

MAINTENANCE MANUAL
PCS™ REAR ASSEMBLY
19D902175G3 (403-440 MHz)
19D902175G4 (440-470 MHz)
19D902175G5 (470-512 MHz)

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DESCRIPTION

Rear Assembly 19D902175G3, G4 and G5 provide a metal housing for RF Board 19D438262G1 (403-440 MHz), 19D438262G2 (440-470 MHz) and 19D438262G3 (470-512 MHz). The RF boards are the same except for certain frequency sensitive elements and the operation and performance of the boards are identical.

The RF boards consist of the following circuits:

- A frequency synthesizer for generating the transmit carrier frequency and the receive circuit first mixer injection frequency.
- The transmit circuit, receive circuit and TX-RX switch.
- A voltage regulator and low battery switch.

Refer to Figure 1 for a block diagram of the synthesizer circuit. Refer to Figure 2 for a transmit and receive circuit block diagram.

Transmit circuit adjustments for frequency and power are accessible from the top side of the board, as are IF alignment, second oscillator and quadrature detector adjustments for the receiver circuit. Chip components on the bottom of the board provide optimum RF performance.

Selected use of sealed modules permit small board size as RF and mechanical protection for sensitive cir-

cuitry. Modules are NOT repairable and must be replaced if they are determined to be damaged. Two friction fit shields provide RF shielding.

CIRCUIT ANALYSIS

SYNTHESIZER CIRCUIT

The frequency synthesizer circuit generates all transmit and receive RF frequencies for the PCS Personal Radio. This circuit uses a phase-locked Voltage Controlled Oscillator (VCO) operating on the actual transmitter frequency (403-512 MHz) during transmit and 45 MHz below the actual receive frequency during receive. The synthesizer output signal is generated directly by VCO module U1 on buffer circuit board A202 and fed through a low pass filter to an LO buffer, a PA buffer and a prescaler buffer.

The synthesizer frequency output is controlled by a microprocessor on the Audio Logic Board. Frequency stability is maintained by a Temperature Compensated crystal controlled Oscillator (TCXO) module. The oscillator has a stability of ±5PPM over the temperature range of -30°C to 60°C and determines the overall frequency stability of the radio.

The VCO assembly (A202) output is also buffered by transistor Q201 to feed divide by 128/129 dual modulus prescaler U202. The prescaler feeds the Fin input of Phase-Lock-Loop (PLL) chip U201. Within U201, the prescaler signal is further divided down to 5 kHz to be compared with a reference signal. This reference signal is derived from 12.8 MHz TCXO module U203. The PLL chip, U201, divides the 12.8 MHz TCXO down to the 5 kHz reference frequency. Divider circuits in U201 are programmed by three inputs from the Audio/Logic Board. These are SYN ENABLE, SYN DATA and SYNC CLOCK lines. A LOCK DETECT line communicates from the PLL chip to the audio board microprocessor for processing to prevent transmissions when the synthesizer is unlocked. A blinking BAT flag is displayed on the Liquid Crystal Display (LCD) and a pulsed beep is sounded if this condition occurs.

Audio modulation from the Audio/Logic Board is applied to loop filter circuit board A201 in the synthesizer circuit. The audio is summed with the unfiltered control voltage and fed to operational amplifier U1 on the loop filter Board. Amplifier U1 is biased to produce gain variation with different control voltages.

When the control voltage is below 1.6 volts, both diodes in diode package D1 are biased off. The operational amplifier gain is then one. As the control voltage rises above approximately 1.6 volts, one of the diodes (D1) is forward biased. This increases the operational amplifier gain to approximately 1.2. Further increases in the control voltage above approximately 2.6 volts turns both diode paths on, thus increasing the gain to about 1.4. Gain variation verses control voltage compensates for decreasing VCO gain at higher control voltages. The net effect of

this is to linearize the loop response across the frequency band to maintain relatively constant audio modulation and constant digital Channel guard waveshape.

The synthesizer enable line also drives bilateral switches U2A and U2B on the loop filter board. The pulse applied to these gates, when channel changes occur, turns the gates on which shorts out resistors R11 and R12. This allows rapid channel acquisition.

At low control voltages, below approximately 0.9 volts, operational amplifier U1B is enabled by the pulse on the synthesizer enable line. This enables transistor Q1 for the duration of the channel change pulse. Transistor Q1 acts as a current sink for operational amplifier U1A which speeds up the new slew rate on U1A at low voltages.

TRANSMITTER CIRCUIT

The transmit circuit consists of a transmit buffer amplifier, a 7-watt power amplifier (U101), a Power Control circuit (A101), a low pass filter circuit and a Tx/Rx switch. Transistors Q103 through Q106 switch power to the TX stages and drive the Disable Line of the Power Control Module.

Tx Buffer

Transmit buffer transistors Q101 and Q102 are driven by the synthesizer VCO output at a level of approximately 0dBm, at R101 input. Amplifier transistor Q101, in turn, drives power module U101 at approximately +3 dBm. DC power is applied

to the buffer only in the transmit mode and is regulated to provide constant drive with decreasing battery voltage.

Power module U101 is a four-stage broadband power amplifier with internal matching. This module mounts to the rear casting for heat sinking. Output power is controlled by varying the Power control Voltage to stage two (Pin 3) of the module. Stage one and bias for stage three and four are supplied with the same regulated 6.8 voltage as the transmit buffer. The final two PA stages are supplied by the battery voltage in order to obtain maximum power. The final stage supply is fed through inductor L103. The DC voltage drop across this coil provides the sense voltage for power control.

Power Control Board

The power control circuitry, located on circuit board A101, has the task of sensing the DC drop across L103 and producing an output DC voltage to control stage two of the PA module. This feedback system holds the current to stage four of the PA module essentially constant as frequency, battery voltage, temperature and load varies. The output current level and output power are set by power adjusting potentiometer R122, located on the Power Control Board. Transistor Q2 on the power control board must be turned ON to enable the R11 path. This transistor is in turn controlled by the microprocessor on the Audio/Logic Board to control high or low power operation.

The input voltages to the power control module are on Pins 7 and 8. These voltages are divided down by precision resistors to set input voltages to operational amplifier U1. The voltage on the positive terminal of U1 may be adjusted above and below the divider voltage on the negative terminal of U1. When the positive and negative terminals are at equal potentials, the output of U1 is about 5 volts (depending on battery voltage). As the voltage on the positive terminal is adjusted by potentiometer R11, the output of U1 moves higher or lower in potential by about 60 times the V_{in} . This output is buffered by emitter follower transistor Q3. The output voltage on Pin 2 is set by the resistor ratio $(R7 + R8)/R7$. Current is supplied at this output mode by external transistor Q106.

Low Pass Filter

A six element low pass filter is provided to prevent excessive transmitter harmonics from being transmitted. This filter, in conjunction with the matching circuitry in the PA module, limits the conducted harmonic energy to less than -30 dBm.

Tx/Rx Switch

The Tx/Rx Switch consists of series PIN diode D101 and shunt PIN diode D102. Both diodes are off during receive and are therefore essentially open. This isolates the transmit circuit from the receive circuit while in the receive mode. During transmit, regulated voltage is switched to inductor L105. This produces a DC current through both D101 and D102, which transforms both diodes into RF shorts. This allows the PA output power to be conducted to the radio antenna. The RF short produced by D102 protects the receiver while presenting essentially an open to the transmitter. This is true because inductor L106 and part of capacitor C118 form a parallel resonant circuit across the transmit output. When D102 is conducting, capacitor C114 is used to series resonate the package inductance of D102 for an improved RF short.

Tx Switches

The transmit circuit is enabled by the DPTT line from the Audio/Logic Board. When the PTT button is activated, the DPTT line is pulled high. This turns transistor Q103 on and allows transistors Q104, Q105 and Q106 to conduct. The voltage on the emitter of transistor Q105 is approximately 0.7 volts ($V_{BE} + V_{SAT}$) below the regulated 5.4 Volts. The voltage at the collector of transistor Q105 is set by the $(R120 + R121)/R120$ resistor ratio. This boosts the output voltage to about 6.8 volts while allowing Q106 to supply the relatively high currents needed for the Tx Buffer, the PA module and the PIN diode switch.

The collector of transistor Q103 is also used to drive transmit disable transistor Q1 located on the power control module. When in the Rx state, the base of Q1 is biased on by a high voltage level at the collector of Q103. This in turn keeps the positive terminal of U1 sufficiently low to drive the output of U1 low enough to bias Q3 off. When Q103 is turned on by the DPTT line, transistor Q1 is biased off. This allows the normal Tx operation previously described.

RECEIVE CIRCUIT

The dual conversion receive circuit consists of a receiver front end, a 45 MHz first IF and a 455 kHz second IF with an FM detector. All audio processing and squelch functions are accomplished on the Audio/Logic Board.

