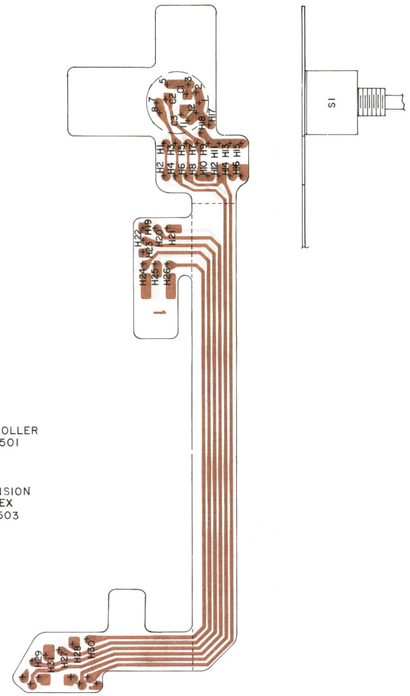


(19A138202, Sh. 1, Rev. 1)
(19A138202, Sh. 2, Rev. 1)





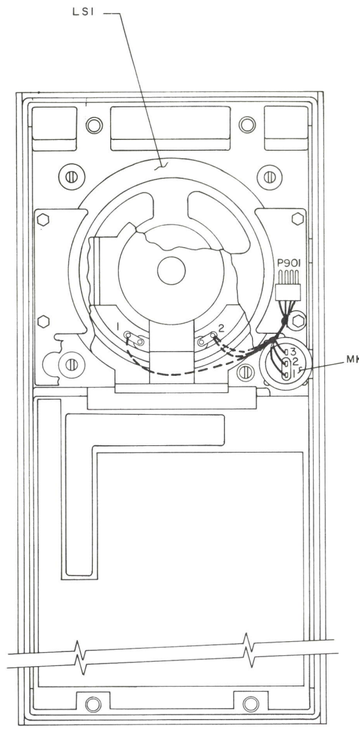
CONTROL FLEX A703



(19A137416, Sh. 1, Rev. 1)
(19A137416, Sh. 2, Rev. 1)

(19D432255, Rev. 1)

FRONT COVER



CONNECTION CHART		
FROM	TO	WIRE
P901	LSI-1	W
	MKI-2	O
	MKI-1	R
	LSI-2	BK
LSI-2	MKI-3	T28-BK

(19C330384, Rev. 0)

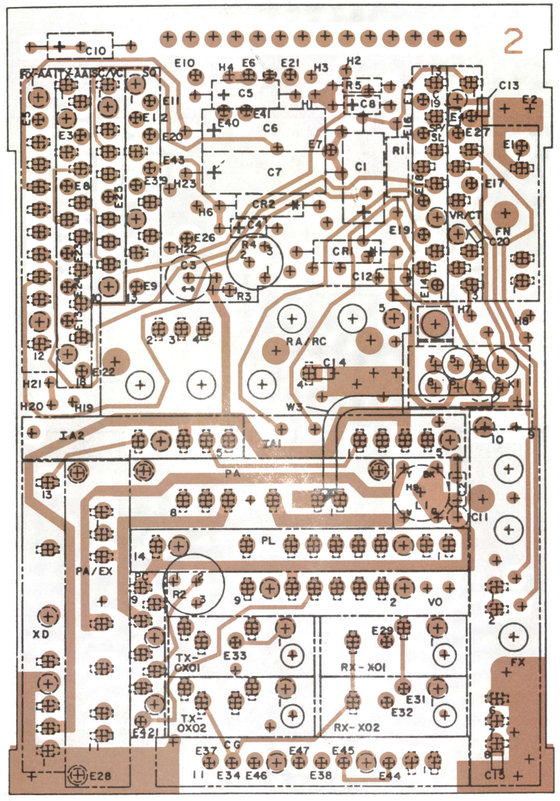
OUTLINE DIAGRAM

CONTROL ASSEMBLY FRONT
(Sheet 1)

CONNECTIONS CHART		
FROM	TO	REMARKS
J901-V	H4	COMP SIDE
J901-Q	H2	COMP SIDE
J901-R	H1	COMP SIDE
J901-BK	H3	COMP SIDE

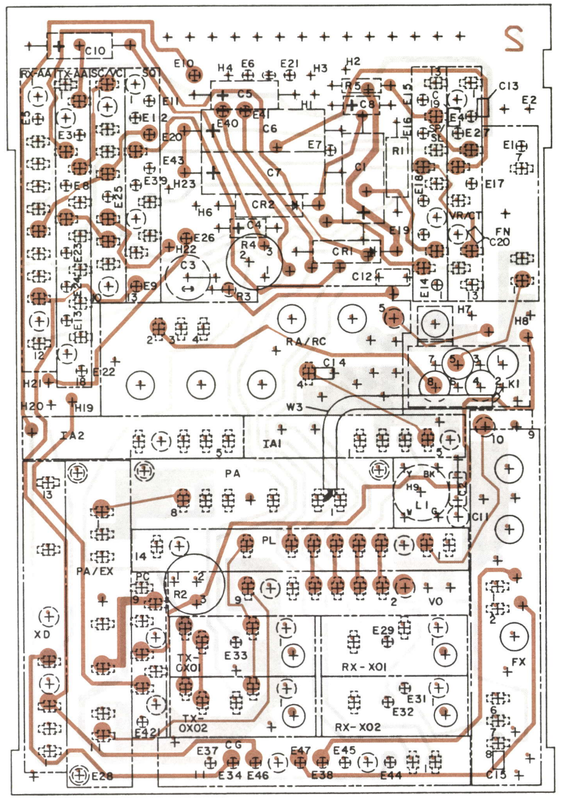
SYSTEM BOARD
BACK SIDE

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



(19A138147, Sh. 1, Rev. 1) 1st Layer - GROUND
(19A138147, Sh. 4, Rev. 2) 4th Layer - PWR. DISTRIBUTION

