MOBILE RADIO

PLS™

MAINTENANCE MANUAL LBI-31743 A

SERVICE SECTION LBI-31790

150 - 174 MHz
PERSONAL
TWO-WAY FM RADIO

GENERAL ELECTRIC

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ILLUSTRATIONS

SPECIFICATIONS SYSTEM

SYSTEM

FCC Identification Number	AXA9WN PLSH05
Frequency Range 150 MHz	150 MHz - 174 MHz
Frequency Stability	5 PPM
Battery Drain (at 7.5 VDC)	
Standby	59 Milliamperes
Receive (Rated Audio)	179 Milliamperes
Transmit	1.9 Amperes
Battery Life	
800 mAh	5 hours at 5-5-90 duty cycle
1200 mAh	8 hours at 5-5-90 duty cycle
Dimensions (H X W X D)	188mm X 68mm X 42mm (With 800 mAh battery pack)
Weight	22 oz (With 800 mAh battery pack)
Operable Temperature Range	-30° C to +60° C

TRANSMIT

RF Power Output	
High Power	5 Watts
Low Power	1 Watt
Spurious Emissions	-53 dBm
Maximum Deviation	5 KHz
FM Hum & Noise (EIA)	-40 dB
Audio Distortion (60% Modulation)	7%
Frequency Stability (PPM) (-30 C to + 60 C)	+5 PPM
RF Load Impedance	50 ohms
Microphone Sensitivity (EIA 60% Modulation)	Less Than 90 dB SPL
Maximum Attack Time (PTT Pushed)	30 milliseconds
Audio Frequency Response	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 Hz to 3000 Hz.

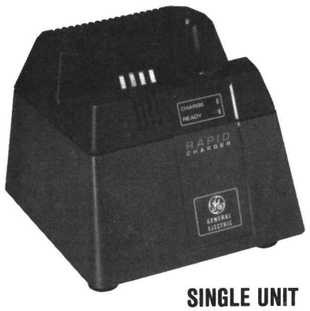
RECEIVER

Sensitivity (12 dB SINAD)	0.4 Microvolts (0.25 typ)
Spurious Emissions	-57 dBm
Spurious Response Rejection (EIA)	-60 dB (Minimum)
Distortion (EIA 0.35W)	10% (3% typ)
Audio Frequency Response	Within +1 and -8 dB/octave de-emphasis from 300 Hz to 3000 Hz with the following constraints; 0 to 210 Hz -30 dB Maximum.Referenced 1000 Hz.

COMBINATION NOMENCLATURE

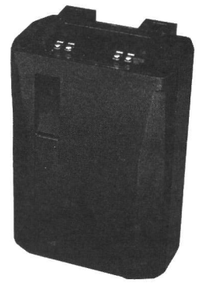
Digits 1&2	Digit 3	Digit 4	Digit 5	Digit 6
Product Code	Radio Type	Frequency Band	Frequency Split	RF Power Output
PL	**S** Synthesized	**H** 150 - 174 MHz	**0** None	**5** 5 Watts

FIVE-UNIT MULTI-BATTERY CHARGER
1 HOUR UNIT H2A2J1A
16 HOUR UNIT H2A2L2A



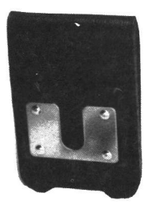
SINGLE UNIT DESK CHARGER
1 HOUR UNIT H2A1J1A
16 HOUR UNIT H2A1J2A

800 mAh BATTERY
OPTION PLPA10
(19A704850P1)

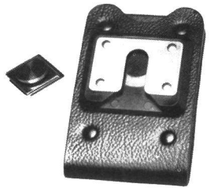


1200 mAh BATTERY
OPTION PLPA11
(19A704860P1)

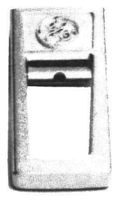
SWIVEL MOUNT/CASE BELT LOOP



SWIVEL MOUNT PLATE & BELT LOOP



BELT CLIP

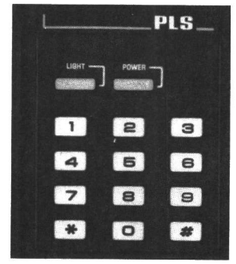


CASE & BELT LOOP
RADIO W/800 mAh BATTERY, OPTION PLHC11
(19D901765P2)
RADIO W/1200 mAh BATTERY, OPTION PLHC12
(19D901765P4)

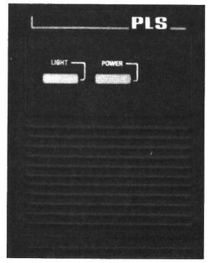
CASE/SWIVEL MOUNT/BELT LOOP
RADIO W/800 mAh BATTERY, OPTION PLHC13
(19D901765P1)
(19B226627G1 LOOP)
RADIO W/1200 mAh BATTERY, OPTION PLHC14
(19D901765P3)
(19B226627G1 LOOP)

BELT CLIP OPTION PLHC15
(19B233241G1)
(19A144704G1 MOD KIT)

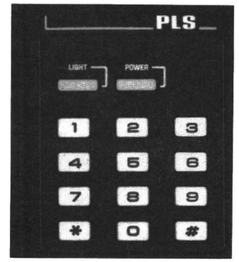
SWIVEL MOUNT PLATE & BELT LOOP
OPTION PLHC16
(19B226627G1 LOOP)
(19B233243 SWIVEL)
(19A144704G1 MOD KIT)



DTMF PANEL
OPTION PLDT01
(19A704723P11)



T99 PANEL
OPTION PLSS01
(19A704723P12)

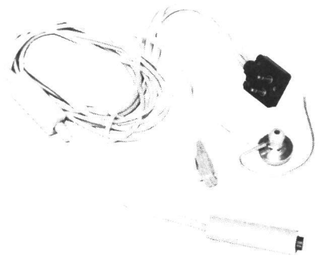


DTMF & T99 PANEL
OPTION PLMK01
(19A704723P13)

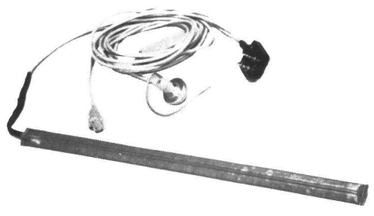
SPEAKER/MICROPHONE WITH VELCRO MOUNT
OPTION PLAE11
(19D43748364 MIKE)
(19A129791G1 BADGE)

SPEAKER/MICROPHONE WITH CLIP MOUNT
OPTION PLAE12
(19D43748362)

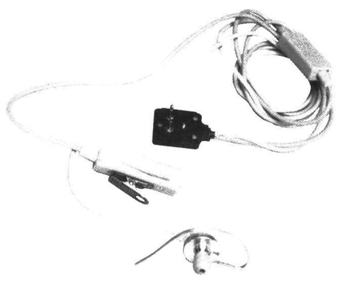
EAR SPEAKER
OPTION PLAC19
(4033570G6)



SK-1 SECURITY PACKAGE
OPTION 1226



SK-2 SECURITY PACKAGE
OPTION 1227



SK-3 SECURITY PACKAGE
OPTION 1228

LAPEL SPEAKER
OPTION PLAD10
(19A116502P1 SPEAKER)
(19A116502P2 CABLE)

DESCRIPTION

General Electric's PLS Personal Radio is a high quality, high performance, two-way, FM, communications unit consisting of a transmit/receiver circuit with a frequency synthesizer controlled by a microprocessor. The PLS Personal Radio is ideal for use in public services by providing the following features:

- **16 Channel Capability:** There are two modes of operation and eight channels are selectable for each mode using the "MODE" button. The channels can be selected with or without tone. The transmit and receive frequencies are programmed separately and can be the same. The channel button is used to increment to the next programmed channel. The monitor push button allows the user to monitor the channel before transmitting.

- **Programmable Multi Tone Channel Guard (CTCSS) Encode/Decode:** Channel Guard tone frequencies within the range of 67 Hz to 210.7 Hz, including all of the standard EIA frequencies, may be programmed. Different encode/decode, encode only and with/without Channel Guard frequencies are also programmable into the radio.

  The same channel is used with and without Channel Guard by programming two different radio channels with the same frequency information but only one with Channel Guard capability.

- **Programmable Carrier Controlled Timer:** Personality information includes an optional period of transit time in thirty second increments after which the unit will automatically unkey and provide an alerting tone. This feature is re-initiated on every PTT and the alert tone is removed upon release of the PTT.

- **Squelch Tail Elimination:** Squelch and audio circuits are designed so that annoying squelch "pops" which may occur at the end of received messages are minimized, both with and without Channel Guard. This system is compatible with an existing GE system.

- **Programmable Squelch:** The noise squelch opening threshold can be programmed for each channel.

- **Channel Busy Lock Out:** Personality information includes the capability to prevent the transmitter from operating on a channel where carrier activity is present. The channel busy indicator (BSY) is active during this time.

- **Surveillance Feature:** In addition to the ability to program the display lighting on or off per channel, the sidetone beep related to the operation of a radio control is capable of being disabled on each individual channel.

- **Three Segment Liquid Crystal Display:** This display has one digit and five status displays and is used to exhibit the condition of the radio. It shows: Channel Designation, Channel Guard or Digital Channel Guard ON/OFF, Transmit, Volume Level, Battery Condition, Channel Busy and High/Low Power output.

- **Simple Remote Control Capability:** By connection through the jack connectors a simple speaker microphone can be operated which can also control PTT.

- **Push Button Controls Only:** All control functions on the radio, with the exception of the power ON/OFF switch, are operated through push button controls on the top and sides of the radio (see Figure 1).

- **Programmable through jack connectors:** The entire personality of the radio is programmed into the radio through the jack connectors. The General Electric TQ2310 Universal Programmer is used for programming the radio.

Physically a PLS radio consists of a plastic control housing, an aluminum back plate assembly, three printed circuit boards and a battery pack as follows;

a. A specially shielded printed wire board radio assembly (transmit/receive/synthesizer) is mounted on the aluminum back plate.

b. A Logic Control board with the microprocessor and audio processor. This board is located in the control housing.

c. A flexible Display board carrying various display and indicating circuits and switches is also mounted in the control housing.

d. Key Board

e. A battery pack that fits the PLS main unit.

f. A POLYCABONATE front and an Aluminum back housing.

Radio Assembly

Transmit:

The transmit circuit is made up of three major circuits as follows:

a. Wideband Power Amplifier: Amplifies the output signal of the exciter (13 dB to 18 dB) to the desired output level for transmission

b. Wideband Power Control module: Provides constant control of the transmit output level.

c. Output Low Pass Filter (LPF): Consists of a three stage LPF to eliminate higher harmonics.

The transmit circuit completely covers the band with no adjustments except for the RF power control voltage from the controller.

Receive Circuit:

The receive circuit, like the transmit circuit, consists of three major circuits as follows:

a. Front End Circuit: Consists of a single stage preamplifier with about 12 dB gain and the pre-BPF's and post-BPF's of the preamplifier.

c. First Mixer and IF Circuit: A special double balanced mixer to provide a 45 MHz first IF, which is passed through band pass filter (BPF) and an IF amplifier to get the desired first IF signal.

d. Second IF: (455 KHz) Consists of one IC and one BPF, containing the second mixer, second IF amplifier and FM detector. The second IF output provides the Logic section with audio output

Frequency Synthesizer:

The frequency synthesizer is made up of three major modules as follows:

a. VCO Module: The UHF band frequency synthesizer has two VCO's one for transmitting and one for receiving. The transmit circuit is modulated at the VCO.

b. TCX Crystal Module: The TCX is a temperature compensated crystal to provide the 13.2 MHz reference frequency.

c. Phase Lock Loop: Consists of a frequency divider and low current drain CMOS IC for phase comparison.

Logic Circuit

The Logic Circuit consists of a LCD board and a control board with an audio IC as follows:

a. LCD Board: Includes Volume Up/Down switches, a mode switch, a channel switch and a LED for LCD illumination.

b. Control Board: Carries a microprocessor, a RAM, audio circuit and I/O interconnections with the radio board and the display. This board commands all of the functions and operations of the PLS radio.

Power Supply

The PLS battery pack connects to the bottom of the PLS radio to supply 7.5 VDC. The battery pack is available in two types: an 800 mAh capacity and a 1200 mAh capacity. To charge these battery packs, the charger is available in two different types: a standard 16 hour charger and a rapid one hour charger.

OPERATION

The PLS Personal Radio is delivered disassembled into three parts as follows:

1. PLS Radio (Main Unit)
2. Antenna
3. Battery Pack

Assemble these parts into one unit according to the following procedure and as shown in Figure 1 - PLS Standard Operating Controls and Accessories.

1. Screw the antenna ② in its receptacle. A clockwise turn will connect the antenna, while a counterclockwise turn will remove it.
2. Slide the battery pack along the bottom of the PLS radio from the arrow marked direction shown in Figure 1 until the battery pack locks into place.

Operating Procedure (Refer to Figures 1 and 2)

To Receive A Message:

1. Slide the Power switch ⑧ on the side of the battery pack up to turn on the radio. The display will indicate the current status of the radio, i.e., channel, mode or Hi/Lo power.
2. Select a desired volume level by pressing and holding the VOL ▼ or ▲ arrow while listening to the beeps.
3. Select the desired operating channel by pressing the MODE switch to select the mode (1 or 2) and then press the CHAN switch to select the channel.
4. Your PLS radio is now ready to receive messages.

TYPE 99 TONE

NOTE

Only those channels programmed to decode Type 99 tones may be used to receive your personal messages. When receiving a message, you will first hear a tone and then your message.

1. Select the appropriate channel to receive the message.
2. After answering the message, momentarily press the MON push-button to reset the radio for the next call and to avoid hearing nuisance calls.

To Send A Message:

1. Turn the radio on and select the operating channel as instructed in To Receive A Message. The current status of the radio is displayed in the LCD window.
2. Select the transmit power level Hi or Lo.
3. Press the **MON** switch to determine if the channel is in use. **NEVER** interrupt another conversation.
4. While holding the radio so that the antenna is vertical, press the PTT switch and speak directly into the grill or across the face of the radio or external microphone. Speak in a normal voice. Release the PTT switch as soon as you stop talking. Messages cannot be received while PTT switch is pressed.

DTMF Signalling:

Your radio may be equipped with a Dual Tone, Multi Frequency (DTMF) encoder key pad. The key pad has 12 keys. The keys are "0" through "9", an asterisk (*) and a pound key (#). These keys are used to gain access to a standard telephone system and a two-way radio DTMF Signalling System.

NOTE

DTMF Signalling is available only on the preprogrammed channel. Before making a call, be sure you select the correct Channel.

1. Select the DTMF channel.
2. Simultaneously press the PTT switch and the individual keys on the keypad. A tone is heard each time a key is pressed.

Controls and Indicators:

NOTE

A beep is sounded each time a switch is operated (except **MON** and **PTT**). For repeating switches (**CHAN**nel and **VOL**ume) a beep is heard each time the action occurs.

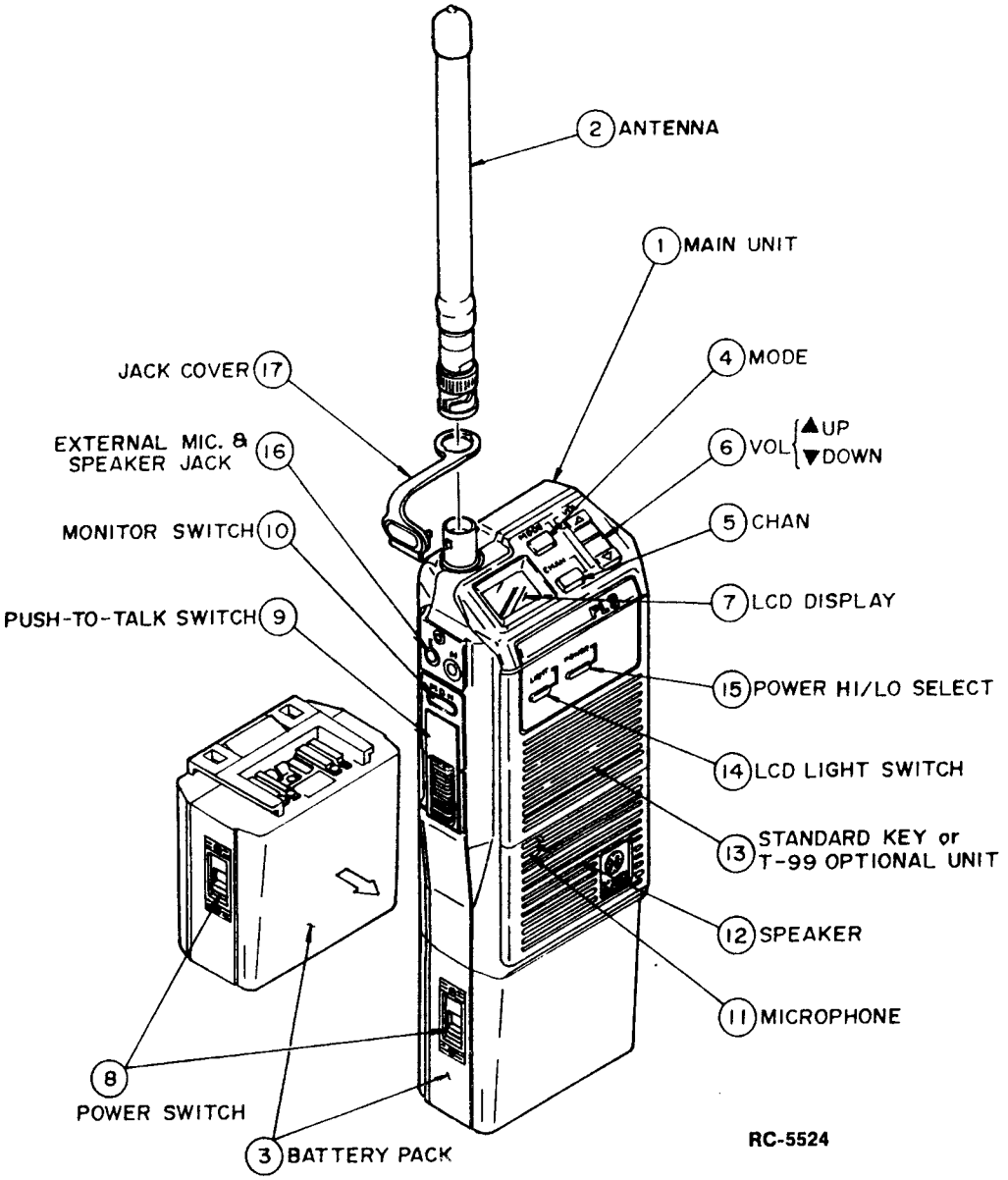


FIGURE 1 - STANDARD PLS OPERATING CONTROLS AND ACCESSORIES

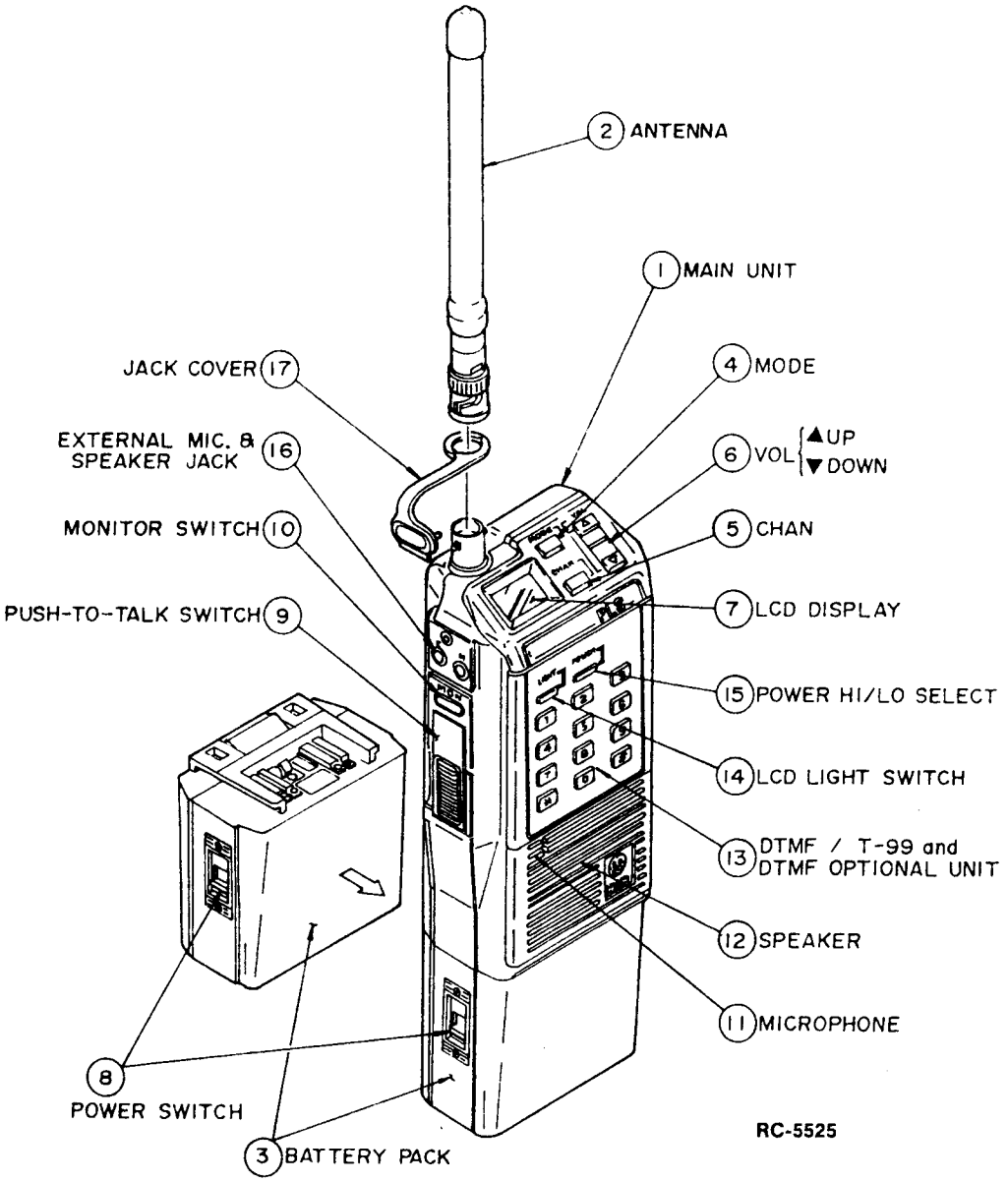


FIGURE 2 - PLS WITH OPTIONAL DTMF AND TYPE 99 OPERATING CONTROLS AND ACCESSORIES

Controls:

WARNING The on/off slide switch on the battery pack controls power from the battery to the radio. When turned on, an audible click will be heard and a light yellow square will show beneath the switch. The radio will assume its last operating state, i.e., channel and volume. Hi Power level is always selected. This status is displayed in the LCD window, indicating power is applied. **BE SURE** the power switch is fully on or fully off.