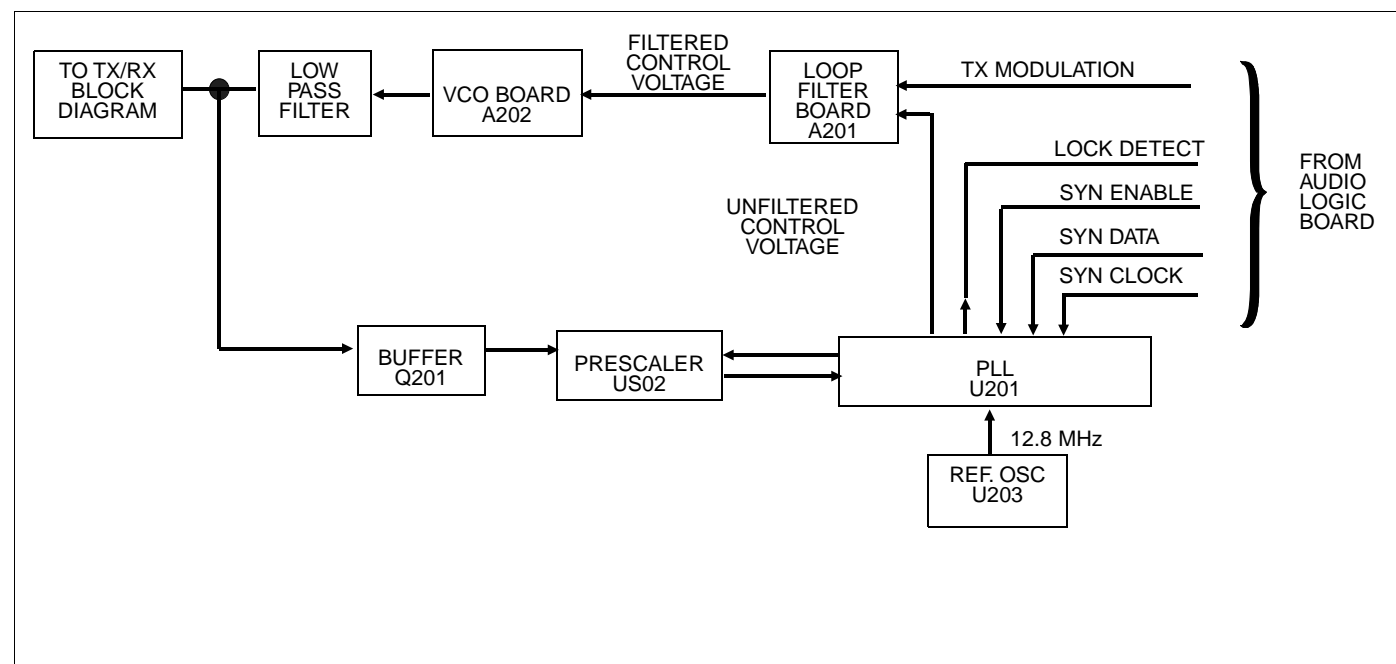


Figure 1 - Synthesizer Circuit Block Diagram

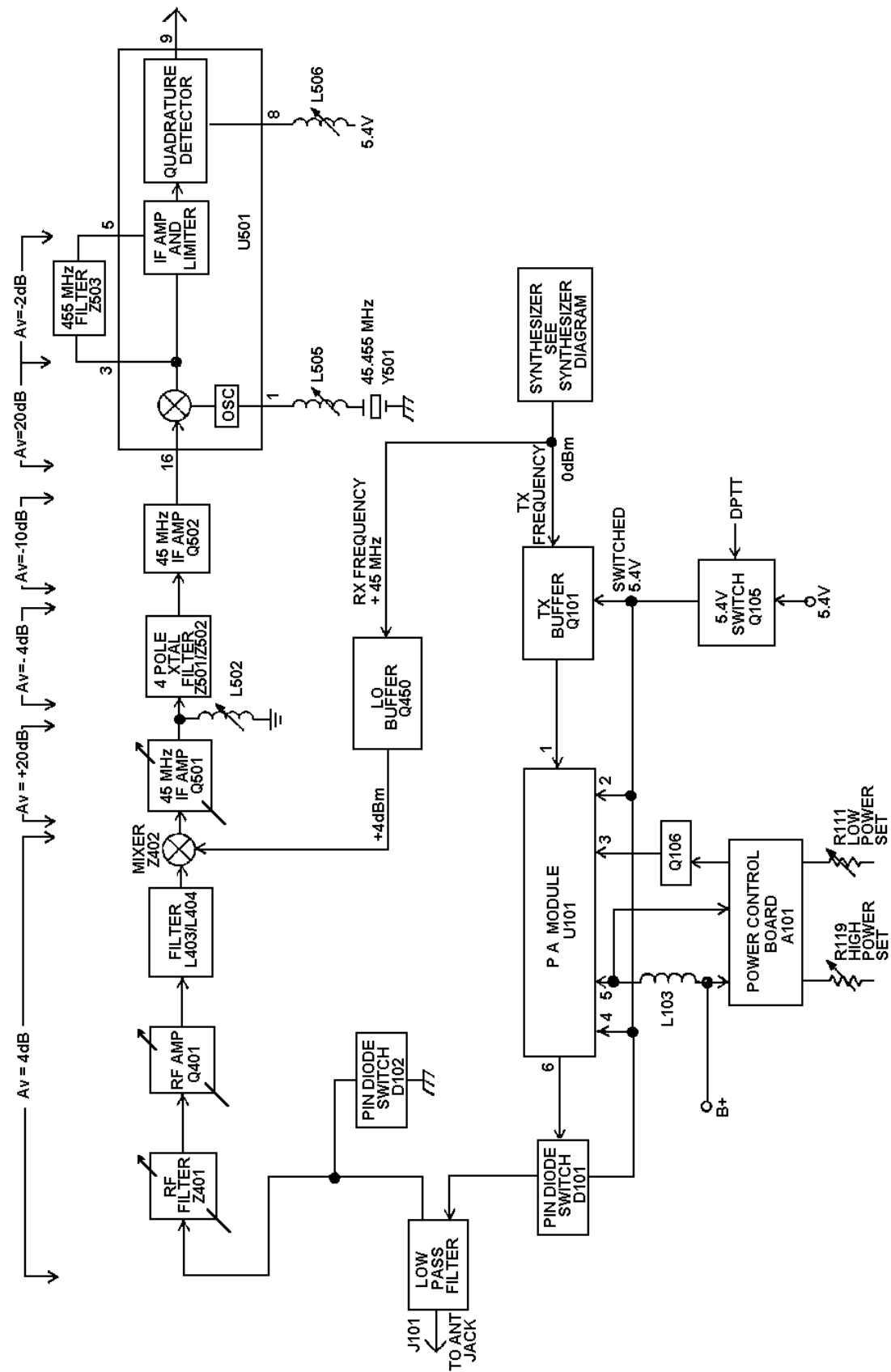


Figure 2 - Transmit and Receive Circuit Block Diagram

Front End

RF is coupled from antenna jack J1 to the RF Board through antenna clip connector J101. The receive signal is then conducted through the Tx low pass filter to receive preselector filter Z401 MHz, 450-70 MHz and 470-512 MHz bands (as shipped). Its output is matched by inductor L401 to the input of RF amplifier transistor Q401. A tuned 2-pole output filter is connected between the RF amplifier and double balanced mixer Z402. About 10 dB of RF gain is provided to the mixer input. The Local Oscillator (LO) port of the mixer (Pin 1) is driven by LO buffer transistor Q450. The filtered synthesizer output drives this buffer. The output of Q450 drives a tuned 2-pole filter which couples the drive to the mixer at about +4 dBm.

45 MHz IF

The mixer output is connected to the source of common gate Field Effect Transistor (FET) Q501. This stage provides a low impedance input to match the mixer and a high impedance output to drive the 45 MHz 4-pole crystal filter. The crystal filter output is amplified by bipolar transistor Q502. This IF amplifier output drives the Second Mixer circuit in Mixer/Limiter/FM Detector module U501. Crystal Y101 is an external crystal operating at 45.455 MHz. This crystal when coupled to the internal circuitry forms the second LO for the second mixer circuit. The frequency of the second LO is adjusted with inductor L505. The second mixer output is a 455 kHz IF and is filtered by a 4-pole ceramic filter. This output is further amplified and limited by U501. A quadrature detector provides an audio output from U501. The quadrature detector coil is L506. The audio output is prefiltered and connected to the Audio/Logic board as VOL SQHI.

5.4 Volt Regulator

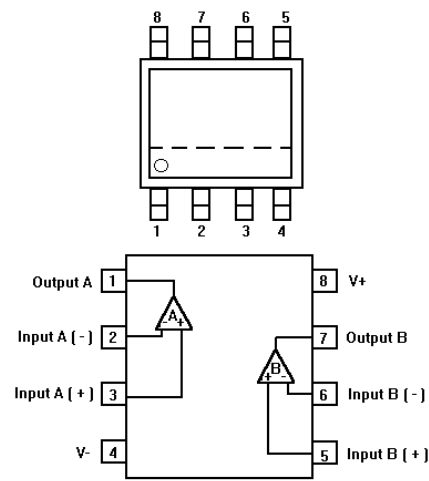
The 5.4 volt regulator circuit supplies a regulated 5.4 volts to all circuits requiring a stable reference voltage. This regulated voltage is generated by voltage reference module U801 and transistors Q801, Q802 and Q803. Module U801 provides 2.5 volts which is stable with both temperature and battery voltage. The 2.5 volt reference is fed to the base of Q802. Transistors Q802 and Q803 form a differential amplifier while Q801 acts as a pass transistor. The regulated 5.4 volts output on the collector of Q801 is divided by voltage divider resistors R805 and R806 to apply a 2.5 volts to the base of transistor Q803. With this voltage on the base of Q803 the differential amplifier is balanced.

Battery Indicator

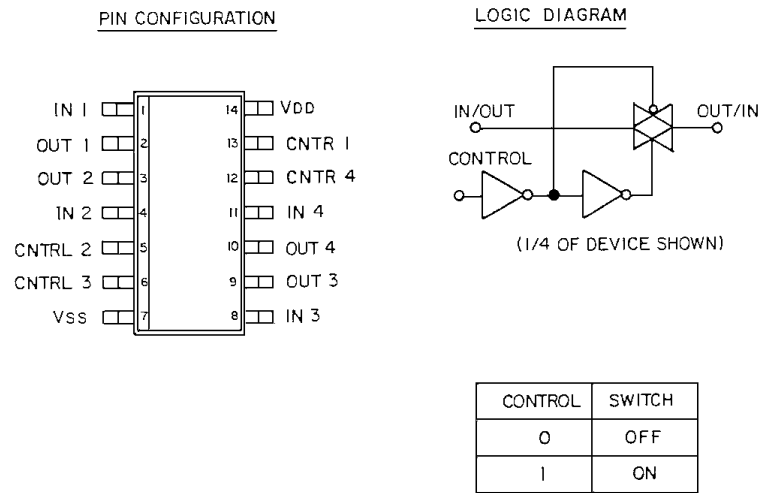
Transistor Q804 senses the battery voltage and compares it to the regulated 5.4 volts on the emitter. When the battery voltage drops to approximately 6.3 volts, Q804 is sufficiently on to produce about 0.4 volts on the battery indicator output (P801-1). This voltage is fed to the audio/logic board to drive an inverter which toggles a microprocessor port to provide a low battery indication.

Another effect at low battery voltage is produced by the voltage on the collector of Q804 driving Pin 6 of power control module U1. A slight increase of this voltage on the negative terminal of U1 causes the output of U1 to drop and the control voltage to be reduced. The final result is a slight drop in RF power output. Consequently, as the end of battery is approached, the RF power is throttled back. This gives the user additional transmit time before total loss of power due to low battery.