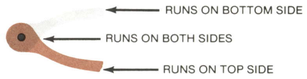
BACK SIDE



(19A138147, Sh. 2, Rev. 2) 2nd Layer - RF SIG. FLOW
(19A138147, Sh. 3, Rev. 3) 3rd Layer - RF SIG. FLOW

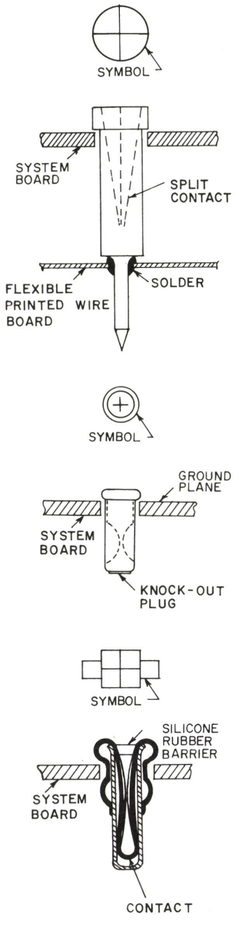
BACK SIDE

(19D429786, Rev. 3)



OUTLINE DIAGRAM

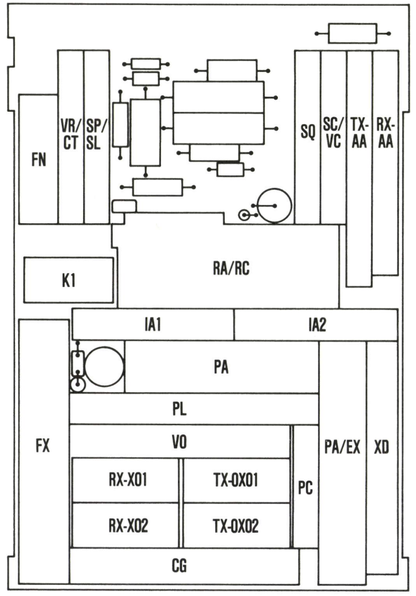
SYSTEM BOARD
(Sheet 2)