VOL Sets receive audio to the desired level while pressing the up or down (arrow) and listening to the beep. Pressing and holding the switch will continue to increment the volume in the direction indicated on the switch.

MON The receiver may be unsquelched by pressing and holding the **MON**itor switch located on the left side of the radio. This allows the user to monitor the channel.

CHAN Selects the transmit/receive operating channel. Channels may be selected one at a time or progressively by pressing and holding the **CHAN** switch. NOTE: The next higher channel is always selected (Channel 1 follows Channel 8).

MODE Selects mode 1 or 2. The current operating mode is displayed in the window (Each mode contains up to eight channels). Momentarily press the **MODE** switch to change modes.

NOTE

When changing modes, the channel and channel status are transferred to the new mode. If the channel is not programmed, the next higher programmed channel will automatically be selected.

LIGHT Controls the display backlight. Momentarily press the **LIGHT** switch to turn on. The backlight will automatically turn off when the preprogrammed time elapses. Pressing the **LIGHT** switch a second time will also turn the light off.

POWER Selects high or low transmit power. The selected power level, "**HI** or **LO**", is displayed in the LCD window.

PTT Keys the radio on the channel and mode displayed. Will not key on channels programmed for receive only, but will sound an alarm (successive beeps and pauses).

E External earphone jack.

M External microphone jack.

Indicators:

The LCD display indicates the channel, mode and power level selected. In addition, the power indicator serves as a transmit indicator.

HI/LO Indicates selected transmit power level for the channel displayed.

TX Transmit mode is indicated by a flashing **HI/LO** (depending on power level selected) in the display window when the PTT switch is operated.

WARNING An audio alert tone (beeps) is sounded as a warning to the user that a failure associated with the selected channel or radio has occurred. A failure of the frequency synthesizer to lock on frequency or receipt of incorrect channel data will cause the alarm to sound and inhibit the transmit mode for that channel. The user may select another channel or have the unit repaired.

CARRIER CONTROL TIMER This option unkeys the transmitter when the user exceeds the preprogrammed time for continuous transmission and produces a continuous beeping tone until the PTT switch is released. Releasing the PTT switch resets the timer.

OPERATING TIPS

The following conditions tend to reduced the effective range of two-way radios and should be avoided whenever possible

- Operating the radio in low areas or while under power lines or bridges.
- Operating the radio inside of a vehicle or in a metal or steel frame building, unless using an outside antenna.
- Obstructions such as mountains or buildings between the person transmitting the message and the person receiving the message.
- In areas where transmission or reception is poor, some improvement may be obtained by insuring that the antenna is vertical. Moving a few meters in another direction or moving to a higher elevation may also improve communications.

REPLACEMENT OF BATTERY PACKS

To Remove The Battery Pack From The Radio:

1. Turn the radio off by sliding the on/off switch to the "off" position.
2. Press down on the battery release latch and slide the battery pack out toward the back of the radio.

To Reconnect the Battery Pack to the Radio:

1. Be sure the on/off slide switch on the battery pack is in the "off" position.
2. Align the battery pack with the groves in the back of the radio and slide the battery pack toward the front of the radio.

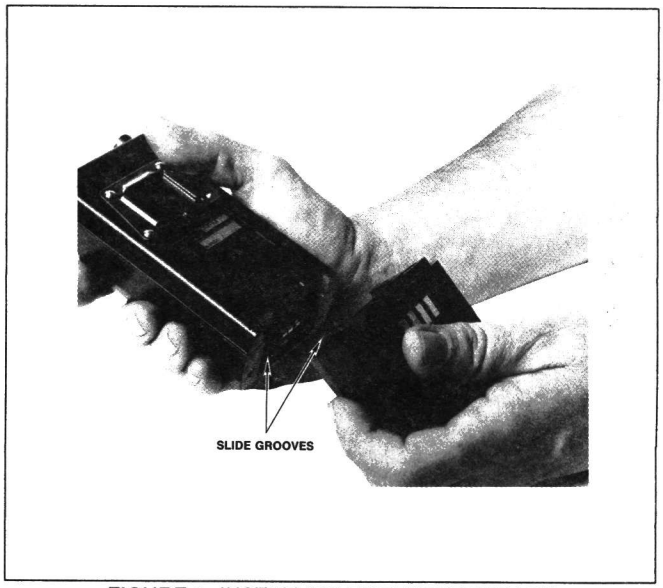


FIGURE 4 - INSTALLING THE BATTERY PACK

FIGURE 3 - REMOVING THE BATTERY PACK

CHARGING BATTERY PACKS

The radio is equipped with a battery indicator which will be displayed in the LCD display when the battery pack voltage drops below 6 volts DC and requires charging. There are several chargers and charge rates available for charging the battery packs. For specific instructions refer to the applicable charger Operating Manual.

SYSTEM ANALYSIS

General Electric PLS Personal radios are two-way, FM radios designed for public communications. The PLS radio consists of three printed wire boards as follows:

- **Radio Board:** carries the transmit, receive and frequency systhesizer circuits.
- **Control Board:** supports logic control and audio processor circuits.
- **Display Board:** carries LCD displays.

Interconnection of the control board with other boards and control circuits is made with flexible circuit boards and connectors. All control leads which are "barred", such as $\overline{PTT}$, means that the function indicated occurs when the lead is in a low voltage condition.

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

RADIO BOARD

Transmit Circuit

The PLS transmit circuit, as shown in Figure 5 - Radio Block Diagram, consists of the following circuits and integrated circuit modules:

- Amplifier (TX-Amp)
- Power Amplifier (PA)
- Antenna Switch (AS)
- Filter Network (FN)

Amplifier Module (TX-Amp):

RF from the synthesizer circuit is applied to the base input of an RF amplifier circuit (TX-Amp) consisting of discrete transistor, Q203. This amplifier circuit with a +2 dBm RF signal on the input produces an RF gain of 17 dB for a level of 38 dBm on the output. This circuit is broadband and does not require tuning. The output is applied through capacitor C206 and resistor R219 to the input of Power Amplifier Module A202 (PA)

Power Amplifier Module (PA):

Power Amplifier A202 is a two stage wide band RF amplifier module with an input and an output impedance of 50 ohms (refer to Figure 6). The first stage of the PA module has the DC power supplied by power control transistor Q202. The RF power output from the TX-Amp circuit is connected to Pin 1 of the PA module where it is applied to the input of the first power amplifier stage in the module. This power amplifier module amplifies the 38 dBm input from the TX-Amp circuit to a typical power output level of 6 watts at Pin 5. The output at Pin 5 connects through power control module A203 and TX-RX switching diode CR201 to a low pass filter network. The low pass filter network consists of capacitors C216 through C222 and C234 and inductors L207 through L210. A minimum power level of 5 watts is on the output of the filter network.

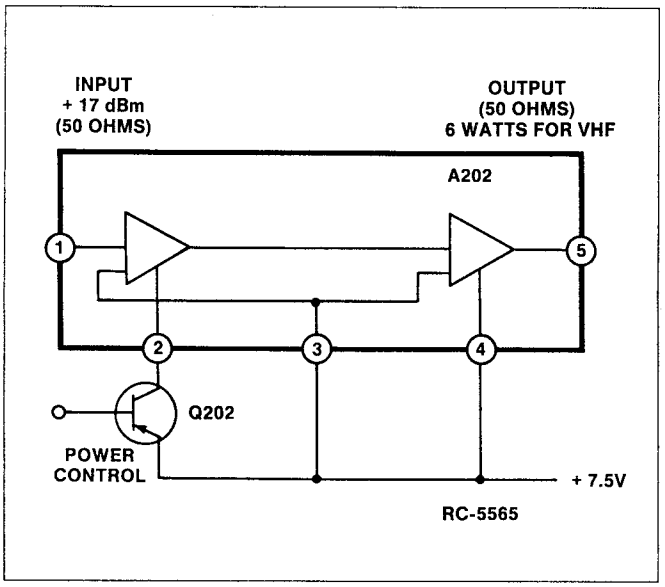


FIGURE 6 - POWER AMPLIFIER MODULE PA

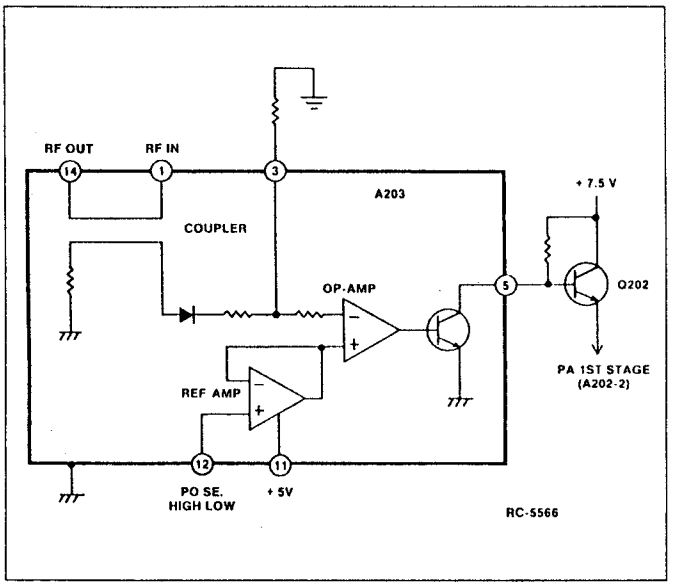


FIGURE 7 - POWER CONTROL MODULE (PC)

Power Control Module (A203):

The RF power output of the radio is regulated by sensing variations in the RF power output of the transmit PA module to control the supply voltage going to the first stage of the PA module (refer to Figure 7). Supply voltage cannot be applied to the first stage of the PA module until the transmit circuit is keyed, applying 5.0 Volts to Pin 11 of the Power Control (PC) module A203. When the transmit circuit is keyed, the output of a reference amplifier, determined by the High/Low power control, is applied to the positive (+) input of a comparator circuit.

The output of the final PA is connected to Pin 1 of the PC module and to the 50 ohm coupled line. The detected voltage of the coupled output is applied to the negative (-) input of the comparator. The amplifier is enabled when the transmit circuit is keyed, until then, the output of the amplifier is low and transistor Q202 is held off. As the PA module begins to increase output power, the detected voltage causes the series regulator circuit to regulate the supply voltage to maintain constant RF output power.

Filter Network (FN):

The output of the PA module is connected to filter network FN through TX-RX switching diode CR201. The FN network is a passive LC low pass filter with an insertion loss of less than 0.5 dB in the pass band. It also has a rejection greater than 45 dB in the stop band. The output of the FN is connected to the system antenna.

Receive Circuit

The PLS receive circuit, as shown in Figure 5 - Block Diagram consists of the following circuits:

- RF Amplifier/Mixer
- First IF Amplifier
- Second IF Amplifier/Discriminator

RF Amplifier/Mixer:

The RF Amplifier/Mixer circuit contains two third order band pass filters (FL301 and FL302), an RF amplifier circuit (transistor Q301) and a double balanced diode mixer circuit (A301). Refer to Figure 8 - RF Amplifier/Mixer. RF from the antenna is coupled through transmit low pass filter FN and RF switching diode CR201 to the input of the RF amplifier circuit. Low pass filter FN is used in the receive circuit to provide additional receive selectivity. The RF signal on the input of the RF amplifier is first coupled through band pass filter FL301 to the input of grounded emitter, broad band RF amplifier transistor Q301. This amplifier provides 12 dB of power gain to reduce thermal noise. The output of the RF amplifier is coupled through band pass filter FL302 to drive double balanced mixer circuit A301.

The RF signal from the RF amplifier and the injection frequency from the synthesizer circuit, provide a difference of 45 MHz IF on the output of the mixer. The double balanced Mixer has a typical conversion loss of 6 dB between the RF input and IF output. All inputs and the output of the RF Amplifier/Mixer have 50 ohms matching impedance. The +7 dBm injection frequency level, provided by the synthesizer and amplifier circuit transistor Q304, is connected to the injection frequency input through a 50 ohm matching circuit. The output of the Mixer circuit is connected to the input of the First IF Amplifier.

First IF Amplifier:

The First IF amplifier contains two amplifier circuits and two crystal filters of two and four poles respectively (refer to Figure 9). The first IF signal (45 MHz) from the first mixer circuit connects to the input of preamplifier transistor Q302 through pre-crystal filter FL303 with an impedance of approximately 3K ohms. Preamplifier Q302 provides a 17 dB power gain. The output is connected to the input of IF amplifier transistor Q303 through crystal filter FL304. If amplifier Q303 has a 13 dB power gain, an input impedance of apporximately 3K ohms and an output impedance of apporximately 2.2K ohms.

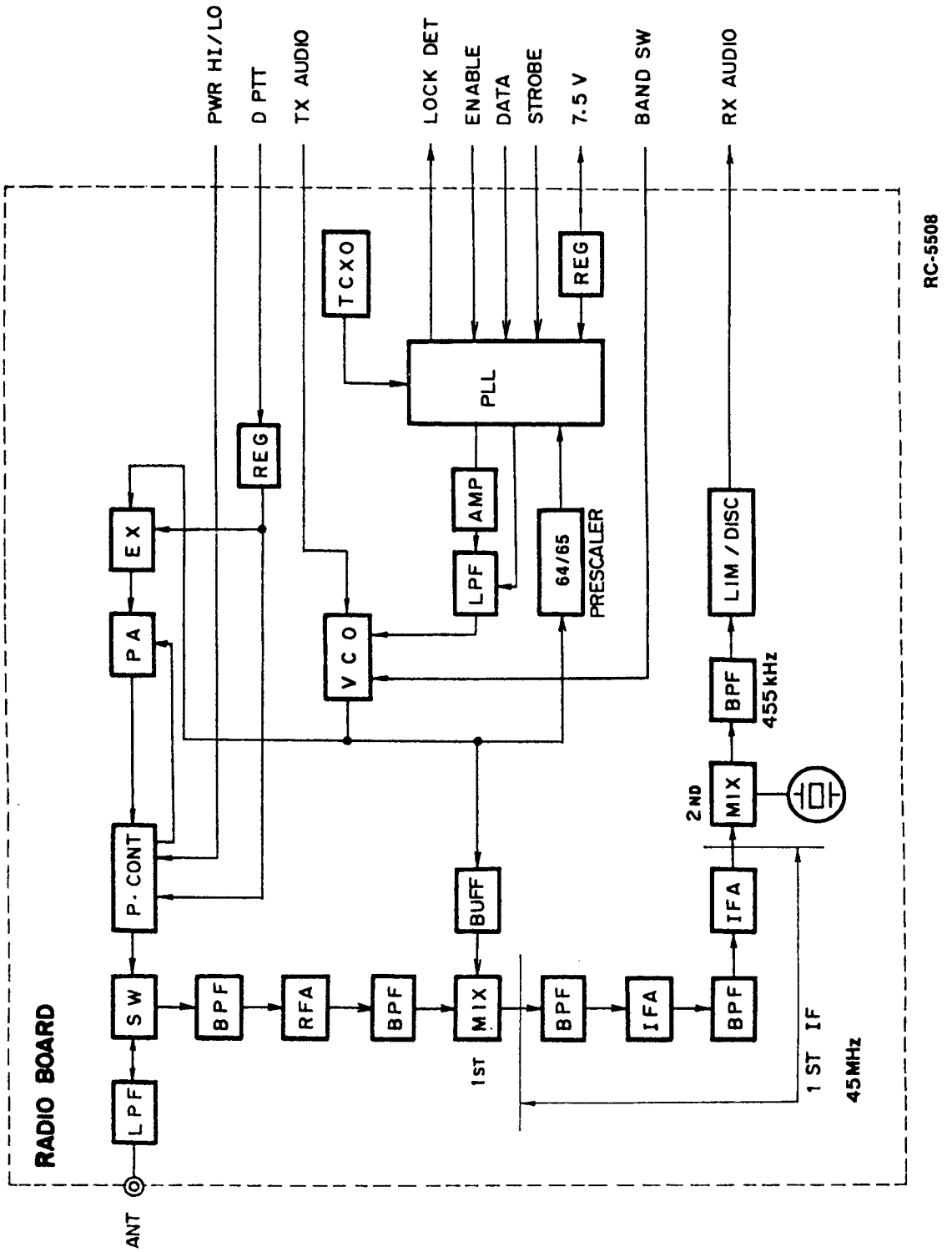


FIGURE 5 - RADIO BLOCK DIAGRAM

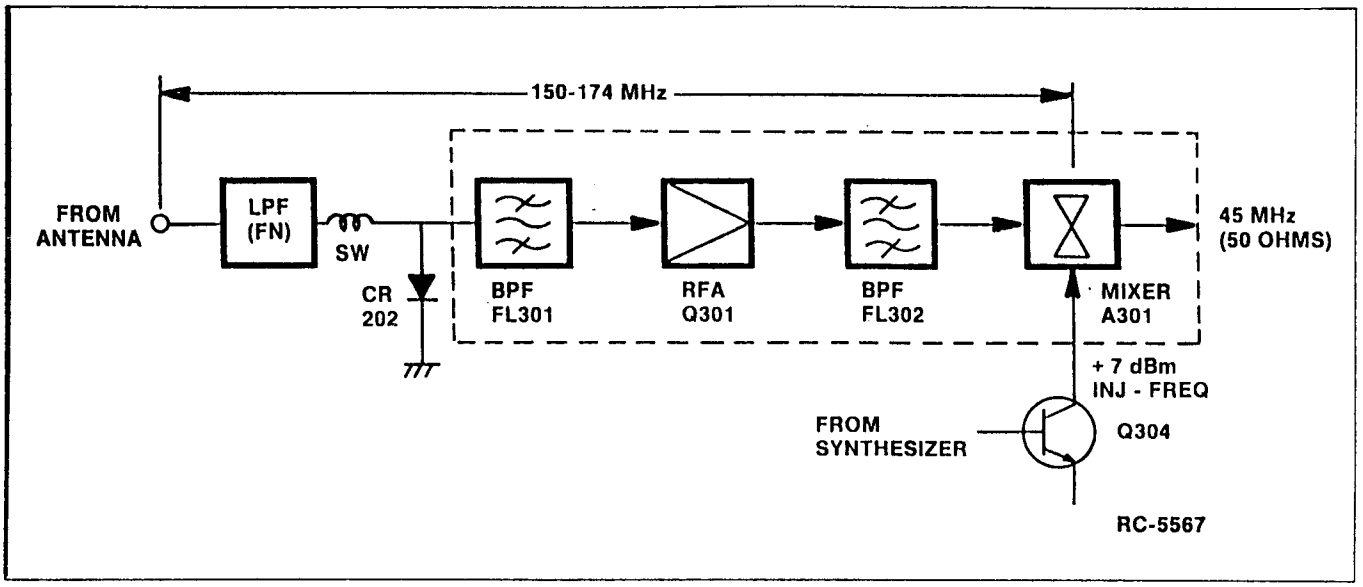


FIGURE 8 - RF AMPLIFIER MIXER

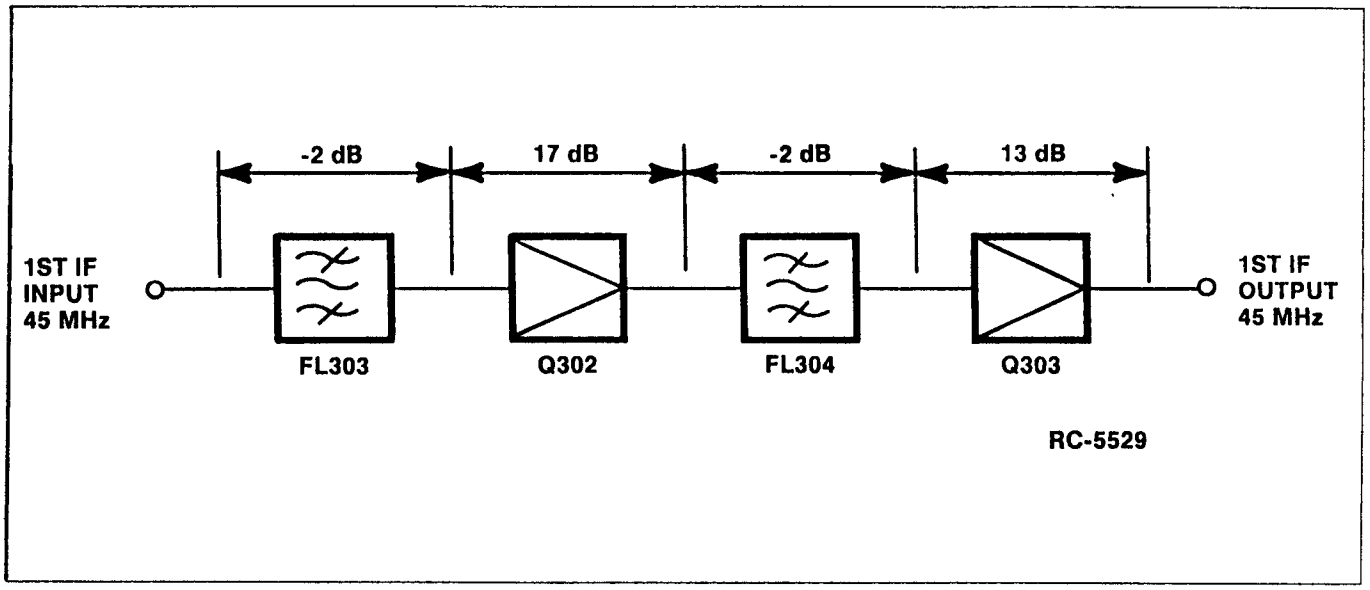


FIGURE 9 - FIRST IF AMPLIFIER

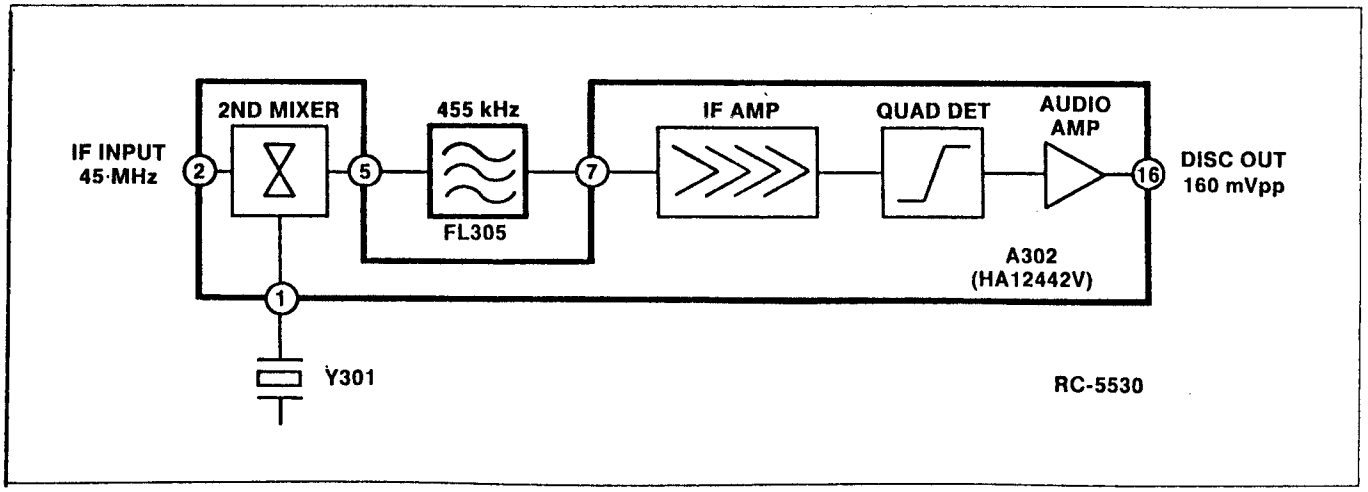


FIGURE 10 - SECOND IF AMPLIFIER/DISCRIMINATOR

Second IF Amplifier/Discriminator (A302):

The Second IF Amplifier/Discriminator circuit contains FM IF IC A302 (HA12442V) and 455 KHz ceramic filter FL305 (refer to Figure 10). The FM IF IC contains a local oscillator, mixer, IF amplifier, FM detector and an audio amplifier. The 45 MHz IF output from the first IF amplifier is connected to the input of second IF amplifier A302, Pin 2 and converted to the second IF frequency (455 KHz). The second IF is connected through the 455 KHz ceramic filter to the IF amplifier and FM detector circuits. The recovered audio from the FM IF IC is connected to connector J102-4.

