MAINTENANCE MANUAL

MDX™, MTD™, AND MDX DATA RADIO 900 MHz RF BOARD 19D902132G3

TABLE OF CONTENTS

DESCRIPTION

This RF Board for the 900 MHz MDX™, MTD™, and MDX DATA RADIO radios contains the following circuits:

- A frequency synthesizer to generate the transmit carrier frequency and the receiver circuit first mixer injection frequency.
- Transmit exciter, Power module, LPF, T/R switch and power control stages.
- Receive circuit front end, IF, and FM detector.
- Voltage regulators.

The RF Board is mounted in the bottom of the frame assembly. Refer to the applicable Combination Manual for a mechanical layout of the radio. Figure 1 is a Block Diagram of the transmitter, receiver and synthesizer circuits.

Transmitter circuit adjustments for frequency, power and deviation are accessible from the topside of the board, as are IF alignment, second oscillator and audio level adjustments for the receiver circuit. Chip components on the bottom of the board provide optimum RF performance and are 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.

CIRCUIT ANALYSIS

SYNTHESIZER CIRCUIT

The synthesizer generates all RF transmit and receive LO frequencies. The circuit uses a phase locked, voltage- controlled oscillator (VCO) operating on a frequency of 896- 902 and 935-941 MHz for transmission and 935-941 MHz for reception. The synthesizer output signal is generated directly by VCO module U201, and buffered by Q201 and Q202 to a level of +8 dBm. The synthesizer output is applied to the receiver mixer, and is also attenuated to 0 dBm by R201 to feed the transmitter exciter module.

The microprocessor (U703) on the Logic Board controls the synthesizer frequency. Frequency stability is maintained by a temperature compensated crystal-controlled oscillator (TCXO - U204) module. The oscillator has a stability of 1.5 PPM (±0.00015%) over the temperature range of -30°C to +75°C. The TCXO also has low frequency modulation capabilities used in digital channel guard implementation.

The VCO output is also buffered by Q207 and feeds the divide by 128/129 dual modulus prescaler U205. The prescaler output is applied to the F_{IN} input of the PLL U206. The prescaled signal is further divided down inside U206 to 12.5 KHz to be compared with a 12.5 KHz reference signal. This reference signal is derived from the 12.8 MHz TCXO module U204. U206 divides the 12.8 MHz TCXO down to the 12.5 KHz reference frequency.

Divider circuits in U206 are programmed by three inputs from the Logic Board that are buffered and inverted by transistors Q210, Q211, and Q212. The S ENABLE pulse activates switch U202 to allow more rapid channel acquisition, during channel changes, by increasing the loop bandwidth.

The PA LOCK DET signal from the PLL goes to the microprocessor and is used to prevent transmission when the VCO is not on frequency (unlocked).

Audio modulation from the Audio Board is applied to the VCO module through R218 and DEVIATION ADJUST potentiometer R224. R256 is the compensation adjust for the TCXO modulation used for digital channel guard operation. Q206 is used to short any AC signal present on the modulation line during receive.

When the radio is used in direct mode (talk-around), the VCO is band switched to the 935 to 941 MHz frequency range. Transistor Q204 inverts and buffers the band switch line from the microprocessor. Transistor Q205 is turned on in the normal mode of operation, and R224 is used to set deviation. In the talk-around mode, Q205 turns off, and Q214 turns on. This allows R226 to set the talk-around deviation.

TRANSMITTER CIRCUIT

The transmitter consists of fixed tuned exciter module U104, PA module U101, a pin diode switch (D104, D401), a low pass filter, a directional coupler, a power control circuit, and a transmit voltage switch.

Exciter Module

The block diagram (Figure 1) shows the synthesizer driving the receiver mixer at +8 dBm. R201 reduces the +8 dBm level to 0 dBm for exciter input drive. Exciter module U104 operates from a switched 8 volt supply and a variable supply. The variable supply is controlled by the power set circuitry. The fixed tuned exciter module bandwidth is sufficiently wide to cover 896 to 941 MHz. Both input and output ports operate at 50 ohms. The exciter module typically provides 23 dB of gain, and 200 milliwatts maximum output power to drive the power amplifier module.

Power Amplifier Module

PA module U101 requires a drive of 200 + mW from the exciter module to deliver up to 15 watts power output. The module is mounted to the rear heatsink. Input and output impedances are 50 ohms. The module output appears at J103 with a configurable coax jumper for a 15 watt radio, or routing to a 25 watt PA Board.

The PA module output power is controlled by varying the DC voltage to the module's first stage. Refer to the Power Control Circuit analysis paragraph below.

Pin Diode Switch, Low Pass Filter, and Directional Coupler

The output from the Power Amplifier Board module feeds transmit pin diode switch D104. In transmit, switched 8 volts is applied through L103, turning on pin diodes D104 and D401. Diode current is set at 40 milliamperes by R104. D104 couples the Power Amplifier Board output from J102 to the lowpass filter composed of C108, L102, C107, L101 and C106.

