MAINTENANCE MANUAL
RF BOARD
188D5062G2 (403-440 MHz)
188D5062G1 (440-470 MHz)
188D5062G3 (470-512 MHz)

TABLE OF CONTENTS

DESCRIPTION

The RF Board for the MDX radio consists of the following circuits:

- A frequency synthesizer for generating the transmit carrier frequency and the receive circuit first mixer injection frequency
- The transmit exciter, PA and power control stages
- The receive circuit front end, IF and FM detector
- Voltage regulators

The 403-512 MHz range of UHF frequencies is covered by three groups of RF Boards:

1. 188D5062G2: 403-440 MHz
2. 188D5062G1: 440-470 MHz
3. 188D5062G3: 470-512 MHz

The RF Board is mounted in the bottom of the frame assembly. Refer to the Combination Manual for the mechanical layout of the radio. Figure 1 provides a block diagram of the receive and transmit circuits. Figure 2 provides a block diagram of the synthesizer.

Transmit circuit adjustments for frequency, power and deviation are accessible form the topside of the board, as are IF alignment, second oscillator and audio level adjustments for the receive circuit. Chip components on the bottom of the board provide optimum RF performance, while being accessible for easy servicing by removing the "friction fit" bottom shields.

Selected use of sealed modules permits small board size as well as RF and mechanical protection for sensitive circuitry. Modules are not repairable and must be replaced if they are determined to be damaged.

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CIRCUIT ANALYSIS

SYNTHESIZER CIRCUIT

The synthesizer circuit generates all transmit and receive RF frequencies for the MDX Conventional mobile radio. This circuit uses a phase-locked VCO module (U201), feeding a doubler circuit to generate the transmit RF operating frequency.

While transmitting, the VCO operates at 1/2 the actual transmitter frequency (201.5-256.0 MHz to produce 403-512 MHz).

While receiving, the VCO operates at 1/2 the of the difference between the receive frequency and the 45 MHz IF (1179.0-2233.5 MHz for 403-512 MHz).

Transistor Q201 doubles the VCO output frequency with input and output filters broadly fixed tuned to allow the VCO second harmonic to pass, while rejecting all other frequencies. The doubled signal is amplified by Q201 to a level of +10 dBm. This signal feeds the receive circuit first mixer and is attenuated to +3 dBm by resistor R202 to feed the transmit exciter module.

The synthesizer frequency is controlled by a microprocessor located on the Audio/Logic Board. Frequency stability is maintained by a **T**emperature **C**ompensated (**X**)crystal **O**scillator (**TCXO**) module. The oscillator has a stability of ±2.5 PPM (0.00025%) over the temperature range of -30°C to +60°C and determines the overall frequency stability of the radio.

The VCO output is also buffered by transistor Q204 to feed the divide by 128/129 dual modulus prescaler U205. The prescaler feeds the FIN input of Phase-Lock-Loop (PLL) U206. Inside of U206, the prescaled signal is further divided down to 6.25 kHz or 5 kHz to be compared with a reference signal. This reference signal is derived from the 12.8 MHz of TCXO module U204. PLL U206 divides the 12.8 MHz TCXO frequency down to the 6.25 kHz or 5 kHz reference frequency.

Divider circuits in U206 are programmed by three inputs from the Audio/Logic Board, which are buffered and inverted by transistors Q208, Q209 and Q210. The S ENABLE pulse (5 milliseconds) activates switch U202 to more rapid channel acquisition during channel changes.

A **LOCK DET** signal from the PLL goes to the microprocessor for processing to prevent transmission when the VCO is not on frequency and to provide an error message to the user. During receive, an unlocked synthesizer is indicated by **SYN LOCK** displayed in the LED display and by a quick, pulsed alert tone. The microprocessor will continually try to reload the frequency information into the PLL until the synthesizer locks. During transmit, only a slower pulsed alert tone will be heard. Once unlocked in transmit, the synthesizer will not be reloaded. The transmitter PTT switch must be unkeyed and then keyed again to attempt to relock.

Audio modulation from the Audio/Logic Board is applied to the VCO module through **DEVIATION ADJUST** potentiometer R226. **VCO TUNE** potentiometer R218 adjusts the operating frequency range of the VCO by varying a negative bias from diodes D202 and D203.

Low frequency modulation is applied to TCXO U204 through **LOW FREQUENCY ADJUST** potentiometer R255.

TRANSMIT CIRCUIT

The transmit circuit consists of a fixed-tuned exciter module, a 10 watt PA module, a PIN diode switch, a low pass filter, a directional coupler, a power control circuit and a transmit voltage switch.

Exciter Module

Figure 1 shows the synthesizer driving the receive mixer at +10 dBm and is attenuated by resistor R202 to +3 dBm for driving the exciter input. Exciter module A102 operates from a switched 8 volt supply. A different exciter module is required for each of the three band splits. No tuning is required . Both input and output ports operate at 50 ohms impedance. The exciter module provides typically 20 dB of gain and 200 mW of output power to drive the power amplifier module.

Power Amplifier Module

The PA module U101 requires a drive of 200 mW from the exciter module to deliver up to 10 watts of power output. The module is mounted to the rear heat sink. The PA module output drive the 40 watt PA Board through connector J103. The power control circuit controls the PA module output power.

PIN Diode Switch, Low Pass Filter and Directional Coupler

The output from the 40 watt PA Board feeds transmit PIN diode switch D104 through J102. In transmit, switched 8 volts is applied through inductor L102, turning on PIN diodes D104 and D401. The DC path is completed through resistors R401 and R420 with the bias current set at about 40 mA. Diode D104 couples the PA Board power from J102 to low pass filter A101. Diode D401 provides an RF path to ground to protect the receiver input.

The lowpass filter reduces the harmonic output from the transmit circuit. The low pass filter feeds the directional coupler, W101 and W102. The directional coupler provides a sample of transmit power for the power control circuit. The coupler output feeds antenna jack J101.

Power Control Circuit

The Power control circuit samples the output power to the antenna to maintain a constant power level across the band. Also, a thermistor senses the heat sink temperature to reduce the power output level above 70°C. The circuit controls the supply voltage to one of the amplifier stages in PA module U101.

Directional coupler W101 and W102 provides a sample of transmit power to diode D101. Diode D101, resistor R106 and capacitor C104 produce a positive DC voltage proportional to the transmit output power level. This DC level feeds the (-) input of amplifier U103-B. Power Set potentiometer R111 and temperature sensor U105 along with buffer U104 determine the DC level to the (+) input of U103-B. Amplifier U103-B amplifiers the difference between the (-) and (+) inputs, forcing the output power level to equal the power set level by varying the drive to transistors Q102, then Q101. Transistor Q101 supplies the control voltage to PA module U101. For example, if the output power level begins to drop below the power set level, the output of U103-B increases positively, causing Q102 to conduct less. The base of Q101 rises, increasing the control voltage to the PA module, which increases the output power level back to the desired set level.

Transistor Q104, capacitor C123 and resistor R105 improve the transient stability of the power control loop when the transmit circuit is keyed.

Transmit Switch

During transmit, the Audio /Logic Board microprocessor pulls the DPTT line low causing the output of amplifier U103-A to go low. Transistor Q103 turns on to supply SW 8V to the exciter module, the power control circuit and the PIN diode switch. During receive, the output of U103-A supplies 12 volts to receive circuit RF pre-amplifier transistor Q401.

RECEIVE CIRCUIT

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

Front End Section

RF is coupled from antenna jack J101 through the directional coupler and the low pass filter to PIN diode D401. In transmit, **SW 8V** is applied through inductor L102, turning on PIN diodes D104 and D401, with the DC path completed through resistors R401 and R402. Diode D401 provides an RF path to ground for the receive input while in transmit. In receive, D401 is off, allowing RF to pass by D401 unattenuated.

Receive front end filtering is provided by RF filters Z401 and Z402. Both filters are fixed tuned, 3-pole, helical filters with 20 MHz bandwidths. These filters do not require tuning unless a different 20 MHz segment of the band split is required. RF amplifier transistor Q401 is a common emitter circuit with 15 dB of gain. Inductor L402 and capacitors C405 and C406 provide a broad band match from Z401 to the transistor input. Diode D402 protects the amplifier from high input signal levels. Inductor s L403 and L404 plus the associated capacitors provide a broad band impedance match from the amplifier output to RF filter Z402.

Test **P**oint **TP**401 is a 50-ohm point for measuring front end gain or to align the receive circuit to another segment of the band split. The front end gain from antenna jack J101 to TP401 is typical 10 dB.