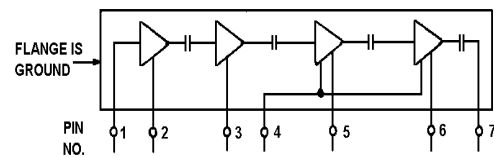
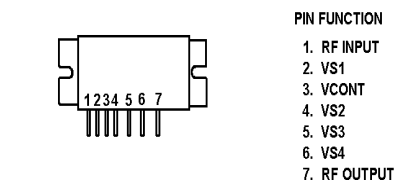
OPERATIONAL AMPLIFIER U1
19A702293P3



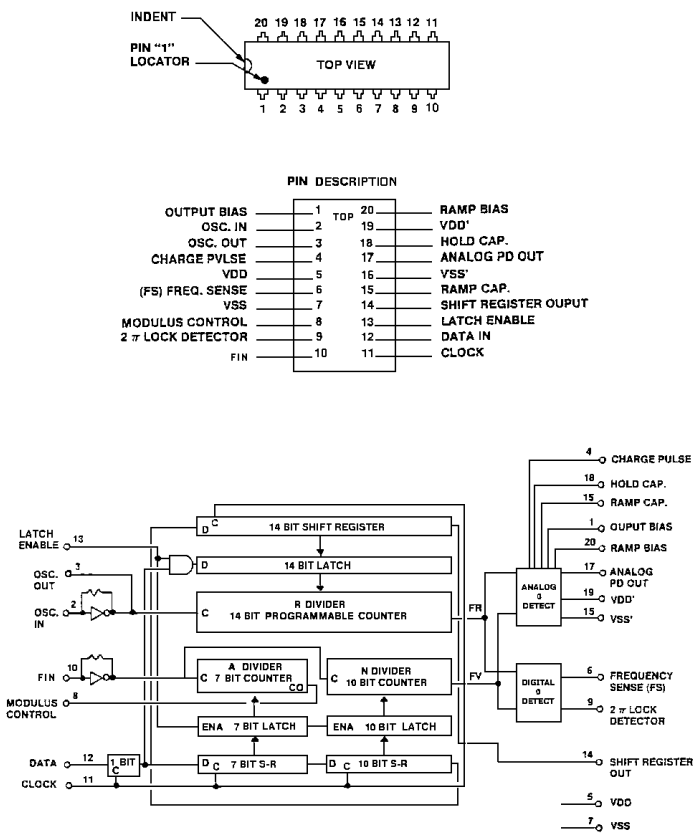
BILATERAL SWITCH U2
19A702705P4



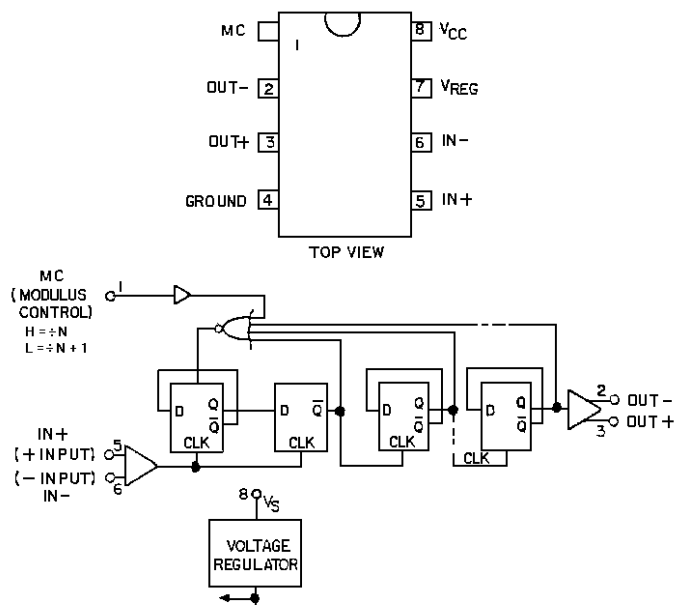
POWER MODULE U101
19A705419P1 (405-440 MHz)
19A705419P2 (440-470 MHz)
19A705419P3 (470-512 MHz)



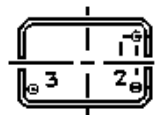
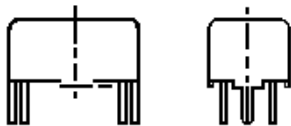
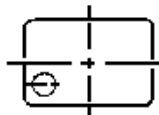
PLL MODULE U201
19B800902P1



PRESCALER MODULE U202
19A704287P2 (128/129)

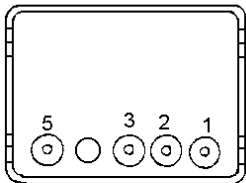


REFERENCE OSCILLATOR U203
19B801351P8



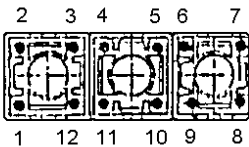
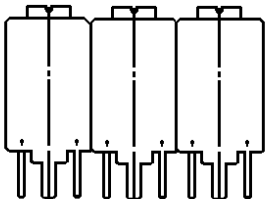
PIN CONNECTIONS
1. COMMON AND CASE
2. OUTPUT
3.+ V_{cc}

VOLTAGE CONTROLLED OSCILLATOR U1 (Part of A202)
19A705628P3 (403-440 MHz)
19A705628P5 (470-512 MHz)



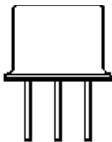
| PIN NO. | 1 | 2 | 3 | | 5 |
|-----------------------|--------|-----------------|-------------------|--|----------|
| CONTENTS | OUT | V _{cc} | V _{ctrl} | | SW |
| VALUE OF FEED THROUGH | 2 (PF) | 470 (PF) | 470 (PF) | | 470 (PF) |

BANDPASS FILTER Z401
19A705458P1 (440-470 MHz)
19A705458P4 (403-440 MHz)
19A705458P2 (470-512 MHz)

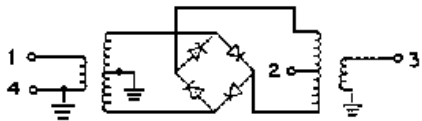


PIN CONNECTIONS :
INPUT - 1
OUTPUT - 7
GROUND - 4,5,6, 12

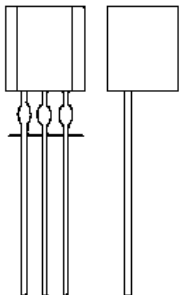
FIRST MIXER Z402
19A705423P1



| PIN CONNECTIONS | |
|-----------------|---|
| LOCAL OSC. | 1 |
| RF | 3 |
| IF | 2 |
| GROUND & CASE | 4 |

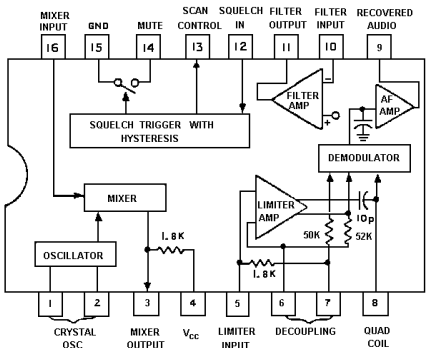
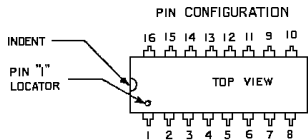


VOLTAGE REGULATOR U801
19A702939P2



BOTTOM VIEW
TO 92 PACKAGE
PIN 1 - REFERENCE
PIN 2 - ANODE
PIN 3 - CATHODE

SECOND MIXER/LIMITER/FM DETECTOR, U501
19A704619P1



REAR ASSEMBLY
19D902175G3 (403-440 MHz)
19D902175G4 (440-470 MHz)
19D902175G5 (470-512 MHz)
ISSUE 4

| SYMBOL | PART NO. | DESCRIPTION |
|-------------|---------------|---|
| A1 | | ----- ASSEMBLIES ----- TRANSMIT/RECEIVE BOARD 19D438262G1 (403-440 MHz) 19D438262G2 (440-470 MHz) 19D438262G3 (470-512 MHz) |
| A101 | | ----- ASSEMBLIES ----- POWER AMPLIFIER MODULE 19B801519G2 |
| C1 | 19A702061P69 | ----- CAPACITORS ----- Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C2 | 19A702061P61 | Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C3 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C4 | 19A702052P28 | Ceramic: 0.022 μF ±10%, 50 VDCW. |
| C5 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| Q1 thru Q3 | 19A700076P2 | ----- TRANSISTORS ----- Silicon, NPN: sim to MMBT3904, low profile. |
| R1 | 19A702931P308 | ----- RESISTORS ----- Metal film: 11.8K ohms ±1%, 200 VDCW, 1/8 w. |
| R2 | 19A702931P334 | Metal film: 22.1K ohms ±1%, 200 VDCW, 1/8 w. |
| R3 | 19B801251P102 | Metal film: 1K ohms ±5%, 1/10 w. |
| R4 | 19A702931P335 | Metal film: 22.6K ohms ±1%, 200 VDCW, 1/8 w. |
| R5 | 19A702931P358 | Metal film: 39.2K ohms ±1%, 200 VDCW, 1/8 w. |
| R6 | 19B801251P474 | Metal film: 470K ohms ±5%, 1/10 w. |
| R7 | 19B801251P221 | Metal film: 220 ohms ±5%, 1/10 w. |
| R8 | 19B801251P471 | Metal film: 470 ohms ±5%, 1/10 w. |
| R9 | 19A702931P281 | Metal film: 6810 ohms ±1%, 200 VDCW, 1/8 w. |
| R10 | 19B801251P123 | Metal film: 12K ohms ±5%, 1/10 w. |
| R11 | 19A705496P8 | Resistor, variable: 100K ohms. |
| R12 and R13 | 19B801251P473 | Metal film: 47K ohms ±5%, 1/10 w. |
| U1 A201 | 19A702293P3 | ----- INTEGRATED CIRCUITS ----- Linear: Dual Op Amp; sim to LM358D. LOOP FILTER MODULE 19C851974G2 (Group 1, 3) 19C851974G3 (Group 2) |