Synthesizer Circuit

The synthesizer circuit contains Phase Lock Loop module (PLL) A102, a reference oscillator circuit with TCX Module A105, TX/RX Voltage Controlled Oscillator module (VCO) A106 and a Low Pass Filter amplifier (LPF). Refer to Figure 11 - Synthesizer. The VCO used to generate the receive and transmit reference frequencies is phase locked to a stable reference oscillator circuit through the use of the PLL. This feedback loop divides the VCO frequency down to a signal in the range of 2 MHz - 7 MHz; divides this signal with a programmable divider to 5/6.25 KHz and generates a VCO control signal by comparing the 5/6.25 KHz feedback with a 5/6.25 KHz derived by dividing the 13.2 MHz reference frequency by 2112/2640. As the least significant bit in the programming is changed, the VCO is forced to change by 5/6.25 KHz.

Phase Lock Loop Module (A102):

The PLL module A102 contains a reference frequency divider, phase detector and a programmable divider. The phase detector DC voltage output signal is filtered with a passive low pass filter followed by a 5/6.25 KHz filter to reduce the level of reference modulation on the VCO. This DC output represents the error between the VCO frequency (phase) and the reference (VCTCXO) and is applied to the VCO on frequency.

Serial data from the microprocessor is shifted into the PLL to set the division parameter which establishes the frequency. A clock signal is provided on another input and the data is locked with the enable input.

Voltage Controlled Oscillator (A106):

The VCO uses a low noise, high gain transistor as the basic oscillator. The resonant circuit, which determines the frequency of oscillation, is formed by a dielectric resonator which is used to set the center frequency at the factory. The output of each VCO (TX and RX) is coupled into a cascade amplifier which produces +3 dBm. The output of the RX-VCO amplifier is coupled into the receive circuit first double balanced mixer circuit A301 through buffer amplifier

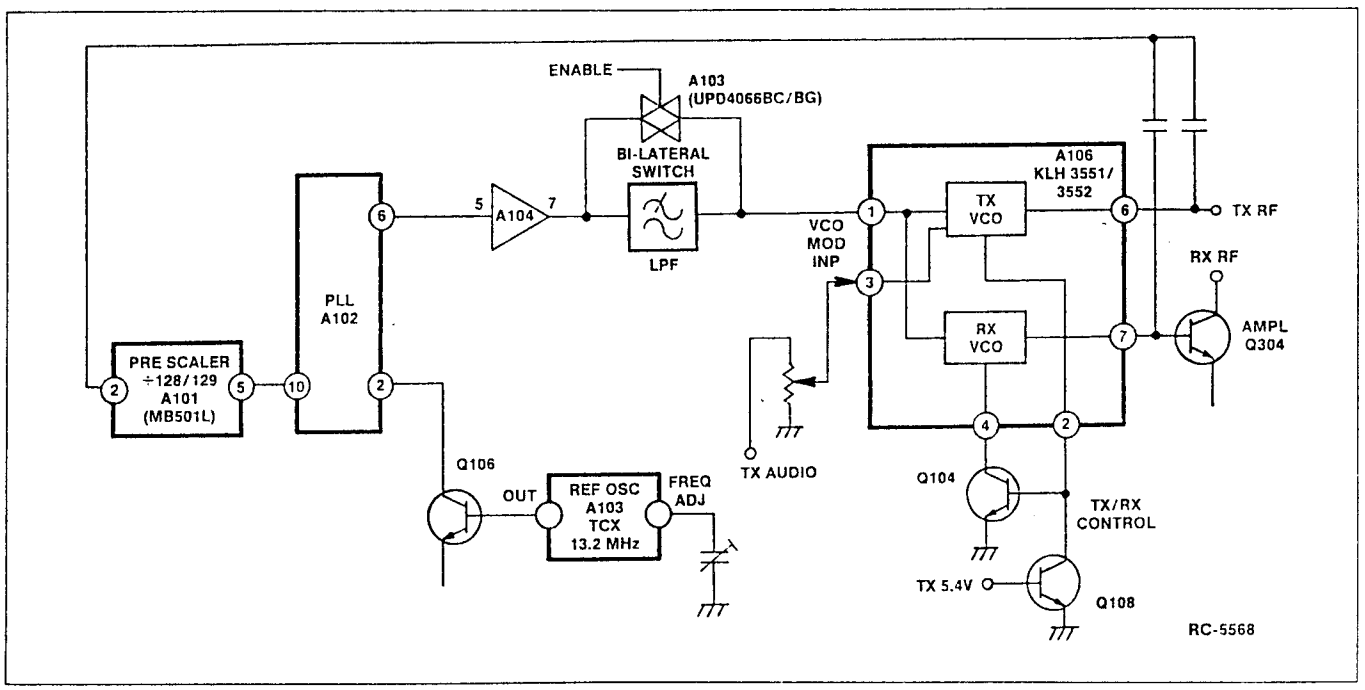


FIGURE 11 - SYNTHESIZER

Q304. The TX-VCO amplifier output is directly connected to the TX-Amp circuit input through an attenuator circuit: resistors R209, R210 and R211.

TCX Reference Oscillator (A105):

The reference oscillator circuit consists of oscillator transistor Q106 and TCX crystal module A105. The A105 oscillator module is self contained, fully temperature compensated and operates at a frequency of 13.2 MHz. The frequency of the reference oscillator is adjusted by a trimmer while monitoring the transmit circuit output at the antenna connector.

CONTROLLER

This controller circuit consists of control circuits and audio circuits. Physically, this circuit consists of three circuit boards as follows:

- Control Board
- Display and Switch Board
- Key Pad

Control Board

The Control Board consists of the following circuits:

- CMOS Microprocessor (A6)
- RAM With Lithium Battery (A7 plus BT1)
- Audio Processor (A9)
- Audio Amplifier (A4, A5 & A6)
- Voltage Regulator Circuit (A1 & A2)
- External Buffer (A4 (1/4))
- Voltage Detector (A3)
- LCD Driver (A8)

Microprocessor (A6):

The microprocessor provides various software for controlling the radio unit as follows:

- Loading data to the frequency synthesizer
- Fetching and processing the PTT, monitor, channel selection and volume control, etc.
- Loading data to the LCD display
- Controlling the audio circuit (processor).
- Encoding /decoding the squelch, Channel Guard.
- Controlling the load interface for the radio data (channel data, etc.)

RAM (A7):

RAM has a capacity of 8 bits X 2K for storing various data for controlling the radio. The data is entered from the outside to the microprocessor through the jack connectors and then to the RAM. The data mainly consist of the following:

- Channel Frequency Data
- Channel Guard Data
- TX Power, TX Modulation Data
- Squelch Data
- Display Data...etc.

Audio Processor (A9):

Audio processor (A9) consists of a single chip IC accommodating almost all of the audio functions. The audio functions are under control of the microprocessor in compliance with the function of the radio. The functions of the audio processor are as follows:

- Tone Reject Filter
- Limiter Amplifier
- Post Limiter Filter
- Squelch Filter and Rectifier
- Channel Guard Encode/Decode Filter and Limiter
- Digital/Analog Converter and Comparator
- Oscillator Circuit and Digital Interface for the Microprocessor

All of these functions are made up of switched, capacitor filters, amplifiers and timing logic. The timing for this logic is derived from the 3.379545 MHz clock generator. The clock signal is also applied to the microprocessor.

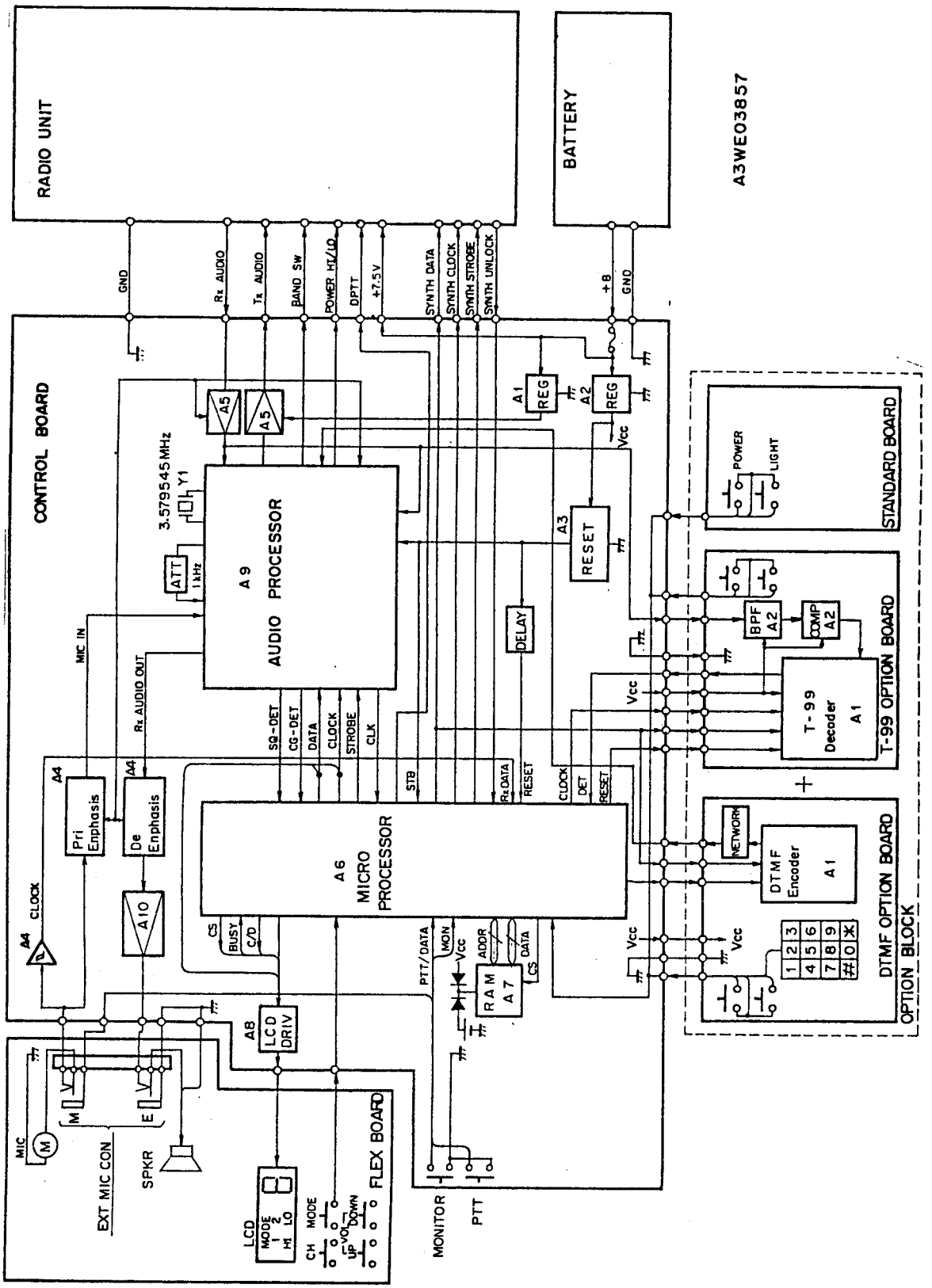


FIGURE 12 - CONTROL CIRCUIT BLOCK DIAGRAM

Audio Amplifiers (A4, A5 & A10):

These audio amplifiers are located between the audio processor and the microphone or the speaker. Amplifier A4 provides pre-emphasis for transmit audio and de-emphasis for the receive audio. Amplifier A10 amplifies the output signal of A4 to the level adequate for driving the speaker.

Voltage Regulator Circuit (A1, A2):

Voltage Regulator Circuit A1 and A2 provides a regulated +5 VDC supply for the Control Board.

External Data Buffer (A4 (1/4)):

External Data Buffer A4 (1/4) is located between the jack connectors on the side of the radio and the microprocessor. This buffer is used for converting the level of external signals to match the internal circuits. This buffer also provides protection of the internal circuits.

Voltage Detector (A3):

Voltage Detector A3 detects a drop in input voltage. When the input voltage becomes less than the specified level, Voltage Detector A3 generates a reset signal to reset the microprocessor.

LCD Driver (A8):

LCD Driver A8 converts data from the microprocessor into a signal which can drive the LCD display.

LCD Board

The LCD Board is composed of the following items:

- LCD
- Back Lighting Circuit (CR1)
- Switch (S1, through S4)

The LCD board is equipped with a three segments, one digit and five status display. Microprocessor signals drive the LCD driver, located on the Control Board. The LCD driver turns the LCD on. Also, the LCD board is equipped with a back lighting circuit to light the dark area with LED light upon receiving a signal from the microprocessor. The microprocessor produces this signal by the operation of a switch (VOLume up and down, MODE and CHANnel).

Key Pad

There are three types of keypads (Part 11, 12 & 13). One is a two key-pad used with the standard PLS radio and a PLS radio equipped with a Type 99 option. The other two key pads are 12-key key pads, used with a PLS radio equipped with a DTMF option plus a Type 99 option. The key pads consist of a key pad board and rubber contacts.

Jack Connector

Jack connectors are located on the side of the main frame, so external MIC and external earphone can be supplied. They are also used as TX data and RX data for the suit case programmer. Connecting signals are as follows:

- External MIC/TX data
- External Speaker/RX data
- PTT

Battery Pack

Two battery packs, one with 800 mAh capacity and one with 1200 mAh capacity are available for use with the PLS radio. Both battery packs provide a nominal 7.5 VDC output.

To protect the battery pack from external short circuits, the positive (+) charging contact is diode protected (see Figure 13).

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 charged in one hour.

The battery pack is shipped fully charged to the customer, ready for use. However, if the battery pack is stored for any length of time, it should be fully charged before placing in to service.

Charger combinations for charging battery packs are available with charge times of 1 hour and 16 hours. A combination can be a single unit desk or a vehicular charger. It can also be a wall mounted multiple charger with the capability of charging up to five battery packs simultaneously.

Charge Level

A fully charged battery pack should provide a terminal voltage greater than 7.5 VDC. A discharged battery pack should provide a reading of no less than 6.4 VDC.

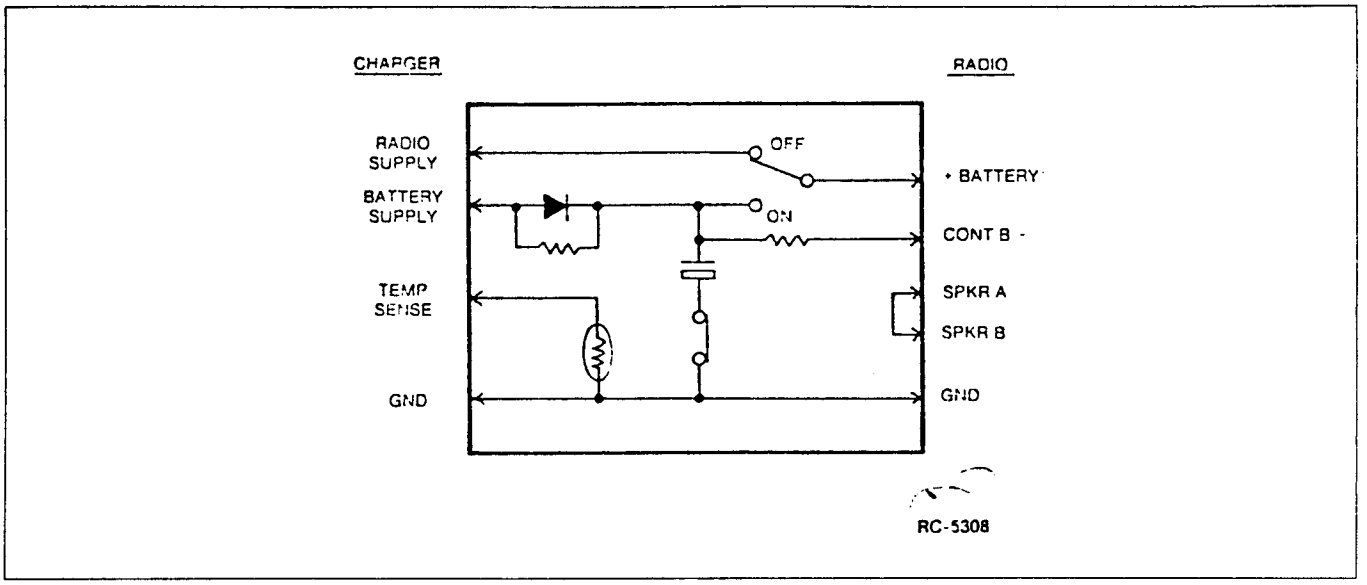


FIGURE 13 - BATTERY PACK

Battery Check

One of the best service checks for the 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 terminal voltage drops to 6.4 volts. The proper load resistor for each of the battery packs is shown in Table 1.

Then use the formula

T/60 = %

Where "T" is the time in minutes required to discharge the battery pack to 6.4 volts and % is the percentage of rated capacity the battery delivered to a load. For example: assume the standard battery pack voltage dropped to 6.4 volts in 65 minutes:

65/60 = 108 (percent of capacity)

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

108 X 800 mA = 864 mAh

The 864 milliampere hour 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 6.4 volts.

Table 1 - Capacity Measurement Data

Rechargeable Battery Pack	Rated Capacity	Average Discharge Rate (for 60 minutes)	Load Resistor	End Voltage
(6 cells)	800 mAh	800 mAh	9.375 ohms 8 Watts	6.4 VDC
(6 cells)	1200 mAh	1200 mAh	6.25 ohms 12 Watts	6.4 VDC

MAINTENANCE

This Maintenance section provides information on adjustments of the radio (transmit, receive and synthesizer), preventive maintenance and a Disassembly Procedure. Information is also provided for removing and replacing chip components and module replacement. The Service Section, called for on the front cover of this manual, provides a more complete set of alignment procedures for the radio plus a detailed Troubleshooting Procedure.

Initial Adjustment

After the radio has been programmed, as described in Programming Instructions (LBI-31745), the following adjustments should be made by a certified electronics technician.

Transmit Circuit Alignment:

The transmit circuit is factory tuned and should not require any readjust. The frequency and modulation should be measured and recorded for future reference.

Receive Circuit:

No initial adjustments to the receive circuit are required.

Synthesizer Circuit:

No initial adjustments to the synthesizer are required.

WARNING

To prevent loss of memory in RAM A2 on the controller board, lithium battery BT1 should be replaced at three years. A procedure for changing BT1 is provided in Service Section LBI-31790.

Preventive Maintenance

To ensure a high operating efficiency and to prevent mechanical and electrical failures, routine checks should be performed for all mechanical and electrical parts at regular intervals. Preventive maintenance should include the following checks:

Antenna:

The antenna and antenna contact should be kept clean, free from dirt or corrosion. If the antenna or contact should become dirty or corroded, loss of radiation and a weak signal will result.

Mechanical Inspection:

Since portable radio units are subject to irregular shock and vibration, check for loose plugs, nuts, screws and other parts to make sure that nothing is loose or is working loose.

Alignment:

The transmit and receive circuit meter readings should be checked periodically and the alignment "touched up" when necessary. Refer to the Service Section for the applicable alignment procedure and troubleshooting sheet for typical voltage reading found in the Service Section.