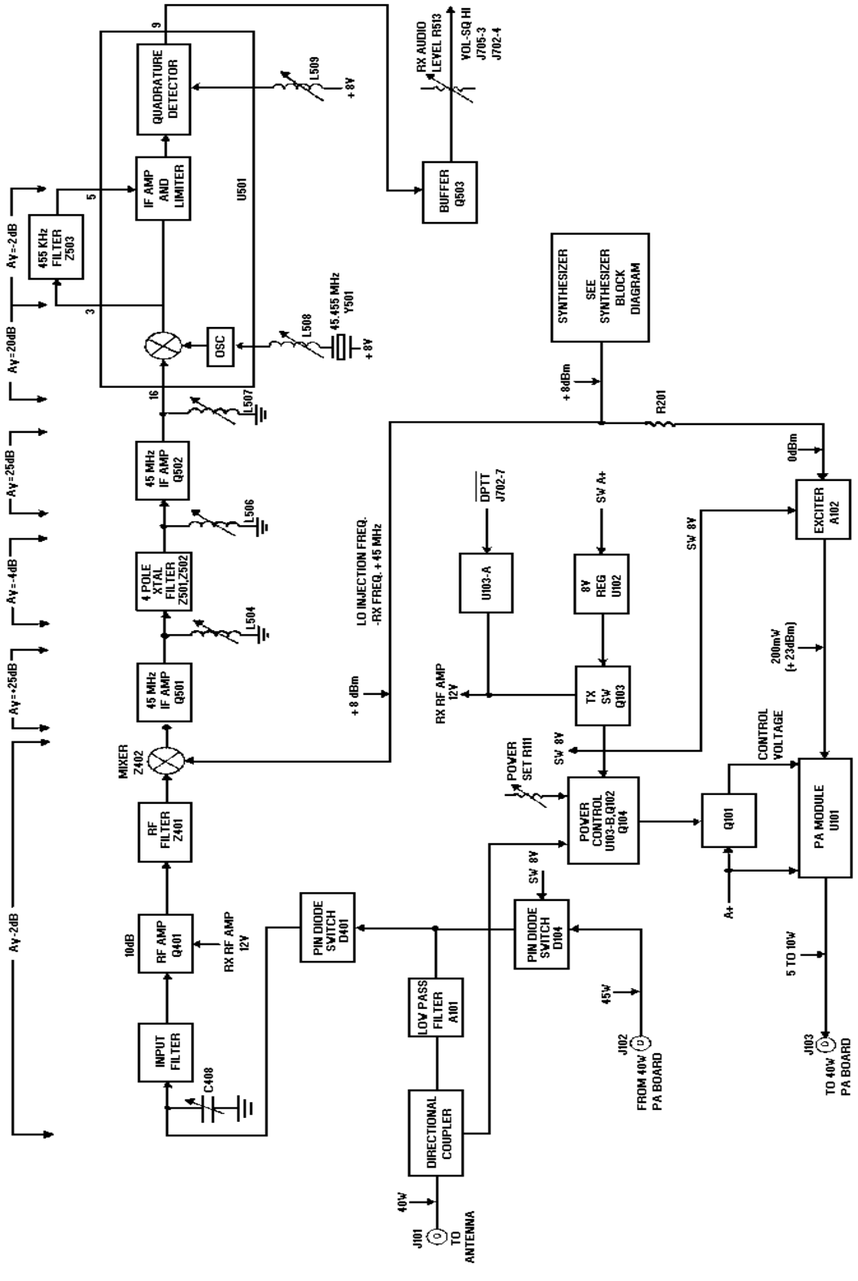


Figure 1 - TX And RX Block Diagram

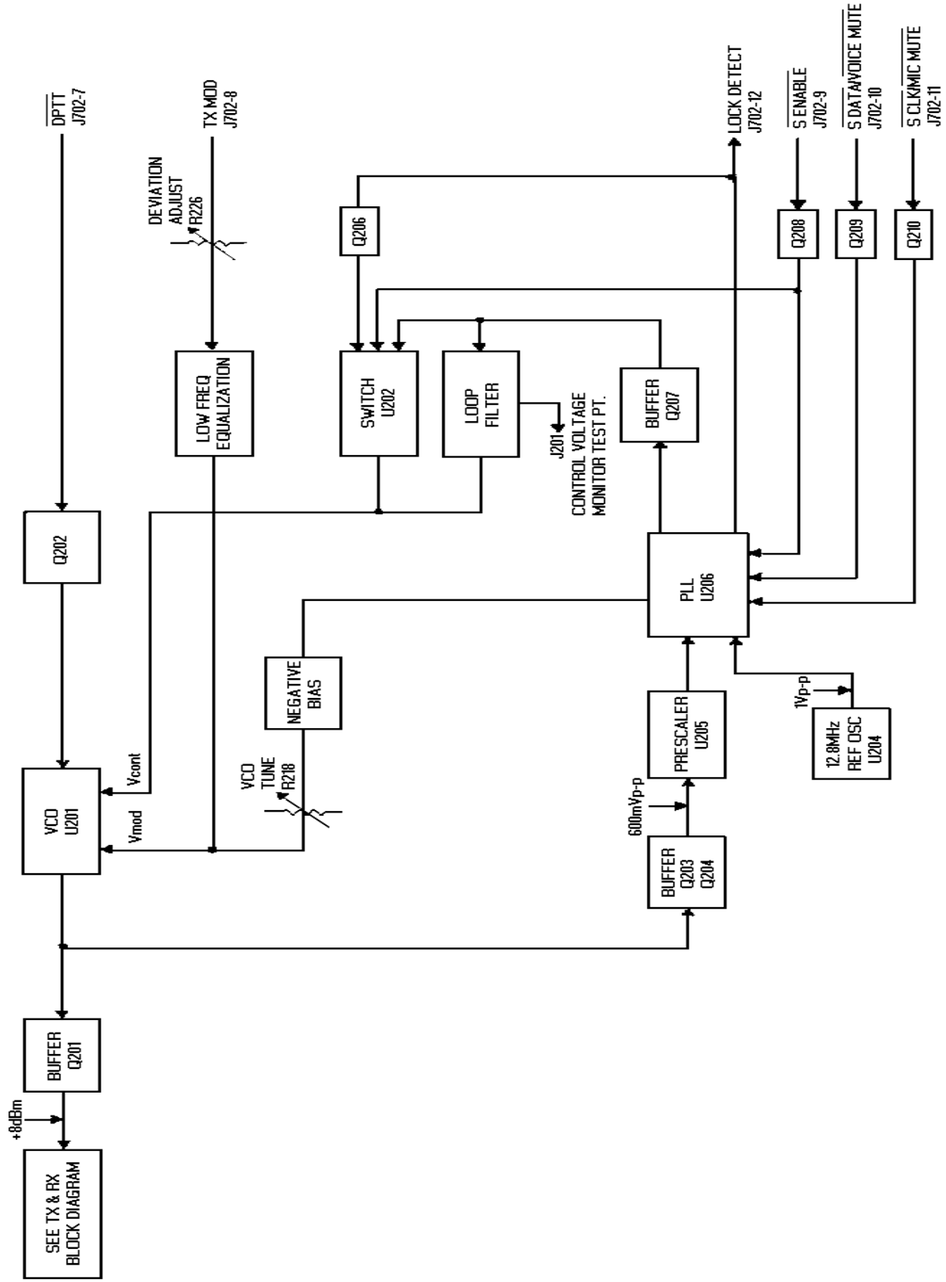


Figure 2 - Frequency Synthesizer Block Diagram

Mixer Z403, is a doubly balanced diode mixer. This mixer is driven by a local oscillator signal of +10 dBm or greater to provide a good inter modulation performance, spurious performance and local oscillator isolation. The mixer conversion loss is typically 6 dB.

45 MHz IF

The first 45 MHz IF amplifier transistor Q501 is a junction FET operated in the common gate mode. This configuration offers a typical input impedance of 75 ohms. The output circuitry is turned by inductor L504 and loaded to provide the proper source termination for the four-pole crystal filter which follows.

The output of the crystal filter is matched by second IF amplifier transistor Q502. This port is also tuned by inductor L506 and loaded to provide the proper filter termination. Transistor Q502 is a dual gate FET operation at a bias current of about 10 milliamps. The output of Q502 is tuned by inductor L507 for maximum gain at 45 MHz and is loaded by the 2nd mixer in the U501 chip. This Q502 stage has a relatively high input and output impedance and provides high isolation within the active device.

Converter/IF/Detector IC

The IF IC, U501, is a MC3361 chip. Pins 1 and 2 connect to an internally biased oscillator transistor. The external circuitry of this oscillator transistor includes crystal Y501 and forms an oscillator circuit operating at 45.455 MHz. The frequency of this third mode oscillator is adjusted by inductor L508. The 45 MHz IF signal is translated to 455 kHz and appears at Pin 3 of U501. This IF signal is filtered by 6-pole ceramic filter Z503 and drives the internal 455 kHz amplifier and limiter. The limited 455 kHz, in turn, drives an internal quadrature detector . The phase shift network needed by the quadrature detector is provided by inductor L509. The audio output port is Pin 9 on U501. Inductor L509 is adjusted for maximum audio output level. The audio signal at Pin 9 is filtered by resistor R512 and capacitor C519 to reduce IF feed through. Buffer amplifier Q503 drives audio potentiometer R513. This allows a VOL/SQ HI signal of which the amplitude may be set for proper system operation using R513.

Power Distribution

UN switched 13.8 Volts (A+) is supplied to the RF Board through connector J704 and feeds power control transistor Q101 and PA module U101.

Switched 13.6 Volts (A+) is supplied to the RF Board through connectors J702 and J705 and feeds regulators U102, U207 and U502. Regulator U102 supplies 8 Volts to the transmit switch, synthesizer 5 volt regulator U203 and the Audio/Logic Board through connector J702. Regulator U207 supplies 8.5 Volts to the synthesizer. Regulator U502 supplies 8 Volts to the receive circuit.

SERVICE NOTES

TRANSMIT CIRCUIT

Most transmit circuit problems can be isolated by checking the TX power gains shown in Figure 1- RX and TX Block Diagram. The 40 watt PA Board may be bypassed by placing a jumper cable between J103 and J102 on the RF Board. The PA module U101 is capable of producing 10 watt output

Transmit DC Measurements

1. First ensure that DPTT is low when the microphone PTT is keyed low.
2. Check for approximately 8 Volts at L105 feeding the Exciter Module. If not present, troubleshoot the TX switch circuitry, TX Switch transistor Q103 and U103.
3. Check for approximately 7 Volts across resistors R401 and R402. If not present, check the PIN diodes D104 and D401 and the conduction path from R401 to Q103.
4. Check for an adjustable voltage of 0 to 12 Volts on Pin 2 of PA module U101. At maximum power, with Power Set adjustment R111 fully clockwise, Pin 2 should be at 12 Volts. If not present, check the power control circuitry (U103, Q101, Q102 and Q104).
5. Check for 13.6 Volts on Pins 3 and 4 of PA module U101 and ensure a good mechanical and electrical ground from the PA module to the bracket and casting.

RECEIVE CIRCUIT

To isolate a receiver circuit problem refer to the Receive Circuit Symptoms and Checks chart as follows:

SYMPTOMS	CHECKS
• No Audio	1. U502 regulator. 2. The level and frequency of the first mixer injection frequency. 3. The level and frequency of the second mixer injection frequency. 4. Quadrature detector circuit. 5. Quadrature detector coil tuning.
• Poor SINAD	1. Consult Figure 1 - RX and TX Block Diagram for RX stage gains and troubleshoot. NOTE: Use a high impedance RF probe when measuring gain at TP401. A 50-ohm probe may be used if C415 is removed. **DO NOT** adjust Z401 or Z402 without sweep equipment or the 20 MHz sensitivity bandwidth will be sharply reduced. 2. Input cable. 3. PIN Diode switch is shorted.
• Distorted Audio	1. Both mixer injection frequencies. 2. Quadrature detector coil tuning. 3. Crystal filter source and load tuning. 4. Z503: 455 kHz ceramic filter.

RECEIVE FRONT END TUNING

Each receive front end has been preset to a fixed 20 MHz segment of each split. To adjust the front end for another 20 MHz segment of the split, a sweep tuning procedure will be required to maintain the necessary bandwidth.

1. Apply a sweep signal generator (or tracking generator) with markers set for the desired 20 MHz bandwidth at antenna jack J101.
2. Measure the RF signal at TP401 with a high impedance RF probe. A 50-ohm RF probe may be used at TP401 if coupling capacitor C415 is removed (If damaged, C415 may be replaced by a short piece of hookup wire).
3. Connect the RF sweep detector/display (or spectrum analyzer) to the RF probe.
4. Tune the slugs of Z401 and Z402 for the required 20 MHz bandwidth. Ripple will be 1 dB to 2 dB typical. Reduce the RF input level, if necessary, to keep Q401 out of saturation and protection diode D402 off. The filter response will not change at lower RF input levels if the front end has been tuned up correctly.