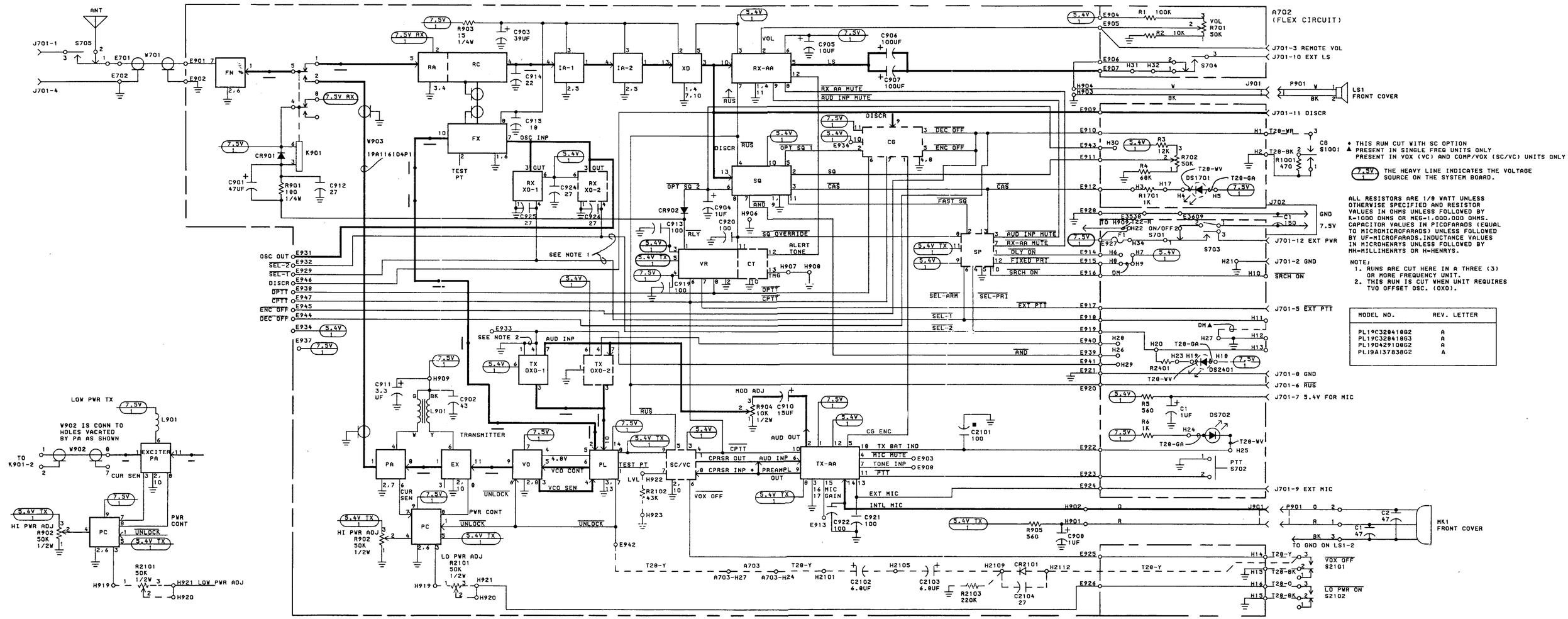


RC3776A

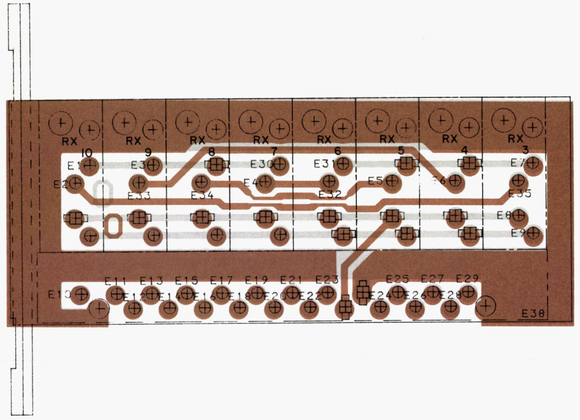
CONTACT IDENTIFICATION

MODULE LAYOUT




ANT
J701-1
S705
E701
W701
E702
J701-4
E901
E902
FN
2,6
7.5V RX
R903
15
1/4W
C903
39UF
RA
RC
3,4
C914
22
IA-1
IA-2
2,5
XD
1,4
7,10
5.4V
VOL
C905
10UF
C906
100UF
RX-AA
LS
C907
100UF
RUS
RX AA MUTE
AUD INP MUTE
A702
(FLEX CIRCUIT)
E904
E905
R1
100K
VOL
R701
50K
R2
10K
J701-3 REMOTE VOL
J701-10 EXT LS
E906
E907
H31
H32
S704
J901
P901
W
BK
LS1
FRONT COVER
H904
H903
E909
J701-11 DISCR
E910
E943
E911
E912
E928
E914
E915
E916
H1
T28-VR
H30
R3
12K
R702
50K
H2
T28-BK
R1001
470
T28-WV
DS1701
T28-GA
R4
68K
R1701
1K
H17
H4
H5
H3
J702
GND
7.5V
C1
150
E3538
E3609
H22
ON/OFF
S701
S703
F1
H34
J701-12 EXT PWR
H6
H7
H9
H8
DM
H21
J701-2 GND
H10
SRCH ON
CG
S1001
♦ THIS RUN CUT WITH SC OPTION
PRESENT IN SINGLE FREQ UNITS ONLY
PRESENT IN VOX (VC) AND COMP/VOX (SC/VC) UNITS ONLY
7.5V
THE HEAVY LINE INDICATES THE VOLTAGE SOURCE ON THE SYSTEM BOARD.
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.
NOTE;
1. RUNS ARE CUT HERE IN A THREE (3) OR MORE FREQUENCY UNIT.
2. THIS RUN IS CUT WHEN UNIT REQUIRES TWO OFFSET OSC. (OXO).
MODEL NO. | REV. LETTER
PL19C32841862 | A
PL19C32841863 | A
PL19D42910862 | A
PL19A13783862 | A
OSC OUT
SEL-2
SEL-1
DISCR
DPTT
CPTT
ENC OFF
DEC OFF
E931
E932
E929
E946
E938
E947
E945
E944
E934
E937
SEE NOTE 1
SEE NOTE 2
E933
AUD INP
TX OXO-1
TX OXO-2
C911
3.3
UF
H909
C902
43
L901
BK
TRANSMITTER
W902 IS CONN TO HOLES VACATED BY PA AS SHOWN
LOW PWR TX
TO K901-2
W902
EXCITER PA
CUR SEN
PWR CONT
HI PWR ADJ
R902
50K
1/2W
PC
UNLOCK
R2101
50K
1/2W
H919
H921 LOW PWR ADJ
H920
PA
EX
VO
PL
VCO CONT
VCO SEN
TEST PT
LVL
H922
R2102
43K
H923
SC/VC
VOX OFF
E942
LO PWR ADJ
R2101
50K
1/2W
H921
MOD ADJ
R904
10K
1/2W
C910
15UF
AUD OUT
CG ENC
CPRSR OUT
CPRSR INP
AUD INP
PREAMPL OUT
TX-AA
TX BAT IND
MIC MUTE
TONE INP
PTT
E903
E908
16 MIC GAIN
EXT MIC
INTL MIC
E913
C921
100
C922
100
C2101
100
R905
560
C908
1UF
H902
H901
E925
E926
T28-Y
A703
A703-H27
A703-H24
T28-Y
H2101
C2102
6.8UF
H2105
C2103
6.8UF
R2103
220K
H2109
CR2101
C2104
27
H2112
T28-Y
H14
H15
H16
H13
T28-BK
T28-O
T28-BK
VOX OFF
S2101
LO PWR ON
S2102
P901
J901
C2
47
C1
47
MK1
FRONT COVER
TO GND ON LS1-2
R1
1K
C1
1UF
DS702
H24
H25
PTT
S702
R5
560
DM
H27
H12
H20
T28-GA
H23
H19
H18
H13
R2401
DS2401
T28-WV
J701-8 GND
J701-6 RUS
J701-7 5.4V FOR MIC
J701-5 EXT PTT
J701-9 EXT MIC
C901
47UF
CR901
K901
R901
180
1/4W
C912
27
W903
19A116104P1
TEST PT
FX
C915
10
OSC INP
RX XO-1
RX XO-2
C924
27
C925
27
C926
27
CR902
C904
1UF
C913
100
C920
100
RLY
DPTT
CPTT
VR
CT
H907
H908
THG
ALERT TONE
SQ OVERRIDE
OPT SQ 1
OPT SQ 2
SQ
CAS
AND
H906
DISCR
CG
DEC OFF
ENC OFF
FAST SQ
SP
AUD INP MUTE
RX-AA MUTE
DLY ON
FIXED PRI
SRCH ON
SEL-ARM
SEL-PRI
EXT PTT
SEL-1
SEL-2
AND