Frequency Check:

Check transmit frequency and deviation. Normally, these checks are made when the unit is first put into operation. They should be repeated after the first month of operation, then again one time each year.

Disassembly

To gain access to the Radio Board (transmit, Receive and synthesizer circuits) or Control Board for servicing, loosen the captive screws and disassemble as follows:

Radio	Step 1 through Step 3
Controller Board	Step 4 through Step 6

Disassembly Procedure (See Figure 14):

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
- Special tool for removing jack nuts.
- Pencil-type soldering iron (25-40 Watts) with a fine tip

Step 1:

To gain access to the radio, loosen, but do not remove, the four screws at Ⓐ . Carefully remove the back cover. For normal radio alignment, the back cover is all that need be removed. When tightening the screws, they should be no tighter than 4 ±0.5 inch-pounds (See Figure 15).

NOTE

These screws are not captive, so be careful not to lose them.

Step 2:

To Remove the Radio Board, use the Phillips-head screwdriver and remove the two (2) screws at Ⓑ . Remove the RF shield cover at Ⓒ (See Figure 16).

Step 3:

The radio portion can now be detached from the rear cover. Remove the ten (10) screws at Ⓓ. Remove the two (2) screws at Ⓔ. Unsolder the wire connected to the antenna connector at Ⓕ. Remove the radio board from the housing (see Figure 17).

Step 4:

To remove the Controller Board, use the Philips-head screwdriver and remove the five (5) screws at Ⓖ from the controller board and remove the shield at Ⓗ . Remove one (1) screw at Ⓘ (See Figure 18)

Step 5:

Remove the two (2) nuts holding the External Microphone/Speaker Jacks at Ⓙ . Remove the four (4) screws at Ⓚ . Unsolder the flexible printed wire board from the speaker at Ⓛ . Peel out the tape at Ⓜ . Remove the flexible printed wiring board from the front housing. The controller Board can now easily be removed from the front housing (see Figure 19).

Step 6:

To remove the Key Board, use the special tool. Using the Phillips-screwdriver, remove the four (4) screws at Ⓝ . The speaker can now be removed from the housing.

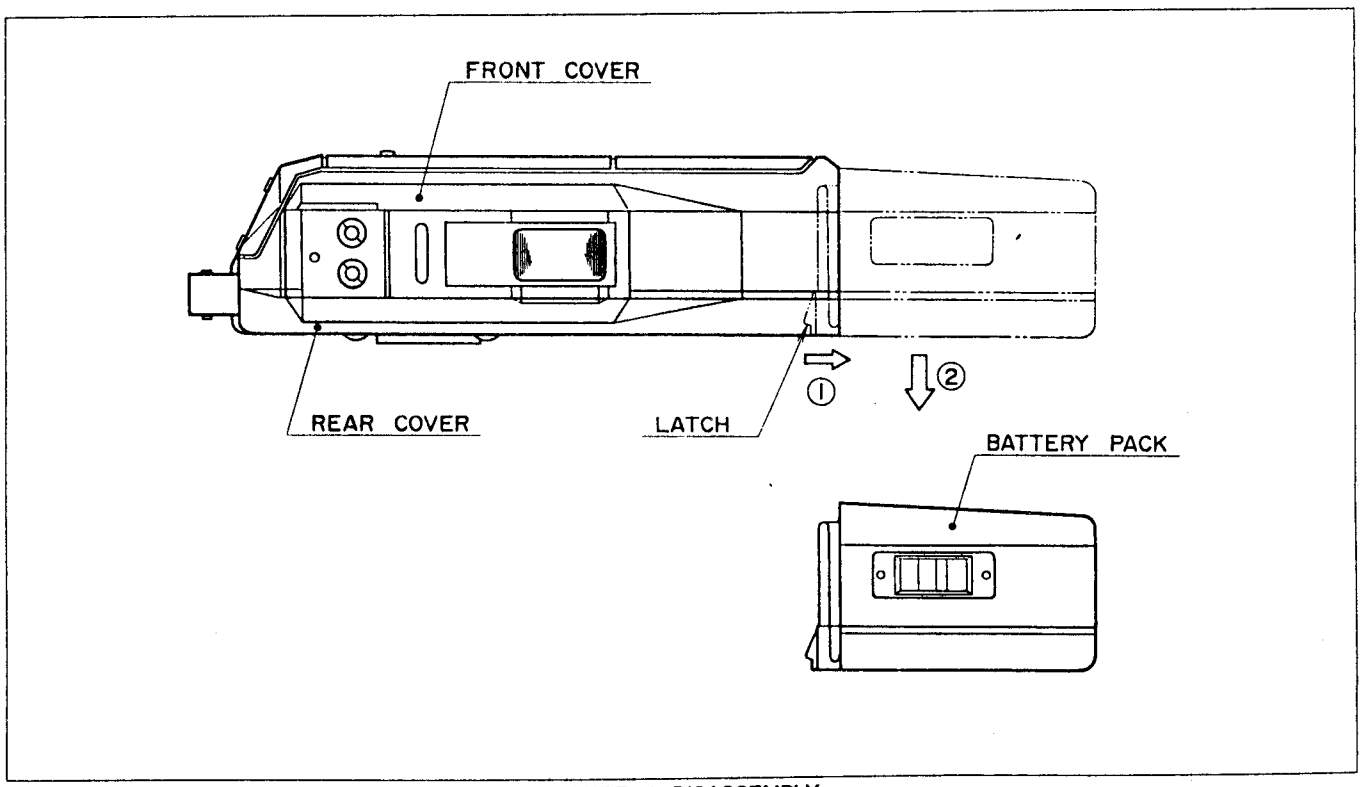


FIGURE 14 - DISASSEMBLY

Replacement of Components

The major components of the PLS Personal Radio are the PA (Power Amplifier Module), PC (power Control Module), VCO (Voltage Controlled Oscillator) and the TCX (Ref. Osc.). These are very reliable devices and will not normally need to be replaced. Before replacing any of these modules, always check out the associated circuitry carefully.

To remove any of these major components, refer to the applicable replace procedure found in the Service Section (LBI-31790).

Troubleshooting Procedure

Maintenance of the PLS Personal Radio is facilitated by using the Troubleshooting Procedures and service techniques unique to this radio. The Troubleshooting Procedures are designed to quickly lead the service technician to the defective component or circuit. These procedures are found in the Service Section.

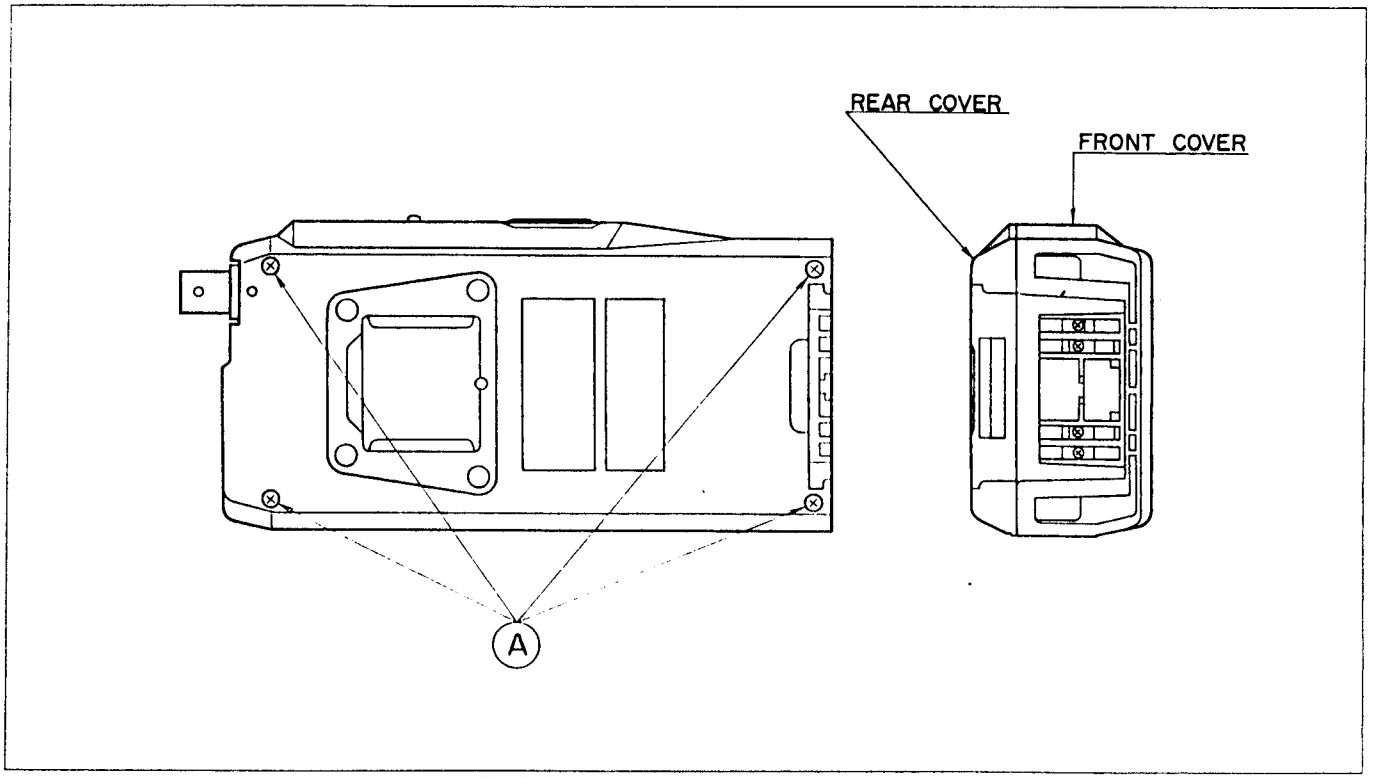


FIGURE 15 - DISASSEMBLY STEP 1

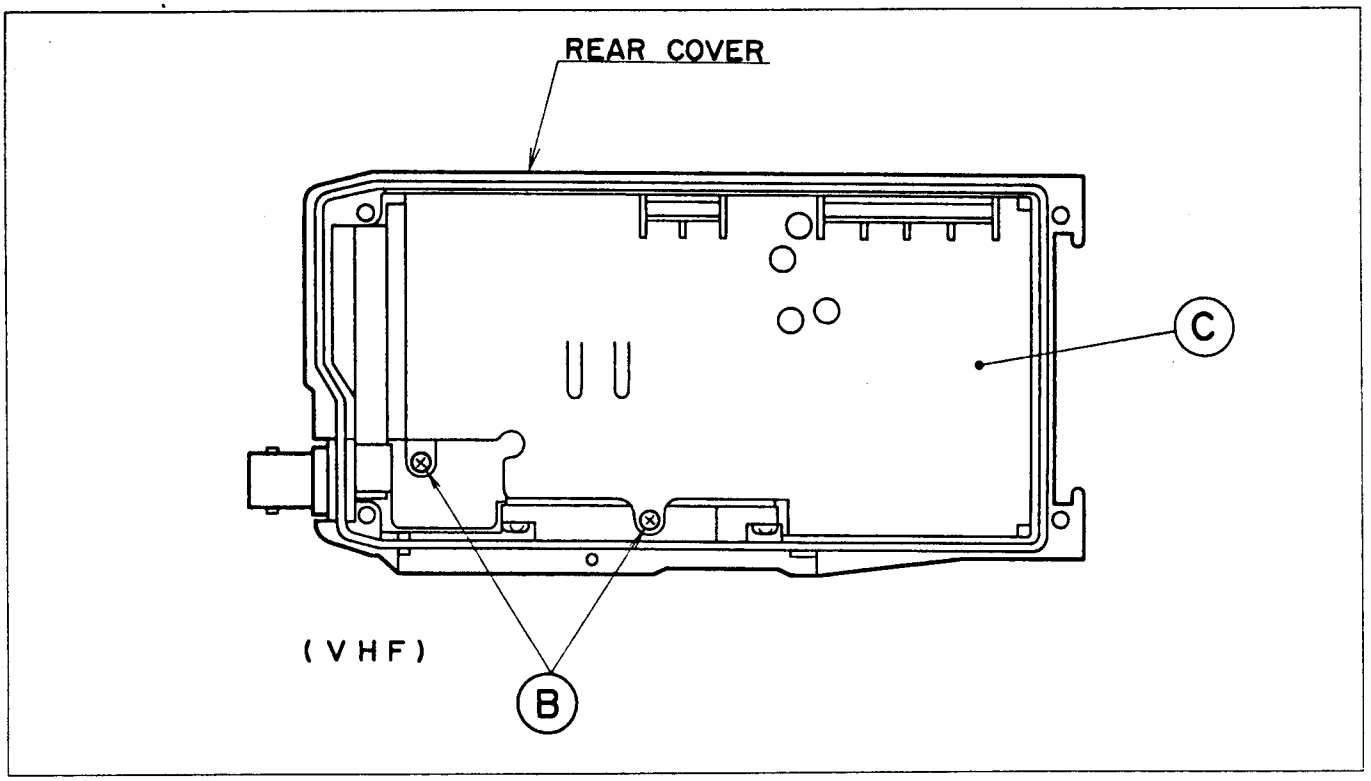


FIGURE 16 - DISASSEMBLY STEP 2

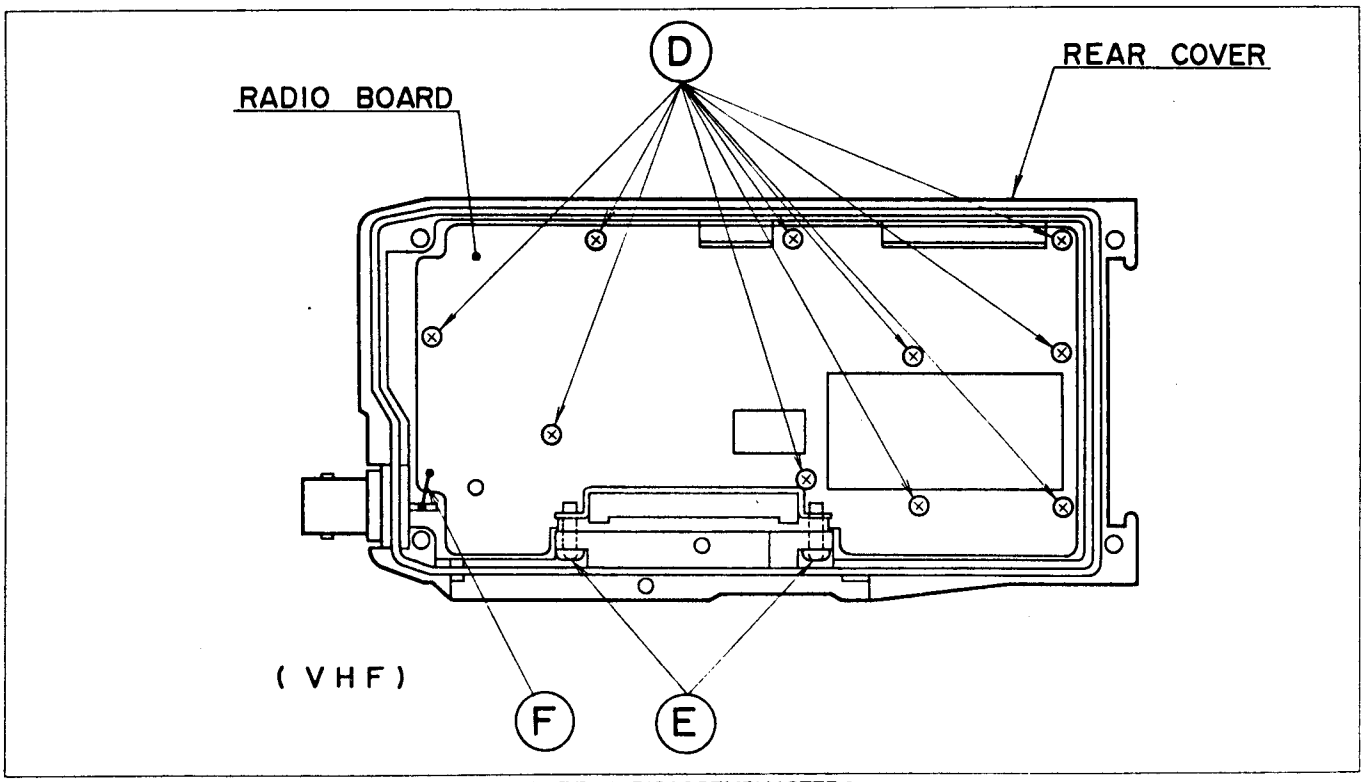


FIGURE 17 - DISASSEMBLY STEP 3

Replacement of Components

The major components of the PLS Personal Radio are the PA (Power Amplifier Module), PC (power Control Module), VCO (Voltage Controlled Oscillator) and the TCX (Ref. Osc.). These are very reliable devices and will not normally need to be replaced. Before replacing any of these modules, always check out the associated circuitry carefully.

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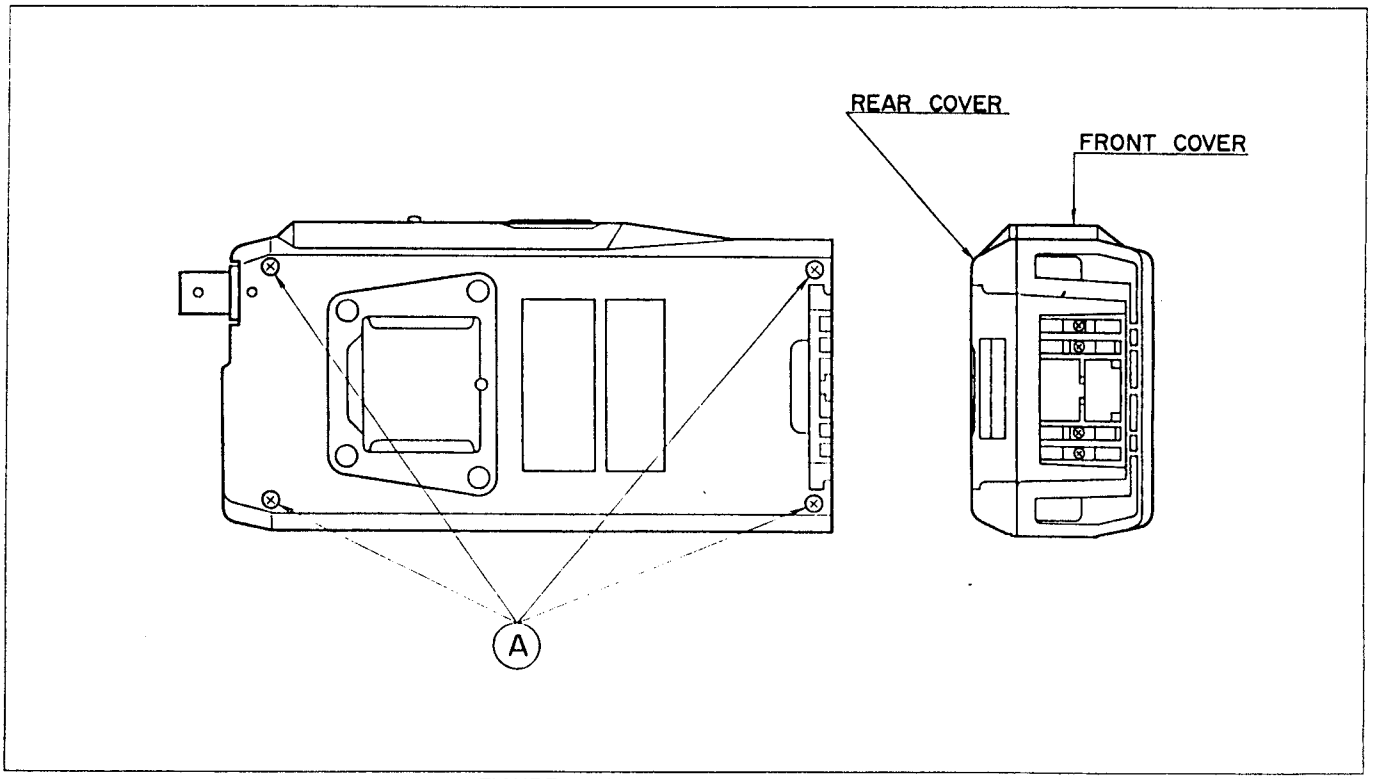