SYNTHESIZER CIRCUIT

DC Analysis

An 8.5 Vdc is supplied by regulator U207 and serves as the biasing voltage for transistor circuits Q204, Q206, Q207, Q208, Q209 and Q210. Resistor R207 decouples the 8.3 volts for use in VCO module U201. The 10 milliamp current drain of this module results in approximately 6.5 Vdc on Pin 4. Transistor Q201 also draws approximately 25 milliamps, resulting in a collector voltage of 3.7 Vdc at the junction of resistor R204 and capacitor C201. Lack of VCO RF output will modify this voltage.

Regulator U203 uses the 8 volts from transmit regulator U102 to generate 5 volts for U204 and U205.

Wave forms

Wave forms associated with the synthesizer were measured with a 10 meg-ohm, 30 pF probe. Use DC coupling (see Figures 3-8).

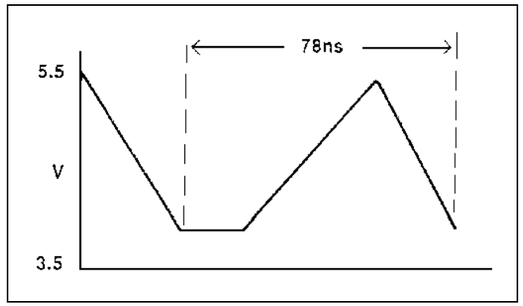


Figure 3 - REFERENCE OSCILLATOR Input To U206, Pin 2)

Select a channel in the center of the band

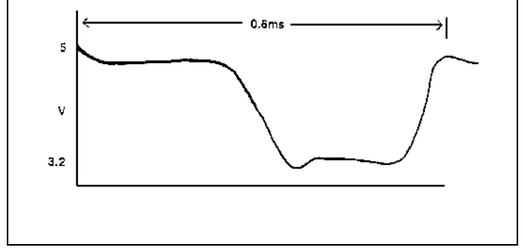


Figure 4 - Fin (Input to U206, Pin 10)

The top of the ramp is approximately 0.8 Vdc greater than the control voltage on PD out, Pin 17. A channel in the center of the band is shown.

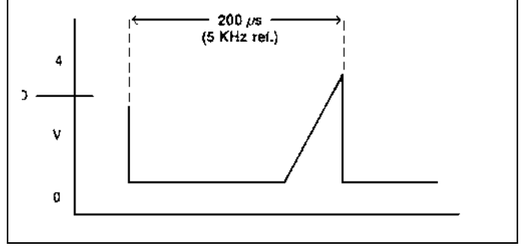


Figure 5 - RAMP (Generated in U206 and appears on Pin 15)

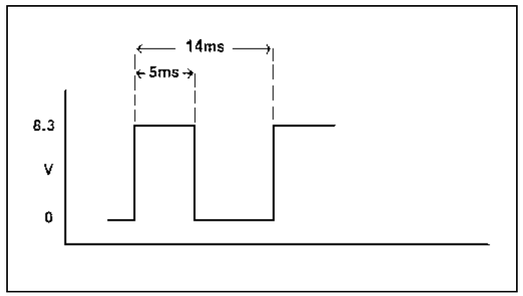


Figure 6 - S ENABLE (Input to U206, Pin 13) (Radio in SCAN on a single channel)

Clock pulses (32) appear as jitter on trailing edge of the wave form

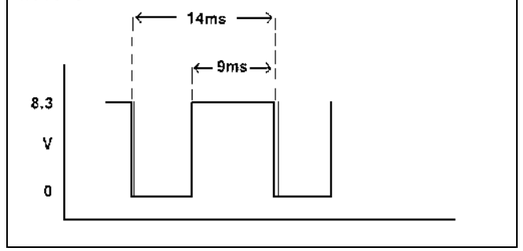


Figure 7 - S CLOCK (Input to U206, Pin 11) (Radio in SCAN on a single channel)

When expanded, data can be seen to be changing as two different bit patterns are loaded

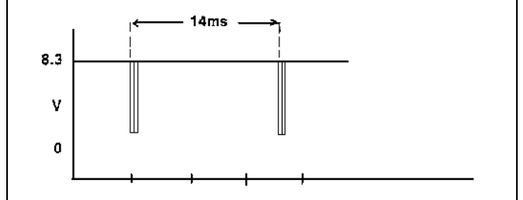


Figure 8 - S DATA (Input to U206, Pin 12) (Radio in SCAN on a single channel)

Module Isolation

Reference Oscillator U204:

Look for a wave form similar to the reference (Figure 3) on Pin 2. If wave form is not present, the oscillator module is probably defective.

VCO U201:

Connect a DC power supply to Pin 3. With 2.5 Vdc on Pin 3, the output of U201 (Pin 5) should be approximately 197 MHz. With 6.5 Vdc on Pin 3, the output should be approximately 212 MHz. These values are correct for the 440-470 MHz split, with the ranges 179-194 MHz and 212-233 MHz being correct for the lower and upper split, respectively.

Power output of the VCO can be measured by connecting a coax directly to the module, between Pin 5 and ground. The output should be approximately 0 dBm with capacitor C237 still connected in the circuit. In transmit, a negative bias should exist on Pin 1. If not present, check transistors Q202, Q203 and capacitor C206 before removing the VCO.

Prescaler U205:

Connect Pin 3 of the VCO to 4.5 Vdc. With the radio in receive, monitor the frequencies of the VCO at the connection of capacitor C210 and resistor R211. DC short Pin 1 of U205 to ground to cause divide by 129 to occur. The frequency output at Pin 3 should be the VCO frequency divided by 129. Tie Pin 1 to Pin 7 (5 volts) to cause divide 128 to occur. check Pin 3 to verify that this occurs. Improper division may indicate a defective prescaler.

Bilateral Switch U202:

The bilateral switch is used to short around parts of the loop filter during channel scan. A shorted (to ground or adjacent gate) gate may be isolated by comparing voltages through the loop filter to those of a functioning radio. Defective gates might be suspected when the radio does not change frequency quickly enough.

Phase-Lock-Loop U206:

There are no other specific checks which aid in evaluation of U206. Usually, it is suspected only if all other checks are OK. Before changing, inspect chip components for mechanical damage and check resistance through the loop filter.

Transistor Q201:

After checking for proper DC operation, measure the frequency and gain from the VCO, Pin 5 to R202/C203. the gain should be approximately 10 dB at 2 times the VCO frequency.

PA MODULE REPLACEMENT

To Remove PA Module U101

1. Unsolder the five leads from U101, using either solder removal braid, or a mechanical de-soldering tool. These leads are fragile and can be bent very easily. DO NOT unsolder the shield that wraps around the module.
2. Remove the RF Board from the radio chassis assembly. Refer to the disassembly procedure provided in the Service Section. Carefully slide the module out of the shield and away from the board.

To Install PA Module U101

1. Apply some silicone grease to the metal side of the replacement module.
2. Carefully insert the five leads from the module into the five corresponding printed wire board holes and slide the module into the shield. DO NOT solder the leads yet.
3. Slide the RF Board assembly back into the radio frame. Reinstall all hardware, harnesses, cables, etc. Replace all screws.
4. Install the two PA bracket screws before soldering the four modules leads. Trim excess wire.

RF BOARD
188D5062G2 (403-440 MHz)
188D5062G2 (403-440 MHz)
188D5062G2 (403-440 MHz)
Issue 3