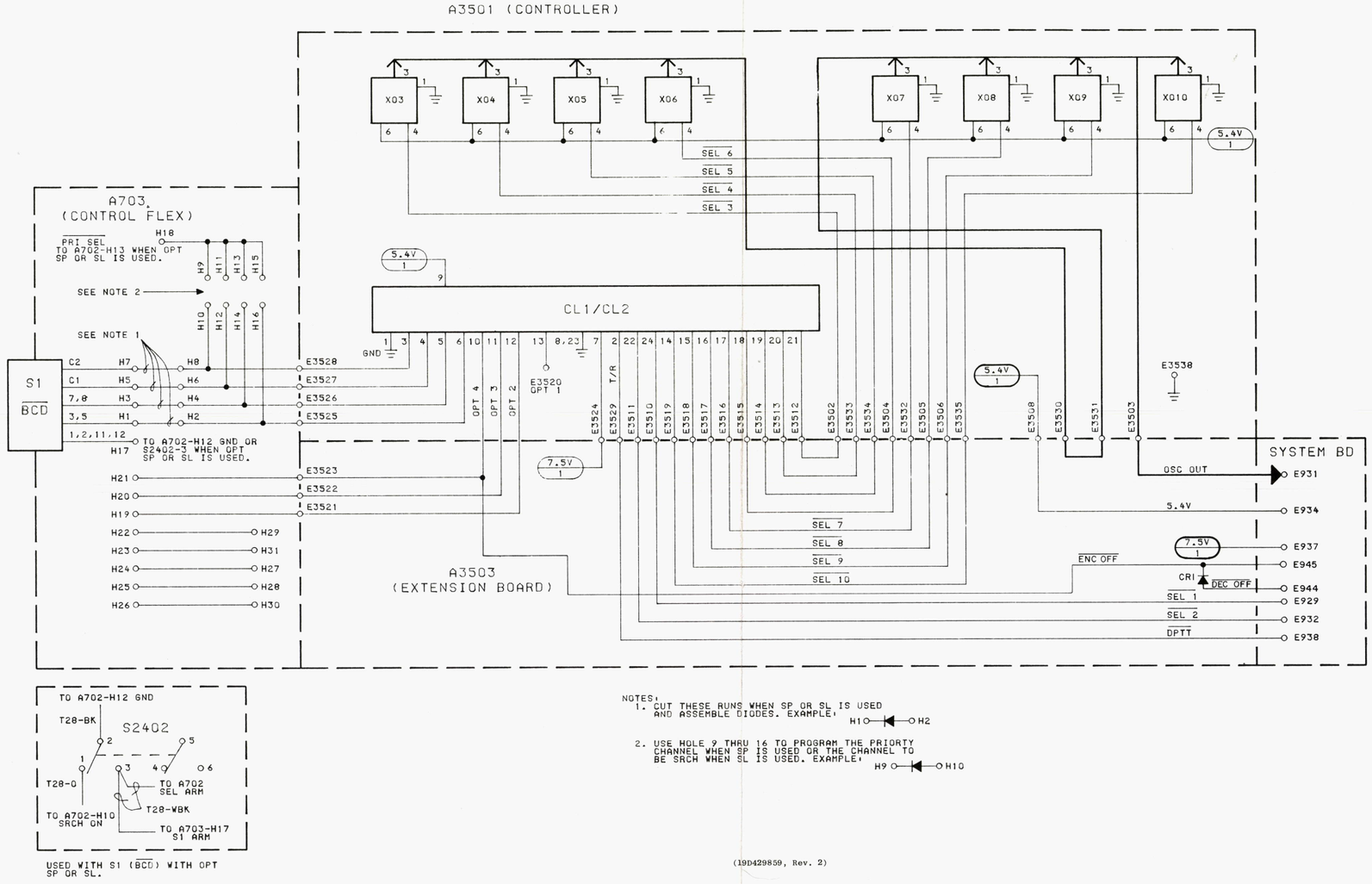
CONTROLLER BOARD
A3501



NOTES.
1. PARTIAL REFERENCE DESIGNATIONS SHOWN. ALL DESIGNATIONS ARE 3500 SERIES. EXAMPLE: E1- E3501.

(RC-4042)
(19C328514, Rev. 2)
(19A138188, Sh. 1, Rev. 0)
(19A138188, Sh. 2, Rev. 0)

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



USED WITH S1 (BCD) WITH OPT SP OR SL.

NOTES:
1. CUT THESE RUNS WHEN SP OR SL IS USED AND ASSEMBLE DIODES. EXAMPLE: H10 — H2
2. USE HOLE 9 THRU 16 TO PROGRAM THE PRIORITY CHANNEL WHEN SP IS USED OR THE CHANNEL TO BE SRCH WHEN SL IS USED. EXAMPLE: H9 — H10

(19D429859, Rev. 2)

OUTLINE & SCHEMATIC DIAGRAM

MULTI-FREQUENCY KIT
19A137837G1

PARTS LIST

LBI31288

MPR MODULE LIST
(406-512 MHz)