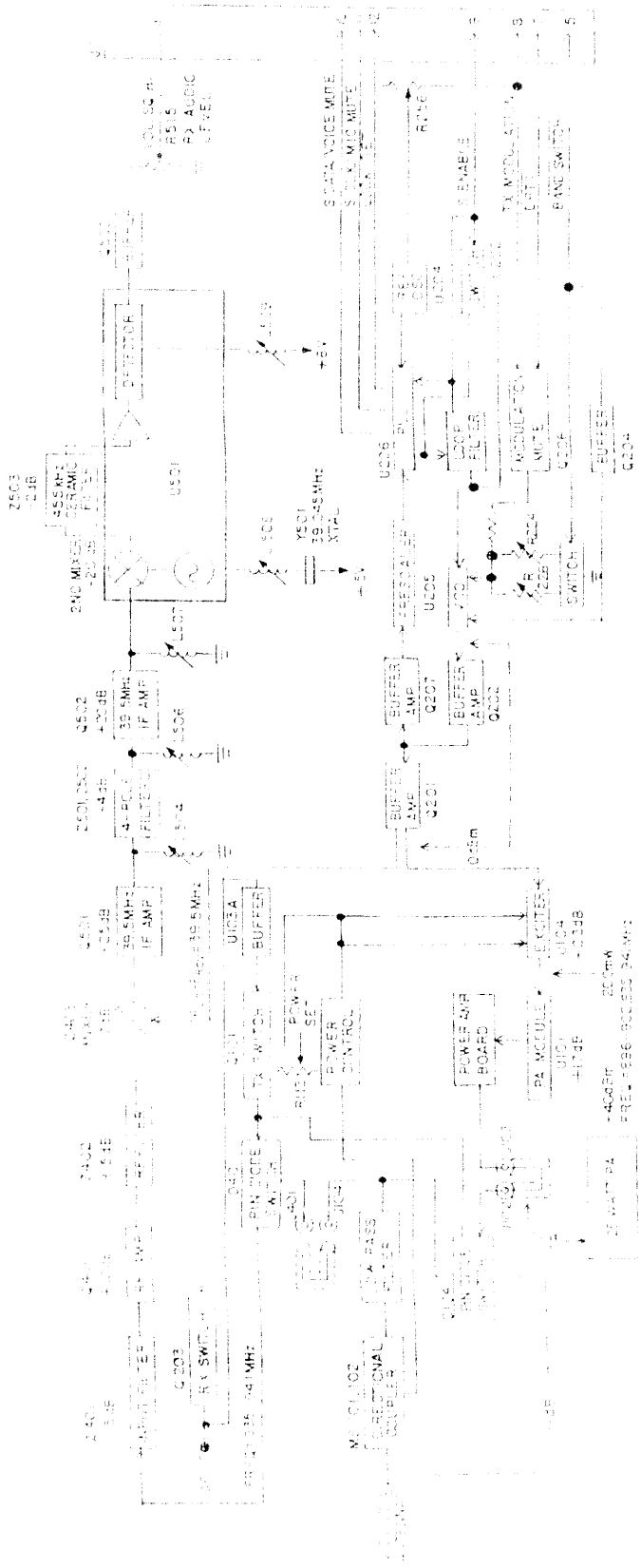


Figure 1 - RF Board Block Diagram

During transmit diode D401, C401, L401 and the cable connecting J401 and J104 form a quarter wave line. The line presents a high impedance at J104, thus minimizing loss of power due to the parallel RF path for the Rx input.

The low pass filter reduces the harmonic output from the transmitter and feeds the directional coupler W101/W102. The directional coupler provides a sample of transmitter power for the power control circuit. The coupler output is applied to antenna jack J101.

Power Control Circuit

Power control is provided by U103.2 and associated circuitry. The circuit samples the output power to the antenna, from the PA Board, to maintain a constant power level across the band. Also, a thermistor senses the heatsink temperature to reduce the power output level at heatsink temperatures above 70°C. The circuit controls the supply voltage to one of the amplifier stages in the exciter module to maintain a constant output power at the antenna.

A directional coupler (W101 and W102) provides a sample of transmitter power to diode D101. D101, R103, and C104 produce a positive DC voltage proportional to the transmitter output power level. This DC level feeds the (-) input of amplifier U103.2. Power set resistor R113 and R112 determine the DC level to (+) input of U103.2. U103.2 amplifies the difference between the (-) and (+) inputs, forcing the output power level to equal the power set level by varying the drive to Q103 and Q104. Q104 supplies the control voltage to the exciter module U104.

For example, if the output power level begins to drop below the power level shown by R113, the output of U103-B increases positively, causing Q103 to conduct less current. The base voltage of Q104 rises, increasing the control voltage to the exciter module, thereby increasing the output power level back to the required setting.

Q102, C114, C117, and R116 improve the transient stability of the power control loop when the transmitter is keyed.

Transmit Switch

When in the transmit mode, the Logic Board microprocessor pulls the DPTT line low, causing the output of U103.1 to go low. Q101 turns on to supply SW 8V to the exciter module, the power control circuit, and the PIN diode switch. At the same time, Q203 and Q213 are controlled by the DPTT line to remove the supply voltage to RX pre-amp Q401.

RECEIVER CIRCUIT

The dual conversion receiver circuit consists of a front end section, a 39.5 MHz first IF, and a 455 KHz second IF with an FM detector. All audio processing and squelch functions are contained on the Audio Board.

Front End Section

The 935-941 MHz receive RF signal is 39.0 MHz above the transmit frequency. The receive signal is coupled from antenna jack J101 through the directional coupler and the low pass filter to pin diode D401. In the transmit mode, SW 8V is applied through L103, turning on PIN diodes D104 and D401, completing the DC path through L401. D401 provides an RF path to ground for the receiver input while in transmit. In the receive mode, D401 is off, allowing the RF signal to pass by D401 unattenuated.

Preselector filters Z401 at the input of the RF preamplifier Q401, and Z402 at the output of the preamplifier, are fixed tuned three pole bandpass filters that determine the 8 MHz RF bandwidth selectivity for the receiver. Q401 is a low-noise amplifier with a 10.5 dB gain. The amplifier is matched to provide approximately 50-ohm input and output impedance for the preselectors.

Mixer Z403 is a doubly balanced diode mixer. The mixer is driven by a local oscillator signal (896-902 MHz) with a level of +8 dBm to provide good intermodulation and spurious performance. The mixer converts the received signal to 39.5 MHz. The mixer conversion loss is typically from 6 to 7 dB.

39.5 MHz IF

The first 39.5 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 tuned by L504 and loaded to provide the proper source termination for the four pole crystal filter that follows.

The output of the crystal filter is matched by second IF amplifier transistor Q502. This port is also tuned by L506, and loaded to provide the proper filter termination. Transistor Q502 is a dual gate FET operating at a bias current of about 10 milliamps. The output of Q502 is tuned by L507 for maximum gain at 39.5 MHz, and is loaded by the 2nd mixer in IC U501. Amplifier Q502 has a relatively high input and output impedance, and provides high isolation between U501 and the 39.5 MHz crystal filter output.

Converter/IF/Detector

IF module U501 is an MC3361 chip. Pins 1 and 2 connect to an internally-biased oscillator transistor. The external circuitry of this oscillator transistor includes crystal Y501 operating at 39.045 MHz. The frequency of this third mode oscillator is adjusted by inductor L508. The oscillator drives the internal balanced mixer. The 39.5 MHz IF signal is translated to 455 KHz and appears at pin 3 of U501. This IF signal is filtered by a 9 element ceramic filter Z503 and drives the internal 455 KHz amplifier and limiter. The limited 455 KHz signal 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 R514 and capacitor C521 to reduce IF feedthrough. Buffer amplifier Q503 drives audio potentiometer R515. This potentiometer is used to set the amplitude of the VOL/SQ HI signal for proper system operation.

POWER DISTRIBUTION

Power (A+ = 13.8 volts nominal) is provided to the radio through connectors J704 (pins 2 and 3) and J705 (pin 1) on the RF Board.

Pin 2 of J704 supplies A+ CONT to the power amplifier module U101, the power control transistor Q104, and the 20-Volt transient suppressor D105. D105 protects the radio from noise spikes and other overvoltage transients appearing on the input power cable.