SYMBOL	PART NO.	DESCRIPTION
A102		TRANSMIT EXCITER BOARD 19C851643G1 - 403-440 MHz 19C851643G2 - 440-470 MHz 19C851643G3 - 470-512 MHz
		- - - -CAPACITORS- - - -
C1 and C2	19A702061P77	Ceramic: 470pF, ±5%, 50 VDCW, temp coef 0 ± 3 0 PPM/°C.
C3	19A702061P17	Ceramic: 12pF, ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 1).
C3	19A702061P13	Ceramic: 10pF, ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 2).
C3	19A702061P11	Ceramic: 6.8pF, ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Group 3).
C4	19A702061P13	Ceramic: 10pF, ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 1).
C4	19A702061P11	Ceramic: 6.8pF, ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Groups 2 and 3).
C5	19A702061P61	Ceramic: 100pF, ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 1).
C5	19A702061P45	Ceramic: 47pF, ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Groups 2 and 3).
C6	19A702061P10	Ceramic: 5.6pF, ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Group 1).
C6	19A702061P9	Ceramic: 4.7pF, ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Groups 2 and 3).
C7	19A702061G12	Ceramic: 8.2pF, ±0.5pF, 50 VDCW, temp coef 0 ±60 PPM/°C (Used in Group 1).
C7	19A702061P11	Ceramic: 6.8pF, ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Groups 2 and 3).
C8 thru C10	19A702061P77	Ceramic: 470pF, ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C11	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C12	19A702061P12	Ceramic: 8.2 pF ±0.5pF, 50 VDCW, temp coef 0 ±60 PPM/°C (Used in Group 1).
		- - - -DIODES- - - -
D1	19A702525P2	Silicon PIN: sim to MMBV3401.
		- - - -INDUCTORS- - - -
L1		Part of printed wire board 19C851644P1.
L2	19B800891P6	Coil: RF: 0.084 H; sim to Paul Smith SK-890-1.
L3 thru L5		Part of printed wire board 19C851644P1.
		- - - -TRANSISTORS- - - -
Q1	19A704708P2	Silicon NPN: sim to NEC2SC3356.
Q2	19A701940P1	Silicon NPN: sim to MRF-559.
		- - - -RESISTORS- - - -
R1	19B800607P471	Metal Film: 470 ohms ±5%, 1/8 Watt.
R2	19B800607P222	Metal Film: 2.2K ohms ±5%, 1/8 Watt.
R3	19B800607P102	Metal Film: 1K ohms ±5%, 1/8 Watt.
R4	19B800607P330	Metal Film: 33 ohms ±5%, 1/8 Watt.
R5	19B800607P272	Metal Film: 2.7K ohms ±5%, 1/8 Watt.
R6	19B800607P331	Metal Film: 330 ohms ±5%, 1/8 Watt.
R7	19B800607P100	Metal Film: 10 ohms ±5%, 1/8 Watt.
R8	19B800607P100	Metal Film: 10 ohms ±5%, 1/8 Watt.
		- - - -CAPACITORS- - - -
C101	19A705108P36	Mica: 91pF ±5% 500 VDCW, temp coef 0 + 50 PPM/°C.
C103	19A702061P19	Ceramic: 13pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 2).
*C103	19A702061P17	Ceramic: 12pF ±5%, 50 VDCW, temp coef 0 ±30PPM/°C (Used in Groups 1 and 3).
C104	19A702061P99	Ceramic: 1000pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C105	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C106	19A702061P73	Ceramic: 330pF ±5%. 50 VDCW, temp coef 0 ± 30 PPM/°C.
C107	19A701534P8	Tantalum: 22µF ±20%, 16VDCW.
C108	19A701534P16	Tantalum: 6.8µF ±20%, 35 VDCW.
C109 and C110	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C111	19A701534P16	Tantalum: 6.8µF ±20%, 35 VDCW.
C113 thru C115	19A702061P73	Ceramic: 330pF ±5%. 50 VDCW, temp coef 0 ± 30 PPM/°C.
C116	19A702061P61	Ceramic:100pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM°/C (Used in Groups 1 and 3).
*C116	19A702236P13	Ceramic: 3.3pF ±0.5pF, 50 VDCW, temp coef 0 ± 120 PPM/°C (Used in Group 2).
C117	19A702052P22	Ceramic: 0.047µF ±10%, 50 VDCW.
C118	19A703314P10	Electrolytic: 10µF -10 +50%, 50 VDCW; Sim to Panasonic LS Series.
C119	19A702061P73	Ceramic: 330pF ±5%. 50 VDCW, temp coef 0 ± 30 PPM/°C.
C120	19A702236P50	Ceramic: 100pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C121	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C122	19A702052P28	Ceramic: 0.022µF ±10%, 50 VDCW.
C123	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C124	19A705108P36	Mica: 91pF ±5% 500 VDCW, temp coef 0 + 50 PPM/°C.
C125 and C126	19A702061P73	Ceramic: 330pF ±5%. 50 VDCW, temp coef 0 ± 30 PPM/°C.
C130	19A705108P3	Mica: 3.9pF ±0.25 pF, 500 VDCW, temp coef 0 +200 PPM/°C (Used in Groups 1 and 2).
*C130	19A705108P1	Mica: 3.3 pF ±0.25pF, 500 VDCW, temp coef 0 +200 PPM/°C (Used in Group 3).
C131	19A705108P15	Mica: 12pF ±5%, 500 VDCW, 0 +200 PPM/°C (Used in Groups 1 and 2).
*C131	19A705108P13	Mica: 10pF ±5%, 500 VDCW, temp coef 0 +200 PPM/°C (Used in Group 3).
C132	19A705108P208	Mica: CHIP, 3pF ±0.25 pF, 500 VDCW, 0 +200 PMM/°C (Used in Groups 1 and 2).
*C132	19A705108P3	Mica: 3.9pF ±0.25pF, 500 VDCW, temp coef 0 +200 PPM/°C (Used in Group 3).
C133	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C134	19A701534P16	Tantalum: 6.8µF ±20%, 35 VDCW.
C135	19A705108P36	Mica: 91pF ±5% 500 VDCW, temp coef 0 + 50 PPM/°C.
C140 and C141	19A702236P19	Ceramic: 5.6 pF ±0.5 pF, 50 VDCW, temp coef 0 ± 60 PPM/°C. (Used in Groups 1 and 3).
C142	19A702236P28	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C201	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C202	19A702061P99	Ceramic: 1000pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C203	19A702061P11	Ceramic: 6.8 pF ±5 pF, 50 VDCW, temp coef 0 ± 60 PPM/°C.
C204	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
C205	19A701534P17	Tantalum: 47µF ±20%, 10 VDCW.
C206	19A702052P5	Ceramic: 1000pF ±10%, 50 VDCW.
C207	19A701534P8	Tantalum: 22µF ±20%, 16 VDCW.
C208	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C210	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C211	19A702061P33	Ceramic: 27pF ±5%, 50 VCDW, temp coef 0 ± 30 PPM/°C.
C212	19A702052P5	Ceramic:1000pF ±10%, 50 VDCW.
C213 and C214	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C215	19A700004P1	Metallized Polyester: 0.068 µF ±10%, 63 VDCW.
C216	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C217	19A700004P11	Metallized Polyester: 1µF ±10%, 63 VDCW.
C218	19A702061P29	Ceramic: 22pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C219	19A702061P93	Ceramic: 2200pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C220	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C222	19A702061P99	Ceramic: 1000pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C223	19A702052P14	Ceramic: 0.01µF 10%, 50 VDCW.
C224	19A702061P77	Ceramic: 470pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C225	19A702061P103	Ceramic: 4700pF ±5%, 50 VDCW, temp coef ±30 PPM/°C at 85°C.
C226	19A701534P17	Tantalum: 47µF ±20%, 10 VDCW.
C227	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C228	19A702061P9	Ceramic: 4.7pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C.
C229	19A702061P61	Ceramic: 100pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C230	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C231	19A703314P10	Electrolytic: 10µF -10 +50%, 50 VDCW; Sim to Panasonic LS Series.
C232	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C234	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C236	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C237	19A702061P17	Ceramic: 12pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C238	19A702061P9	Ceramic: 4.7pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C.
C239	19A702061P12	Ceramic: 8.2pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Groups 1 and 2).
*C239	19A702061P11	Ceramic: 6.8pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Group 3).
C240	19A702061P25	Ceramic: 18pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C241	19A702061P73	Ceramic: 330pF ±5%. 50 VDCW,temp coef 0 ± 30 PPM/°C.
C242	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C245	19A703314P10	Electrolytic: 10µF -10 +50%, 50 VDCW; Sim to Panasonic LS Series.
C246	19A702061P73	Ceramic: 330pF ±5%. 50 VDCW, temp coef 0 ± 30 PPM/°C.
C247	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C248 and C249	19A702061P73	Ceramic: 330pF ±5%. 50 VDCW, temp coef 0 ± 30 PPM/°C.
C250	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C251 and C252	19A703314P10	Electrolytic: 10µF -10 +50%, 50 VDCW; Sim to Panasonic LS Series.
C253	19A701534P4	Tantalum: 1µF ±20%, 35 VDCW.
C254	19A701534P7	Tantalum: 10µF ±20%, 16 VDCW.
C255	19A701534P4	Tantalum: 1µF ±20%, 35 VDCW.
C402	19A705108P9	Mica: 6.8pF ±0.25pF. 500 VDCW, temp coef 0 +200 PPM/°C (Used in Groups 1 and 3).
*C402	19A705108P13	Mica: 10pF ±5%, 500 VDCW, temp coef 0 +200 PPM/°C (Used in Group 2).
C403	19A702236P15	Ceramic: 3.9pF ±0.25pF @3kHz, temp coef 0 ± 30 PPM/°C.
C404	19A702061P63	Ceramic: 120pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 2).
C405	19A702061P13	Ceramic: 10pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 2).
* C405	19A702061P11	Ceramic: 6.8pF, ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Groups 1 and 3).
C406	19A702061P13	Ceramic: 10pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 2).
C406	19A702061P10	Ceramic: 5.6pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 1).
* C406	19A702061P9	Ceramic: 4.7pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 3).
C407	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C408	19A702061P99	Ceramic: 0.1µF ±10%,50 VDCW, temp coef 0 ± 30 PPM/°C.