SYMBOL	GE PART NO.	DESCRIPTION
CG	19D429618G2	Channel Guard (Encode Only).
	19D429618G3	Channel Guard (Encode/Decode).
CL1	19D430085G2	Simple Controller. (B and C Case only).
CL2	19D430953G1	Deluxe Controller. (B and C Case only).
CT	19D43343G5	Carrier Controlled Timer. (Includes Voltage Regulator).
EX	19D429888G4	(406-435 MHz) Exciter for 3.8 to 6.4 Watt transmit.
	19D429888G5	(435-470 MHz) Exciter for 3.8 to 6.4 Watt transmit.
	19D429888G6	(470-512 MHHz) Exciter for 3.8 to 6.4 Watt transmit.
EX/PA	19D429888G1	(406-435 MHz) Exciter and Power Amplifier for 1.6 to 3.8 Watt transmit.
	19D429888G2	(435-470 MHz) Exciter and Power Amplifier for 1.6 to 3.8 Watt transmit.
	19D429888G3	(470-512 MHz) Exciter and Power Amplifier for 1.6 to 3.8 Watt transmit.
FN	19D429965G1	Low Pass Filter.
FX	19D430185G1	(406-435 MHz) Frequency Multiplier.
	19D430185G2	(435-470 MHz) Frequency Multiplier.
	19D430185G3	(470-512 MHz) Frequency Multiplier.
IA-1	19D429542G1	IF preamplifier.
IA-2	19D429482G1	IF Amplifier.
PA	19D429854G1	(406-435 MHz) RF Power Amplifier.
	19D429854G2	(435-470 MHz) RF Power Amplifier.
	19D42854GG3	(470-512 MHz) RF Power Amplifier.
PC	19D429538G1	Power Control.
PL	19D430222G1	(406-435 MHz) Phase Lock Loop.
	19D430222G2	(435-470 MHz) Phase Lock Loop.
	19D430222G3	(470-512 MHz) Phase Lock Loop.
RA/RC	19D429928G1	(406-435 MHz) Receiver Front End.
	19D429928G2	(470-512 MHz) Receiver Front End.
	19D429928G3	(470-512 MHz) Receiver Front End.
RX-AA	19D429420G2	Receive Audio Amplifier.
RX-XO	19A13764SG7	Receive Oscillator.
SC	19D429546G1	Speech Compressor.
SC/VC	19D429546G3	Speech Compressor and Voice Control.
SP	19D42952SG5	Priority Search Lock Monitor.
SQ	19D429426G1	Squelch.
TX-AA	19D429486G2	Transmit Audio Processor.
TX-OXO	19D429739G1	Module. (OXO). (Used with standard 21.4 MHz IF Frequency range 14.8-28.1 MHz).
	19D429739G11	Module. (OXO). (Used with alternate 23.0 MHz IF Frequency range 14.8-28.1 MHz).
VC	19D42954G2	Voice Control.
VO	19D430071G1	(406-435 MHz) Voltage Controlled Oscillator.
	19D430071G2	(435-470 MHz) Voltage Controlled Oscillator.
	19D43007IG3	(470-512 MHz) Voltage Controlled Oscillator.
VR	19D43343G1	Voltage Regulator. (Does not include Controlled Timer).
XD	19D42942G1	Receiver Discriminator. (21.4 MHz).
	19D42942G2	Receiver Discriminator. (23 MHz).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

SYSTEM BOARD
19D429108G2
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	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.
C919 and C920	19A700007P61	Ceramic: 100 pF ±5%, 50 VDCW; temp coef 0 ±30 PPM.
C921* thru C923*	19A700007P61	Ceramic: 100 pF ±5%, 50 VDCW; temp coef 0 ±30 PPM. Added by REV A.
C924* thru C926*	19A700229P44	Ceramic: 27 pF ±5%, 100 VDCW, temp coef -3300 PPM. Added by REV A.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR901 and CR902	5494922P1	Silicon: sim to Hughes 1N456.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
E3 thru E27	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
E28	4033513P23	Contact, electrical: sim to Bead Chain R62-11A.
E31 thru E34	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
E37 thru E47	19A134591P1	Contact, electrical: sim to Augat LSG-1AG14-14.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J901	19A134584P1	Plug: 3 amp max rating, wire No. 28 AWG stranded.
		- - - - - - - - - - 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 MF1401G03.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L901	19B232664G1	Coil.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

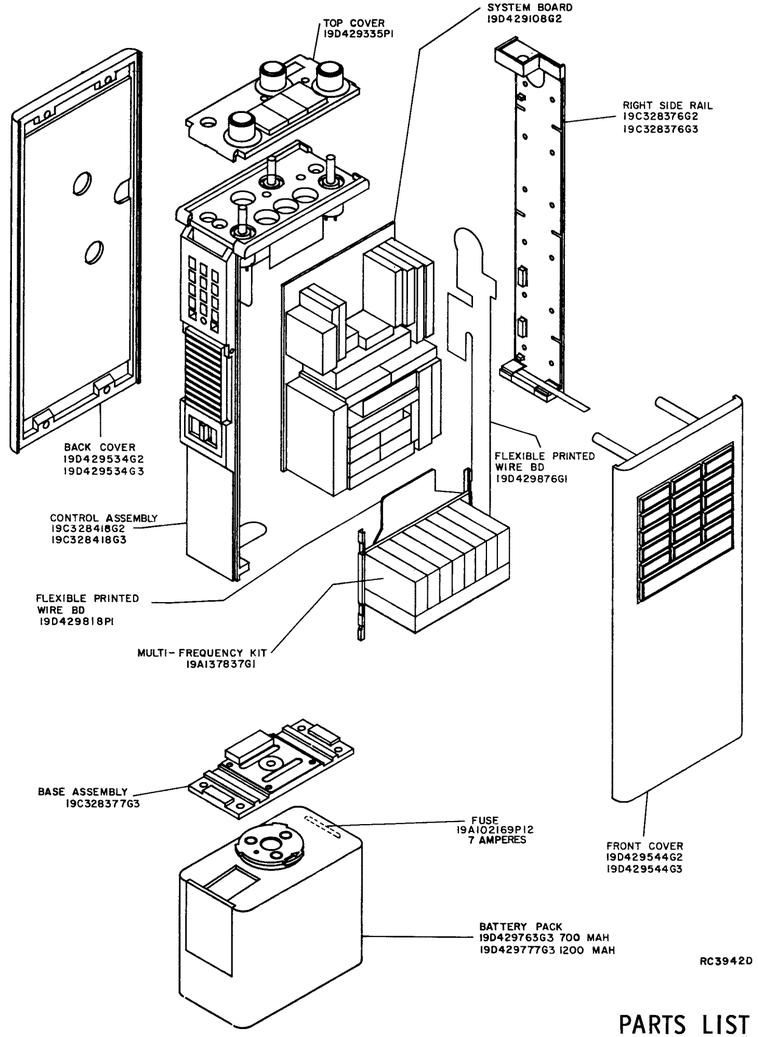
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R901	19A700106P45	Composition: 180 ohms ±5%, 1/4 w.
R902	19A134512P8	Variable: 50K ohms ±5%, 1/2 w.
R903	19A134564P1	Metal film: 15 ohms ±5%, 1/4 w.
R904	19A134512P7	Variable, cermet: 50K ohms ±10%, 1/2 w; sim to A-B A2A503.
R905	3R151P561J	Composition: 560 ohms ±5%, 1/8 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W903	19A137417G2	Cable, RF.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19B232662P1	Support. (K901).
	19A115834P6	Contact, electrical. (Used with K901).
	19B800608P2	Rivet, tubular. (Secures K901 support).
	19A115834P9	Contact, electrical: sim to AMP 3-332070-4. (Quantity 30).
	19B209648P1	Contact, electrical. (Quantity 120).
	N503P308C13	Cotter pin.
	19A116466P1	Pressure sensitive tape. (Located on K901-1, 4, 5 & 8).
	19A121175P13	Insulator, plate. (Used with K901).
		ASSOCIATED ASSEMBLIES
		- - - - - - - - - - CABLES - - - - - - - - - -
W902	19B232677G1	Jumper.
	19B233301G2	Module Extractor Tool Kit. (2)