*COMPONENTS, ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

| SYMBOL | PART NO. | DESCRIPTION |
|------------|---------------|--|
| C1 | 19A702052P114 | ----- CAPACITORS ----- Ceramic: 0.01 μF ±5%, 50 VDCW. (Group 2). |
| C1 | 19A702052P130 | Ceramic: 0.022 μF ±5%, 50 VDCW. (Group 3). |
| C2 and C3 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C4 | 19A702061P29 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C5 | 19A702052P30 | Ceramic: 0.022 μF ±10%, 50 VDCW. |
| D1 | 19A703561P2 | ----- DIODES ----- Silicon, fast recovery (2 diodes in series). |
| Q1 | 19A700076P2 | ----- TRANSISTORS ----- Silicon, NPN: sim to MMBT3904, low profile. |
| R1 | 19B801251P823 | ----- RESISTORS ----- Metal film: 82K ohms ±5%, 1/10 w. |
| R2 | 19B801251P823 | Metal film: 82K ohms ±5%, 1/10 w. (Group 3). |
| R2 | 19B801251P124 | Metal film: 120K ohms ±5%, 1/10 w. (Group 2). |
| R3 | 19B801251P473 | Metal film: 47K ohms ±5%, 1/10 w. (Group 3). |
| R3 | 19B801251P683 | Metal film: 68K ohms ±5%, 1/10 w. (Group 2). |
| R4 | 19B801251P682 | Metal film: 6.8K ohms ±5%, 1/10 w. |
| R5 | 19A702931P358 | Metal film: 39.2K ohms ±1%, 200 VDCW, 1/8 w. (Group 3). |
| R5 | 19A702931P366 | Metal film: 47.5K ohms ±1%, 200 VDCW, 1/8 w. (Group 2). |
| R6 | 19B801251P393 | Metal film: 39K ohms ±5%, 1/10 w. (Group 3). |
| R6 | 19B801251P333 | Metal film: 33K ohms ±5%, 1/10 w. (Group 2). |
| R7 | 19B801251P104 | Metal film: 100K ohms ±5%, 1/10 w. |
| R8 | 19B801251P222 | Metal film: 2.2K ohms ±5%, 1/10 w. |
| R9 and R10 | 19B801251P104 | Metal film: 100K ohms ±5%, 1/10 w. |
| R11 | 19B801251P105 | Metal film: 1M ohms ±5%, 1/10 w. |
| R12 | 19B801251P333 | Metal film: 33K ohms ±5%, 1/10 w. |
| R13 | 19B801251P224 | Metal film: 220K ohms ±5%, 1/10 w. |
| R14 | 19B801251P104 | Metal film: 100K ohms ±5%, 1/10 w. |
| U1 | 19A702293P3 | --- INTEGRATED CIRCUITS --- Linear: Dual Op Amp; sim to LM358D. |
| U2 | 19A702705P4 | Digital: Quad Analog Switch/Multiplexer; sim to 4066BM. |
| A202 | | VOLTAGE CONTROLLED OSCILLATOR 19C851844G1 (GROUP 1) 19C851916G4 (GROUP 2) 19C851844G3 (GROUP 3) |
| U1 | 19A705628P3 | --- INTEGRATED CIRCUITS --- Voltage Controlled Oscillator (403-440 MHz. (Group 1) |

| SYMBOL | PART NO. | DESCRIPTION |
|-------------|--------------|---|
| U1 | 19C851916G4 | Voltage Controlled Oscillator (440-470 MHz). (Group 2). VCO BOARD 19C851916G4 |
| C1 | 19A702236P28 | ----- CAPACITORS ----- Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C2 | 19A149897P43 | Ceramic: 150 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C4 | 19A702236P54 | Ceramic: 150 pF ±5%, 500 VDCW, temp coef 0 ±30 PPM/°C. |
| C5 | 19A702061P77 | Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C6 | 19A702236P54 | Ceramic: 150 pF ±5%, 500 VDCW, temp coef 0 ±30 PPM/°C. |
| C7 | 19A702236P10 | Ceramic: 2.2 pF ±2.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C8 | 19A705205P19 | Tantalum: 2.2 μF, 10 VDCW; sim to Sprague 293D. |
| C9 | 19A702236P18 | Ceramic: 5.6 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM. |
| C10 | 19A702236P34 | Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C11 | 19A702236P10 | Ceramic: 2.2 pF ±2.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C13 and C14 | 19A702061P77 | Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C15 | 19A705205P12 | Tantalum: .33 μF, 16 VDCW; sim to Sprague 293D. |
| C16 | 19A149897P43 | Ceramic: 150 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C17 | 19A702236P54 | Ceramic: 150 pF ±5%, 500 VDCW, temp coef 0 ±30 PPM/°C. |
| C18 | 19A702236P36 | Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C19 | 19A702061P77 | Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C20 | 19A702236P28 | Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C21 | 19A702236P25 | Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C22 | 19A702236P21 | Ceramic: 6.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM. |
| C23 | 19A702236P13 | Ceramic: 3.3 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C24 | 19A702236P17 | Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C25 | 19A702061P77 | Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C26 | 19A702236P10 | Ceramic: 2.2 pF ±2.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C27 | 19A702236P36 | Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C28 | 19A702061P77 | Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |

| SYMBOL | PART NO. | DESCRIPTION |
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| C29 | 19A702236P54 | Ceramic: 150 pF ±5%, 500 VDCW, temp coef 0 ±30 PPM/°C. |
| C30 | 19A702061P77 | Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C31 | 19A149897P43 | Ceramic: 150 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. ----- DIODES ----- |
| D1 | 19A700085P4 | Silicon, capacitive. |
| D2 | 19A700085P2 | Silicon; sim to MMBV109. |
| D3 | 19A700079P4 | Silicon, capacitive; sim to MMBV105G. |
| D4 | 19A702525P2 | Silicon, PIN: sim to MMBV3401. |
| D5 | 19A705377P1 | Silicon, Hot Carrier: sim to MMB0201. |
| D6 | 19A700155P2 | Silicon: 100 mA, 35 PIV; sim to BAT 18. ----- INDUCTORS ----- |
| L1 thru L4 | 19A700021P17 | Coil, fixed: 1 μH ±10%. |
| L5 | 19A705470P4 | Coil, Fixed: 18 nH; sim to Toko 380NB-18nM. |
| L6 | 19B235531P22 | Coil, molded, 2.5 turns: 38 nH. |
| L7 | 19A700021P17 | Coil, fixed: 1 μH ±10%. |
| L8 and L9 | 19A705470P3 | Coil, Fixed: 15 nH; sim to Toko 380NB-15nM. ----- TRANSISTORS ----- |
| Q1 | 19A700059P2 | Silicon, PNP: sim to MMBT3906, low profile. |
| Q2 | 19A702524P2 | N-Type, field effect; sim to MMBFU310. |
| Q3 and Q4 | 19A704708P2 | Silicon, NPN: sim to NEC 2SC3356. |
| Q6 | 19A704708P2 | Silicon, NPN: sim to NEC 2SC3356. ----- RESISTORS ----- |
| R1 | 19A149818P822 | Metal film: 8.2K ohms ±5%, 1/16 w. |
| R4 | 19A149818P332 | Metal film: 3.3K ohms ±5%, 1/16 w. |
| R5 | 19A149818P393 | Metal film: 39K ohms ±5%, 1/16 w. |
| R6 | 19A149818P470 | Metal film: 47 ohms ±5%, 1/16 w. |
| R7 | 19A149818P103 | Metal film: 10K ohms ±5%, 1/16 w. |
| R8 and R9 | 19A149818P332 | Metal film: 3.3K ohms ±5%, 1/16 w. |
| R10 | 19A149818P102 | Metal film: 1K ohms ±5%, 1/16 w. |
| R11 | 19A149818P221 | Metal film: 220 ohms ±5%, 1/16 w. |
| R12 | 19A149818P472 | Metal film: 4.7K ohms ±5%, 1/16 w. |
| R14 | 19A149818P103 | Metal film: 10K ohms ±5%, 1/16 w. |
| R15 | 19A149818P102 | Metal film: 1K ohms ±5%, 1/16 w. ----- CAPACITORS ----- |
| C101 thru C105 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C106 and C107 | 19A705205P2 | Tantalum: 1 μF, 16 VDCW; sim to Sprague 293D. |
| C110 | 19A702236P21 | Ceramic: 6.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM. (Group 1). |

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| SYMBOL | PART NO. | DESCRIPTION |
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| C110 | 19A702236P17 | Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 2). |
| C110 | 19A702236P19 | Ceramic: 5.6 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 3). |
| C111 | 19A705205P2 | Tantalum: 1 µF, 16 VDCW; sim to Sprague 293D. |
| C112 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C113 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 2, 3). |
| C114 | 19A702061P49 | Ceramic: 56 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1, 2). |
| C114 | 19A702061P45 | Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 3). |
| C115 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C116 | 19A702236P23 | Ceramic: 8.2 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM. (Group 1). |
| C116 | 19A702236P21 | Ceramic: 6.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM. (Group 2, 3). |
| C117 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C118 | 19A702236P19 | Ceramic: 5.6 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C119 | 19A702236P19 | Ceramic: 5.6 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 1). |
| C119 | 19A702236P17 | Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 2). |
| C119 | 19A702236P15 | Ceramic: 3.9 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 3). |
| C120 | 19A702236P17 | Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1). |
| C120 | 19A702236P11 | Ceramic: 2.7 pF ±0.25 pF, 50 VDCW, temp coef 0 ±30 PPM. (Group 2, 3). |
| C121 thru C124 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C125 | 19A702052P14 | Ceramic: 0.01 µF ±10%, 50 VDCW. |
| C126 | 19A705205P2 | Tantalum: 1 µF, 16 VDCW; sim to Sprague 293D. |
| C201 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C202 and C203 | 19A702052P5 | Ceramic: 1000 pF ±10%, 50 VDCW. |
| C204 | 19A702061P61 | Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C205 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C207 | 19A702052P14 | Ceramic: 0.01 µF ±10%, 50 VDCW. |
| C208 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C209 | 19A702052P5 | Ceramic: 1000 pF ±10%, 50 VDCW. |
| C210 | 19A702061P61 | Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C211 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C212 | 19A702236P13 | Ceramic: 3.3 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1, 2). |

| SYMBOL | PART NO. | DESCRIPTION |
|----------------|--------------|---|
| C212 | 19A702236P10 | Ceramic: 2.2 pF 2.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 3). |
| C213 | 19A705205P14 | Tantalum: 6.8 µF, 6 VDCW; sim to Sprague 293D. |
| C213 | T644CP347K | Polyester: .047 µF ±10%, 50 VCDW. (Group 2). |
| C214 | T644ACP347K | Polyester: .047 µF ±10%, 50 VDCW. (Group 2). |
| C214 | T644ACP322K | Polyester: .022 µF ±10%, 50 VDCW. (Group 1, 3). |
| C215 | 19A700004P10 | Metallized Polyester: 1.0 µF ±10%, 63 VDCW |
| C216 | 19A702052P14 | Ceramic: 0.01 µF ±10%, 50 VDCW. |
| C218 | 19A702236P17 | Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1, 2). |
| C218 | 19A702236P13 | Ceramic: 3.3 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 3). |
| C219 thru C221 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C222 | 19A702061P61 | Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C223 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C401 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C402 | 19A705205P2 | Tantalum: 1 µF, 16 VDCW; sim to Sprague 293D. |
| C403 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C405 | 19A702236P17 | Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1). |
| C405 | 19A702236P15 | Ceramic: 3.9 pF .25 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 2). |
| C405 | 19A702236P13 | Ceramic: 3.3 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 3). |
| C406 | 19A702236P30 | Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 1). |
| C406 | 19A702236P25 | Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 2). |
| C406 | 19A702236P21 | Ceramic: 6.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM. (Group 3). |
| C407 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C408 | 19A702236P32 | Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1). |
| C408 | 19A702236P30 | Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 2). |
| C408 | 19A702236P25 | Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 3). |
| C409 | 19A702236P25 | Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 1). |
| C409 | 19A702236P21 | Ceramic: 6.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM. (Group 2). |
| C409 | 19A702236P23 | Ceramic: 8.2 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM. (Group 3). |
| C410 | 19A702236P9 | Ceramic: 1.8 pF ±0.25 pF, 50 VDCW, temp coef 0 ±30 PPM. (Group 1). |
| C410 | 19A702236P8 | Ceramic: 1.5 pF ±.25 pF, 50 VDCW. (Group 2). |