*COMPONENTS ADDED, DELECTED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

SYMBOL	PART NO.	DESCRIPTION
* C409	19A702236P11	Ceramic: 2.7pF, ±0.25pF, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Groups 1 and 3).
*C409	19A702236P10	Ceramic: 2.2pF ±0.25pF, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 2).
*C410	19A702236P15	Ceramic: 3.9pF ±0.25pF, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 1).
*C410	19A702236P21	Ceramic: 6.8pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Group 2).
*C410	19A702236P17	Ceramic: 4.7pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Group 3).
* C411	19A702061P11	Ceramic: 4.7pF ±5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C (Used in Groups 1 and 2).
*C411	19A702061P7	Ceramic: 4.7pF ±0.5pF, 50 VDCW, temp coef 0 ± 120 PPM/°C (Used in Group 3).
C412	19A702061P10	Ceramic: 5.6pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 1).
*C412	19A702061P9	Ceramic: 4.7pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C Used in Group 2).
*C412	19A702061P11	Ceramic: 6.8pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C Used in Group 3).
* C413	19A702061P17	Ceramic: 12pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Groups 1 and 3).
* C413	19A702061P13	Ceramic: 10pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 2).
*C414	19A702234P15	Ceramic: 3.9 pF ±0.25pF, 50 VDCW, temp coef 0 ±30 PPM/°C (Used in Group 1).
*C414	19A702236P17	Ceramic: 4.7 pF ±0.5pF, 50 VDCW, temp coef 0 ±60 PPM/°C (Used in Group 2).
C415 and C416	19A702061P63	Ceramic: 120pF ±5pF, 50 VDCW, temp coef 0 ± 120 PPM/°C.
C417	19A702061P9	Ceramic: 4.7pF ±0.5pF, 50 VDCW, temp coef 0 ± 60 PPM/°C.
C418	19A702052P5	Ceramic: 1000pF ±10%, 50 VDCW.
*C419	19A702236P15	Ceramic: 3.9pF ±0.25pF, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C421	19A702236P52	Ceramic: 120pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C (Used in Groups 1 and 2).
*C421	19A702236P50	Ceramic: 100pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 3).
C502	19A702061P99	Ceramic: 1000pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C (Used in Group 3).
C503	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C504	19A702061P29	Ceramic: 22pF ±10%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C505	19A702061P25	Ceramic: 18pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C506	19A701534P7	Tantalum: 10µF ±20%, 16 VDCW.
C507 thru C509	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C510	19A702061P6	Ceramic: 2.7pF ±0.5pF, 50 VDCW, temp coef 0 ± 150 PPM/°C.
C511	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C512	19A702061P1	Ceramic: 1pF ±0.5pF, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C513	19A702061P12	Ceramic: 8.2pF ±0.5pF, 50 VDCW,temp coef 0 ± 60 PPM/°C.
C514	19A702061P33	Ceramic: 27pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM/°C.
C515 and C516	19A702061P29	Ceramic: 22pF ±10%, 50 VDCW,temp coef 0 ± 30 PPM/°C.
C517 and C518	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C519	19A702052P5	Ceramic: 1000pF ±10%, 50 VDCW.
C520	19A702052P14	Ceramic: 0.01µF ±10%, 50 VDCW.
C521	19A703314P10	Electrolytic: 10µF -10 +50%, 50 VDCW; Sim to Panasonic LS Series.
C522	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C523 and C524	19A701534P4	Tantalum: 1µF ±20%, 35 VDCW.
C525	19A701534P7	Tantalum: 10µF ±20%, 16 VDCW.
		- - - -DIODES- - - -
D101	19A705377P1	Silicon, Hot Carrier: simi to MMB0201.
D104	344A3316P1	Silicon PIN: sim to MA4P1250.
D106	19A702526P2	Silicon: Schottky Barrier;sim to Bat 17.
D202 and D203	19A702526P2	Silicon: Schottky Barrier;sim to Bat 17.
D401	344A3316P1	Silicon PIN: sim to MA4P1250.
D402	19A700155P2	Silicon, fwd Current: 100 mA, 35 PIV.
D501 and D502	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
		- - - -JACKS- - - -
J101 thru J103	19A705512P1	RF jack.
J201 and J501	19A700072P1	Printed wire: 2 contacts rated at 2.5 amps; sim to Molex 22-03-2021.
J702	19A704779P11	Connector; sim to Molex 22-17-2122.
J704	19A700072P29	Printed wire: 3 contacts rated at 2.5 amps; sim to Molex 22-03-2031.
J705	19A700072P30	Printed wire: 4 contacts rated at 2.5 amps; sim to Molex 22-27-2041.
		- - - -INDUCTORS- - - -
L102	19A700024P7	Coil, RF: 330nH ±5%.
L103 thru L106	19A704921P1	Coil.
L120	19A705470P3	Coil, RF: 15µH ±20%, sim to Toko 380NB-15nH (Used in Groups 1 and 3).
*L120	19A705470P8	Coil, RF: 39µH ±20%, sim to Toko 380NB-39nH (Used in Group 2).
L130 and L131	19B800891P1	Coil, RF choke: sim to Paul Smith SK-890-1.
L202 and L203	19A705470P6	Coil: 27nH; sim to Toko 380NB-27nH (Used in Groups 1 and 2).
*L202 and L203	19A705470P5	Coil: 22nH; sim to Toko 380NB-22nH (Used in Group 3).
L401	19B800891P2	Coil, RF Choke: sim to Paul Smith SK-890-1.
L402	19B800891P1	Coil, RF Choke: sim to Paul Smith SK-890-1.
L403	19B800890P3	Coil, RF: 11.7µH ±5%, sim to Paul Smith SK-896-1.
L404	19B800891P2	Coil, RF Choke: sim to Paul Smith SK-890-1.
L405	19B800891P1	Coil, RF Choke: sim to Paul Smith SK-890-1.
L502 and L503	H343CLP10022	Coil,Fixed: 10µH ±10%.
L504	19B801413P4	Coil:39MHz.
L505	19B209420P21	Coil, RF:.4.7µH ±5%, 1.20 ohms DC res max; sim to Jeffers 4436-8J.
L506 thru L508	19B801413P4	Coil, 39MHz.
L509	19B801415P2	Transformer:455 KHz; sim to AEPD 162B3277P17.
		- - - -TRANSISTORS- - - -
Q101	344A3224P1	Silicon, NPN: sim to Motorola MJP3055.
Q102	19A703197P2	Silicon, PNP: sim to MMBT4403 Low profile Pkg.
Q103	19A704972P1	Silicon, PNP: sim to Motorola 2N4918.
Q104	19A700076P2	Silicon, PNP: sim to MMBT3904 Low profile Pkg.
*Q105	19A700059P2	Silicon PNP: sim to MMBT 3906 Low Profile Pkg. (Used in Groups 1 and 3).
Q201	19A704708P2	Silicon, NPN: sim to NEC 2SC3356.
Q202	19A700059P2	Silicon, PNP: sim to MMBT3906 Low profile Pkg.
Q203	19A700076P2	Silicon, PNP: sim to MMBT3904 Low profile Pkg.
Q204	19A704708P2	Silicon, NPN: sim to NEC 2SC3356.
Q206	19A700076P2	Silicon, PNP: sim to MMBT3904 Low profile Pkg.
Q207	19A700059P2	Silicon, PNP: sim to MMBT3906 Low profile Pkg.
Q208	19A700023P2	Silicon, NPN: sim to 2N3904.
Q209 and Q210	19A702084P2	Silicon, NPN: sim to MPS 2369.
Q401	19A704708P2	Silicon, NPN: sim to NEC 2SC3356.
Q501	19A702524P2	N-Type, Field Effect; sim to MMBFU310.
Q502	19A116818P3	N-Channel, Field Effect; sim to Type 3N1877.
Q503	19A700023P2	Silicon, NPN: sim to 2N3904.
		- - - -RESISTORS- - - -
R101	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R102	19B800607P390	Metal Film: 39 ohms ±5%, 1/8 Watt. (Used in Group 1).
*R102	19B800607P510	Metal Film: 51 ohms ±5%, 1/8 Watt. (Used in Group 2).
*R102	19B800607P560	Metal Film: 56 ohms ±5%, 1/8 Watt. (Used in Group 3).
R103	19B800607P821	Metal Film: 820 ohms ±5%, 1/8 Watt.
R104	19B800607P223	Metal Film: 22K ohms ±5%, 1/8 Watt.
R105	19B800607P473	Metal Film: 47K ohms ±5%, 1/8 Watt.
R106	19B800607P102	Metal Film: 1K ohms ±5%, 1/8 Watt.
R107	19B800607P394	Metal Film: 390K ohms ±5%, 1/8 Watt.
R108	19B800607P123	Metal Film: 12K ohms ±5%, 1/8 Watt.
R109	19B800607P394	Metal Film: 390K ohms ±5%, 1/8 Watt.
R110	19B800607P102	Metal Film: 1K ohms ±5%, 1/8 Watt.
R111	19B800779P8	Variable: 4.7K ohms ±25%, 100 VDCW, 0.3 Watt.
R112	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R113	19B800607P102	Metal Film: 1K ohms ±5%, 1/8 Watt.
R114	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R115	19B800607P562	Metal Film: 5.6K ohms ±5%, 1/8 Watt.
R116	19B800607P183	Metal Film: 18K ohms ±5%, 1/8 Watt.
R117	19B800607P221	Metal Film: 220 ohms ±5%, 1/8 Watt.
R118	19A702931P326	Metal Film: 18.2K ohms ±5%, 1/8 Watt.
R119	19B800607P100	Metal Film: 10 ohms ±5%, 1/8 Watt.
R120	19B800607P100	Metal Film: 10 ohms ±5%, 1/8 Watt.
R121	19B800607P100	Metal Film: 10 ohms ±5%, 1/8 Watt.
R122	19B800607P821	Metal Film: 820 ohms ±5%, 1/8 Watt.
R123	19B800607P100	Metal Film: 10 ohms ±5%, 1/8 Watt.
R124	19B800607P101	Metal Film: 100 ohms ±5%, 1/8 Watt.
R125	19A702931P259	Metal Film: 4020 ohms ±5%, 1/8 Watt.
R126	19A702931P201	Metal Film: 1000 ohms ±5%, 1/8 Watt.
R127	19A702931P262	Metal Film: 4320 ohms ±5%, 1/8 Watt.
R128	19B800607P1	Metal Film: 0 ohms ±5%, 1/8 Watt.
R129	19B800607P153	Metal Film: 15K ohms ±5%, 1/8 Watt.
R140	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R141	19B800607P102	Metal Film: 1K ohms ±5%, 1/8 Watt.
R142	19B800607P221	Metal Film: 220 ohms ±5%, 1/8 Watt.
R202	19B800607P101	Metal Film: 100 ohms ±5%, 1/8 Watt.
R203	19B800607P560	Metal Film: 56 ohms ±5%, 1/8 Watt.
R204	19B800607P221	Metal Film: 220 ohms ±5%, 1/8 Watt.
R205	19B800607P332	Metal Film: 3.3K ohms ±5%, 1/8 Watt.
R206	19B800607P102	Metal Film: 1K ohms ±5%, 1/8 Watt.
R207	19B800607P181	Metal Film: 180 ohms ±5%, 1/8 Watt.
R208	19B800607P473	Metal Film: 47K ohms ±5%, 1/8 Watt.
R209	19B800607P332	Metal Film: 3.3K ohms ±5%, 1/8 Watt.
R210	19B800607P332	Metal Film: 3.3K ohms ±5%, 1/8 Watt.
R211	19B800607P101	Metal Film: 100 ohms ±5%, 1/8 Watt.
R213	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R214	19B800607P331	Metal Film: 330 ohms ±5%, 1/8 Watt.
R215	19B800607P822	Metal Film: 8.2K ohms ±5%, 1/8 Watt.