PARTS LIST

MULTI-FREQUENCY KIT
19A137837G1
ISSUE 4

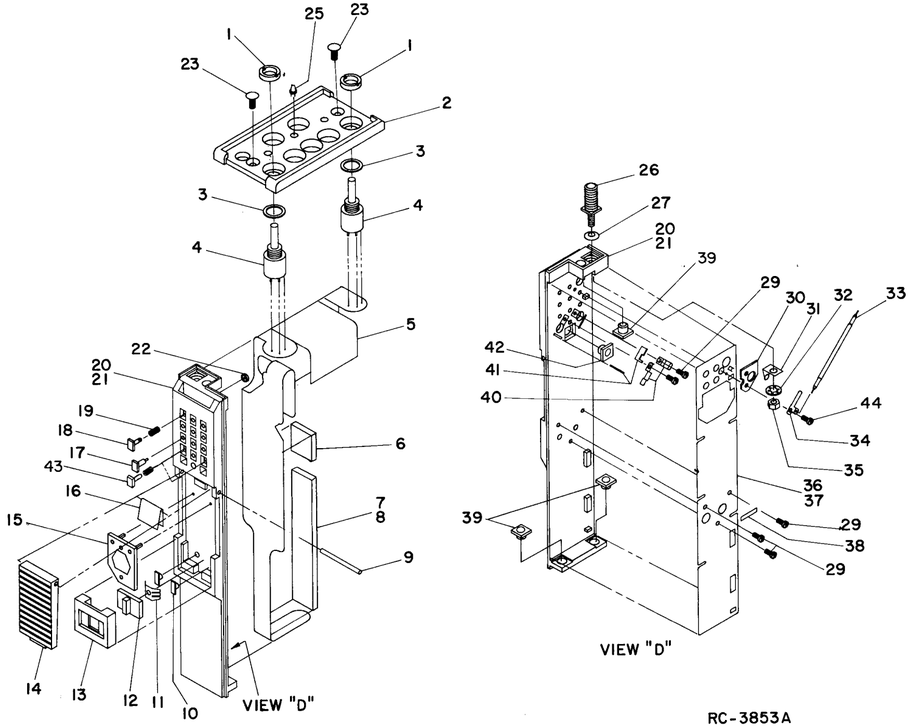
SYMBOL	GE PART NO.	DESCRIPTION
A703	19D429876G1	Flexible Printed Wire Board. (Includes S1 - 19A134781P1 rotary switch).
A3501	19C328512G1	Controller Board.
A3503	19C331225G1	Flexible Printed Wire Board.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19C328108P3	Knob.
	19A143453P1	Set screw, self locking: 3-48 x 1/8.
	19C328193P1	Knob, scaled dial.
	19A127319P2	Nut: No. thd. size 1/4-28.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



PARTS LIST

Sheet 1



RC-3853A

PARTS LIST

CONTROL ASSEMBLY
19C328418G2 B CASE - REV C
19C328418G3 C CASE - REV C
ISSUE 6

SYMBOL	GE PART NO.	DESCRIPTION
A702		B & C SYSTEM FLEX BOARD 19D429687G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5491674P1	Tantalum: 1 uF +40-20%, 10 VDCW; sim to Sprague Type 162D.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R151P104J	Composition: 100K ohms ±5%, 1/8 w.
R2	3R151P103J	Composition: 10K ohms ±5%, 1/8 w.
R3	3R151P123J	Composition: 12K ohms ±5%, 1/8 w.
R4	3R151P683J	Composition: 68K ohms ±5%, 1/8 w.
R5	3R151P561J	Composition: 560 ohms ±5%, 1/8 w.
R6	3R151P102J	Composition: 1K ohms ±5%, 1/8 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W701	19A137417G1	Cable wire: approx 2 inches long.
		SIDE RAIL 19D429564G2 (B CASE) 19D429564G3 (C CASE)
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J701		(See items 17-19 & 22 on RC3853).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701		(See items 10-13 on RC3853).
S702		(See items 9, 14-16 on RC3853).
S703		(See items 18, 19, 22, 29, 40 & 41 on RC3853).
S704		(See items 18, 19, 22, 29, 40 & 41 on RC3853).
S705		(See items 18, 19, 22, 30, 31 & 34 on RC3853).
		TOP PLATE 19C328388G2
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R701 and R702	19A134528P3	Variable, cermet: 50K ohms ±10%, 1 w. (Part of Mechanical Parts RC3853, item 4).
		MECHANICAL PARTS (SEE RC3853)
1	19A127319P1	Nut: No. thd. size 1/4-32. (Used with R701 & R702 - Volume & Squelch).
2	19D429340P1	Top plate.
3	4037064P25	Washer, non-metallic. (Used with R701 & R702 - Volume & Squelch, & dummy plug).
4	19A134528P3	Variable, cermet: 50K ohms ±10%, 1 w. (R701 & R702).
5	19D429686P1	Printed Board. (A702).
6	19b232682P8	Pad.
7	19B232682P20	Pad. (B CASE).
8	19B323682P21	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 Bowmar KB3256-1D. (Part of S702).
	19C331442P1	Seal.
16	19A137414P1	Spring. (Part of S702).
17	19B234407G1	Contact. (J701-2 thru J701-9, J701-11).
18	19B234407G2	Contact. (Part of S703-S705).
19	4035235P13	Spring. (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).
23	19A134586P2606E	Machine screw: 2.5-0.45 x 6MM. (Secures top plate and Base assembly to side rails).
24	19A134582P1	Washer, non-metallic. (Not Used).
25	19A143255G1	Diode, optoelectronic: red. (Not Used).
26	19A137411P1	Antenna stud.
27	19A700127P3	Packing.
28	19A137410P1	Bushing. (Secures top plate to left side rail).
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	19A137417G1	Cable wire: approx 2 inches long. (W701).
34	19B232670P1	Contact. (Part of S705).
35	19A700034P3	Hex nut, metric: M2.5 x 0.45.
36	19C328385P2	Shield. (B CASE).
37	19C328385P3	Shield. (C CASE).
38	19A137609G2	Strap.
39	19A137410P1	Bushing. (Secures base assembly to side rails).
40	19A144581G1	Contact. (Part of S703 & S704).
41	19B234407G5	Contact. (Part of S703 & S704).
42	19B232415P1	Bushing.
43	19B234407G4	Contact. (Part of S703 & S704).
44	19A134588P4	Screw, panhead: size 0-40. (Part of S705).
		ASSOCIATED ASSEMBLIES
F1	19A127884G1	Fuse Kit.