| SYMBOL | PART NO. | DESCRIPTION |
|----------------|--------------|---|
| C410 | 19A702236P7 | Ceramic: 1.2 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM. (Group 3). |
| C411 | 19A702236P30 | Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 1). |
| C411 | 19A702236P25 | Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 2, 3). |
| C412 | 19A702236P34 | Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1, 2). |
| C412 | 19A702236P30 | Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 3). |
| C450 | 19A704879P5 | Electrolytic: 10 µF 20%, 16 VDCW. |
| C451 thru C453 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C454 | 19A702236P42 | Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1). |
| C454 | 19A702236P46 | Ceramic: 68 pF ±5%, 50 VDCW, temp coef 0 PPM ±30 PPM. (Group 2). |
| C454 | 19A702236P44 | Ceramic: 56 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 3). |
| C455 | 19A702236P30 | Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 1). |
| C455 | 19A702236P25 | Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 2). |
| C455 | 19A702236P23 | Ceramic: 8.2 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM. (Group 3). |
| C456 | 19A702236P9 | Ceramic: 1.8 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM. (Group 1). |
| C456 | 19A702236P8 | Ceramic: 1.5 pF ±.25 pF, 50 VDCW. (Group 2). |
| C456 | 19A702236P10 | Ceramic: 2.2 pF ±2.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 3). |
| C457 | 19A702061P21 | Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 1, 3). |
| C457 | 19A702236P28 | Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 2). |
| C458 | 19A702236P38 | Ceramic: 33 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Group 1). |
| C458 | 19A702236P34 | Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 2). |
| C458 | 19A702236P28 | Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. (Group 3). |
| C501 | 19A702061P41 | Ceramic: 39 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C502 and C503 | 19A702052P14 | Ceramic: 0.01 µF ±10%, 50 VDCW. |
| C504 | 19A702061P41 | Ceramic: 39 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |
| C505 | 19A702061P12 | Ceramic: 8.2 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM. |
| C506 | 19A702061P9 | Ceramic: 4.7 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM. |
| C507 and C508 | 19A702052P14 | Ceramic: 0.01 µF ±10%, 50 VDCW. |
| C509 | 19A702061P33 | Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C510 and C511 | 19A702061P29 | Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM. |

| SYMBOL | PART NO. | DESCRIPTION |
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| C512 thru C514 | 19A702052P26 | Ceramic: 0.1µF ±10%, 50 VDCW |
| C515 | 19A705205P14 | Tantalum: 6.8 µF, 6 VDCW; sim to Sprague 293D. |
| C516 | 19A702052P14 | Ceramic: 0.01 µF ±10%, 50 VDCW. |
| C517 | 19A702052P10 | Ceramic: 4700 pF ±10%, 50 VDCW. |
| C518 | 19A702061P25 | Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C801 | 19A702052P14 | Ceramic: 0.01 µF ±10%, 50 VDCW. |
| C802 | 19A702061P73 | Ceramic: 330 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. |
| C803 | 19A702052P14 | Ceramic: 0.01 µF ±10%, 50 VDCW. |
| C804 | 19A705205P14 | Tantalum: 6.8 µF, 6 VDCW; sim to Sprague 293D. |
| C805 thru C807 | 19A702061P69 | Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 30 PPM/°C. |
| C808 | 19A705205P19 | Tantalum: 2.2 µF, 10 VDCW; sim to Spargue 293D. |
| | | ----- DIODES ----- |
| D101 and D102 | 19A700155P2 | Silicon: 100 mA, 35 PIV; sim to BAT 18. |
| D401 | 19A700155P2 | Silicon: 100 mA, 35 PIV; sim to BAT 18. |
| D801 | 19A116585P1 | Silicon, fast recovery, 600 mA, 50 PIV. |
| | | ----- JACKS ----- |
| J101 | 19B801491P2 | Antenna clip. |
| J501 | 19B801566P12 | Shield. |
| | | ----- INDUCTORS ----- |
| L101 and L102 | 19A700024P7 | Coil, RF: 330 nH ±10%. |
| L103 | 19A700024P1 | Coil, RF: 100 nH ±10%, 0.08 ohms DC res max, 100 v. |
| L105 | 19A700024P7 | Coil, RF: 330 nH ±10%. |
| L106 | 19B800890P5 | Coil, RF: sim to Paul Smith SK-891-1. (Group 1). |
| L106 | 19B800890P4 | Coil, RF: sim to Paul Smith SK-891-1. (Group 2). |
| L106 | 19B800890P2 | Coil, RF: sim to Paul Smith SK-891-1. (Group 3). |
| L107 | 19A705470P17 | Coil, Fixed: 0.22 µH; sim to Toko 380NB-R22M. |
| L401 | 19B801493P21 | Coil, RF, Shielded: 12 nH; sim to TOKO NE545BNAS-100081. |
| L402 | 19B801493P3 | Coil, RF, shielded: 35 nH; sim to TOKO NE545GNAS-100127. |
| L403 and L404 | 19B801493P21 | Coil, RF, Shielded: 12 nH; sim to TOKO NE545BNAS-100081. |
| L450 | 19B801493P3 | Coil, RF, shielded: 35 nH; sim to TOKO NE545GNAS-100127. |
| L451 | 19B801493P21 | Coil, RF, Shielded: 12 nH; sim to TOKO NE545BNAS-100081. (Group 1, 3). |
| L451 | 19B801493P1 | Coil, RF: 13 nH; sim to TOKO NE545GNAS-100125. (Group 2). |

| SYMBOL | PART NO. | DESCRIPTION |
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| L452 | 19B801493P21 | Coil, RF, Shielded: 12 nH; sim to TOKO NE545BNAS-100081. (Group 1, 3). |
| L452 | 19B801493P1 | Coil, RF: 13 nH; sim to TOKO NE545GNAS-100125. (Group 2). |
| L501 | 19A700024P7 | Coil, RF: 330 nH ±10%. |
| L502 | 19B801413P4 | Coil, 39 MHz. |
| L503 | 19A700024P18 | Coil, RF: 2.7 μH ±10%. |
| L504 | 19A705753P17 | Coil, Toroidal: 2.2 μH ±5%; sim to Standex MT2122-17. |
| L505 | 19B801413P4 | Coil, 39 MHz. |
| L506 | 19A703591P1 | IF: sim to Toko America P5SVLC-A291EL. |
| | | ----- PLUGS ----- |
| P801 | 19C851673P2 | Connector, 12 position. |
| | | ----- TRANSISTORS ----- |
| Q101 and Q102 | 19A704708P2 | Silicon, NPN: sim to NEC 2SC3356. |
| Q103 | 19A700076P2 | Silicon, NPN: sim to MMBT3904, low profile. |
| Q104 | 19A700059P2 | Silicon, PNP: sim to MMBT3906, low profile. |
| Q105 | 19A700076P2 | Silicon, NPN: sim to MMBT3904, low profile. |
| Q106 and Q107 | 19A704972P1 | Silicon, PNP: sim to Motorola 2N4918. |
| Q201 | 19A704708P2 | Silicon, NPN: sim to NEC 2SC3356. |
| Q401 | 19A704708P2 | Silicon, NPN: sim to NEC 2SC3356. |
| Q450 | 19A704708P2 | Silicon, NPN: sim to NEC 2SC3356. |
| Q501 | 19A702524P3 | N-Type, field effect; sim to MMBFJ310. |
| Q502 | 19A704708P2 | Silicon, NPN: sim to NEC 2SC3356. |
| Q801 | 19A700026P2 | Silicon, PNP: sim to BC369. |
| Q802 and Q803 | 19A700076P2 | Silicon, NPN: sim to MMBT3904, low profile. |
| Q804 | 19A700059P2 | Silicon, PNP: sim to MMBT3906, low profile. |
| | | ----- RESISTORS ----- |
| R101 | 19B801251P390 | Metal film: 39 ohms ±5%, 1/10 w. |
| R102 | 19B801251P152 | Metal film: 1.5K ohms ±5%, 1/10 w. |
| R103 | 19B801251P182 | Metal film: 1.8K ohms ±5%, 1/10 w. |
| R104 | 19B801251P332 | Metal film: 3.3K ohms ±5%, 1/10 w. |
| R105 | 19B801251P101 | Metal film: 100 ohms ±5%, 1/10 w. |
| R106 | 19B801251P2R2 | Metal film: 2.2 ohms ±5%, 1/10 w. |
| R107 | 19B801251P151 | Metal film: 150 ohms ±5%, 1/10 w. |
| R110 and R111 | 19B801251P271 | Metal film: 270 ohms ±5%, 1/10 w. |
| R112 | 19B801251P473 | Metal film: 47K ohms ±5%, 1/10 w. |
| R113 | 19B801251P223 | Metal film: 22K ohms ±5%, 1/10 w. |
| R114 | 19B801251P183 | Metal film: 18K ohms ±5%, 1/10 w. |
| R115 | 19B801251P473 | Metal film: 47K ohms ±5%, 1/10 w. |
| R116 and R117 | 19B801251P104 | Metal film: 100K ohms ±5%, 1/10 w. |
| R118 and R119 | 19B801251P102 | Metal film: 1K ohms ±5%, 1/10 w. |