SYMBOL	PART NO.	DESCRIPTION
R216	19B800607P222	Metal Film: 2.2K ohms ±5%, 1/8 Watt.
R217	19B800607P101	Metal Film: 100 ohms ±5%, 1/8 Watt.
R218	19B800779P16	Variable: 100K ohms ±25%, 100 VDCW, 0.3 Watt.
R219	19B800607P273	Metal Film: 27K ohms ±5%, 1/8 Watt.
R221	19B800607P154	Metal Film: 150K ohms ±5%, 1/8 Watt.
R222	19B800607P333	Metal Film: 33K ohms ±5%, 1/8 Watt.
R223	19B800607P105	Metal Film: 1M ohms ±5%, 1/8 Watt.
R224	19B800607P472	Metal Film: 4.7K ohms ±5%, 1/8 Watt.
R226	19B800779P4	Variable: 1k ohms ±25%, 100 VDCW, 0.3 Watt.
R227	19B800607P473	Metal Film: 47K ohms ±5%, 1/8 Watt.
R228	19B800607P223	Metal Film: 22K ohms ±5%, 1/8 Watt.
R229	19B800607P183	Metal Film: 18K ohms ±5%, 1/8 Watt.
R230	19B800607P332	Metal Film: 3.3K ohms ±5%, 1/8 Watt.
R231	19B800607P472	Metal Film: 4.7K ohms ±5%, 1/8 Watt.
R232	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R233	19B800607P332	Metal Film: 3.3K ohms ±5%, 1/8 Watt.
R234	19B800607P472	Metal Film: 4.7K ohms ±5%, 1/8 Watt.
R235	19B800607P183	Metal Film: 18K ohms ±5%, 1/8 Watt.
R236	19B800607P471	Metal Film: 470 ohms ±5%, 1/8 Watt.
R237	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R238	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R239	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R240	19B800607P154	Metal Film: 150K ohms ±5%, 1/8 Watt.
R241	19B800607P154	Metal Film: 150K ohms ±5%, 1/8 Watt.
R242	19B800607P154	Metal Film: 150K ohms ±5%, 1/8 Watt.
R245	19B800607P223	Metal Film: 22K ohms ±5%, 1/8 Watt.
R246	19B800607P102	Metal Film: 1K ohms ±5%, 1/8 Watt.
R248	19B800607P1	Metal Film: jumper.
R249	19B800607P100	Metal Film: 10 ohms ±5%, 1/8 Watt.
R251 thru R254	19B800607P100	Metal Film: 10 ohms ±5%, 1/8 Watt.
R255	19B800779P16	Variable: 100K ohms ±25%, 100 VDCW, 0.3 Watt.
R256	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R401	19B801486P151	Metal Film: 150 ohms ±5%, 1/2 Watt.
R403	19B800607P102	Metal Film: 1K ohms ±5%, 1/8 Watt.
R404	19B800607P472	Metal Film: 4.7K ohms ±5%, 1/8 Watt.
R405	19B800607P271	Metal Film: 270 ohms ±5%, 1/8 Watt.
* R406	19B800607P391	Metal Film: 390 ohms ±5%, 1/8 Watt. (Used in Group 1).
* R406	19B800607P271	Metal Film: 270 ohms ±5%, 1/8 Watt. (Used in Group 2).
* R406	19B800607P471	Metal Film: 470 ohms ±5%, 1/8 Watt. (Used in Group 3).
R501	19B800607P181	Metal Film: 180 ohms ±5%, 1/8 Watt.
R502	19B800607P270	Metal Film: 27 ohms ±5%, 1/8 Watt.
R503	19B800607P562	Metal Film: 5.6K ohms ±5%, 1/8 Watt.
R504	19B800607P270	Metal Film: 27 ohms ±5%, 1/8 Watt.
R505	19B800607P683	Metal Film: 68K ohms ±5%, 1/8 Watt.
R506	19B800607P823	Metal Film: 82K ohms ±5%, 1/8 Watt.
R507	19B800607P183	Metal Film: 18K ohms ±5%, 1/8 Watt.
R508	19B800607P101	Metal Film: 100 ohms ±5%, 1/8 Watt.
R509	19B800607P272	Metal Film: 2.7K ohms ±5%, 1/8 Watt.
R510	19B800607P270	Metal Film: 27 ohms ±5%, 1/8 Watt.
R511	19B800607P473	Metal Film: 47K ohms ±5%, 1/8 Watt.
R512	19B800607P822	Metal Film: 8.2K ohms ±5%, 1/8 Watt.
R513	19B800779P4	Variable: 1K ohms ±25%. 100 VDCW, 0.3 Watt.
R514	19B800607P103	Metal Film: 10K ohms ±5%, 1/8 Watt.
R515	19B800607P821	Metal Film: 820 ohms ±5%, 1/8 Watt.
		- - - -INTEGRATED CIRCUITS- - - -
U101	19A705457P1	RF Power Amplifier Module. Part of next highter assembly (Used in Group 2).
U101	19A705457P2	RF Power Amplifier Module. Part of next highter assembly (Used in Group 1).
U101	19A705457P3	RF Power Amplifier Module. Part of next highter assembly (Used in Group 3).
U102	RYT1246003/4	IC; sim to LM35.
U103 and U104	19A701789P2	Linear: Dual Op Ampl.; sim to MM358.
U105	RYT1246003/4	IC LM35.
U201	19D901958G4	Voltage Controlled Oscillator (Used in Group 1).
*U201	19D901958G3	Voltage Controlled Oscillator (Used in Group 2).
*U201	19D901958G5	Voltage Controlled Oscillator (Used in Group 3).
U202	19A700029P44	Digital: Bilateral Switch.
U203	19A704971P1	Linear: 5-Volt Regulator; sim to MC78L05ACP.
U204	19B801351P27	Crystal Oscillator, temperature compensated.
U205	19A704287P2	Prescaler: 128, 129; sim to MC12018.
U206	19B800902P4	Digital: Synthesizer, CMOS Serial Input.
U207	344A3820P1	8-Volt Regulator.
U501	19A704619P1	Linear: Osc/Mixer/IF/Det/Ampl; sim to MC3361AP.
U502	19A704073P2	Linear: 8-Volt Regulator; sim to MC78L08CP.
U503	344A3820P1	8-Volt Regulator.
		- - - -CRYSTALS- - - -
Y501	19A705376P5	Crystal, Fixed Frequency: 45.455 MHz ± 10 PPM.
		- - - -FILTERS- - - -
Z401 and Z402	19A705458P4	Helical, UHF: 403-450 MHz. (Used in Group 2).
Z401 and Z402	19A705458P1	Helical, UHF: 450-470 MHz. (Used in Group 1).
Z401 and Z402	19A705458P2	Helical, UHF: 470-492 MHz. (Used in Group 3).
Z403	19B801025P1	Balanced Mixer (Double); sim to Mini-Circuits SEL-1.
Z501 and Z502	19A705613G6	Monolithic Crystal: 45.000 MHz; sim to Toyocom 45E2B2.
Z503	19B801021P2	Bandpass filter: 455 kHz ±1.5 kHz; sim to Murata CFW-455E.
		- - - -MISCELLANEOUS- - - -
	19B801566P1	SHIELD.
	19B801566P2	SHIELD.

PRODUCTION CHANGES

Changes in the equipment to improve 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.

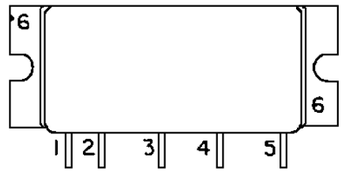
REV. A - RF BOARD 188D5062G1
Incorporated in initial shipments.

REV. B - RF BOARD 188D5062G1
To improve radio performance at temperature extremes. Changed C108, C111 & C134 (19A703314P10) to tantalum 6.8uF.
C103 was 12pF (19A702061P17).
R202 was 33 ohm (19B801607P330).

REV. A - RF BOARD 188D5062G2

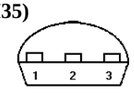
REV. C - RF BOARD 188D5062G1
To update parts list and schematic.

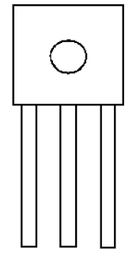
RF POWER AMPLIFIER U101
19A705457P1 (M57704M (403-440 MHz)
19A705457P2 (M57794H (440-470 MHz)
19A705457P3 (M57704SH (470-512 MHz)



1. P_{in}
2. V_{cc1} - 1ST STAGE
3. V_{cc} - 2ND STAGE
4. V_{cc} - OUTPUT STAGE
5. P_{out}
6. FIN-GROUND

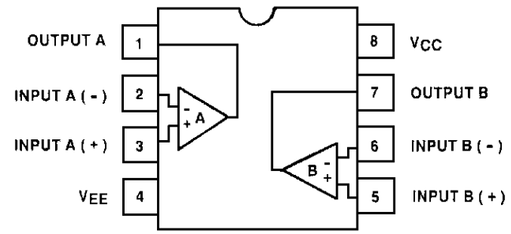
8 VOLT REGULATOR U102, U105
RYT1246003/4 (LM35)



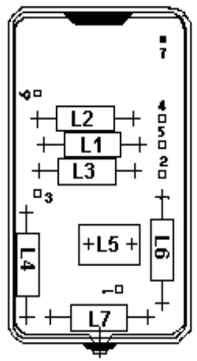


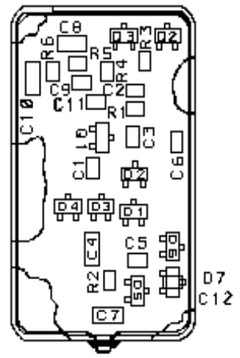
PINS:
1 - Vcc
2 - VOUT
3 - GND

DUAL OPERATIONAL AMPLIFIER U103
19A701789P2 (LM358)

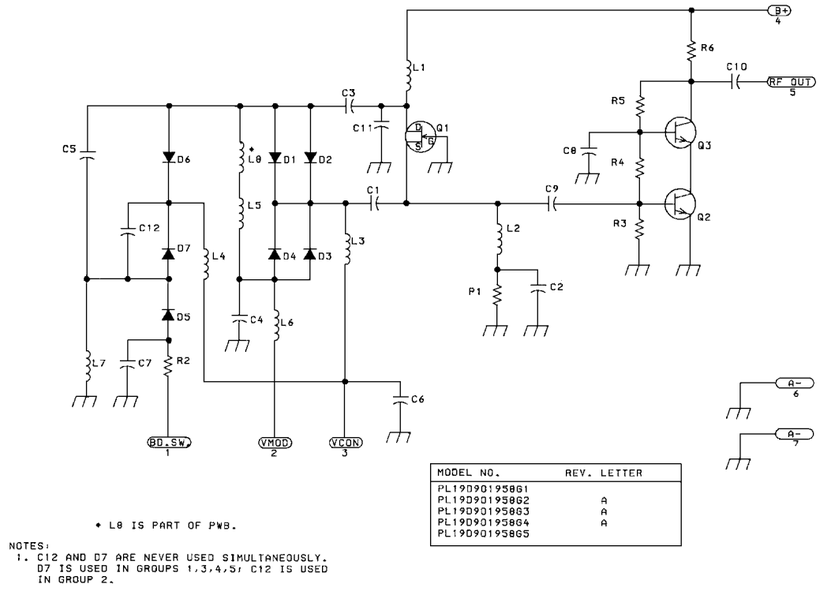


VOLTAGE CONTROLLED OSCILLATOR U201
19D901958G3 (403-440 MHz)
19D901958G4 (440-470 MHz)
19D901958G5 (470-512 MHz)





VIEW FROM BACK OF BOARD

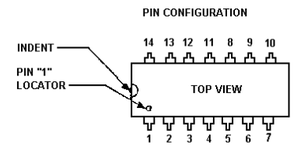


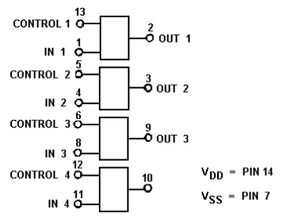
MODEL NO.	REV. LETTER
PL19D90195861	
PL19D90195862	A
PL19D90195863	A
PL19D90195864	A
PL19D90195865	

* L0 IS PART OF PWB.

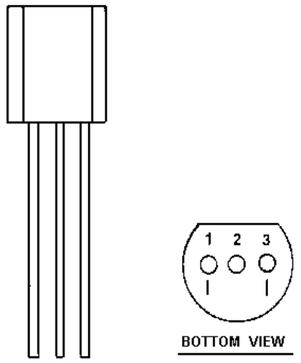
NOTES:
1. C12 AND D7 ARE NEVER USED SIMULTANEOUSLY. D7 IS USED IN GROUPS 1,3,4,5; C12 IS USED IN GROUP 2.