FIGURE 15 - DISASSEMBLY STEP 1

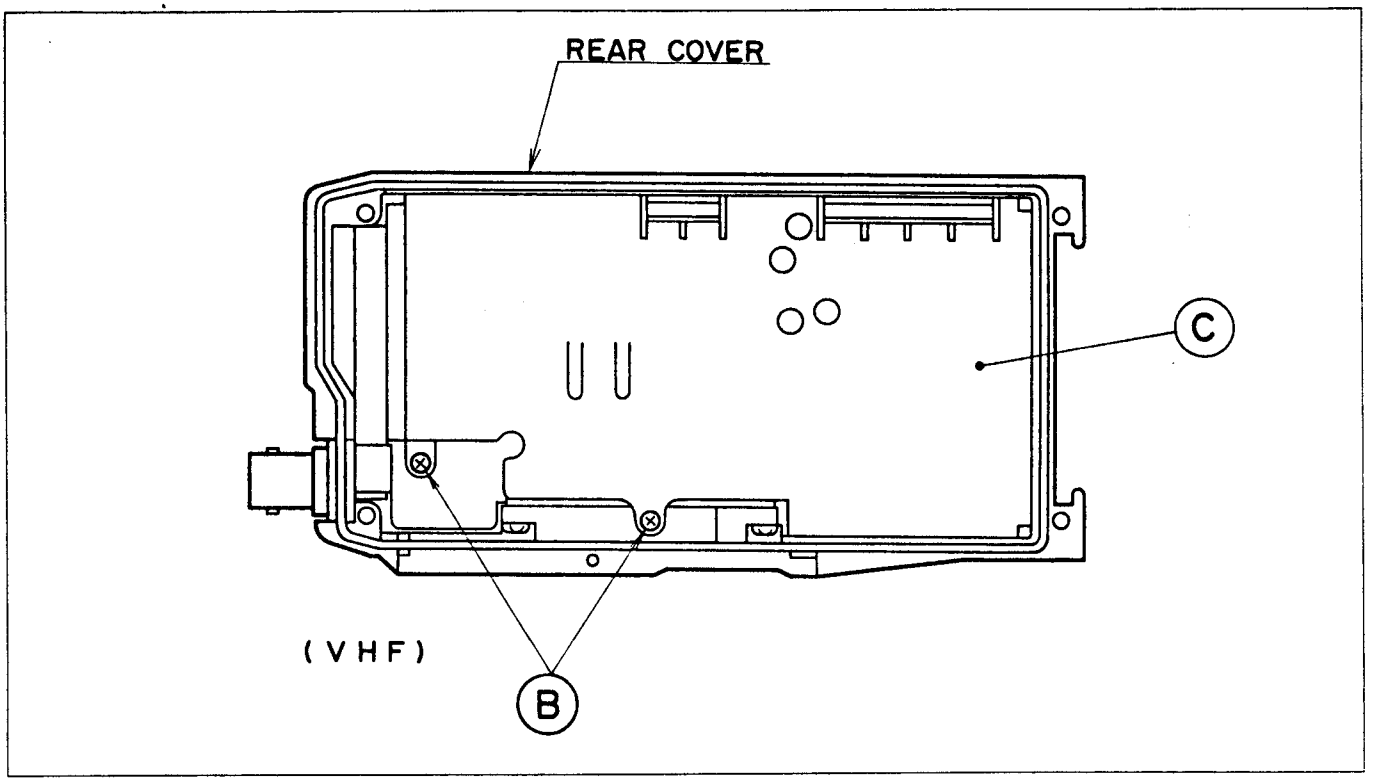


FIGURE 16 - DISASSEMBLY STEP 2

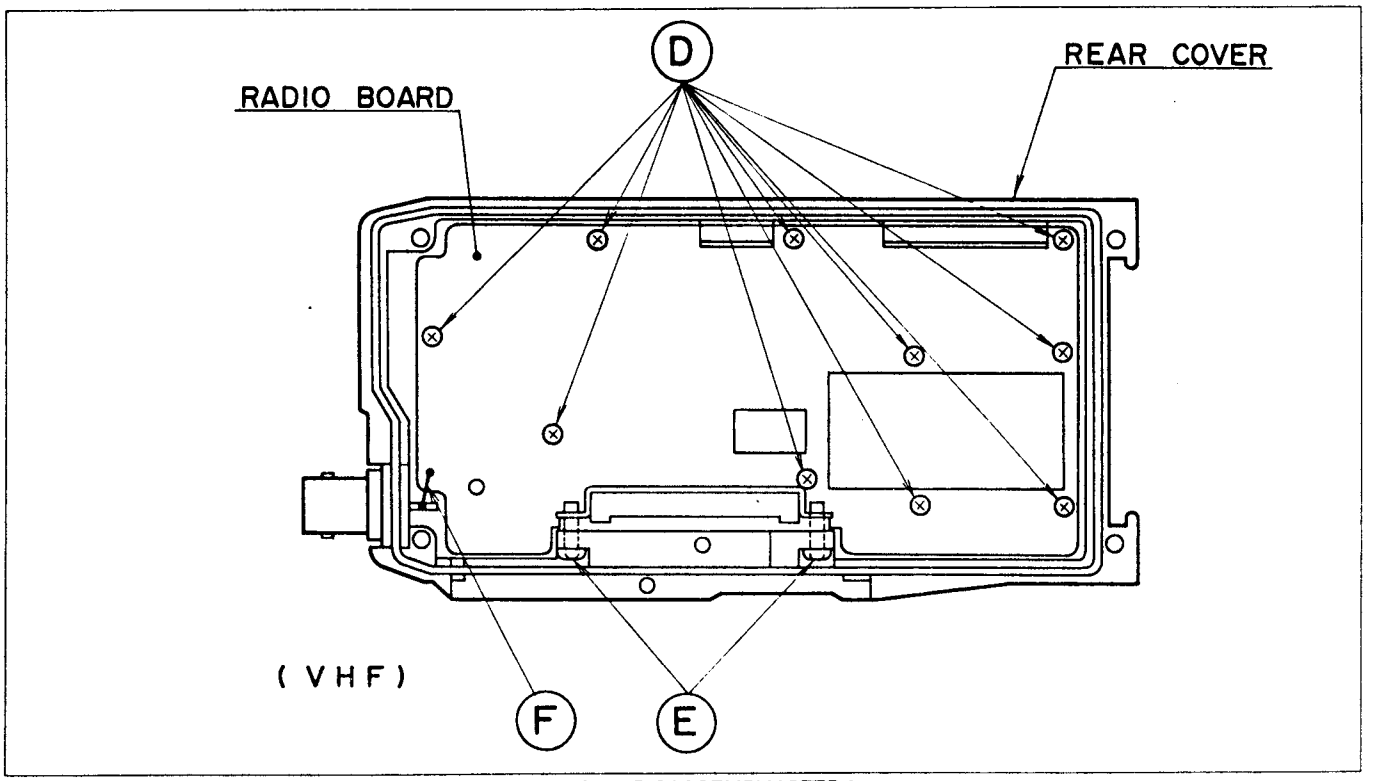


FIGURE 17 - DISASSEMBLY STEP 3

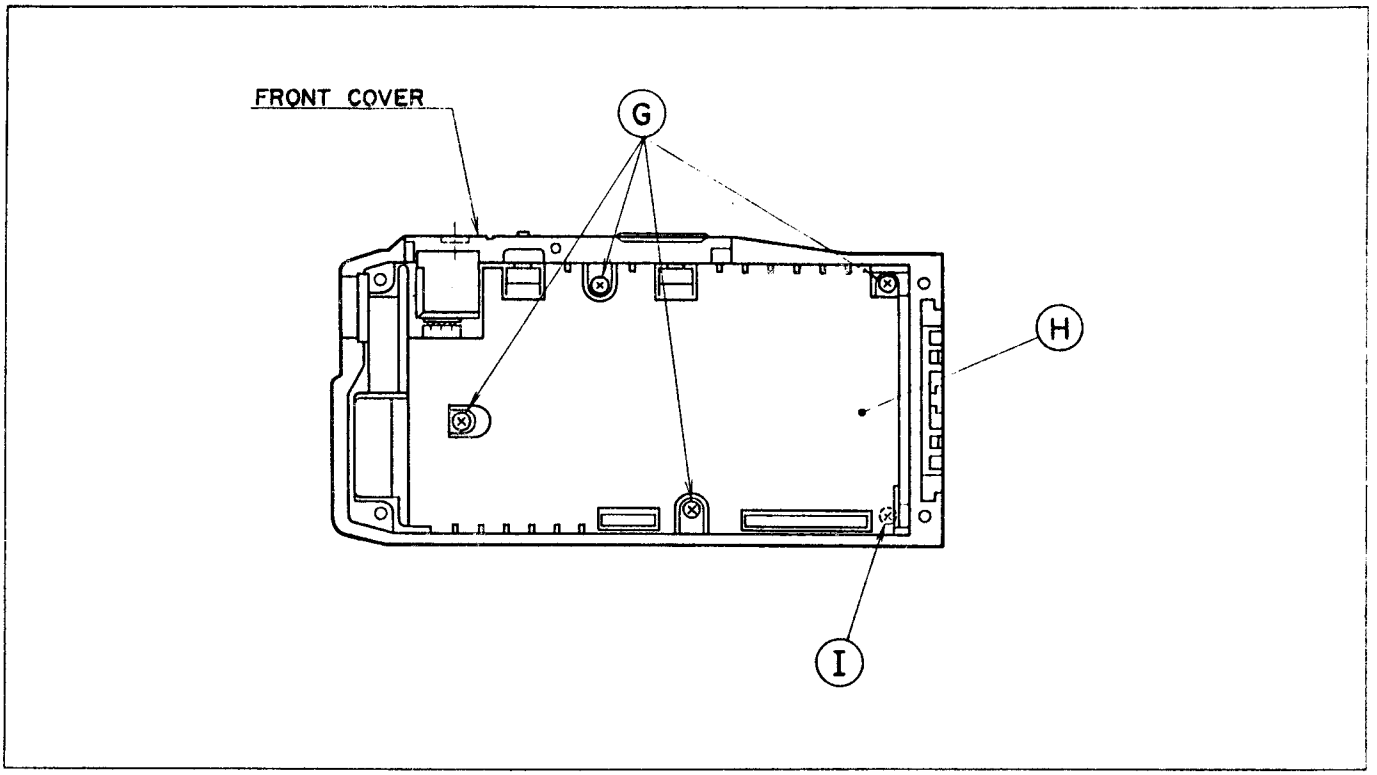


FIGURE 18 - DISASSEMBLY STEP 4

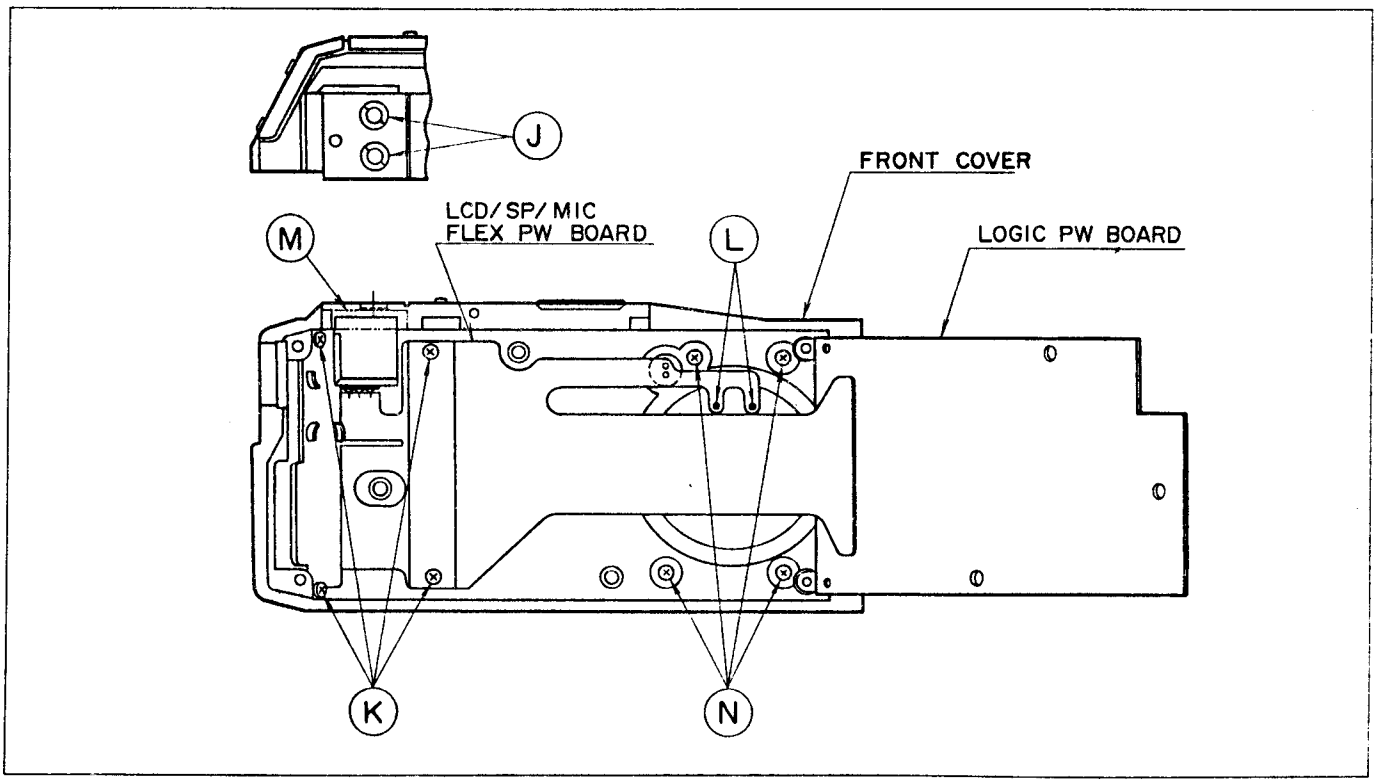
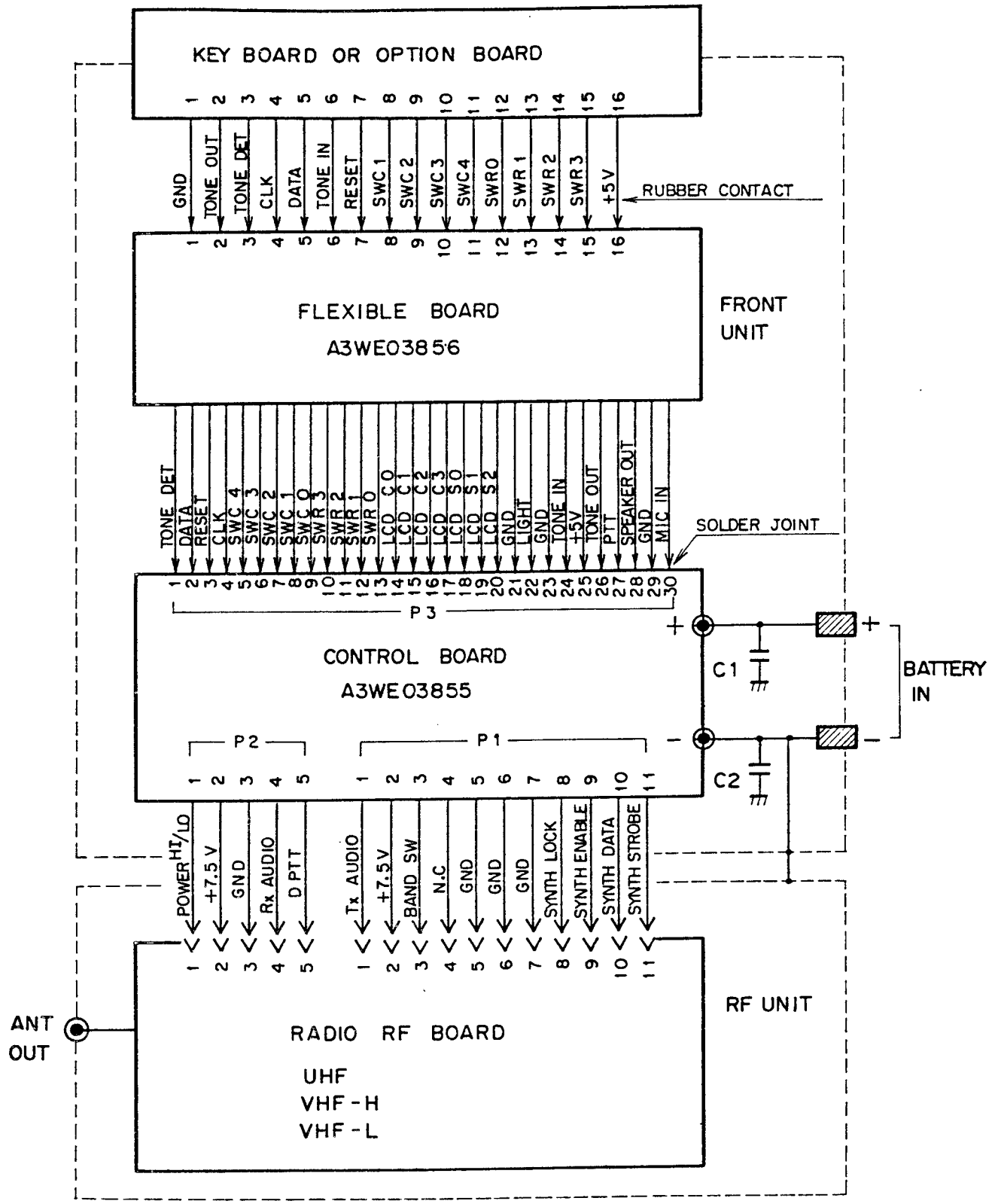


FIGURE 19 - DISASSEMBLY STEP 5 AND 6


KEY BOARD OR OPTION BOARD
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
GND
TONE OUT
TONE DET
CLK
DATA
TONE IN
RESET
SWC 1
SWC 2
SWC 3
SWC 4
SWRO
SWR 1
SWR 2
SWR 3
+5 V
RUBBER CONTACT
FLEXIBLE BOARD
A3WE03856
FRONT UNIT
TONE DET
DATA
RESET
CLK
SWC 4
SWC 3
SWC 2
SWC 1
SWC O
SWR 3
SWR 2
SWR 1
SWR O
LCD CO
LCD C1
LCD C2
LCD C3
LCD SO
LCD S1
LCD S2
GND
LIGHT
GND
TONE IN
+5V
TONE OUT
PTT
SPEAKER OUT
GND
MIC IN
SOLDER JOINT
P3
CONTROL BOARD
A3WE03855
C1
C2
BATTERY IN
P2
P1
POWER HI/LO
+7.5 V
GND
Rx AUDIO
D PTT
Tx AUDIO
+7.5V
BAND SW
N.C
GND
GND
GND
SYNTH LOCK
SYNTH ENABLE
SYNTH DATA
SYNTH STROBE
ANT OUT
RADIO RF BOARD
UHF
VHF-H
VHF-L
RF UNIT

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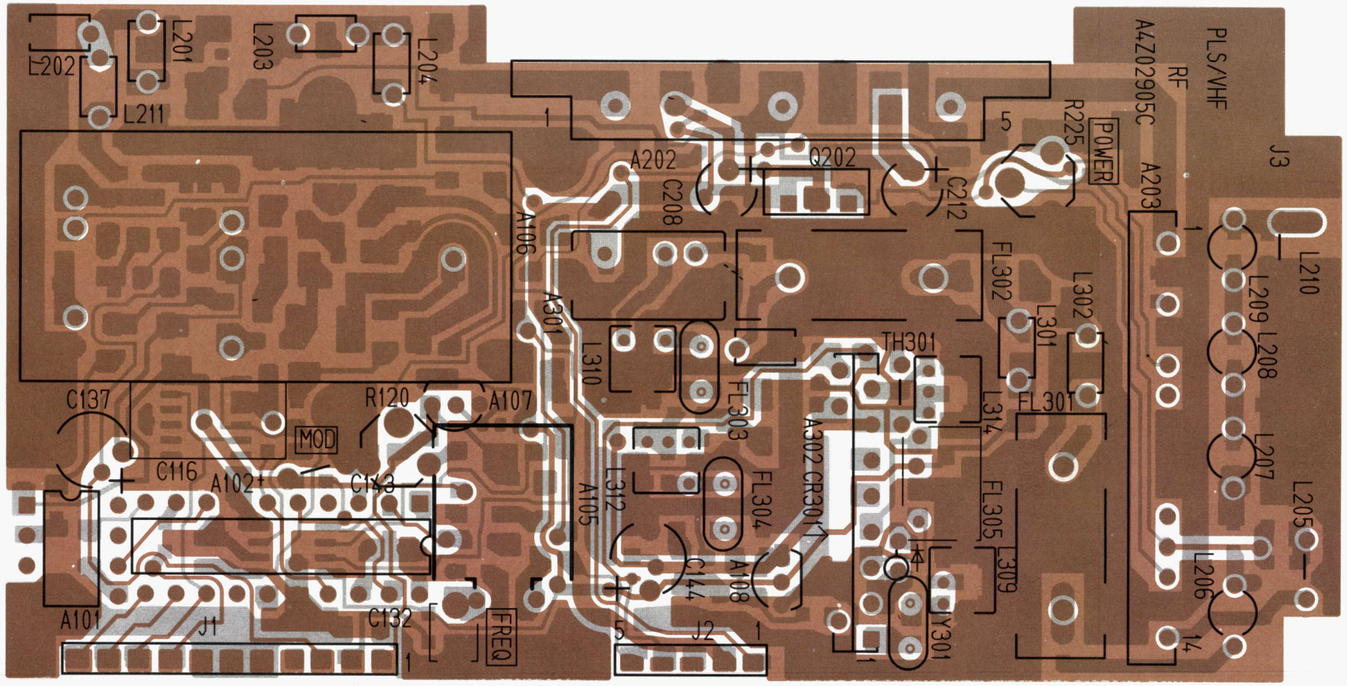
COMPONENT SIDE



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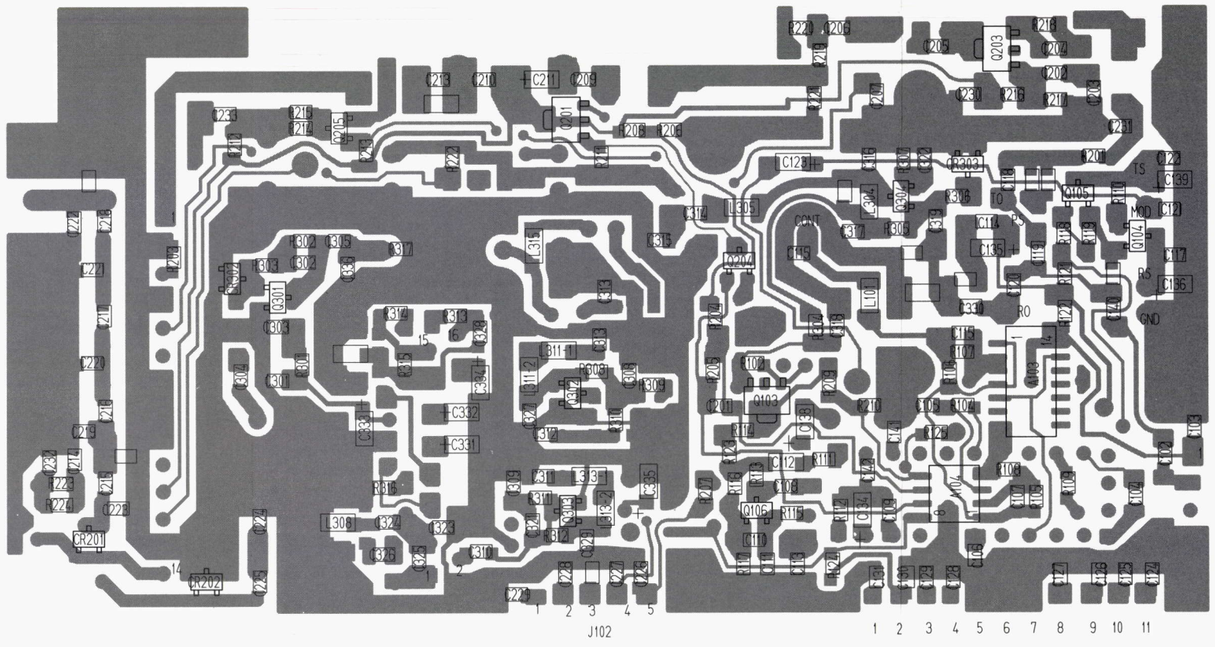
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