| SYMBOL | PART NO. | DESCRIPTION |
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| R120 | 19B801251P471 | Metal film: 470 ohms ±5%, 1/10 w. |
| R121 | 19B801251P221 | Metal film: 220 ohms ±5%, 1/10 w. |
| R122 | 19B800779P7 | Variable: 3.3K ohms ±25%, 100 VDCW, .3 w. |
| R123 | 19B801251P184 | Metal film: 180K ohms ±5%, 1/10 w. |
| R201 | 19B801251P104 | Metal film: 100K ohms ±5%, 1/10 w. |
| R202 | 19A702931P401 | Metal film: 100K ohms ±1%, 200 VDCW, 1/8 w. |
| R203 | 19A702931P189 | Metal film: 825 ohms ±1%, 200 VDCW, 1/8 w. |
| R204 | 19B801251P272 | Metal film: 2.7K ohms ±5%, 1/10 w. |
| R205 | 19B801251P100 | Metal film: 10 ohms ±5%, 1/10 w. |
| R206 | 19B801251P331 | Metal film: 330 ohms ±5%, 1/10 w. |
| R207 and R208 | 19B801251P103 | Metal film: 10K ohms ±5%, 1/10 w. |
| R209 | 19B801251P102 | Metal film: 1K ohms ±5%, 1/10 w. |
| R210 | 19B801251P470 | Metal film: 47 ohms ±5%, 1/10 w. |
| R211 | 19B801251P103 | Metal film: 10K ohms ±5%, 1/10 w. |
| R212 | 19B801251P470 | Metal film: 47 ohms ±5%, 1/10 w. |
| R213 | 19B801251P1 | Metal film: 0 ohms ±5%, 1/10 w. |
| R214 | 19B801251P560 | Metal film: 56 ohms ±5%, 1/10 w. |
| R401 | 19B801251P560 | Metal film: 56 ohms ±5%, 1/10 w. |
| R402 | 19B801251P123 | Metal film: 12K ohms ±5%, 1/10 w. |
| R403 | 19B801251P103 | Metal film: 10K ohms ±5%, 1/10 w. |
| R404 | 19B801251P102 | Metal film: 1K ohms ±5%, 1/10 w. |
| R451 | 19B801251P221 | Metal film: 220 ohms ±5%, 1/10 w. |
| R452 | 19B801251P123 | Metal film: 12K ohms ±5%, 1/10 w. |
| R453 | 19B801251P102 | Metal film: 1K ohms ±5%, 1/10 w. |
| R454 | 19B801251P272 | Metal film: 2.7K ohms ±5%, 1/10 w. |
| R455 | 19B801251P680 | Metal film: 68 ohms ±5%, 1/10 w. |
| R501 | 19B801251P151 | Metal film: 150 ohms ±5%, 1/10 w. |
| R502 | 19B801251P102 | Metal film: 1K ohms ±5%, 1/10 w. |
| R504 | 19B801251P273 | Metal film: 27K ohms ±5%, 1/10 w. |
| R505 | 19B801251P103 | Metal film: 10K ohms ±5%, 1/10 w. |
| R506 | 19B801251P822 | Metal film: 8.2K ohms ±5%, 1/10 w. |
| R507 | 19B801251P151 | Metal film: 150 ohms ±5%, 1/10 w. |
| R508 | 19B801251P821 | Metal film: 820 ohms ±5%, 1/10 w. |
| R509 | 19B801251P154 | Metal film: 150K ohms ±5%, 1/10 w. |
| R510 | 19B801251P104 | Metal film: 100K ohms ±5%, 1/10 w. |
| R511 | 19B801251P103 | Metal film: 10K ohms ±5%, 1/10 w. |
| R512 | 19B801251P270 | Metal film: 27 ohms ±5%, 1/10 w. |
| R513 | 19B801251P332 | Metal film: 3.3K ohms ±5%, 1/10 w. |
| R801 and R802 | 19B801251P392 | Metal film: 3.9K ohms ±5%, 1/10 w. |
| R803 and R804 | 19B801251P102 | Metal film: 1K ohms ±5%, 1/10 w. |
| R805 | 19A702931P334 | Metal film: 22.1K ohms ±1%, 200 VDCW, 1/8 w. |
| R806 | 19A702931P328 | Metal film: 19.1K ohms ±1%, 200 VDCW, 1/8 w. |
| R807 | 19B801251P123 | Metal film: 12K ohms ±5%, 1/10 w. |
| R808 | 19B801251P393 | Metal film: 39K ohms ±5%, 1/10 w. |

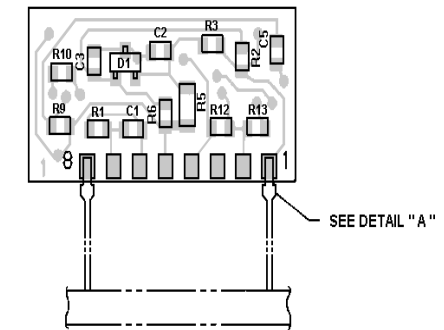
| SYMBOL | PART NO. | DESCRIPTION |
|----------------|---------------|--|
| R809 | 19B801251P182 | Metal film: 1.8K ohms ±5%, 1/10 w. |
| R810 and R811 | 19B801251P473 | Metal film: 47K ohms ±5%, 1/10 w. |
| R812 | 19B801251P104 | Metal film: 100K ohms ±5%, 1/10 w. |
| | | ----- INTEGRATED CIRCUITS ----- |
| U101 | 19A705419P1 | Module: UHF RF Power Amplifier; sim to MHW-707-1. |
| U101 | 19A705419P2 | Module: UHF RF Power Amplifier; sim to MHW-707-2. |
| U101 | 19A705419P3 | Module: UHF RF Power Amplifier; sim to MHW-707-3. |
| U201 | 19B800902P1 | Synthesizer: CMOS, Serial Programming; sim to MC145159P. |
| U202 | 19A704287P2 | Prescaler: /128, /129; sim to MC12018. |
| U203 | 19B801351P8 | Crystal Oscillator, temp comp, 12.8 MHz ±5 PPM. |
| U501 | 19A704619P1 | Linear: Osc/Mixer/IF/Det/Amp; sim to MC3361AP. |
| U801 | 19A702939P2 | Linear: Adjustable Shunt Regulator; sim to TL431CLP. |
| | | ----- CABLES ----- |
| W101 thru W103 | | Part of printed wire board. |
| W201 and W202 | | Part of printed wire board. |
| | | ----- CRYSTALS ----- |
| Y501 | 19A705376P5 | Crystal, Fixed Frequency: 45.455 MHz 10 PPM. |
| | | ----- FILTER ----- |
| Z401 | 19A705458P4 | Helical, UHF: 403-425 MHz. (Group 1). |
| Z401 | 19A705458P1 | Helical, UHF: 450-470 MHz. (Group 2). |
| Z401 | 19A705458P2 | Helical, UHF: 470-492 MHz. (Group 3). |
| Z402 | 19A705423P1 | Mixer: Double (balanced); sim to Tele-Tech MT45 |
| Z501 | 19A705613G6 | Monolithic Crystal Pair: 45.000 MHz. |
| Z503 | 19A702171P3 | Bandpass: 455 kHz; sim to Murata CFU55E2. |
| | | ----- MISCELLANEOUS ----- |
| 3 | 19B801566P3 | Shield. |
| 2 | 19D902174G2 | Cover. |
| 3 | 19A702364P304 | Machine screw, TORX drive, Pan Head. |
| 6 | 19B801572G1 | RF Shield. |
| 7 | 19A705732P329 | Machine Screw, Oval Head, TORX drive. |
| 8 | 19A705732P333 | Machine Screw, Oval Head, TORX drive. |
| 9 | 19B801492P2 | Clip, antenna. |
| 10 | 19A705883P5 | Crystal cushion. |
| 11 | 19B801657P1 | Insulator plate. |
| 12 | 19B801655P1 | Shield. |
| 14 | 19A703346P2 | Pad. |
| 15 | 19B801671P1 | Connector. |

| PRODUCTION CHANGES | |
|--|---|
| Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for the descriptions of parts affected by these revisions. | |
| REV. A - RF BOARD 19D438262G1_G2 | To improve TX LPB matching, boost PA drive and to correct error in PA module for low split. 19D438262G1: Changed capacitor C119; was: 4.7 pF 19A702236P17. Changed resistor R101; was: 100 ohms 19B801251P101. Corrected U101 part number; was 19A705419P2. 19D438262G2: Changed capacitor C110; was: 3.3 pF 19A702236P13. Changed capacitor C116; was: 5.6 pF 19A702236P19. Changed capacitor C119; was: 3.9 pF 19A702236P15. Changed resistor R101; was: 100 ohms 19B801251P101. |
| REV. B - RF BOARD 19D438262G1 | To improve the sensitivity on the 403-440 MHz radio split by boosting the L.O. Drive. Changed capacitor C457; was: 56 ohms 19B801251P560. Changed RF Coil L451 and L452; were: 13.1 to 14.5 nH (19B801493P1). |
| REV. C - RF BOARD 19D438262G1 | To improve the PA module operation. |
| REV. B - RF BOARD 19D438262G2 | Changed resistor R101; was: 56 ohms 19B801251P60. Changed resistor R102; was: 2.2K ohms 19B801251P222. Changed resistor R105; was 82 ohms 19B801251P820. Changed resistor R106; was: 18 ohms 19B801251P180. |
| REV. A - VCO MODULE 19C851844G1_G2 | Deleted R1; was: 56 ohms 19B801251P560. Changed R1; was: 100 ohms 19B801251P101. |
| REV. D - RF BOARD 19D438262G1 | |
| REV. C - RF BOARD 19D438262G2 | |
| REV. A - RF BOARD 19D438262G3 | To improve selectivity and to allow scan operation. Deleted capacitor C206; was: 220 pF 19A702061P69, Replaced A201; was: Filter Module 19C851646G4. |
| REV. E - RF BOARD 19D438262G1 | |
| REV. D - RF BOARD 19D438262G2 | |
| REV. B - RF BOARD 19D438262G3 | To improve operation. Added C126, C221, and C518. Changed C506 and C518. C506 was: 19A702236P3 |
| REV. F - RF BOARD 19D438262G1 | |
| REV. E - RF BOARD 19D438262G2 | |
| REV. C - RF BOARD 19D438262G3 | To improve operation change L504. L504 was: 19A705753P19. Coil RF 3.3 μH. |
| REV. F - RF BOARD 19D438262G2 | To improve modulation and selectivity. Changed A201, R213, C214. A201 from 19C851974G2 to 19C851974G3. R213 from 19B801251P103(10K) to 19B801251P1(0). C214 from T644ACP322K(0.22μ) to T644ACP347K(.047μ). |
| REV. G - RF BOARD 19D438262G2 | To improve operation. Changed A202 from 19C851844G2 to 19C851916G4. |
| REV. G - RF BOARD 19D438262G1 | To improve maximum transmitter output power. C110 changed from 3.9 pF (19A702236P15) to 6.8 pF (19A702236P21). |
| REV. H - RF BOARD 19D438262G1 | To improve maximum transmttter output power. Changed C113 from 19A702061P38(33 pF) to 19A702236P69(220 pF). |
| REV. H - RF BOARD 19D438262G2 | To prevent synthesizer from intermittently going out of lock. Added C222 and C223. Replaced A202 with Revision A module. |