BILATERAL SWITCH U202
19A700029P44





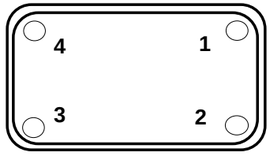
5 VOLT REGULATOR U203
19A704971P1 (MC78L05ACP)



PIN IDENTIFICATION

PIN 1. OUTPUT
PIN 2. GROUND
PIN 3. INPUT

TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR U204
19B801351P27

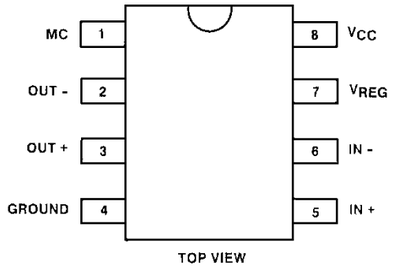


PIN CONNECTIONS

1. COMMON AND CASE
2. OUTPUT
3. +Vcc
4. MODULATION

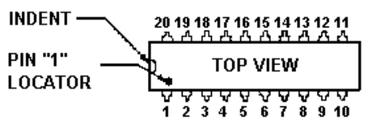
(19C851614, Rev. 1)

PRESCALER U205
19A704287P2

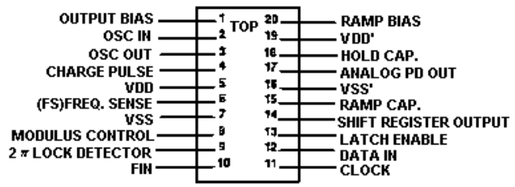


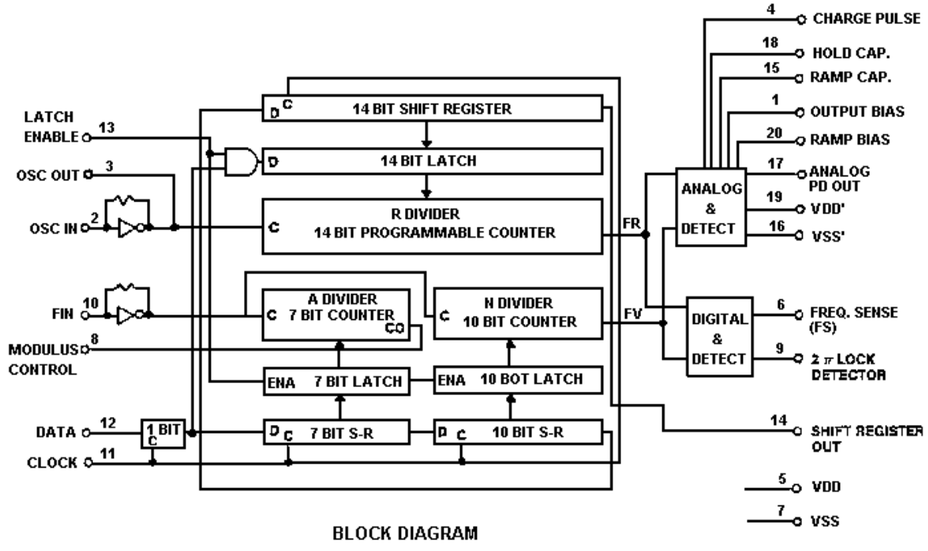
SYNTHESIZER U206
19B800902P4

PIN CONFIGURATION



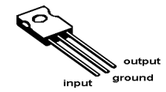
PIN DESCRIPTION

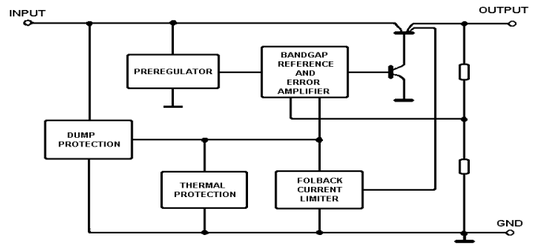




BLOCK DIAGRAM

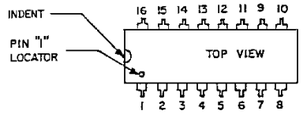
VOLTAGE REGULATOR U207, U503
344A3820P1

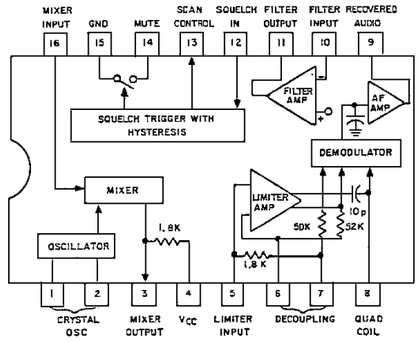




OSC/MIXER/IF/DET/AMP U501
19A704619P1 (MC3361AP)

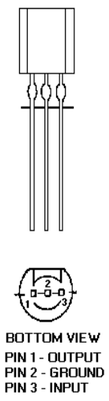
PIN CONFIGURATION

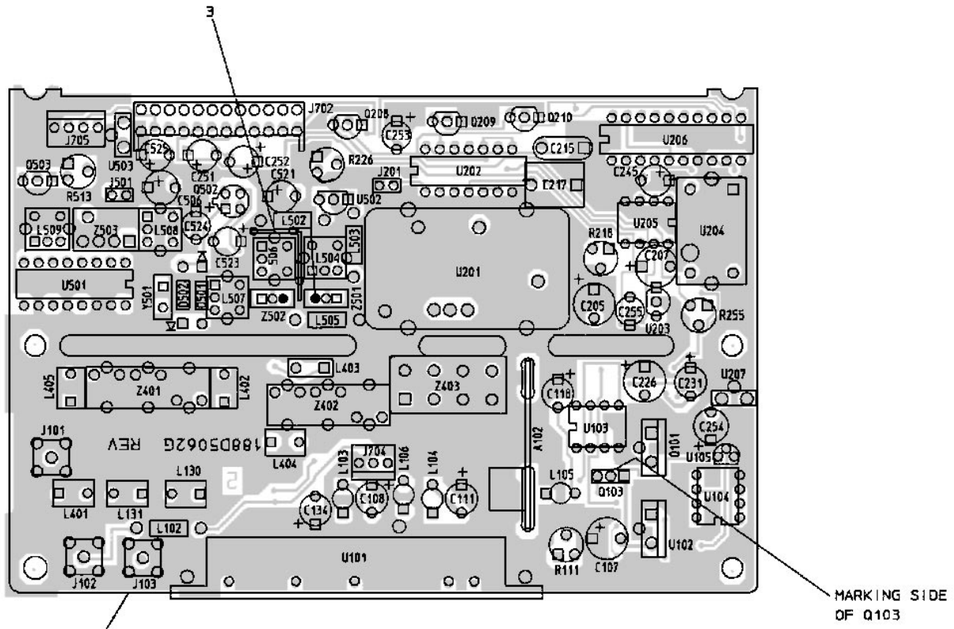




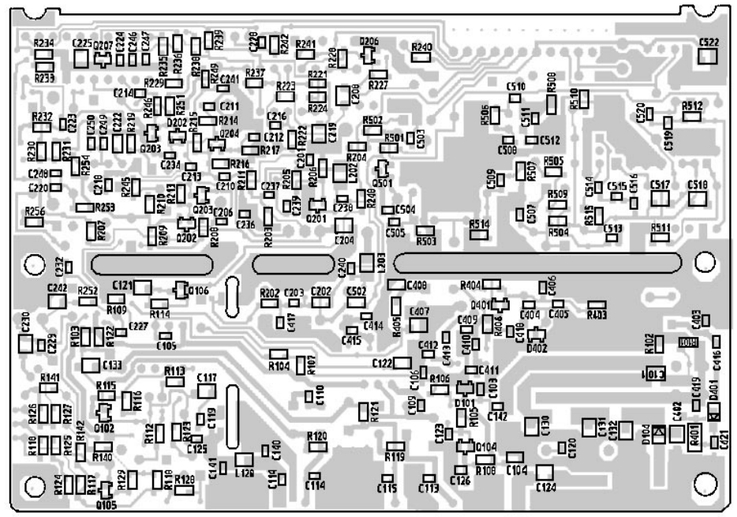
BLOCK DIAGRAM

8 VOLT REGULATOR U502
19A704073P2 (MC78L05ACP)





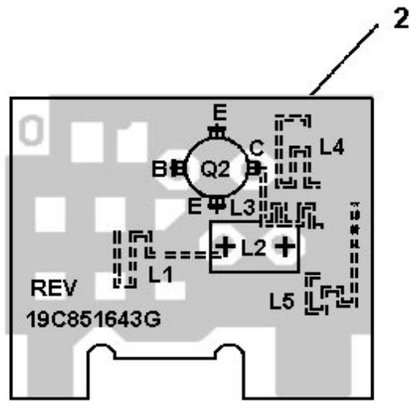
VIEW FROM COMPONENT SIDE



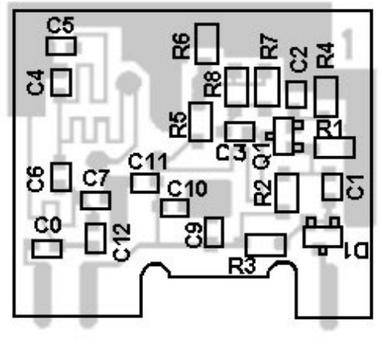
VIEW FROM SOLDER SIDE

LEAD IDENTIFICATION
FOR Q2

(TOP VIEW)
LEAD IDENTIFICATION
FOR D1



EXCITER BOARD A102
19B851643G1, G2 & G3



RF BOARD

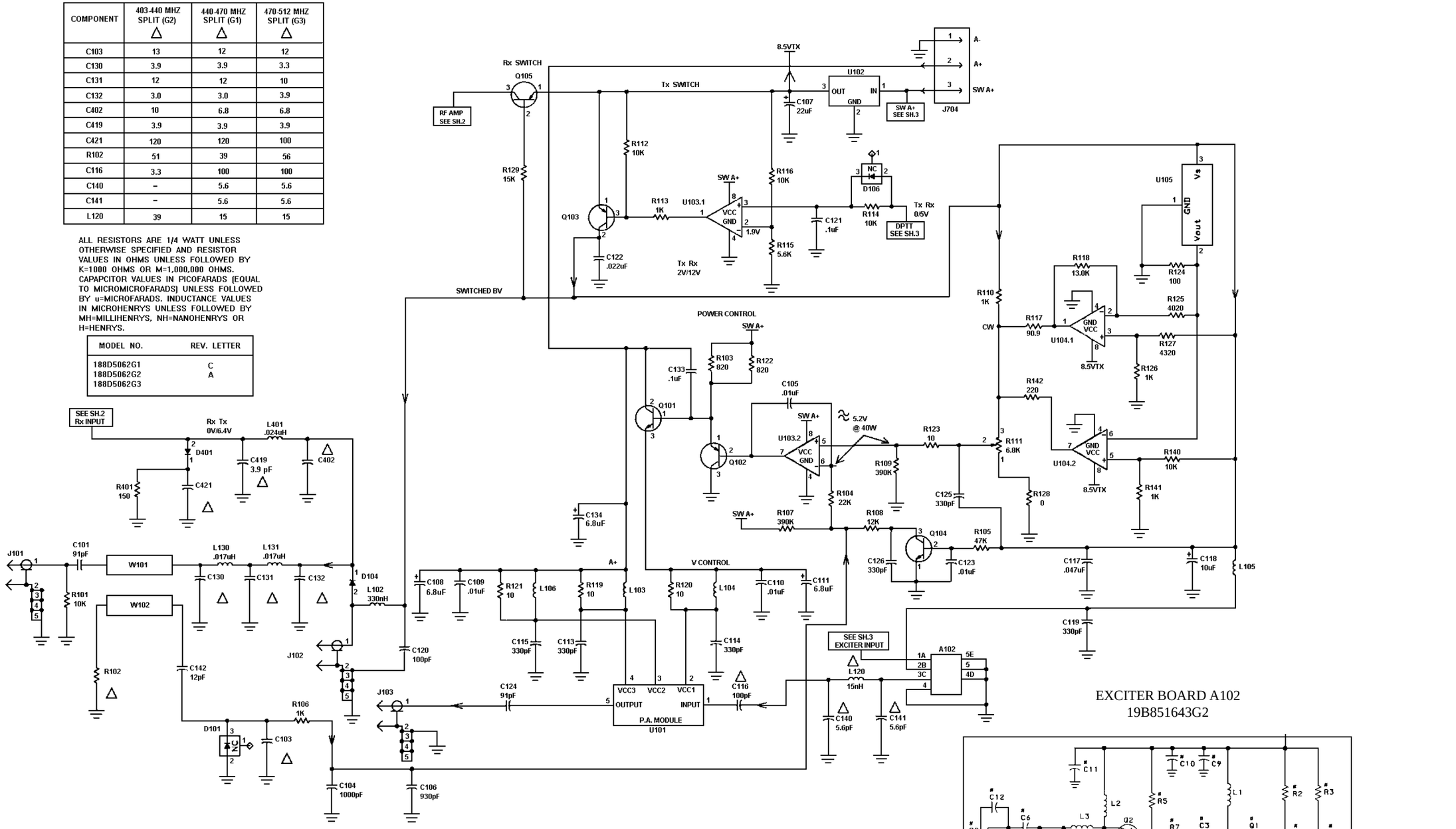
(188D5062, Sh. 1, Rev. 0)
(188D5061, Component Side, Rev. 2)
(188D5061, Solder Side, Rev. 2)