SOLDER SIDE



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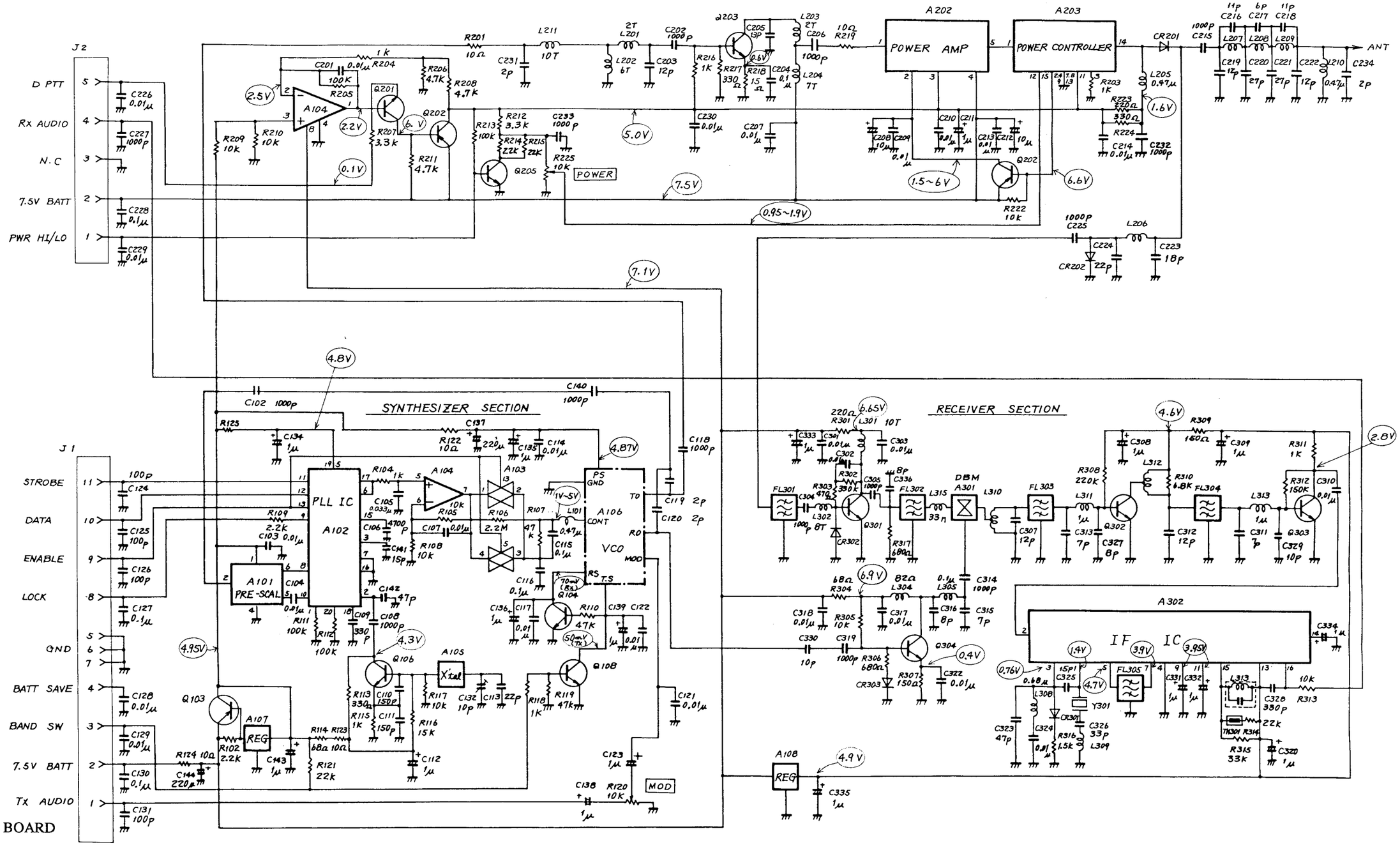
RADIO BOARD

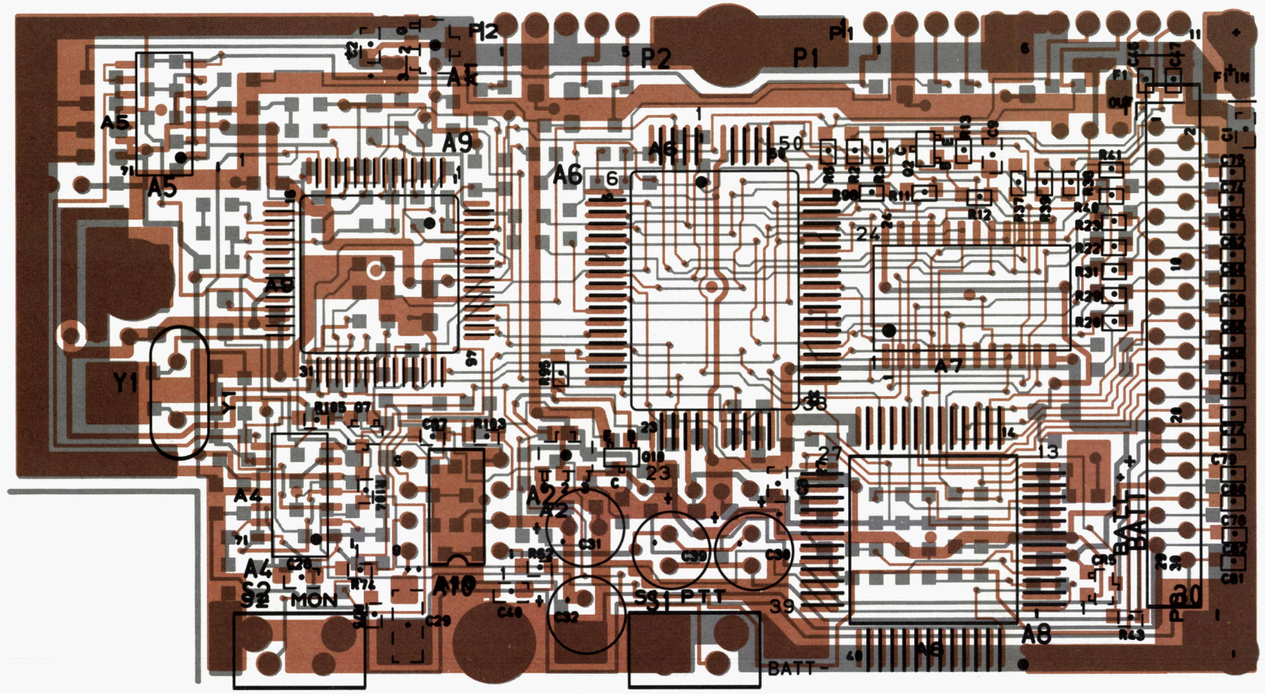
Issue 1

TRANSMITTER SECTION



RADIO BOARD

COMPONENT SIDE



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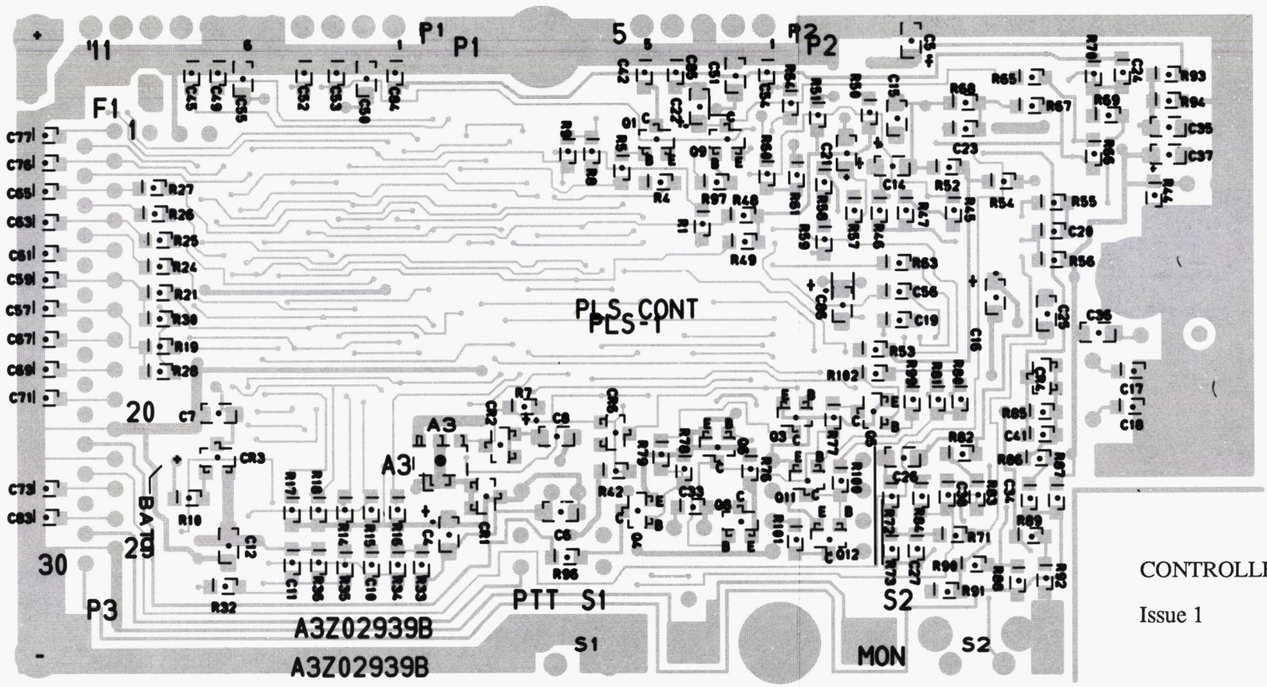
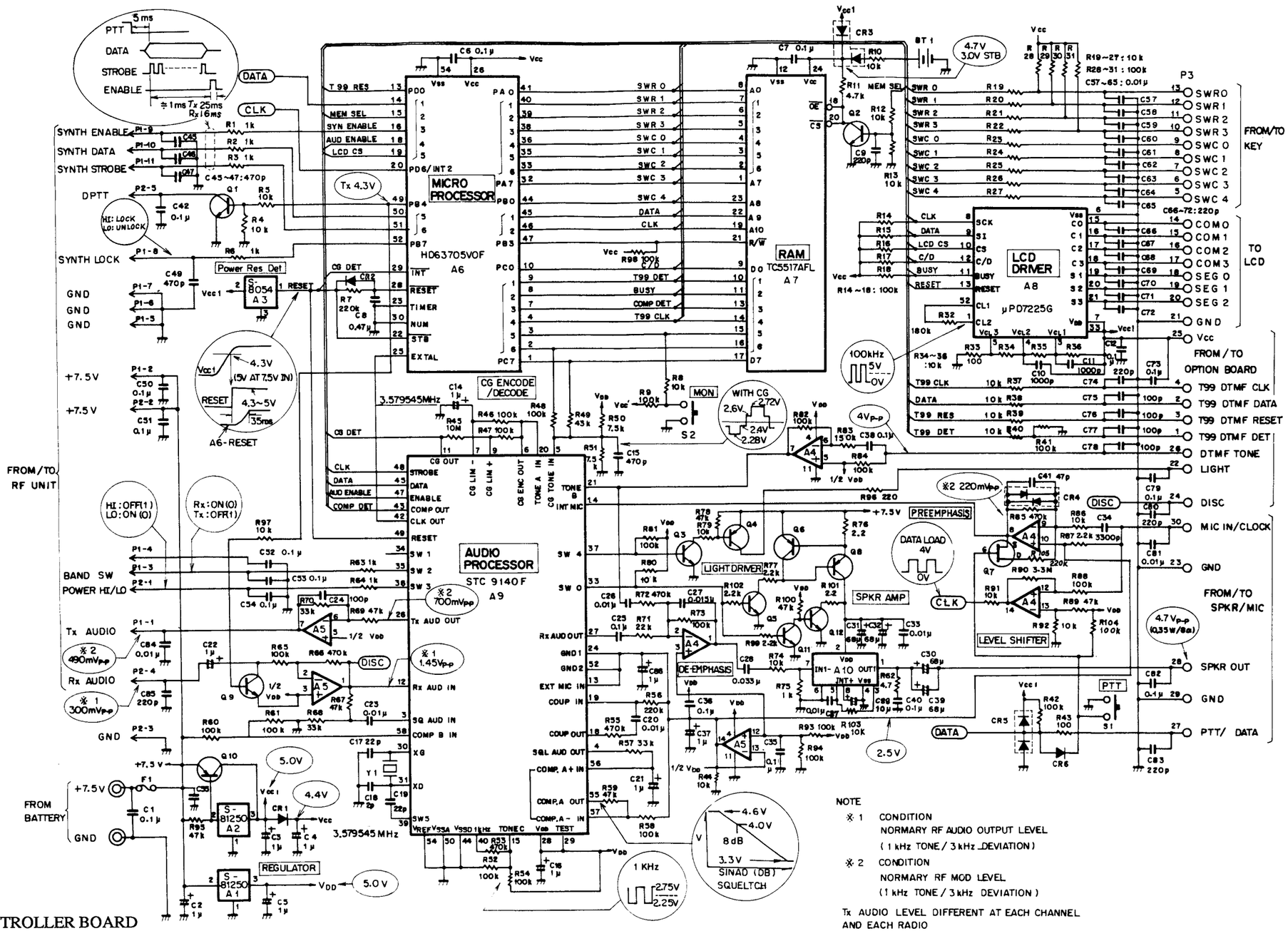
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

SOLDER SIDE



CONTROLLER BOARD

Issue 1



CONTROLLER BOARD

Issue 1

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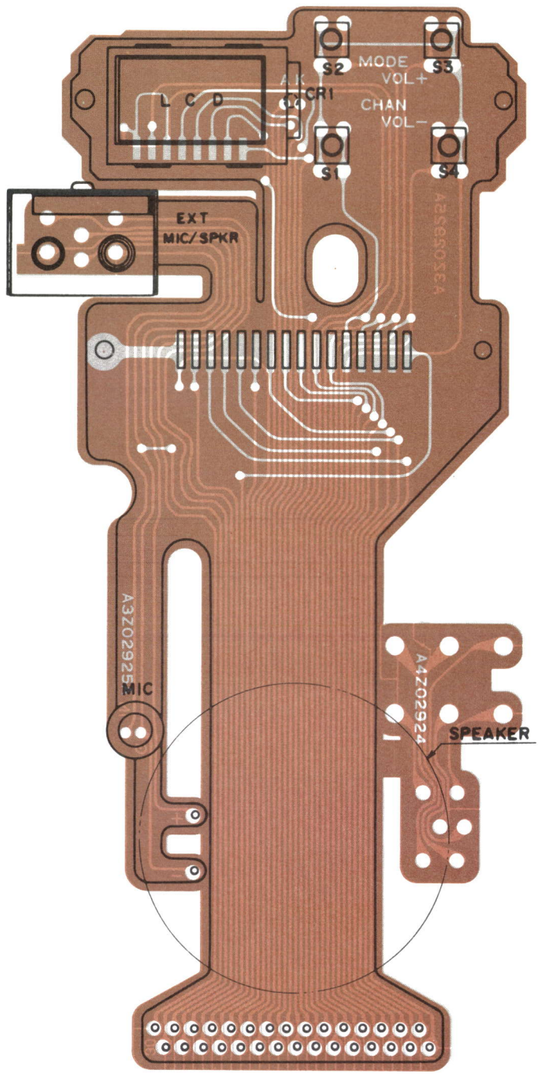
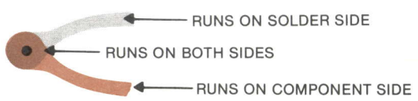
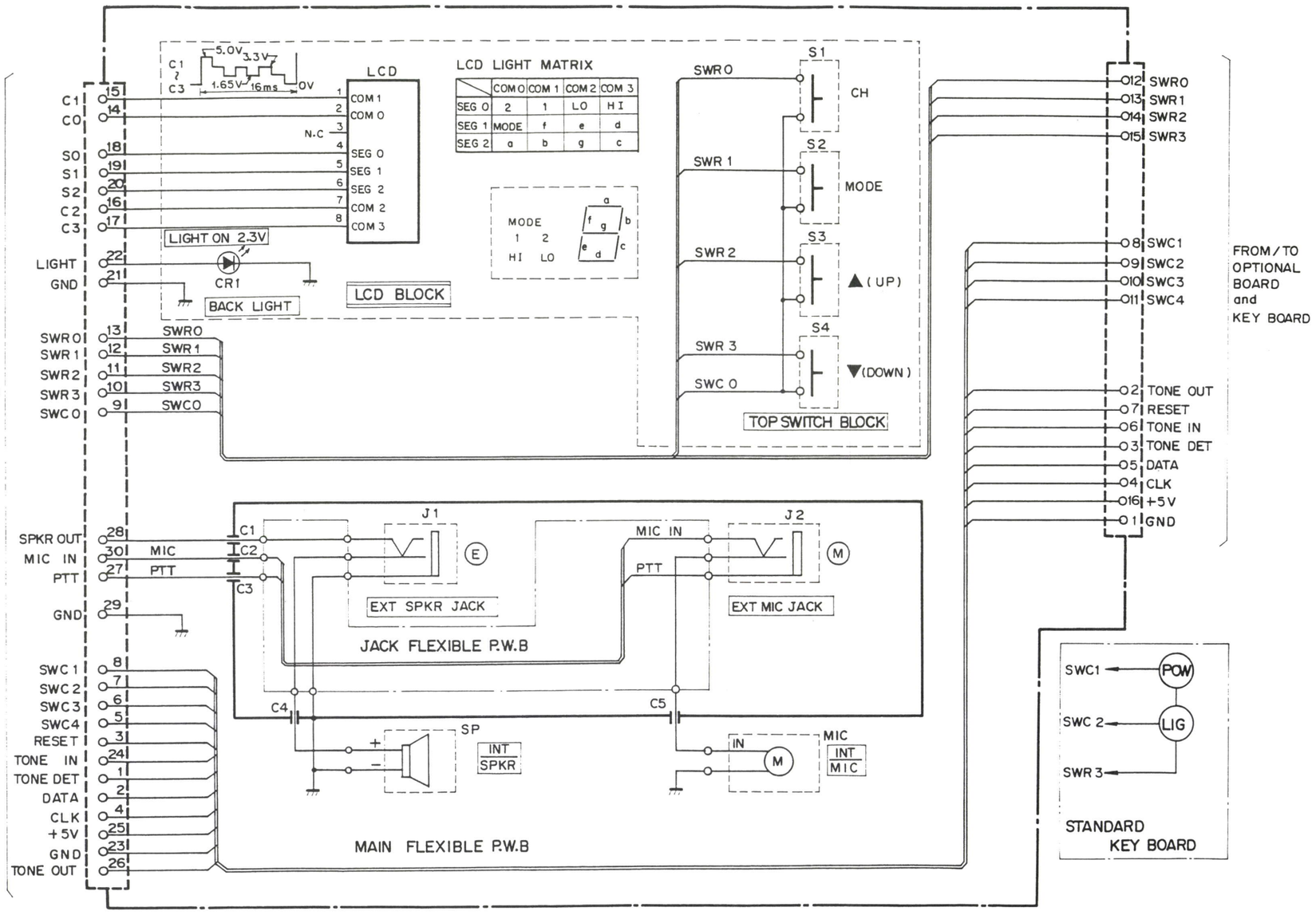


(ND6846-A2B)
(ND6846-A3B)



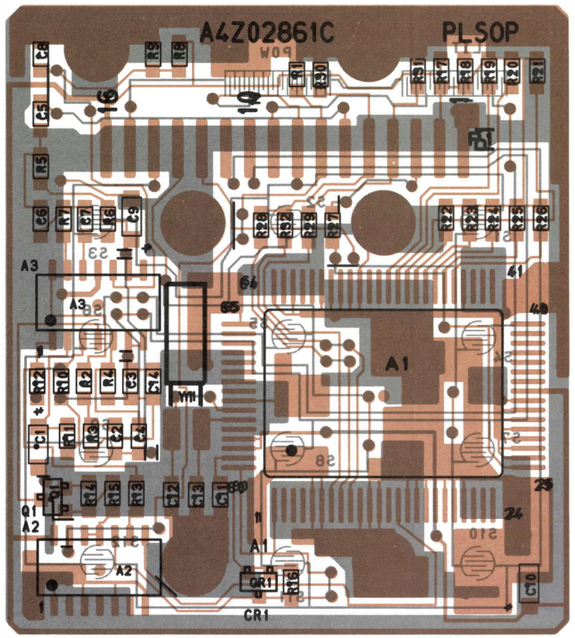


(A3WE03056)