Pin 3 of J704 supplies A+ SW to regulators U102 and U207 and the PA module. U102 supplies 8 Volts to the transmitter switch, synthesizer 5-volt regulator U203, and the Audio/Logic Board through J702 pin 3. U207 supplies 8.3 Volts to the synthesizer.

Pin 1 of J705 supplies A + SW to U502. U502 supplies 8 Volts to the receiver and routes A + SW to the Logic Board.

SERVICE NOTES

SYNTHESIZER CIRCUIT

Synthesizer troubleshooting consists of first checking for the proper DC levels, determining if the proper waveforms are present, and then checking individual modules.

DC Analysis

8.3 Vdc is supplied by regulator U207. This regulator supplies the biasing for transistor circuits Q201, Q202, Q207, Q208, Q209, Q210, Q211, and Q212. Resistor R211 and capacitors C204 and C205 decouple the 8.3 volts for use in the VCO module U201. The 10 milliamp current drain of this module results in approximately 8.2 Vdc on pin 4.

Transistor Q202 draws approximately 10 milliamps, resulting is a collector voltage of 4.3 Vdc at the junction of resistor R209 and Capacitor C206. Lack of VCO RF output will modify this voltage.

Transistors Q201 and Q207 have collector voltages of approximately 3.95 volts and 4.06 volts, respectively.

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

Waveforms

Waveforms associated with the synthesizer (see Figures 2-6) were measured with a 10-megohm, 30 pF probe with DC coupling. The waveforms in Figure 5 and Figure 6 are sent by the microcomputer on the Logic Board to the synthesizer to load a new channel.

For Figure 3, select a channel in the center of the band (channel 240 in this case, frequency = 899/128 = 7.02 MHz).

The top of the ramp is approximately 0.6 Vdc greater than the control voltage on PD out, Pin 17. Channel 240 is shown.

Module Isolation

Reference Oscillator U204:

> Look for a waveform similar to the reference (Figure 2) on Pin 2. If the waveform is not present, check the 5 volt regulator U203. If the oscillator is being supplied 5 volts and the waveform is not present, the oscillator module is probably defective.

VCO U201:

> Disconnect control voltage circuitry from VCO, and connect a DC power supply to Pin 3. With 4.5 volts DC on Pin 3, the output of U201 (pin 5) should be 899 MHz ±3 MHz.

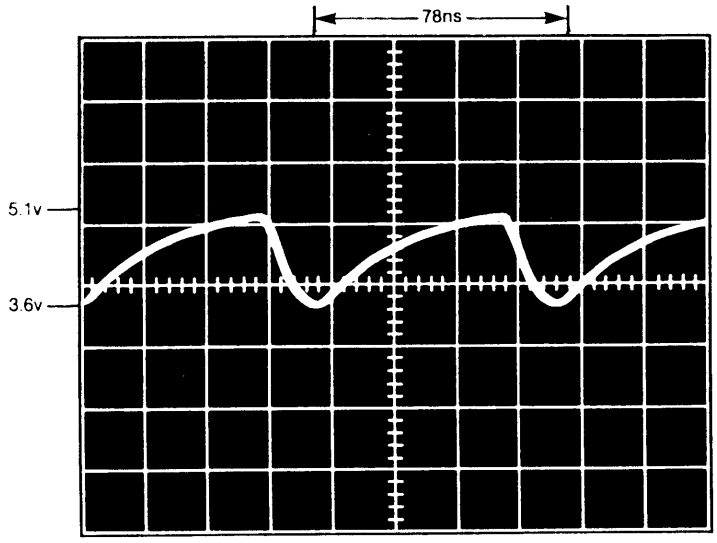


Figure 2 - Reference Oscillator (Input to U206, Pin 2)

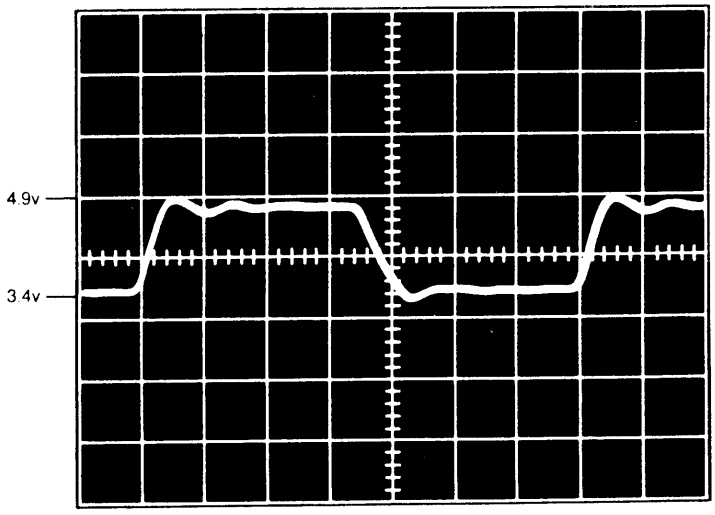


Figure 3 - F_{in} (input to U206, Pin 10)

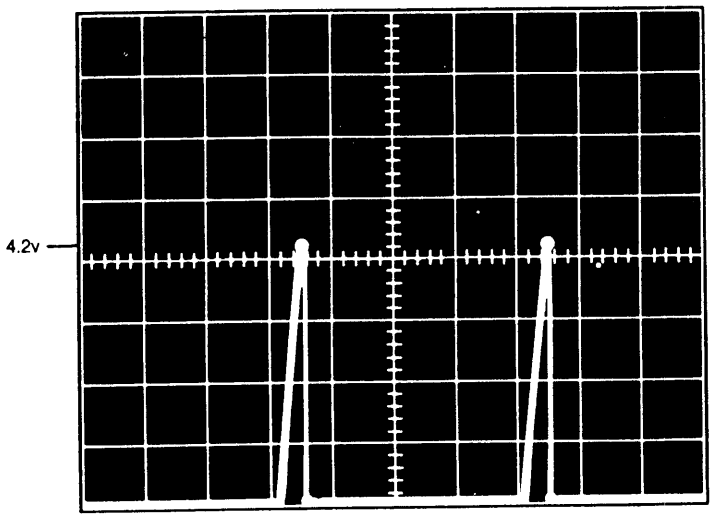


Figure 4 - Ramp (output U206, Pin 3)