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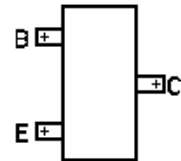
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LOOP FILTER BOARD A201
19C851974



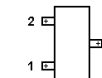
(19C851974, Sh. 1, Rev. 1)
(19C851975, Solder Side, Rev. 1)

LEAD IDENTIFICATION FOR
Q1, Q2, & Q3
(TOP VIEW)



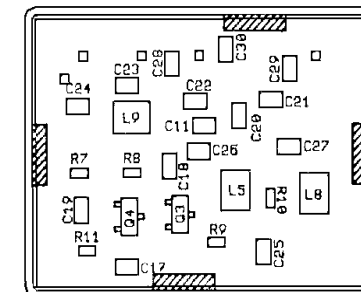
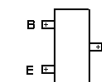
LEAD IDENTIFICATION FOR
D1

(TOP VIEW)



LEAD IDENTIFICATION FOR
Q1

(TOP VIEW)



(19B851844, Rev. 3)

VOLTAGE CONTROLLED OSCILLATOR BOARD A202
19C851844G1 (403-440 MHz)
19C851844G3 (470-512 MHz)

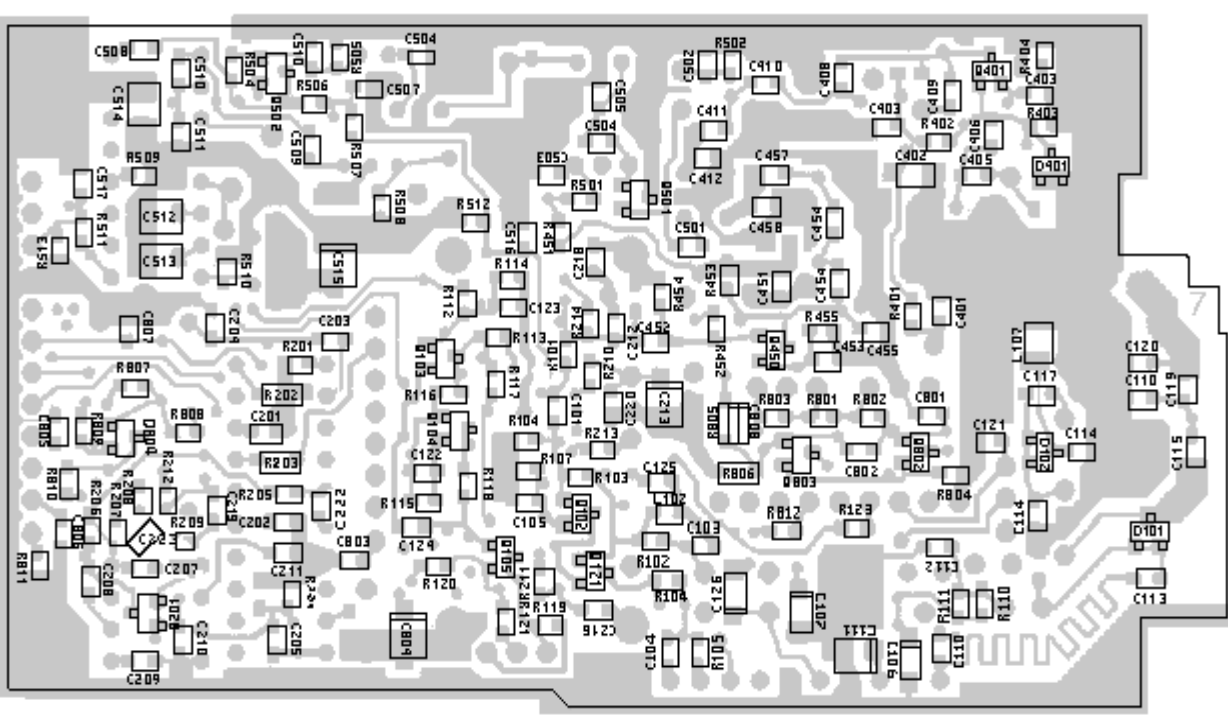
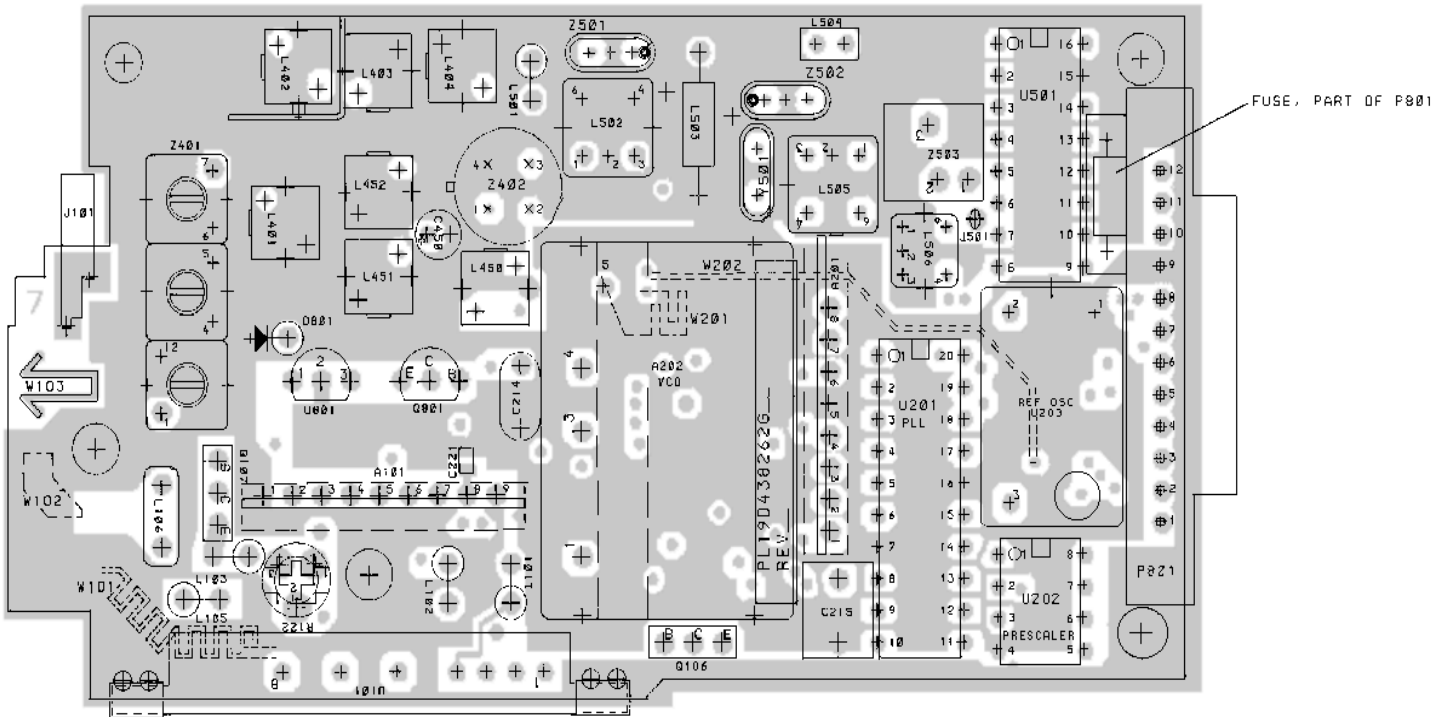
UHF VFO BOARD
19C851916G4

(19C851916, Rev. 3)



COMPONENT SIDE

SOLDER SIDE

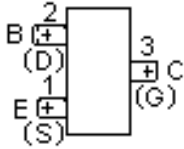


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(19D438262, Sh. 1, Rev. 4)
(19D438261, Sh. 1, Rev. 7)

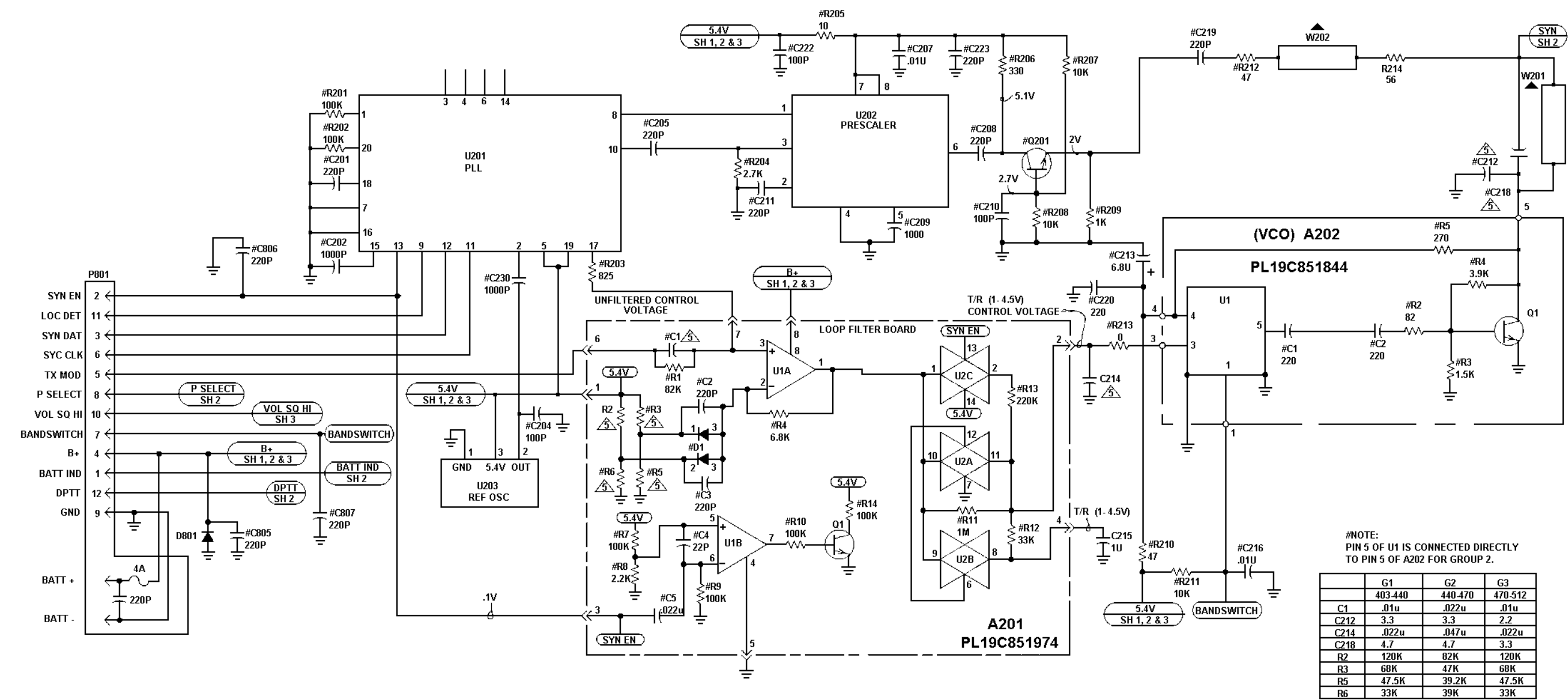
(19D438262, Sh. 2, Rev. 6)
(19D438261, Sh. 4, Rev. 7)

LEAD IDENTIFICATION FOR
(SOT) TRANSISTORS



CAUTION
OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

RF BOARD
19D438262G1-G3



#NOTE:
PIN 5 OF U1 IS CONNECTED DIRECTLY
TO PIN 5 OF A202 FOR GROUP 2.