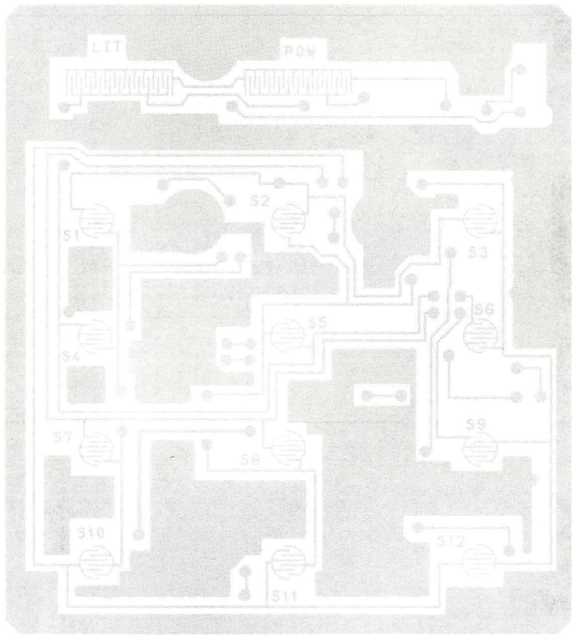
FLEXIBLE PRINTED WIRE BOARD

Issue 1

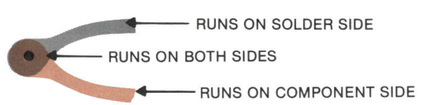
COMPONENT SIDE



SOLDER SIDE

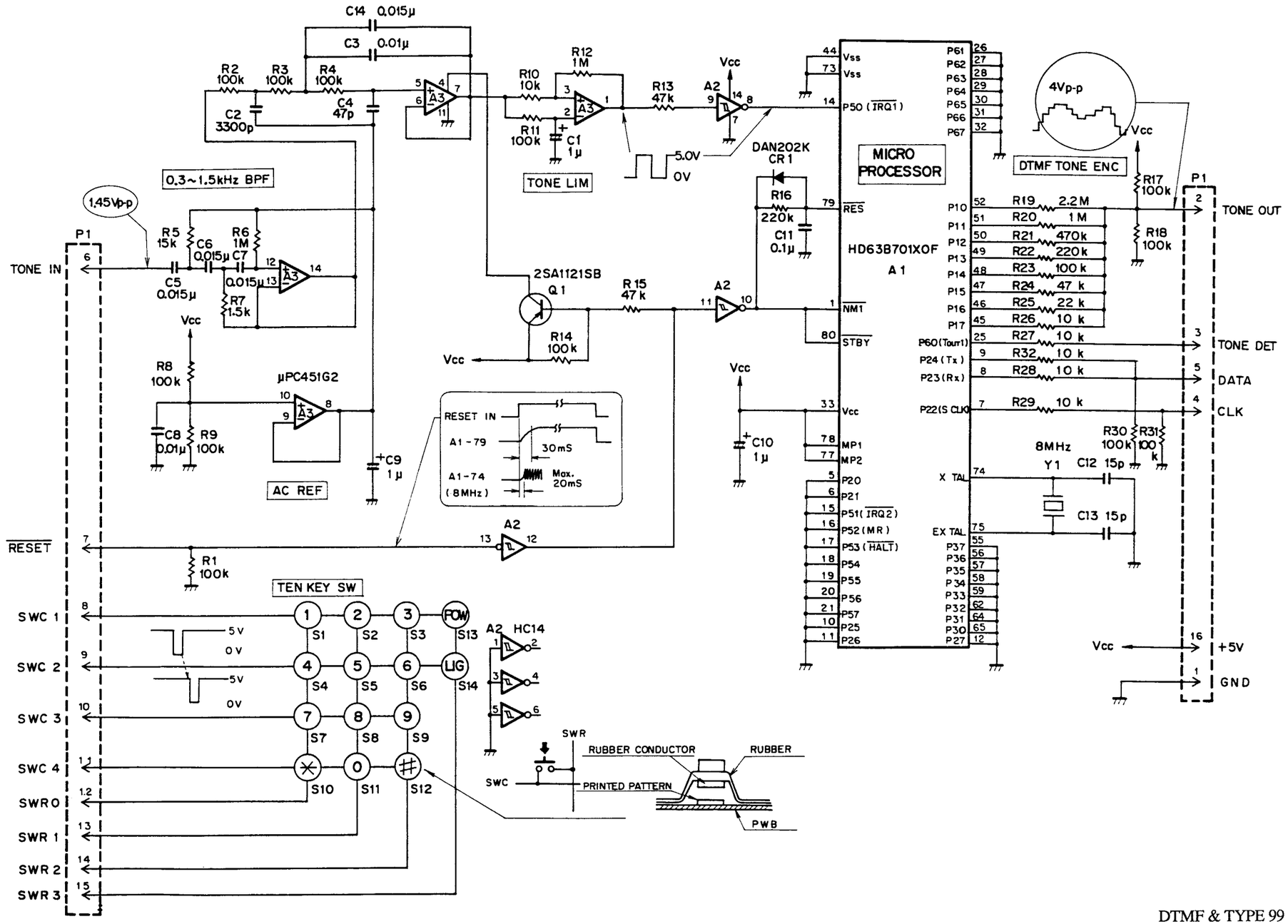


(A4Z02861C)



DTMF & TYPE 99
OPTION BOARDS

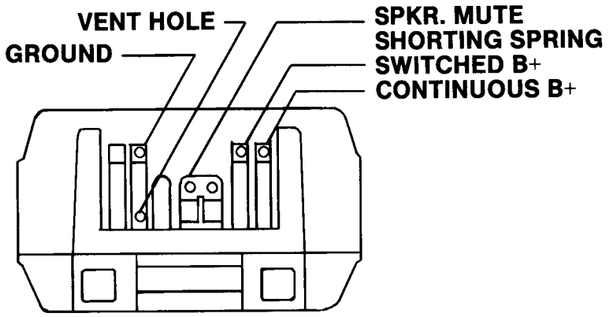
Issue 1



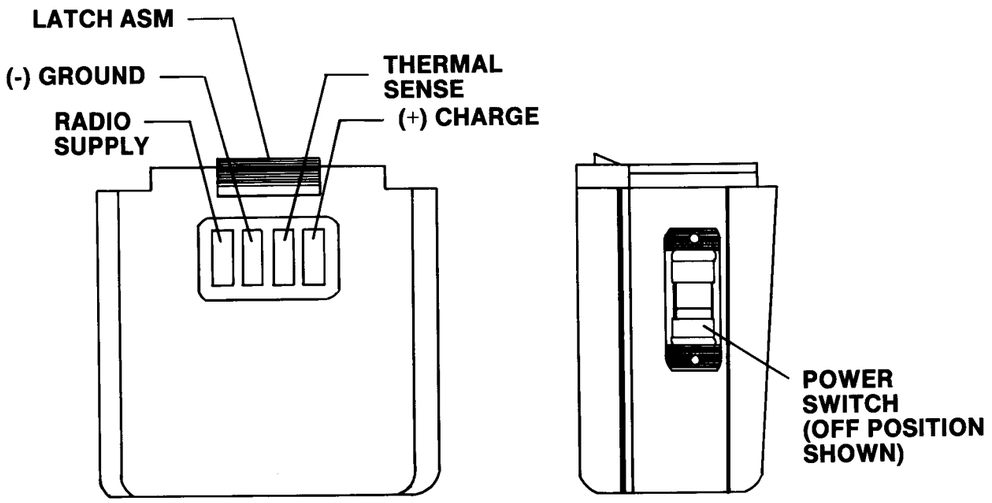
(A3W03648-1)

DTMF & TYPE 99
OPTION BOARDS

Issue 1



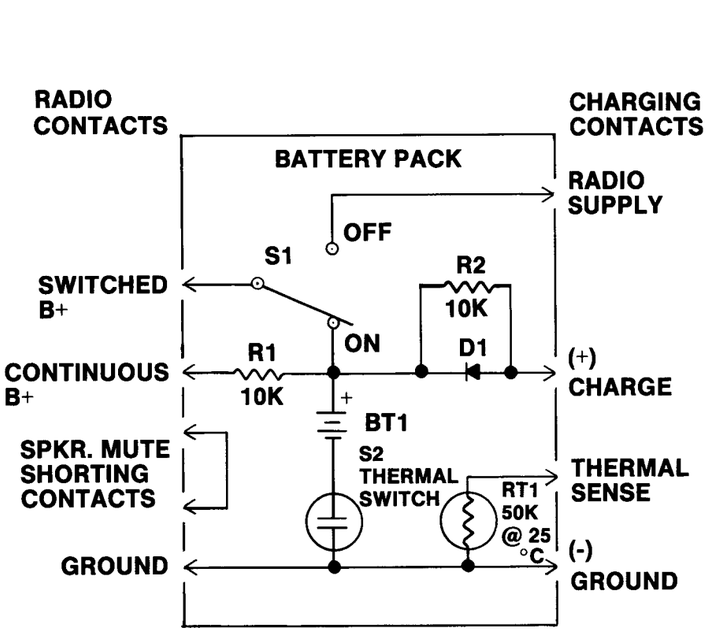
TOP VIEW



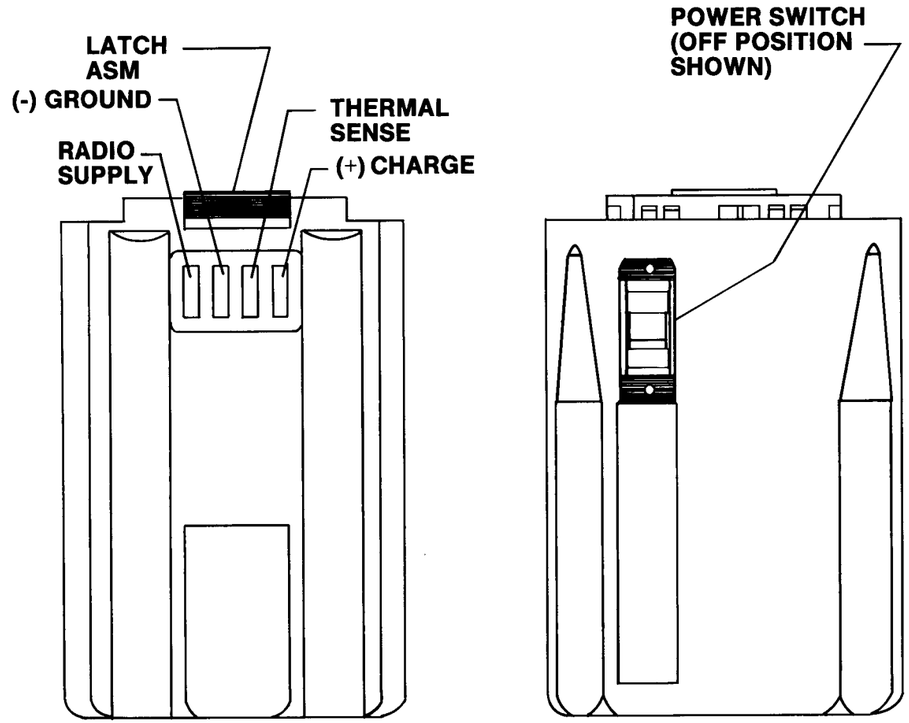
REAR VIEW

SIDE VIEW

19A704850P1 & P3
(800 mAh)



(800 mAh AND 1200 mAh BATTERY PACKS)

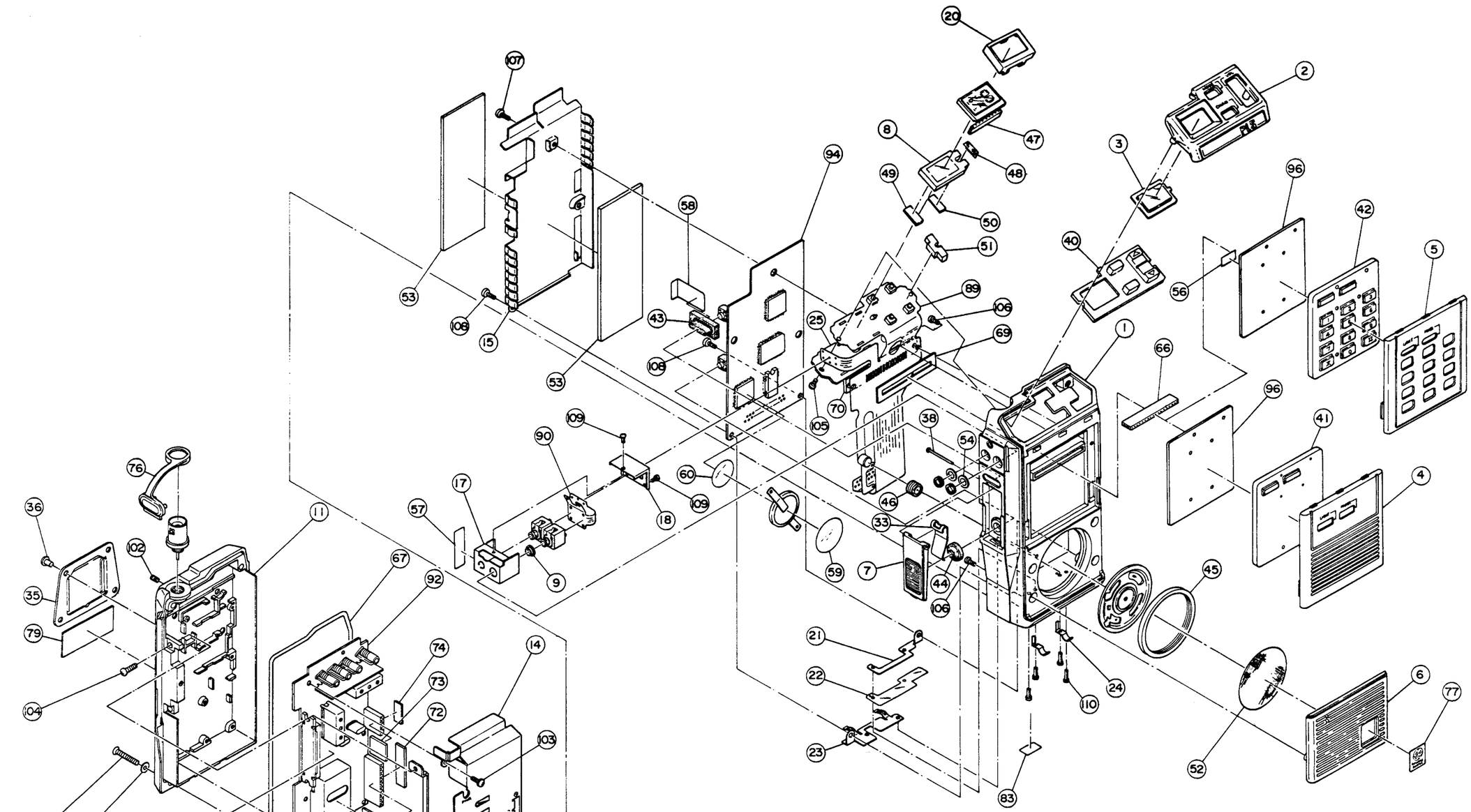


REAR VIEW

FRONT VIEW

19A704860P1 & P3
(1200 mAh)

RC-5493



(A1WL09609)

PARTS LIST

LBI-31857

PLS HIGH BAND
(MECHANICAL PARTS)

SYMBOL	GE PART NO.	DESCRIPTION
1	K19/A1WL08209	Frame
2	K19/A2WL08165	Top Cover
3	K19/A4WL08170	LCD Crystal
4	K19/A2WL08167	Non-Keyset Insert
5	K19/A2WL08166	Keyset Insert
6	K19/A2WL08168	Speaker Escutcheon
7	K19/A3WL08169	PTT Lever
8	K19/A3WL08142	Lighting Board
9	K19/A4WL08406	Spacer
10		NOT USED
11	K19/A1WL08177	Cabinet Back
12		NOT USED
13		NOT USED
14	K19/A3WL08627	RF Shield for VHF
15	K19/A3WL08626	Logic Shield
16		NOT USED
17	K19/A4WL08404	Jack Shield
18	K19/A4WL08405	Jack Shield Cover
19	K19/A4WL08715	Power Pack Bracket
20	K19/A4WL08141	LCD Frame
21	K19/A3WL08215	Positive Strap
22	K19/A4WL08561	Insulator Sheet
23	K19/A3WL08214	Negative Strap
24	K19/A4WL08213	Battery Connector Spring
25	K19/A3WL08596	Protector
26	K19/A4WL09039	DBM Case
27	K19/A4WL09132	Plate for VCO Shield
28		NOT USED
29		NOT USED
30		NOT USED
31		NOT USED
32		NOT USED
33	K19/A4WL09379	PTT Spring
34		NOT USED
35	K19/A3WL07509	Receptacle Plate
36	K19/A4WL07694	Rivet
37		NOT USED
38	K19/A4WL08175	Pivot Pin
39		NOT USED
40	K19/A3WL08171	Top Key Pad
41	K19/A2WL08130	Key Pad B
42	K19/A2WL08129	Key Pad A
43	K19/A3WL08172	Monitor Control Key
44	K19/A4WL08173	PTT Pad
45	K19/A4WL08153	Speaker Gasket
46	K19/A4WL07594P1	MIC Gasket
47	K19/A4WL08144	Inter Connector
48	K19/A4WL08149	Himelon
49	K19/A4WL08146	LCD Sponge A
50	K19/A4WL08147	LCD Sponge B
51	K19/A4WL08888	Top Sponge
52	K19/A4WL08155	Speaker Dust Screen
53	K19/A4WL09161	Sponge for Logic Shield
54	K19/A4WL08205	Washer
55	K19/A4WL08928	Washer
56	K19/A4WL09189	Tape for Crystal
57	K19/A4WL09190	Tape A
58	K19/A4WL09191	Tape B
59	K19/A4WL09192	Insulator for Battery
60	K19/A4WL09193	Battery Tape
61		NOT USED
62		NOT USED
63		NOT USED
64		NOT USED
65		NOT USED
66	K19/A4WL08154	Inter Connector L
67	K19/A4WL09303	Housing Gasket
68		NOT USED
69	K19/A4WL08563	Spacer
70	K19/A4WL08595	Plate
71	K19/A4WL09185	CN Spacer A
72	K19/A4WL09186	CN Spacer B
73	K19/A4WL09187	CN Spacer C
74	K19/A4WL09188	CN Spacer D
75		NOT USED
76	K19/A4WL09349	Jack Cover
77	K19/A4WL07721	STD Name Plate (GE)
78		NOT USED
79	K19/A4WL08414	FCC Label (H05)
80		NOT USED
81		NOT USED
82		NOT USED
83	K19/A4WL09603	Serial Number Label
84		NOT USED
85		NOT USED
86		NOT USED
87		NOT USED
88		NOT USED
89	K19/A2WL08896	Flexible P.W.B.
90	K19/A4WL08900	Jack Flexible P.W.B.
91		NOT USED
92	K19/A3WL08519	PLS VHF-H P.W.B.
93		NOT USED
94	K19/A3WL08741	Logic P.W.B. (2 Layer)
95		NOT USED
96	K19/A3WL08191	Option P.W.B.
97		NOT USED
98		NOT USED
99		NOT USED
100		NOT USED
101	K19/A4WL08543	Screw
102	K19/3NAC026033	Screw
103	K19/3NAX001116	Screw
104	K19/3NAA009056	Screw
105	K19/3NAD049034	Screw
106	K19/3NAD049042	Screw
107	K19/3NAD049026	Screw
108	K19/3NAA405056	Screw
109	K19/3NAA502134	Screw
110	K19/3NAA502142	Screw
111		NOT USED
112		NOT USED
113		NOT USED
114		NOT USED
115		NOT USED
116		NOT USED
117		NOT USED
118		NOT USED
119		NOT USED
120		NOT USED
121		NOT USED
122		NOT USED
123		NOT USED
124		NOT USED
125		NOT USED
126		NOT USED
127		NOT USED
128		NOT USED
129		NOT USED
130		NOT USED

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

LBI-31867

PLS VHF CHASSIS

SYMBOL	GE PART NO.	DESCRIPTION
		Radio RF Board
	K19/A4WE04030	Control Board
	K19/A4WE04031	Flexible Board
	K19/A4WE04032	Key Board
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	K19/2CAJ023094	Ceramic: 1000 pF
		- - - - - - - ASSOCIATED ASSEMBLIES - - - - - - -
	19A704723P24	Antenna (150-174 MHz) with a BLUE colored ring around BNC connector.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