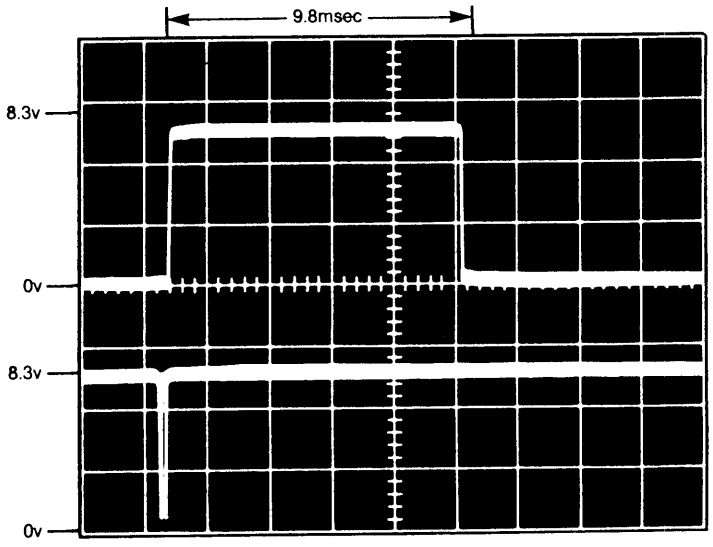


Figure 5 - Top-S ENABLE (Input U206, Pin 13) (Triggered on loading a new channel)
Bottom-S CLOCK (Input U206, Pin 11)

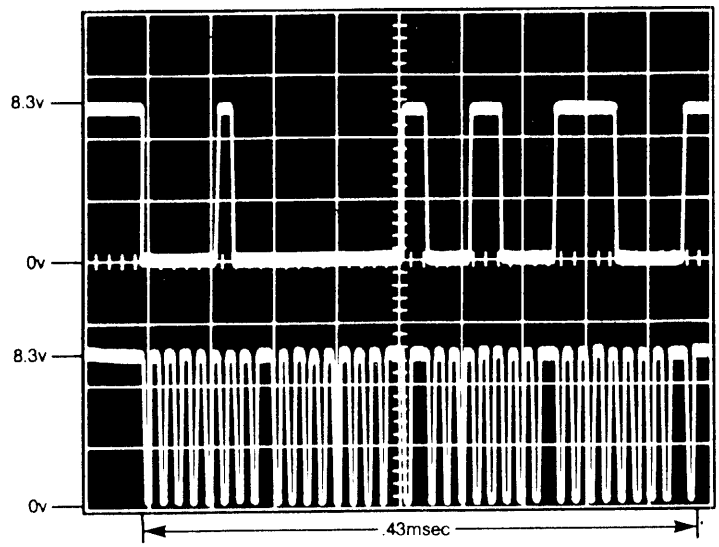


**Figure 6 - Top-S DATA (Input U206, Pin 12) (Channel 240 being loaded)
Bottom-S CLOCK (Input U206, Pin 11)**

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 C207 still connected in the circuit.

Prescaler U205:

Connect pin 3 of the VCO to 4.5 volts DC. With the radio in receive, monitor the frequency of the VCO at the connection of capacitor C210 and resistor R212. DC short pin 7 of U205 to ground to cause divide by 129 to occur. The frequency output at pin 5 should be the VCO frequency divided by 129. Tie pin 7 to pin 1 (5 volts) to cause divide by 128 to occur. Check pin 5 to verify that this occurs. Improper division may indicate a defective prescaler.

Bilateral Switch U202:

The bilateral switch is used to short around the loop filter during channel change. 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 to 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 resistances through the loop filter.

Transistors Q201 and Q202:

After checking for proper DC operation, measure the gain from the VCO, pin 5 to the synthesizer output C201/R201. The gain should be approximately 10 dB.

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 PA bracket screws and the RF Board screws.

3. 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 heat conducting silicone grease to the entire metal side of the replacement module.

2. Carefully insert the five leads from the module into the five corresponding PWB 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. Solder the five module leads. Trim excess wire.

TRANSMITTER CIRCUIT

Most transmitter circuit problems can be isolated by checking the TX power gains shown in Figure 1 - RF Board Block Diagram.

Transmitter DC Measurements:

1. Ensure that DPTT is low when the mic PTT is keyed low.

2. Check for approximately 8 volts at pin 5 of the exciter module U104. If not present, troubleshoot the TX switch circuitry, Q101 and U103.

3. Check for approximately 0.7 volts across each PIN diode D104 and D401. If not present, check the conduction path from L401 to the TX switch Q101.

4. Check for an adjustable voltage of 0 to 12 volts on pin 9 of the exciter module U104. At maximum power, with Power Set adjustment R113 fully clockwise, pin 9 should be approximately 2-8 volts. If not present, check the power control circuitry: U103, Q102, Q103, and Q104.

5. Check for 13.8 volts on pins 2, 3, and 4 of the PA module U101, and ensure a good mechanical and electrical ground from the PA module to the bracket and casting.

RECEIVER CIRCUIT

To isolate a receiver circuit problem refer to the Receiver Circuit Symptoms and Checks chart below.

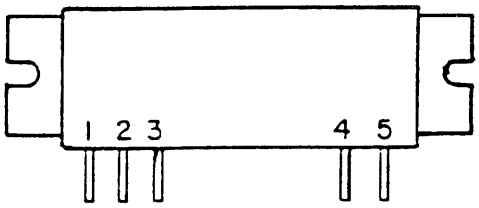
RECEIVER CIRCUIT QUICK CHECKS

SYMPTOM:	CHECK:
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 (L509).
Poor SINAD	1. Troubleshoot receive circuit stage gains (see Figure 1). 2. Input cable. 3. PIN diode switch 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.

ERICSSON

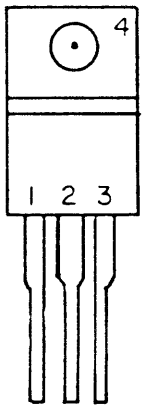
Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

Printed in U.S.A.



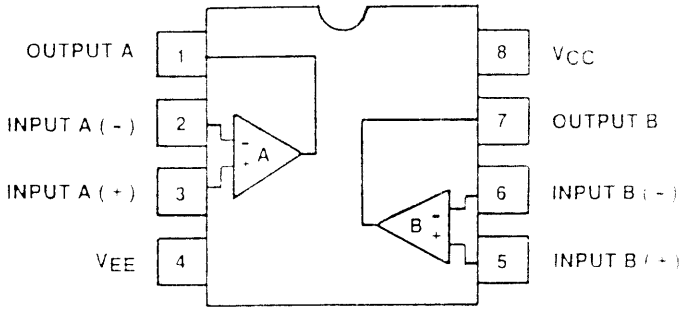
1. Pin
2. Vcc 1
3. Vcc 2
4. Vcc3
5. Pout