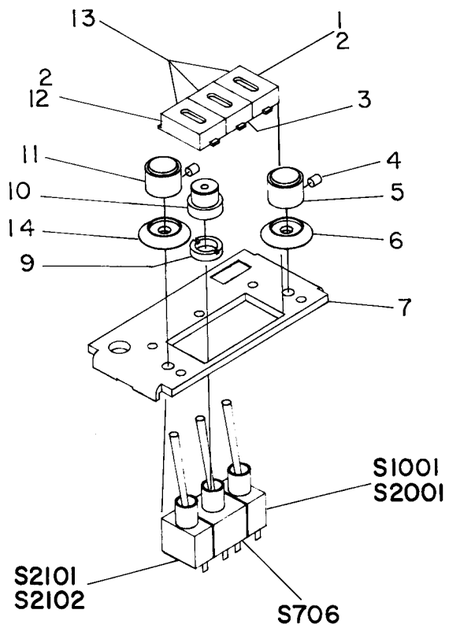
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

TOP COVER ASSEMBLY
(Can not be ordered as an assembly)
(SEE RC3854)
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
1	19B232996G3	Decorative cap. (Channel Guard).
2	19B232996G5	Decorative cap. (VOX).
3	19B232996G1	Decorative cap. (2 Frequency).
4	19A143453P1	Set screw: No. 3-48 x 1/8.
5	19C328108P1	Knob. (Volume).
6	19C328193P2	Dial, scale. (min - max).
7	19D429335P1	Top plate.
8	19A134582P1	(Not Used).
9	19A127319P6	Nut: 1/4-40. (Used with 2 frequency switch S706).
10	19B232508P1	Seal. (Used with S706, S1001, S2101, S2102 switches).
11	19C328108P2	Knob. (Squelch).
12	19B232996G4	Decorative cap. (Hi-Lo).
13	19B232517P1	Dummy cap.
14	19C328193P3	Dial, scale.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



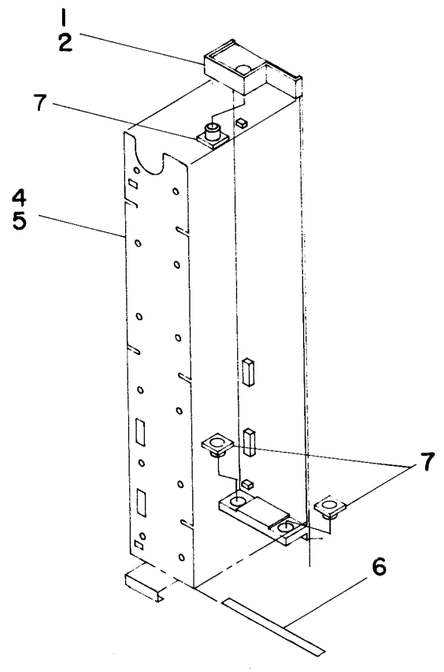
RC-3854B

PARTS LIST

RIGHT SIDE RAIL
19C328376G2 B CASE
19C328376G3 C CASE
(SEE RC3852)
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
1	19D429242P2	Side rail. (B CASE).
2	19D429242P3	Side rail. (C CASE).
3		(Not Used).
4	19C328322P2	Shield. (B CASE).
5	19C328322P3	Shield. (C CASE).
6	19A137609G1	Strap.
7	19A137410P1	Bushing. (Secures base assembly & top plate to right side rail- Not included with side rail).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



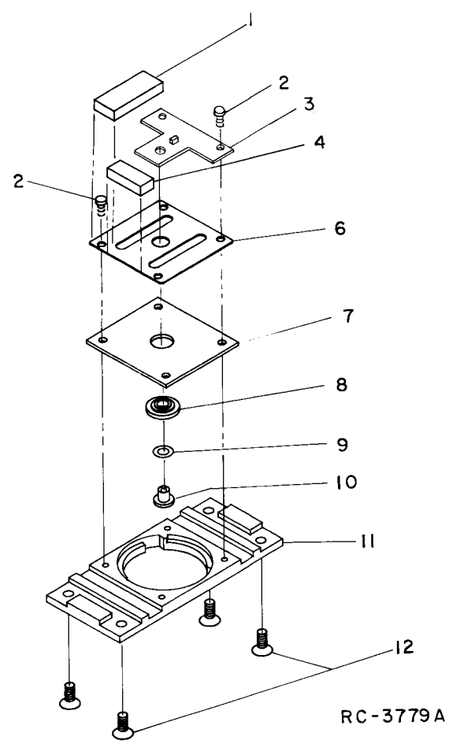
RC-3852A

PARTS LIST

BASE ASSEMBLY
19C328377G3
(SEE RC3779)
ISSUE 2

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.
3	19C331904P1	Printed Board.
4	19B232682P11	Pad.
6	19B232497P2	Spring.
7	19B237706P2	Pad.
8	19A137490P2	Insulator.
9	4035306P70	Washer, non-metallic.
10	19A137531P3	Contact.
11	19D429248P2	Base.
12	19A134586P2506	Machine screw: 2.5 with 0.45 thd. pitch, 6MM long. (Not included with base assembly).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