MECHANICAL PARTS

PARTS LIST

PLS RADIO BOARD
HIGH BAND
A42D2905C
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - - -
A101	K19/2AAH025069	uPB571C
A102	K19/2AAJ004062	MC145159P1
A103	K19/2ABC039121	BU4066BF
A104	K19/2AAB004292	UPC1251G2
A105	K19/2YAA181707	Crystal TCX-(2) A4WX01472
A106	K19/5UAD001123	VCO A4WX01580
A107	K19/2AAE053015	S-81250HG TO-92
A108	K19/2AAE053015	S-81250HG TO-92
A201		NOT USED
A202	K19/2AAA013112	Hybrid IC A4WX01422-1H #2
A203	K19/2AAA021651	Hybrid IC KLH8516 A4JX00400
A301	K19/2EDG002036	DBM UST-2L-LO A4WX01451
A302	K19/2AAJ008089	HA1244V
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C101		NOT USED
C102	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C103 and C104	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C105	K19/2CAK013234	Ceramic chip: 0.033 uF ±10%, 50V.
C106	K19/2CAK011501	Ceramic chip: 4700 pF ±10%, 50V.
C107	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C108	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C109	K19/2CAK005925	Ceramic chip: 330 pF ±10%, 50V.
C110 and C111	K19/2CAK013309	Ceramic chip: 150 pF ±5%, 50V.
C112	K19/2CCF002072	Tantalum: 1 uF, 16V.
C113	K19/2CAK005818	Ceramic chip: 22 pF ±5%, 50V.
C114	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C115	K19/2CAK013010	Ceramic chip: 0.1 uF +80/-20%, 25V.
C116	K19/2CDA055024	Pory-Prop. film CF92P2A 104K
C117	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C118	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C119 and C120	K19/2CAK005685	Ceramic chip: 2 pF ±0.25 pF, 50V.
C121 and C122	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C123	K19/2CCF002072	Tantalum: 1 uF, 16V.
C124 thru C126	K19/2CAK005909	Ceramic chip: 100 pF ±5%, 50V.
C127	K19/2CAK013010	Ceramic chip: 0.1 uF +80/-20%, 25V.
C128 and C129	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C130	K19/2CAK013010	Ceramic chip: 0.1 uF +80/-20%, 25V.
C131	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C132	K19/2CGD013064	Variable: TZB04N100BC
C133		NOT USED
C134 thru C136	K19/2CCF002072	Tantalum: 1 uF, 16V.
C137	K19/2CBB033180	Electrolytic: 220 uF, 10V.
C138 and C139	K19/2CCF002072	Tantalum: 1 uf, 16V.
C140	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C141	K19/2CAK005792	Ceramic chip: 15 pF ±5%, 50V.
C142	K19/2CAK005867	Ceramic chip: 47 pF ±5%, 50V.
C143	K19/2CCF002072	Tantalum: 1 uF, 16V.
C144	K19/2CBB033180	Electrolytic: 220 uF, 10V.
C201	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C202	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C203	K19/2CAK005784	Ceramic chip: 12 pF ±5%, 50V.
C204	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C205	K19/	Ceramic chip: 13 pF ±0.5 pF, 50V.
C206	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C207	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C208	K19/2CCC026264	Tantalum: 10 uF, 16V.
C209 and C210	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C211	K19/2CCF002072	Tantalum: 1 uF, 16V.
C212	K19/2CCC026264	Tantalum: 10 uF, 16V.
C213 and C214	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C215	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C216	K19/2CAK005776	Ceramic chip: 11 pF ±5%, 50V.
C217	K19/2CAK005727	Ceramic chip: 6 pF ±0.5 pF, 50V.
C218	K19/2CAK005776	Ceramic chip: 11 pF ±5%, 50V.
C219	K19/2CAK005784	Ceramic chip: 12 pF ±5%, 50V.
C220 and C221	K19/2CAK005834	Ceramic chip: 27 pF, ±5%, 50V.
C222	K19/2CAK005784	Ceramic chip: 12 pF ±5%, 50V.
C223	K19/2CAK005800	Ceramic chip: 18 pF ±5%, 50V.
C224	K19/2CAK005818	Ceramic chip: 22 pF ±5%, 50V.
C225	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C226	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C227	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C228	K19/2CAK013010	Ceramic chip: 0.1 uF +80/-20%, 25V.
C229 and C230	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C231	K19/2CAK005685	Ceramic chip: 2 pF ±0.25 pF, 50V.
C232 and C233	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C234	K19/2CAK005685	Ceramic chip: 2 pF ±0.25 pF, 50V.
C301 thru C303	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C304 and C305	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C306		NOT USED
C307	K19/2CAK005784	Ceramic chip: 12 pF ±5%, 50V.
C308 and C309	K19/2CCF002072	Tantalum: 1 uF, 16V.
C310	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C311	K19/2CAK005735	Ceramic chip: 7 pF ±0.5 pF, 50V.
C312	K19/2CAK005784	Ceramic chip: 12 pF ±5%, 50V.
C313	K19/2CAK005735	Ceramic chip: 7 pF ±0.5 pF, 50V.
C314	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C315	K19/2CAK005735	Ceramic chip: 7 pF ±0.5 pF, 50V.
C316	K19/2CAK005743	Ceramic chip: 8 pF ±0.5 pF, 50V.
C317 and C318	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C319	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C320	K19/2CCF002072	Tantalum: 1 uF, 16V.
C321	K19/2CAK005818	Ceramic chip: 22 pF ±5%, 50V.
C322	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C323	K19/2CAK005867	Ceramic chip: 47 pF ±5%, 50V.
C324	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C325	K19/2CAK005792	Ceramic chip: 15 pF ±5%, 50V.
C326	K19/2CAK005842	Ceramic chip: 33 pF ±5%, 50V.
C327	K19/2CAK005743	Ceramic chip: 8 pF ±0.5 pF, 50V.
C328	K19/2CAK005295	Ceramic chip: 330 pF ±10%, 50V.
C329 and C330	K19/2CAK005768	Ceramic chip: 10 pF ±0.5 pF, 50V.
C331 thru C335	K19/2CCF002072	Tantalum: 1 uF, 16V.
C336	K19/2CAK005743	Ceramic chip: 8 pF ±0.5 pF, 50V.
C337		NOT USED
		- - - - - - - - - - DIODES - - - - - - - - - -
CR201 and CR202	K19/2QBE004035	MA57-TX
CR301	K19/2QBA006166	1S2075(K)
CR302	K19/2QBE005016	DAN202K T-96
CR303	K19/2QBE005024	DAP202K T-96
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL301 and FL302	K19/2FBD001612	BPF 150-174 A4WX01576
FL303 and FL304	K19/2FAA103082	Crystal filter A4WX01449 45 MHz
FL305	K19/2FAD001572	Ceramic filter CFWM455E
		- - - - - - - - - - JACKS - - - - - - - - - -
J101	K19/2PDA023044	69775-011
J102	K19/2PDA023036	69775-005
		- - - - - - - - - - COILS - - - - - - - - - -
L101		Inductor: 0.47 uH
L201	K19/2LAB013044	0.5UEW Ø 2 2T A4WX00027
L202	K19/2LAB013085	0.5UEW Ø 2 6T A4WX00027
L203	K19/2LAB013044	0.5UEW Ø 2 2T A4WX00027
L204	K19/2LAB013093	0.5UEW Ø 2 7T A4WX00027
L205	K19/2LAA001743	Inductor LAL02KR R47M
L206	K19/2LAB014984	MC108-4 A4WX01442
L207	K19/2LAB014976	MC108-3 A4WX01442
L208	K19/2LAB014984	MC108-4 A4WX01442
L209	K19/2LAB014976	MC108-3 A4WX01442
L210	K19/2LAA001743	Inductor LAL02KR R47M

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
L211	K19/2LAB013127	0.5UEW @ 2 10T A4WX00027
L301	K19/2LAB013127	0.5UEW @ 2 10T A4WX00027
L302	K19/2LAB013101	0.5UEW @ 2 8T A4WX00027
L303		NOT USED
L304	K19/2LAD001179	Inductor NL322522T-082M
L305	K19/2LAD001070	Inductor NL322522T-R10M
L306		Jumper
L307		NOT USED
L308	K19/2LAD001211	Inductor MLF3216DR68K
L309	K19/2LAB015064	Coil A4WX01457
L310	K19/2LAB015072	Coil A4WX01456
L311	K19/2LAD001229	Inductor MLF3216A1ROM
L312	K19/2LAB015072	Coil A4WX01456
L313	K19/2LAD001229	Inductor MLF3216A1ROM
L314	K19/2LAB015080	Coil A4WX01458
L315	K19/2LAD001104	Inductor NL322522T-033M
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q101		NOT USED
Q102		NOT USED
Q103	K19/2QAD005084	2SB1188-101
Q104 and Q105	K19/2QAD005076	2SD1781K-T96
Q106	K19/2QAD004020	2SC3356-T2B
Q201	K19/2QAD005084	2SB1188-101
Q202	K19/2QAD015077	2SB1169
Q203	K19/2QAD004038	2SC3357-T1B
Q204 and Q205	K19/2QAD005076	2SD1781K-T96
Q301 thru Q304	K19/2QAD004020	2SC3356-T2B
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101		NOT USED
R102	K19/2RGC001593	Square chip: 2.2K ohms ±5%, 1/10W.
R103		NOT USED
R104	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R105	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R106	K19/2RGC004456	Square chip: 2.2M ohms ±5%, 1/10W.
R107	K19/2RGC001726	Square chip: 47K ohms ±5%, 1/10W.
R108	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R109	K19/2RGC001593	Square chip: 2.2K ohms ±5%, 1/10W.
R110	K19/2RGC001726	Square chip: 47K ohms ±5%, 1/10W.
R111 and R112	K19/2RGC001643	Square chip: 100K ohms ±5%, 1/10W.
R113	K19/2RGC001551	Square chip: 330 ohms ±5%, 1/10W.
R114	K19/2RGC001650	Square chip: 68 ohms ±5%, 1/10W.
R115	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R116	K19/2RGC004126	Square chip: 15K ohms ±5%, 1/10W.
R117	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R118	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R119	K19/2RGC001726	Square chip: 47K ohms ±5%, 1/10W.
R120	K19/2RFB017063	Variable: RGS6-FAN 10K ohms.
R121	K19/2RGC001635	Square chip: 22K ohms ±5%, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R122 and R123	K19/2RGC001502	Square chip: 10 ohms ±5%, 1/10W.
R124	K19/2RGC001841	Square chip: 4.7 ohms ±5%, 1/10W.
R125	K19/2RGC004266	Square chip: 33 ohms ±5%, 1/10W.
R201	K19/2RGC001502	Square chip: 10 ohms ±5%, 1/10W.
R202		NOT USED
R203 and R204	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R205	K19/2RGC001643	Square chip: 100K ohms ±5%, 1/10W.
R206	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R207	K19/2RGC001601	Square chip: 3.3K ohms ±5%, 1/10W.
R208	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R209 and R210	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R211	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R212	K19/2RGC001601	Square chip: 3.3K ohms ±5%, 1/10W.
R213	K19/2RGC001643	Square chip: 100K ohms ±5%, 1/10W.
R214	K19/2RGC001593	Square chip: 2.2K ohms ±5%, 1/10W.
R215	K19/2RGC001635	Square chip: 22K ohms ±5%, 1/10W.
R216	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R217	K19/2RGC001551	Square chip: 330 ohms ±5%, 1/10W.
R218	K19/2RGC005792	Square chip: 15 ohms ±5%, 1/10W.
R219	K19/2RGC001502	Square chip: 10 ohms ±5%, 1/10W.
R220		NOT USED
R221		NOT USED
R222	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R223	K19/2RGC001544	Square chip: 220 ohms ±5%, 1/10W.
R224	K19/2RGC001551	Square chip: 330 ohms ±5%, 1/10W.
R225	K19/2RFB017063	Variable: RGS6-FAN 10K ohms.
R301	K19/2RGC001544	Square chip: 220 ohms ±5%, 1/10W.
R302	K19/2RGC001742	Square chip: 330K ohms ±5%, 1/10W.
R303	K19/2RGC001569	Square chip: 470 ohms ±5%, 1/10W.
R304	K19/2RGC001650	Square chip: 68 ohms ±5%, 1/10W.
R305	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R306	K19/2RGC001577	Square chip: 680 ohms ±5%, 1/10W.
R307	K19/2RGC001536	Square chip: 150 ohms ±5%, 1/10W.
R308	K19/2RGC001825	Square chip: 220K ohms ±5%, 1/10W.
R309	K19/2RGC001536	Square chip: 150 ohms ±5%, 1/10W.
R310	K19/2RGC001718	Square chip: 6.8K ohms ±5%, 1/10W.
R311	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R312	K19/2RGC004449	Square chip: 150K ohms ±5%, 1/10W.
R313	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R314	K19/2RGC001635	Square chip: 22K ohms ±5%, 1/10W.
R315	K19/2RGC001817	Square chip: 33K ohms ±5%, 1/10W.
R316	K19/2RGC001700	Square chip: 1.5K ohms ±5%, 1/10W.
R317	K19/2RGC001577	Square chip: 680 ohms ±5%, 1/10W.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
TM301	K19/2QBD016139	NTCDS30183HG103HC
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y301	K19/2YAA181723	44.54 MHz A4WX01448

PARTS LIST

PLS CONTROL BOARD
A4WE04030

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
A1 and A2	K19/2AAE053023	Voltage Regulator, S-81250HG-RD-T1
A3	K19/2AAE053049	Voltage Detector, S-8054ALR-LN-T1
A4 and A5	K19/2AAB004284	OP AMP, uPC451G2-T1
A6	K19/2ADA004404	MICRO PROCESSOR, HD63705VOF
A7	K19/2ACA017382	S-RAM, TC5517AFL-2
A8	K19/2ADC003107	LCD Driver, uPD7225G
A9	K19/2AAJ016017	Audio Processor, STC 9140F
A10	K19/2AAJ010036	Audio IC, NJM2073D
		- - - - - - - - - LITHIUM BATTERY - - - - - - - - -
BT1	K19/5PBA002052	CR2032-T4
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	K19/2CAK013010	Ceramic chip, 0.1 uF
C2 thru C5	K19/2CCF002072	Tantalum, 1 uF
C6 and C7	K19/2CAK013010	Ceramic chip, 0.1 uF
C8	K19/2CCF002122	Tantalum, 0.47 uF
C9	K19/2CAK005917	Ceramic chip, 220 pF
C10 and C11	K19/2CAK013127	Ceramic chip, 1000 pF
C12	K19/2CAK013010	Ceramic chip, 0.1 uF
C14	K19/2CCF002072	Tantalum, 1 uF
C15	K19/2CAK005933	Ceramic chip, 470 pF
C16	K19/2CCF002072	Tantalum, 1 uF
C17	K19/2CAK005818	Ceramic chip, 22 pF
C18	K19/2CAK005685	Ceramic chip, 2 pF
C19	K19/2CAK005818	Ceramic chip, 22 pF
C20	K19/2CAK013119	Ceramic chip, 0.01 uF
C21 and C22	K19/2CCF002072	Tantalum, 1 uF
C23	K19/2CAK013119	Ceramic chip, 0.01 uF
C24	K19/2CAK005909	Ceramic chip, 100 pF
C25	K19/2CAK013010	Ceramic chip, 0.1 uF
C26	K19/2CAK013119	Ceramic chip, 0.01 uF
C27	K19/2CAK013135	Ceramic chip, 0.015 uF
C28	K19/2CAK013176	Ceramic chip, 0.033 uF
C29	K19/2CCF006024	Tantalum, 6.8 uF
C30 thru C32	K19/2CBJ001577	Electrolytic, 68 uF
C33	K19/2CAK013119	Ceramic chip, 0.01 uF
C34	K19/2CAK013143	Ceramic chip, 3300 pF
C35 and C36	K19/2CAK013010	Ceramic chip, 0.1 uF

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
C37	K19/2CCF002072	Tantalum, 1 uF
C38	K19/2CAK013010	Ceramic chip, 0.1 uF
C39	K19/2CBJ001577	Electrolytic, 68 uF
C40	K19/2CAK013010	Ceramic chip, 0.1 uF
C41	K19/2CAK005867	Ceramic chip, 47 pF
C42	K19/2CAK013010	Ceramic chip, 0.1 uF
C45 thru C47	K19/2CAK005933	Ceramic chip, 470 pF
C49	K19/2CAK005933	Ceramic chip, 470 pF
C50 thru C55	K19/2CAK013010	Ceramic chip, 0.1 uF
C57 thru C65	K19/2CAK013119	Ceramic chip, 0.01 uF
C66 thru C72	K19/2CAK005917	Ceramic chip, 220 pF
C73	K19/2CAK013010	Ceramic chip, 0.1 uF
C74	K19/2CAK005917	Ceramic chip, 220 pF
C75 thru C77	K19/2CAK005909	Ceramic chip, 100 pF
C78	K19/2CAK013127	Ceramic chip, 1000 pF
C79	K19/2CAK013010	Ceramic chip, 0.1 uF
C80	K19/2CAK005917	Ceramic chip, 220 pF
C81	K19/2CAK013119	Ceramic chip, 0.01 uF
C82	K19/2CAK013010	Ceramic chip, 0.1 uF
C83	K19/2CAK005917	Ceramic chip, 220 pF
C84	K19/2CAK013119	Ceramic chip, 0.01 uF
C85	K19/2CAK005917	Ceramic chip, 220 pF
C86	K19/2CCF002072	Tantalum, 1 uF
C87	K19/2CAK013119	Ceramic chip, 0.01 uF
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1 thru CR3	K19/2QBE005016	DAN202KT-96
CR4 and CR5	K19/2QBE005032	DA204KT-96
CR6	K19/2QBE005016	DAN202KT-96
		- - - - - - - - - - FUSES - - - - - - - - - -
F1	K19/2DDB010183	251005
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	K19/2PDA023101	65646-211
P2	K19/2PDA023093	65646-205
P3	K19/2PDA023192	68907-110
	K19/2PDA023184	68907-105
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q3	K19/2QAD001034	NPN, 2SC2462LCTL
Q4	K19/2QAD001026	PNP, 2SA1121SBTL
Q5	K19/2QAD001034	NPN, 2SC2462LCTL
Q6	K19/2QAD001026	PNP, 2SA1121SBTL
Q8	K19/2QAD001026	PNP, 2SA1121SBTL
Q9	K19/2QAD001034	NPN, 2SC2462LCTL
Q10	K19/2QAD001026	PNP, 2SA1121SBTL
Q11 and Q12	K19/2QAD001034	NPN, 2SC2462LCTL

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R3	K19/2RGC001585	Square chip, 1/10W, 1K ohm ±5%
R4 and R5	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R6	K19/2RGC001585	Square chip, 1/10W, 1K ohm ±5%
R7	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
R8	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R9	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R10	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R11	K19/2RGC001619	Square chip, 1/10W, 4.7K ohm ±5%
R12 and R13	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R14 thru R18	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R19 thru R27	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R28 thru R31	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R32	K19/2RGC001734	Square chip, 1/10W, 180K ohm ±5%
R33	K19/2RGC001528	Square chip, 1/10W, 100 ohm ±5%
R34 thru R40	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R41 and R42	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R43	K19/2RGC001528	Square chip, 1/10W, 100 ohm ±5%
R44	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R45	K19/2RGC001791	Square chip, 1/10W, 10M ohm ±5%
R46 thru R48	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R49	K19/2RGC004464	Square chip, 1/10W, 43K ohm ±5%
R50 and R51	K19/2RGC004381	Square chip, 1/10W, 7.5K ohm ±5%
R52	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R53	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R54	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R55	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R56	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
R57	K19/2RGC001817	Square chip, 1/10W, 33K ohm ±5%
R58	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R59	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R60 and R61	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R62	K19/2RGC001841	Square chip, 1/10W, 4.7 ohm ±5%
R63 and R64	K19/2RGC001585	Square chip, 1/10W, 1K ohm ±5%
R65	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R66	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R67	K19/2RGC001726	Square chip, 1/1-W, 47K ohm ±5%
R68	K19/2RGC001817	Square chip, 1/10W, 33K ohm ±5%
R69	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R70	K19/2RGC001817	Square chip, 1/10W, 33K ohm ±5%
R71	K19/2RGC001635	Square chip, 1/10W, 22K ohm ±5%

SYMBOL	GE PART NO.	DESCRIPTION
R72	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R73	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R74	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R75	K19/2RGC001585	Square chip, 1/10W, 1K ohm ±5%
R76	K19/2RGC001833	Square chip, 1/10W, 2.2 ohm ±5%
R77	K19/2RGC001593	Square chip, 1/10W, 2.2K ohm ±5%
R78	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R79 and R80	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R81 and R82	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R83	K19/2RGC004449	Square chip, 1/10W, 150K ohm ±5%
R84	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R85	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R86	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R87	K19/2RGC001593	Square chip, 1/10W, 2.2K ohm ±5%
R88	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R89	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R90	K19/2RGC001783	Square chip, 1/10W, 3.3M ohm ±5%
R91 and R92	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R93 and R94	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R95	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R96	K19/2RGC001544	Square chip, 1/10W, 220 ohm ±5%
R97	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R98	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R99	K19/2RGC001593	Square chip, 1/10W, 2.2K ohm ±5%
R100	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R101	K19/2RGC001833	Square chip, 1/10W, 2.2 ohm ±5%
R102	K19/2RGC001593	Square chip, 1/10W, 2.2K ohm ±5%
R103	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R104	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R105	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1 and S2	K19/2KJA001042	B3P-3120
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	K19/2YAA181665	AT-41 3.579545 MHz A4WX01429
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
XY1	K19/2YYZ001062	NB-0252-0.5t

PARTS LIST

PLS TYPE 99/DTMF BOARD
A4WE03822

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
A1	K19/2ADA004412	Micro Processor, HD637B01X0F
A2	K19/2ABD025020	N-H-CMOS, uPD74HC14G-T1
A3	K19/2AAB004284	OP AMP, uPC451G2-T1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	K19/2CCF002072	Tantalum, 1 uF
C2	K19/2CAK013143	Ceramic chip, 3300 pF
C3	K19/2CAK013119	Ceramic chip, 0.01 uF
C4	K19/2CAK005867	Ceramic chip, 47 pF
C5 thru C7	K19/2CAK013135	Ceramic chip, 0.015 uF
C8	K19/2CAK013119	Ceramic chip, 0.01 uF
C9 and C10	K19/2CCF002072	Tantalum, 1 uF
C11	K19/2CAK013010	Ceramic chip, 0.1 uF
C12 and C13	K19/2CAK005792	Ceramic chip, 15 pF
C14	K19/2CAK013135	Ceramic chip, 0.015 uF
		- - - - - - - - - - - DIODES - - - - - - - - - -
CR1	K19/2QBE005016	DAN202KT-96
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	K19/2QAD001026	PNP 2SA1121SBTL
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R4	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R5	K19/2RGC004126	Square chip, 1/10W, 15K ohm ±5%
R6	K19/2RGC001775	Square chip, 1/10W, 1M ohm ±5%
R7	K19/2RGC001700	Square chip, 1/10W, 1.5K ohm ±5%
R8 and R9	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R10	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R11	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R12	K19/2RGC001775	Square chip, 1/10W, 1M ohm ±5%
R13	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R14	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R15	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R16	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
R17 and R18	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R19	K19/2RGC003305	Square chip, 1/10W, 2.2M ohm ±5%
R20	K19/2RGC001775	Square chip, 1/10W, 1M ohm ±5%
R21	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R22	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
R23	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R24	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R25	K19/2RGC001635	Square chip, 1/10W, 22K ohm ±5%
R26 thru R29	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R30 and R31	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R32	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	K19/2YAA181749	SAT-310, 8 MHz, A4WX01728

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

PLS FLEX BOARD
A4WE04031

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 thru C5		uDF4Y102
		- - - - - - - - - - - - LED - - - - - - - - - - -
CR1	K19/2HAA005343	GL-1EG1
		- - - - - - - - - - - JACKS - - - - - - - - - - -
J1 and J2	K19/2PFA001128	S-G8512
		- - - - - - - - - - LCD DISPLAY - - - - - - - - -
LCD	K19/2DCA005111	T164009
		- - - - - - - - - ELECTRIC MICROPHONE - - - - - - -
MIC	K19/2SAA006109	EM-78
		- - - - - - - - - KEY BOARD SWITCH - - - - - - - -
S1 thru S4	K19/2KJA018053	JPM 1990-0101
		- - - - - - - - - - - - SPEAKER - - - - - - - - - - -
SP1	K19/2SDA005147	T040S13

PRODUCTION CHANGES

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

REV A - HIGH BAND RADIO BOARD A4Z02905C
REV B - HIGH BAND RADIO BOARD A4Z02905C
Incorporated in initial shipment.

REV C - HIGH BAND RADIO BOARD A4Z02905C
To improve system operation, changed R124.

R124 was: K19/2RGC001502 Square Chip: 10 ohms ± 5%, 1/10W.