POWER AMPLIFIER MODUEL U101
19A143904P3

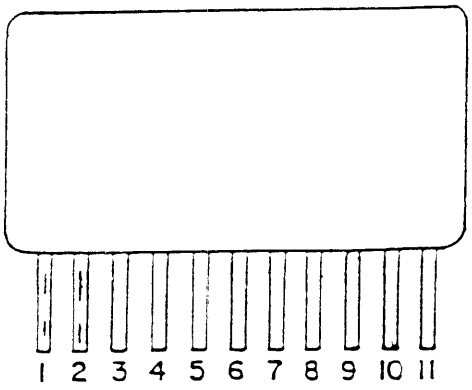


1. INPUT
2. COMMON
3. OUTPUT
4. TAB COMMON

VOLTAGE REGULATOR U102
19A134717P3

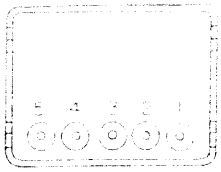


DUAL OP AMP U103
19A701789P2



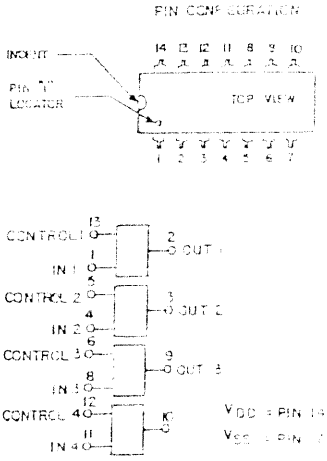
1- P_{IN}
10, 6, 7, 8, 2, 3, 4 -GROUND
5 - V_{CC1}
9 - V_{CC2}
11 - P_{OUT}

RF AMPLIFIER MODULE U104
19A704695P2

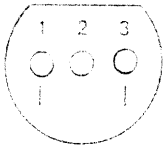


PIN	FUNCTION
5	SWITCH
4	MOD
3	CONTROL
2	Vcc
1	OUTPUT

VOLTAGE CONTROLLED OSC U20
19A705616P2



QUAD BILATERAL SWITCH U2021
19A700029P44

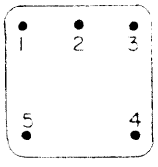


BOTTOM VIEW

PIN INDENTIFICATION

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

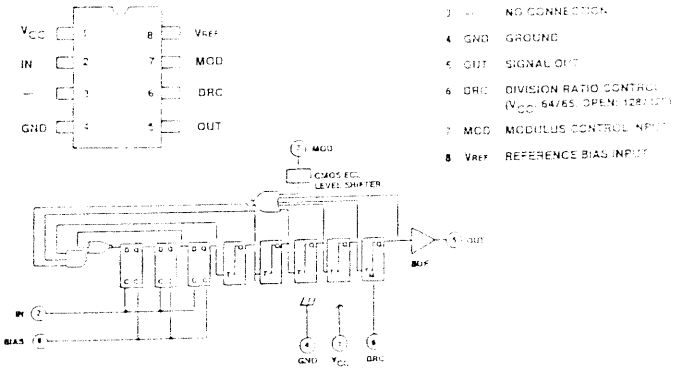
VOLTAGE REGULATOR U203
19A704971P1



PIN CONNECTIONS

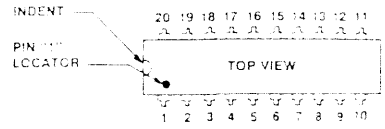
1. +Vcc
2. OUTPUT
3. COMMON & CASE
4. COMMON & CASE *
5. COMMON & CASE

* PIN 4 IS PERMISSIBLE BUT NOT NECESSARY FOR OPERATION.



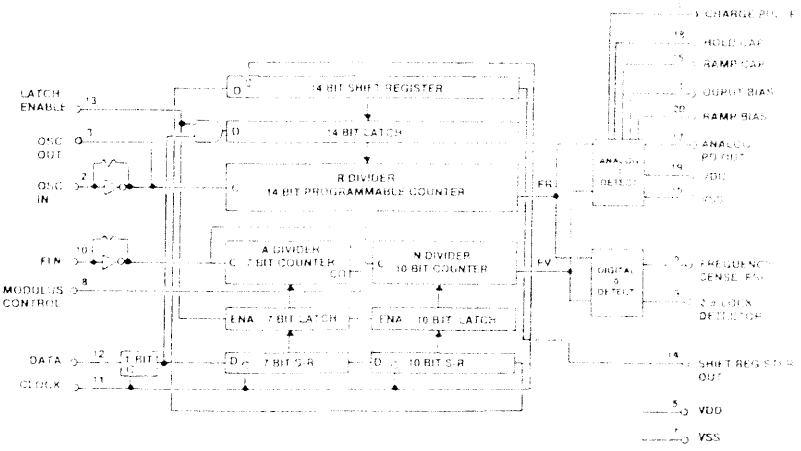
OSCILLATOR (TCXO) U204
19B801351P16

DIVIDER U205
19A704740P1

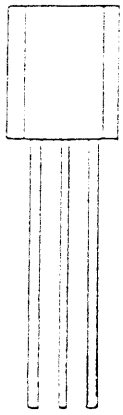


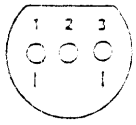
PIN DESCRIPTION

OUTPUT BIAS	1	20	RAMP BIAS
OSC. IN	2	19	VDD
OSC. OUT	3	18	HOLD CAP
CHARGE PVLSE	4	17	ANALOG PD OUT
VDD	5	16	VSS
(FS) FREQ. SENSE	6	15	RAMP CAP
VSS	7	14	SHIFT REGISTER OUPUT
MODULUS CONTROL	8	13	LATCH ENABLE
(LD) LOCK DETECTOR	9	12	DATA IN
FIN	10	11	CLOCK