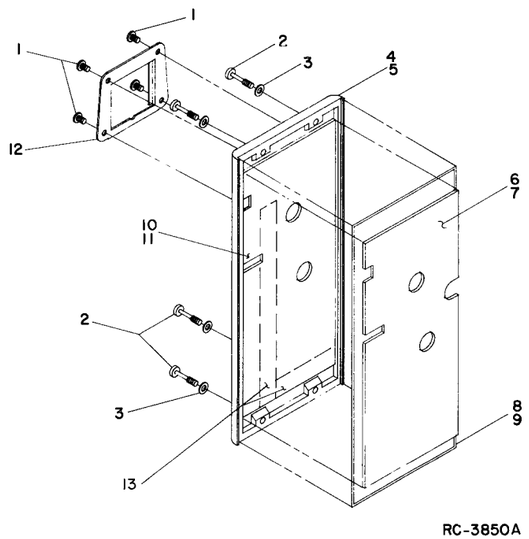
RC-3779A

PARTS LIST

REAR COVER
19D429534G2 B CASE
19D429534G3 C CASE
(SEE RC 3850)
ISSUE 5

SYMBOL	GE PART NO.	DESCRIPTION
1	N327P9010E	Rivet, tubular.
2	19A702863P1	Machine screw: M2.5-.45 x 13MM.
3	19A700032P3	Lockwasher, tooth, steel, metric: 2.5.
4	19C328374G2	Rear cover. (B CASE).
5	19C328374G3	Rear cover. (C CASE).
6	19B232524P1	Pad. (B CASE).
7	19B232524P1	Pad. (C CASE)
8	19A134583P2	Cover seal, rubber. (B CASE).
9	19A134583P3	Cover seal, rubber. (C CASE).
10	19B233545P2	Pad. (B CASE).
11	19B233545P3	Pad. (C CASE).
12	19B232216P1	Option, receptacle.
13	19A134285P1	Tape, pressure sensitive.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



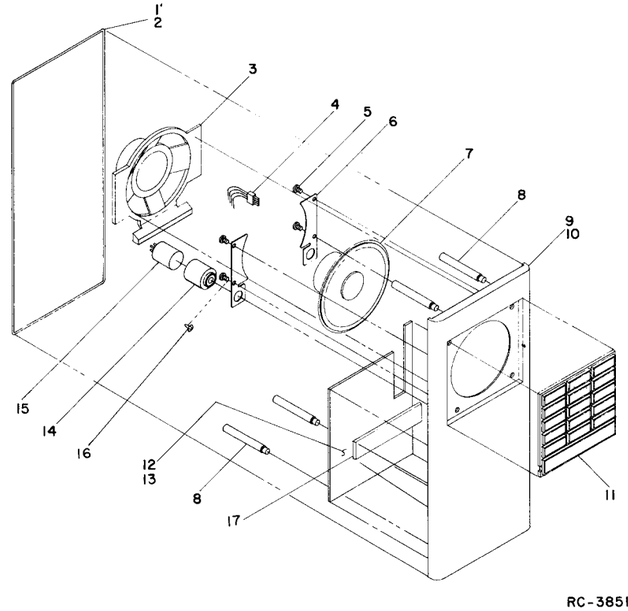
RC-3850A

PARTS LIST

FRONT COVER ASSEMBLY
19D429544G2 (B CASE)
19D429544G3 (C CASE)
ISSUE 3

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 inch, 8 ohms ±10% voice coil imp, 400-3000 Hz freq range; sim to Pioneer A50AP1301F.
		- - - - - - - - MICROPHONES - - - - - - - - -
MK1	19A134461P1	Cartridge, electret: 200 to 1000 ohms imp at 1 KHz; sim to Primo EM-60.
		- - - - - - - - - - - - PLUGS - - - - - - - - -
P901	19A134584P2	Connector, plug: stranded wire No. 28 AWG, 3 amps max.
		MECHANICAL PARTS (SEE RC3851)
1	19A134583P2	Seal, rubber. (B CASE).
2	19A134583P3	Seal, rubber. (C CASE).
3	19D429314P1	Speaker boot.
4	19A134584P2	Connector, plug. (P901).
5	19A134793P1804	Tap screw, thd. forming (Metric).
6	19B232496P1	Speaker retaining plate.
7	19A134460P1	Speaker, permanent magnet. (LS1).
8	19A137709P1	Spacer.
9	19C328382G2	RF Cover. (B CASE).
10	19C328382G3	RF Cover. (C CASE).
11	19D429300P1	Grille.
12	19B232816P1	Pad. (B CASE).
13	19B232816P5	Pad. (C CASE).
14	19B232498P1	Mike boot.
15	19A134461P1	Microphone. (MK1).
16	4033714P14	Solderless terminal.
17	19A121175P15	Insulator, plate.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



RC-3851A

PARTS LIST

MPR ANTENNAS
(406-512 MHz)
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
	19B209548P2	Spring Whip Antenna.
	19B219887P3	2" Spring Whip Antenna.

INSTALLATION INSTRUCTIONS FOR MODIFICATION KIT 19A144704

Modification Kit 19A144704 provides a small rubber pad to prevent a "clicking " sound while walking and carrying the radio in carrying assembly options.

INSTALLATION INSTRUCTIONS (19B234194, Rev. 0)

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 norman 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.

INSTALLION 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 carrying 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 securley 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.