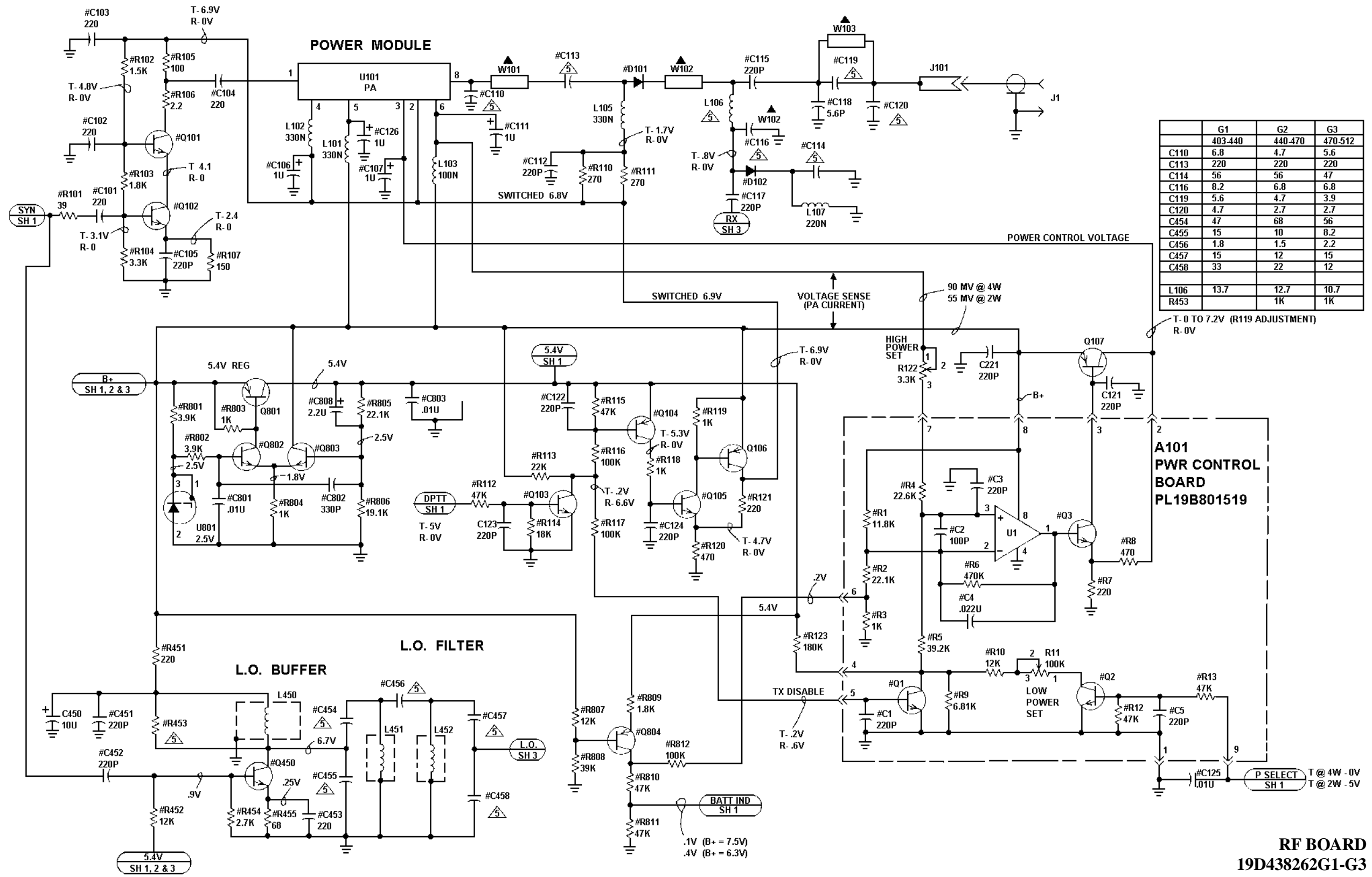
| | G1 | G2 | G3 |
|------|---------|---------|---------|
| | 403-440 | 440-470 | 470-512 |
| C1 | .01u | .022u | .01u |
| C212 | 3.3 | 3.3 | 2.2 |
| C214 | .022u | .047u | .022u |
| C218 | 4.7 | 4.7 | 3.3 |
| R2 | 120K | 82K | 120K |
| R3 | 68K | 47K | 68K |
| R5 | 47.5K | 39.2K | 47.5K |
| R6 | 33K | 39K | 33K |

| MODEL NO. | REV. LETTER | FREQ. |
|---------------|-------------|-----------|
| PL19D438262G1 | H | 403 - 440 |
| PL19D438262G2 | H | 440 - 470 |
| PL19D438262G3 | C | 470 - 512 |
| PL19C851844G1 | A | 403 - 440 |
| PL19C851844G2 | A | 440 - 470 |
| PL19C851844G3 | | 470 - 512 |

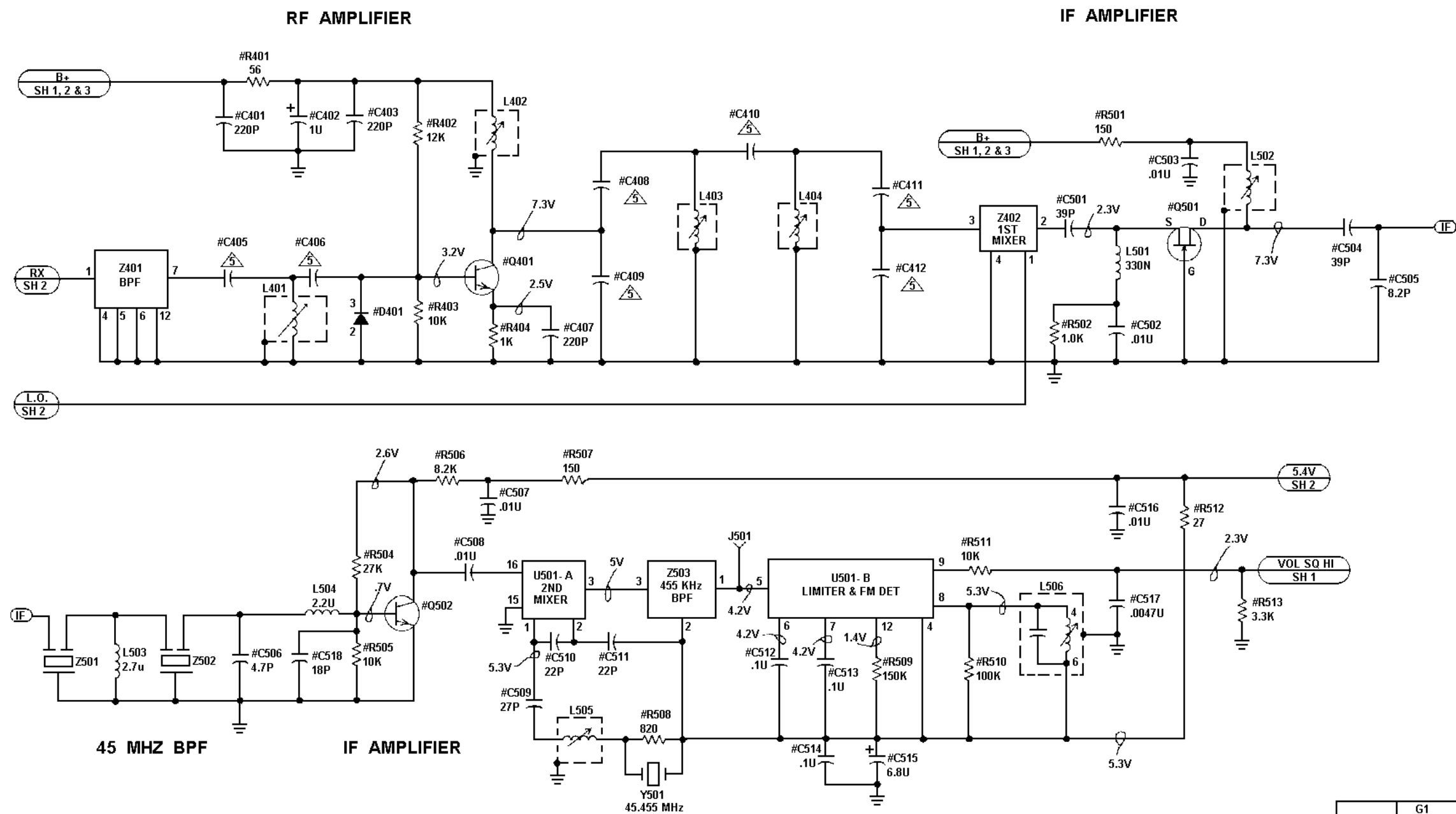
- NOTES:
- ALL RSISTORS ARE .1 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY A MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER U, N OR P.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER M OR U.
 - # INDICATES CHIP COMPONENTS.
 - ▲ PART OF PWB.
 - ALL D.C. VOLTAGES TAKEN AT B+ = 7.5V.
 - SEE GROUP VALUE CHART. (SH. 1 THRU SH. 3).

RF BOARD
19D438262G1-G3

(19D438273, Sh. 1, Rev. 12)



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| | G1 | G2 | G3 |
|------|---------|---------|---------|
| | 403-440 | 440-470 | 470-512 |
| C405 | 4.7 | 3.9 | 3.3 |
| C406 | 15 | 10 | 6.8 |
| C408 | 18 | 15 | 10 |
| C409 | 10 | 6.8 | 8.2 |
| C410 | 1.8 | 1.5 | 1.2 |
| C411 | 15 | 10 | 10 |
| C412 | 22 | 22 | 15 |

RF BOARD
19D438262G1-G3

(19D438273, Sh. 3, Rev. 12)

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