SYNTHESIZER U206
19B800902P4



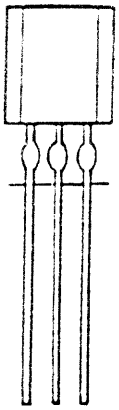


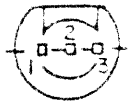
BOTTOM VIEW

PIN INDENTIFICATION

PIN 1 ADJUST
PIN 2 OUTPUT
PIN 3 INPUT

VOLTAGE REGULATOR U207
19A701999P4



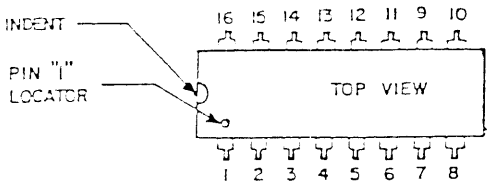


BOTTOM VIEW

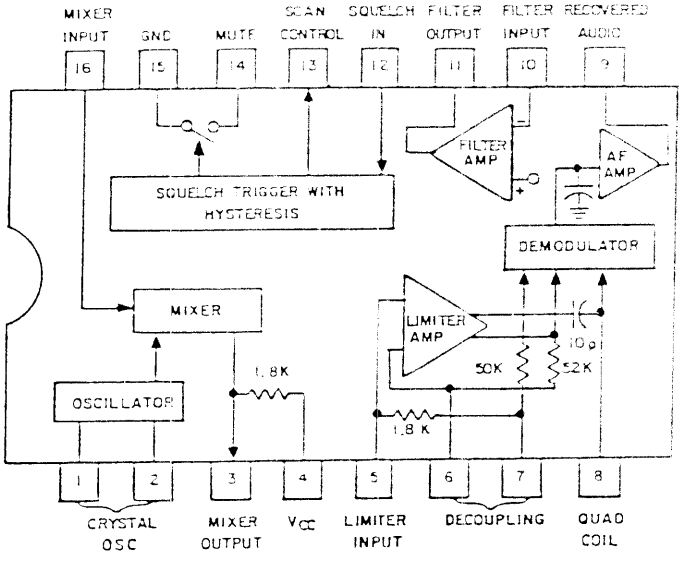
PIN 1 - OUTPUT
PIN 2 - GROUND
PIN 3 - INPUT

VOLTAGE REGULATOR U502
19A704073P2

PIN CONFIGURATION



OSC/MIXER/IF/DET/AMP U501
19A704619P1



BLOCK DIAGRAM

19D902132G3

SYMBOL	PART NUMBER	DESCRIPTION
		CAPACITORS
C101	19A705108P25	Mica Chip: 33 pF ±5%, 500 VDCW, temp coef 0 + 50 PPM/°C
C102	19A702236P6	Ceramic: 1.0 pF ± .25 pF, 50 VDCW, temp coef 0 ±30 PPM/°C
C103	19A702236P3	Ceramic: 2.7 pF ± .5 pF, 50 VDCW, temp coef 0 ±30 PPM
C104	19A702061P99	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C105	19A702236P10	Ceramic: 2.2 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM/°C
C106	19A705108P206	CAP, MICA
C107	19A705108P7	CAP, MICA
C108	19A705108P206	CAP, MICA
C109	19A702061P81	Ceramic: 100 pF ± 5%, 50 VDCW, temp coef 0 ±30 PPM
C110	19A701534P5	Tantalum: .47 µF ±20%, 35 VDCW
C111	19A702061P99	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C112	19A702052P22	Ceramic: 0.047 µF ± 10%, 50 VDCW
C113	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW, sim to Panasonic LS Series
C114	19A702061P73	Ceramic: 330 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C115	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C116 and C117	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW
C118 and C119	19A702061P73	Ceramic: 330 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C120	19A705108P25	Mica Chip: 33 pF ±5%, 500 VDCW, temp coef 0 + 50 PPM/°C
C121	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW
C122	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW, sim to Panasonic LS Series
C123 and C124	19A702061P73	Ceramic: 330 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C125	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW
C126	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW, sim to Panasonic LS Series.
C127	19A702236P6	Ceramic: 1.0 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM/°C.
C128	19A702061P73	Ceramic: 330 pF ±5% 50 VDCW, temp coef 0 ±30 PPM/°C
C129	19A705108P25	Mica Chip: 33 pF ±5%, 500 VDCW, temp coef 0 + 50 PPM/°C
C201 thru C203	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C204	19A702052P26	Ceramic: 0.1µF ± 10%, 50 VDCW
C205	19A701534P17	Tantalum: .47 µF ±20%, 10 VDCW
C206 and C207	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C208	19A702236P10	Ceramic: 2.2 pF ±2.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C
C209	19A702052P26	Ceramic: 0.1µF ± 10% 50 VDCW
C210 and C211	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C
C213	19A700004P1	Metallized polyester: 0.068 µF ± 10%, 50 VDCW
C212	19A702052P26	Ceramic: 0.1µF ± 10%, 50 VDCW
C214	19A700004P11	Metallized polyester: 1.0 µF ± 10%, 50 VDCW

SYMBOL	PART NUMBER	DESCRIPTION
C215	19A702052P14	Ceramic: 0.01 µF ± 10% 50 VDCW
C217	19A702236P50	Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C218	19A702052P26	Ceramic: 0.1µF ± 10% 50 VDCW
C219	19A703314P2	Tantalum: 220 µF -10+50% 10 VDCW
C220 and C221	19A702052P14	Ceramic: 0.01 µF ± 10% 50 VDCW
C222	19A702052P28	Ceramic: 0.022 µF ± 10% 50 VDCW
C223	19A702236P10	Ceramic: 2.2 pF ±2.5 pF, 50 VDCW temp coef 0 ±30 PPM/°C
C224	19A702061P99	Ceramic: 1000 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C225	19A702052P14	Ceramic: 0.01 µF ± 10% 50 VDCW
C226	19A702061P77	Ceramic: 470 pF ± 5% 50 VDCW temp coef 0 ± 30 PPM
C227	19A702052P7	Ceramic: 2200 pF ± 10% 50 VDCW
C228	19A702236P36	Ceramic: 27 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C229	19A701534P17	Tantalum: .47 µF ±20% 10 VDCW
C230	19A702052P14	Ceramic: 0.01 µF ± 10% 50 VDCW
C231	19A702061P9	Ceramic: 4.7 pF ± 0.5 pF, 50 VDCW temp coef 0 ± 60 PPM
C232	19A702236P50	Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C233 and C234	19A701534P7	Tantalum: 10 µF ±20% 16 VDCW
C235	19A705205P5	Tantalum: 6.8 µF 10 VDCW sim to Sprague 293D.
C236 and C237	19A702061P37	Ceramic: 33 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C401	19A702236P19	Ceramic: 5.6 pF ± 5 pF, 50 VDCW temp coef 0 ±30 PPM/°C
C402	19A702236P48	Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±30 PPM
C403	19A702236P44	Ceramic: 56 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C405	19A702236P1	Ceramic: 0.5 pF ± .1 pF, 50 VDCW temp coef 0 ±30 PPM
C406	19A702061P99	Ceramic: 1000 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C408	19A702236P44	Ceramic: 56 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C410	19A702236P19	Ceramic: 5.6 pF ± 5 pF, 50 VDCW temp coef 0 ±30 PPM/°C
C411	19A702236P6	Ceramic: 1.0 pF ±.25 pF, 50 VDCW temp coef 0 ±30 PPM/°C
C412	19A702236P1	Ceramic: 0.5 pF ± .1 pF, 50 VDCW temp coef 0 ±30 PPM
C413	19A702236P11	Ceramic: 2.7 pF ±0.25 pF, 50 VDCW temp coef 0 ±30 PPM
C414	19A702236P10	Ceramic: 2.2 pF ±2.5 pF, 50 VDCW temp coef 0 ±30 PPM/°C
C501	19A702061P99	Ceramic: 1000 pF ±5% 50 VDCW temp coef 0 ±30 PPM/°C
C502	19A702236P23	Ceramic: 8.2 pF ± 25 pF, 50 VDCW temp coef 0 ±30 PPM
C503 and C504	19A702052P14	Ceramic: 0.01 µF ± 10% 50 VDCW
C505	19A702236P13	Ceramic: 3.3 pF ±5% 50 VDCW temp coef 0 ±30 PPM
C506	19A702236P7	Ceramic: 1.2 pF ± .25 pF, 50 VDCW temp coef 0 ± 30 PPM
C507	19A702236P13	Ceramic: 3.3 pF ±5% 50 VDCW temp coef 0 ±30 PPM
C508 thru C510	19A702052P14	Ceramic: 0.01 µF ± 10% 50 VDCW
C511	19A701534P7	Tantalum: 10 µF ±20% 16 VDCW

★ COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

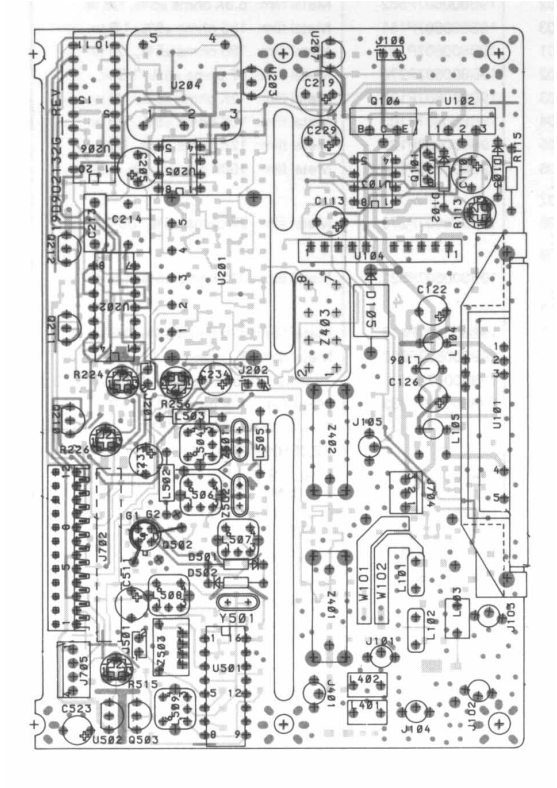
SYMBOL	PART NUMBER	DESCRIPTION
C512	19A702061P6	Ceramic: 2.7 pF ± 0.5 pF, 50 VDCW, temp coef: 0 ± 120 PPM.
C514	19A702061P1	Ceramic: [illegible] pF ± 0.5 pF, 50 VDCW.
C515	19A702061P12	Ceramic: 8.2 pF ± 0.5 pF, 50 VDCW, temp coef: 0 ± 60 PPM.
C516 and C517	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef: 0 ± 30 PPM.
C518	19A702061P41	Ceramic: 39 pF ±5%, 50 VDCW, temp coef: 0 ± 30 PPM.
C519 and C520	19A702052P26	Ceramic: [illegible] µF ±10%, 50 VDCW.
C521	19A702052P5	Ceramic: [illegible] µF ±10%, 50 VDCW.
C522	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C523	19A703314P10	Electrolytic: [illegible] µF +50% -10%, 50 VDCW. Sim to Panasonic EB Series.
C524	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
		— — — — — DIODES — — — — —
D101	19A705377P1	Silicon, dual Zener: sim to MMBZ20[illegible].
D102 and D103	19A700028P1	Silicon: 75 mA, 75 P.I.V. sim to 1N4148.
D104	344A3316P1	DIO[illegible].
D105	19A703588P3	Zener: [illegible] watt, ±10% tol, sim to 1N6278A.
D106	19A702526P2	Silicon: Schottky Barrier, sim to BAT[illegible].
D401	344A3316P1	DIO[illegible].
D501 and D502	19A700028P1	Silicon: 75 mA, 75 P.I.V. sim to 1N4148.
		— — — — — — JACKS — — — — — —
J101 thru J104	19B801341P1	RF jack.
J106	19A700072P1	Printed wire: 2 contacts rated @ 2.5 amps, sim to Molex 22-03-2021.
J201 and J202	19A700072P1	Printed wire: 2 contacts rated @ 2.5 amps, sim to Molex 22-03-2021.
J401	19B801341P1	RF jack.
J501	19A700072P1	Printed wire: 2 contacts rated @ 2.5 amps, sim to Molex 22-03-2021.
J702	19A704779P11	Connector, sim to Molex 22-27-2122.
J704	19A700072P29	Printed wire: 3 contacts rated at 2.5 amps, sim to Molex 22-27-2031.
J705	19A700072P30	Printed wire: 4 contacts rated at 2.5 amps, sim to Molex 22-27-2041.
		— — — — — INDUCTORS — — — — —
L101	19B800890P4	RF: sim to Paul Smith SK-891-1.
L102	19B800890P3	Coil, RF: 11.7 µH ±5%, sim to Paul Smith SK-896-1.
L103	19B800891P6	Coil, RF: .084 µH, sim to Paul Smith SK-890-1.
L104 thru L106	19A704921P1	Coil.
L201		PART OF PWB.
L401	19B800890P8	Coil, RF: sim to Paul Smith SK-891-1.
L402	19B800890P3	Coil, RF: 11.7 µH ±5%, sim to Paul Smith SK-896-1.
L403 and L404		PART OF PWB.
L502 and L503	H343CLP10022	Coil, Fixed: 10 µH ± 10%.
L504	19B801413P4	Coil, 39 MHz.