(19B851143, Rev. 1)
(19A705441, Sh. 1, Rev. 0)
(19A705441, Sh. 2, Rev. 1)

COMPONENT	403-440 MHZ SPLIT (G2) △	440-470 MHZ SPLIT (G1) △	470-512 MHZ SPLIT (G3) △
C103	13	12	12
C130	3.9	3.9	3.3
C131	12	12	10
C132	3.0	3.0	3.9
C402	10	6.8	6.8
C419	3.9	3.9	3.9
C421	120	120	100
R102	51	39	56
C116	3.3	100	100
C140	–	5.6	5.6
C141	–	5.6	5.6
L120	39	15	15

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR M=1,000,000 OHMS. CAPAPCITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY u=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS, NH=NANOHENRYS OR H=HENRYS.

MODEL NO.	REV. LETTER
188D5062G1	C
188D5062G2	A
188D5062G3	



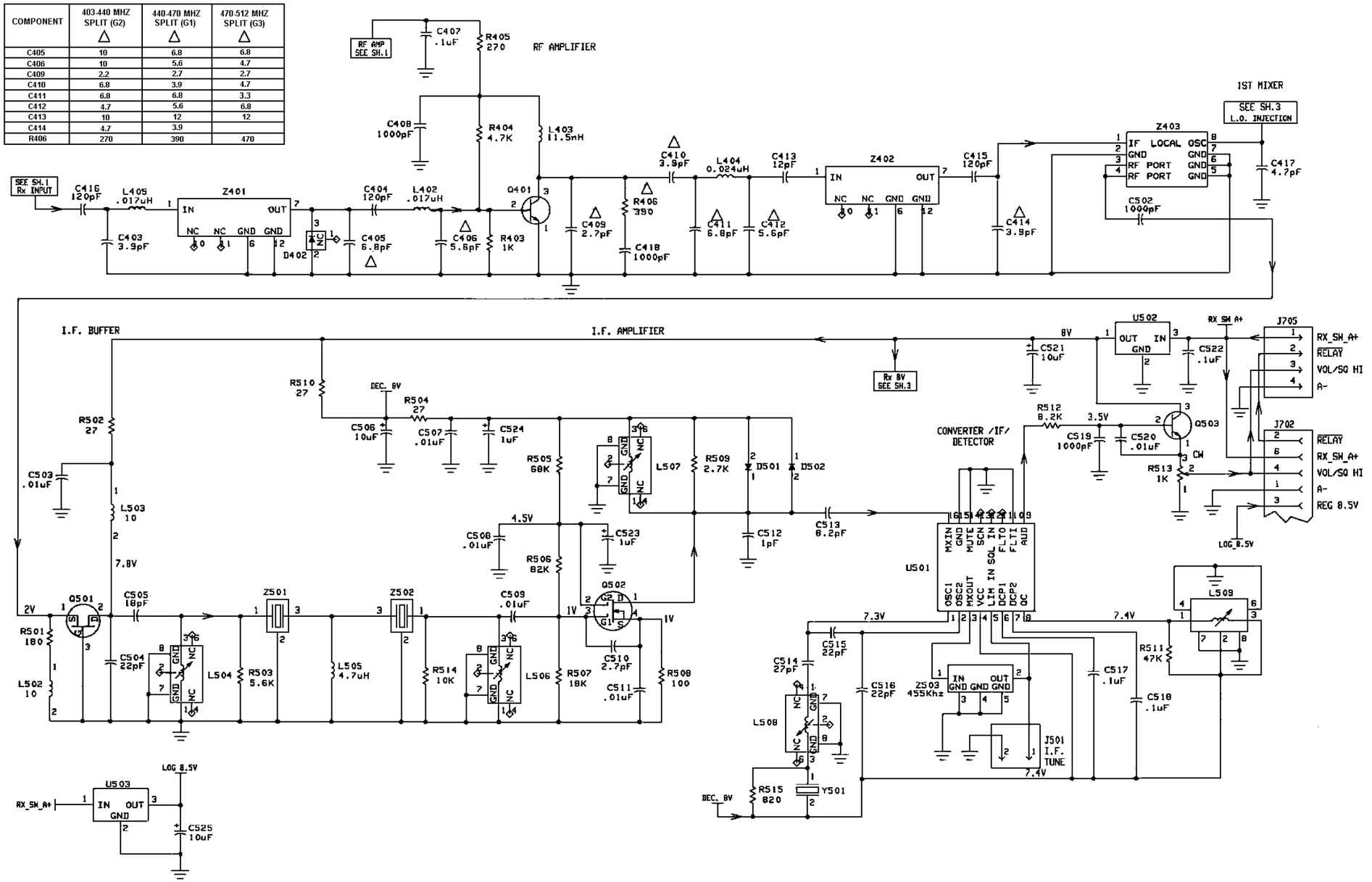
EXCITER BOARD A102
19B851643G2

RF BOARD

(199D5060, Sh. 2, Rev. 3)

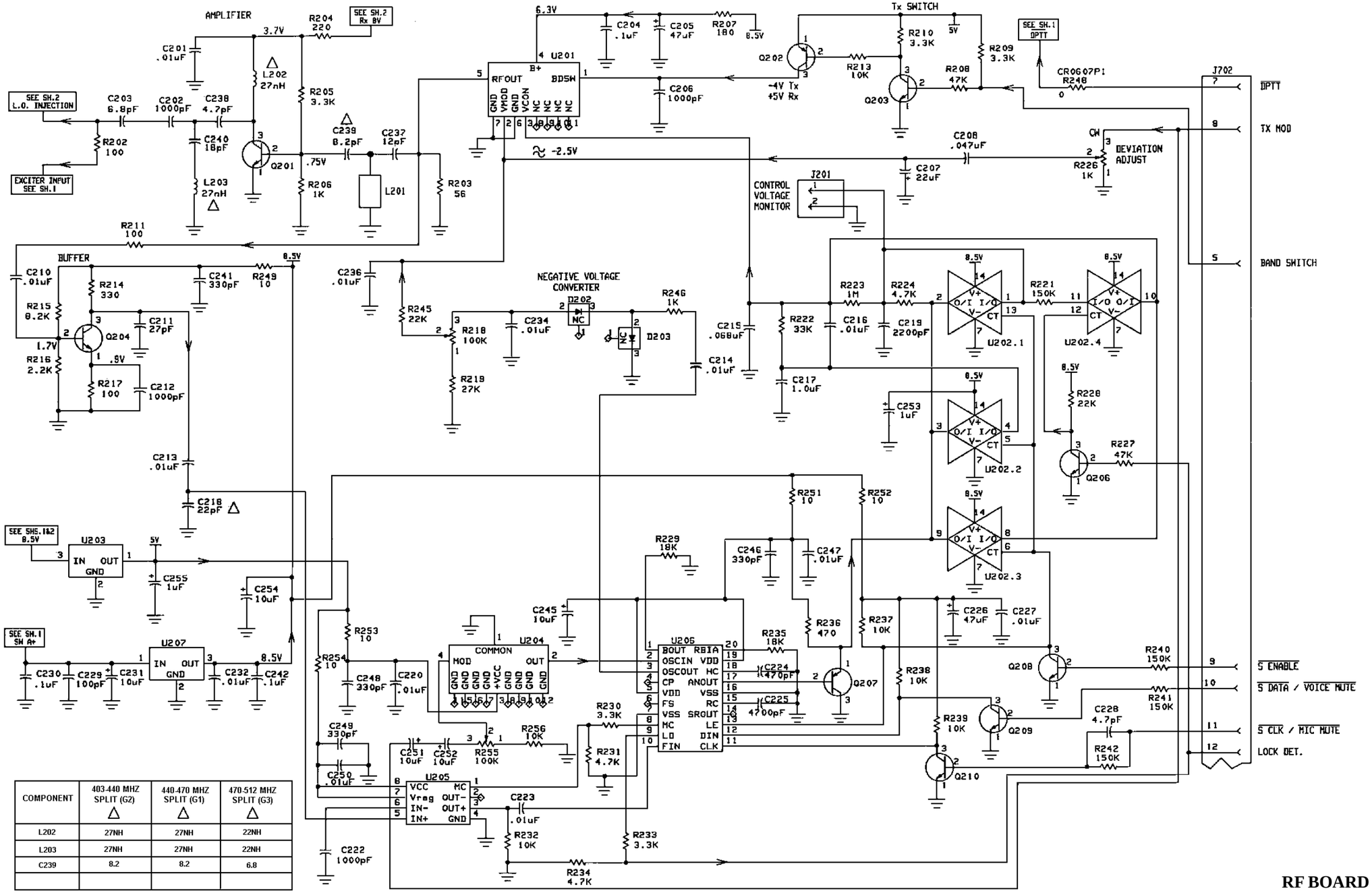
(19D902035, Sh. 1, Rev. 5)

COMPONENT	403-440 MHZ SPLIT (G2) △	440-470 MHZ SPLIT (G1) △	470-512 MHZ SPLIT (G3) △
C405	10	6.8	6.8
C406	10	5.6	4.7
C409	2.2	2.7	2.7
C410	6.8	3.9	4.7
C411	6.8	6.8	3.3
C412	4.7	5.6	6.8
C413	10	12	12
C414	4.7	3.9	
R406	270	390	470



RF BOARD

(188D5060, Sh. 2, Rev. 2)



COMPONENT	403-440 MHZ SPLIT (G2) △	440-470 MHZ SPLIT (G1) △	470-512 MHZ SPLIT (G3) △
L202	27NH	27NH	22NH
L203	27NH	27NH	22NH
C239	8.2	8.2	6.8

RF BOARD

(188D5060, Sh. 3, Rev. 1)