SYMBOL	PART NUMBER	DESCRIPTION
L505	19A700024P21	Coil, RF, fixed: 4.7 µH ±10%; sim to Jeffers 4436-8K.
L506 thru L508	19B801413P4	Coil, 39 MHz.
L509	19B801415P2	Transformer, 455 KHz: sim to AEPD 162B3277P17.
		— — — — TRANSISTORS — — — —
Q101	19A704972P1	Silicon, PNP: sim to Motorola 2N4918.
Q102	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q103	19A703197P2	Silicon, PNP; sim to MMBT4403 low profile.
Q104	344A3225P1	Silicon, NPN: sim to MJF3055.
Q201 and Q202	19A[illegible]708P2	Silicon, NPN: sim to NEC 2SC3356.
Q203	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.
Q204 thru Q206	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q207	19A704708P2	Silicon, NPN: sim to NEC 2SC3356.
Q208	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q209	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.
Q210	19A700023P2	Silicon, NPN: sim to 2N3904.
Q211 and Q212	19A702084P2	Silicon, NPN: sim to MPS 2369.
Q213 and Q214	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q401	19A705622P1	High frequency, NPN: sim to MMBR951.
Q501	19A702524P3	N-Type, field effect; sim to MMBFJ310.
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 w.
R102	19B800607P560	Metal film: 56 ohms ±5%, 1/8 w.
R103	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R104	19B801486P151	Metal film: 150 ohms ±5%, 1/2 w.
R105	19B800607P183	Metal film: 18K ohms ±5%, 1/8 w.
R106	19B800607P560	Metal film: 56 ohms ±5%, 1/8 w.
R107	19B800607P154	Metal film: 150K ohms ± 5%, 1/8 w.
R108	19B800607P183	Metal film: 18K ohms ±5%, 1/8 w.
R109	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w.
R110	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R111	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R112	19B800607P392	Metal film: 3.9K ohms ±5%, 1/8 w.
R113	19B800779P6	Variable: 2.2K ohms ±25%, 1/3 w.
R114	19B800607P152	Metal film: 1.5K ohms ±5%, 1/8 w.
R115	19A701864P5	Thermal: 2K ohms ±10%, sim to Midwest Components 2H-202.
R116	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R117	19B800607P123	Metal film: 12K ohms ±5%, 1/8 w.
R118 and R119	19B800607P394	Metal film: 390K ohms ±5%, 1/8 w.
R120	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.

SYMBOL	PART NUMBER	DESCRIPTION
R121 and R122	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w
R123	19B801479P120	Metal film: 12 ohms ±5%, 1 w
R124 thru R126	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R201	19B800607P330	Metal film: 33 ohms ±5%, 1/8 w
R202	19B800607P331	Metal film: 330 ohms ±5%, 1/8 w.
R203	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w
R204	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w
R205	19B800607P181	Metal film: 180 ohms ±5%, 1/8 w.
R206	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w
R207	19B800607P181	Metal film: 180 ohms ±5%, 1/8 w.
R208	19B800607P331	Metal film: 330 ohms ±5%, 1/8 w.
R209	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w.
R210	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R211	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R212	19B800607P181	Metal film: 180 ohms ±5%, 1/8 w.
R213	19B800607P471	Metal film: 470 ohms ±5%, 1/8 w.
R214	19B800607P331	Metal film: 330 ohms ±5%, 1/8 w
R215	19B800607P822	Metal film: 8.2K ohms ±5%, 1/8 w.
R216	19B800607P222	Metal film: 2.2K ohms ±5%, 1/8 w.
R217	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R218	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w
R219	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R220	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R221	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R222	19B800607P683	Metal film: 68K ohms ±5%, 1/8 w.
R223	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w
R224	19B800779P7	Variable: 3.3K ohms ±25%, 100 VDCW, 3 w
R225	19B800607P683	Metal film: 68K ohms ±5%, 1/8 w
R226	19B800779P7	Variable: 3.3K ohms ±25%, 100 VDCW, 3 w
R227	19B800607P333	Metal film: 33K ohms ±5%, 1/8 w.
R228	19B800607P334	Metal film: 330K ohms ±5%, 1/8 w.
R229	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w
R230	19B800607P224	Metal film: 220K ohms ±5%, 1/8 w
R231	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w
R232	19B800607P474	Metal film: 470K ohms ±5%, 1/8 w
R234	19A702931P137	Metal film: 237 ohms ±1%, 200 VDCW, 1/8 w
R235	19A702931P213	Metal film: 1330 ohms ±1%, 200 VDCW, 1/8 w
R236	19B800607P823	Metal film: 82K ohms ±5%, 1/8 w
R237	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w.
R238	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w
R239	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R240	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w
R241	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w.
R242	19B800607P393	Metal film: 39K ohms ±5%, 1/8 w
R243	19B800607P471	Metal film: 470 ohms ±5%, 1/8 w
R244 thru R246	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w
R247 thru R250	19B800607P154	Metal film: 150K ohms ± 5%, 1/8 w.
R251	19B800607P683	Metal film: 68K ohms ±5%, 1/8 w
R252	19B800607P330	Metal film: 33 ohms ±5%, 1/8 w
R253	19B800607P1	Metal film: Jumper
R254	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R255	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w
R256	19B800779P16	Variable: 100K ohms ±25%, 100 VDCW, 3 watt

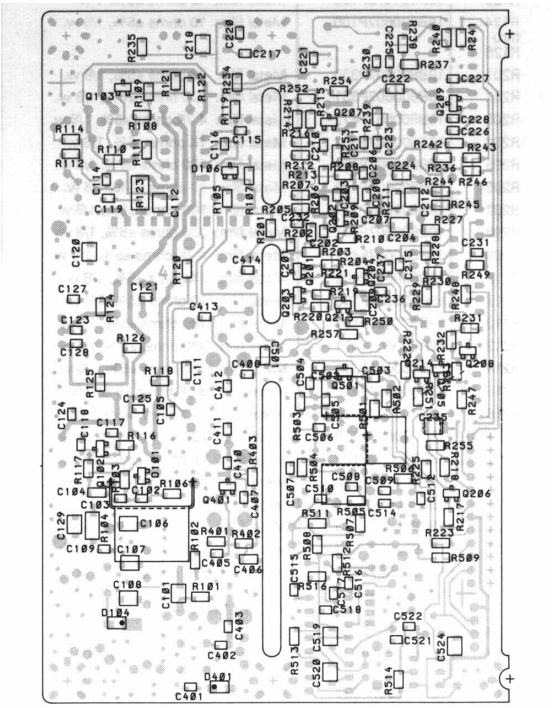
SYMBOL	PART NUMBER	DESCRIPTION
R257	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w
R401	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w
R402	19B800607P562	Metal film: 5.6K ohms ±5%, 1/8 w
R403	19B800607P151	Metal film: 150 ohms ±5%, 1/8 w
R501	19B800607P181	Metal film: 180 ohms ±5%, 1/8 w
R502	19B800607P270	Metal film: 27 ohms ±5%, 1/8 w
R503	19B800607P123	Metal film: 12K ohms ±5%, 1/8 w
R504	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w
R505	19B800607P123	Metal film: 12K ohms ±5%, 1/8 w
R506 and R507	19B800607P154	Metal film: 150K ohms ± 5%, 1/8 w
R508 and R509	19B800607P270	Metal film: 27 ohms ±5%, 1/8 w
R511 and R512	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w
R513	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w
R514	19B800607P822	Metal film: 8.2K ohms ±5%, 1/8 w
R515	19B800779P4	Variable: 1K ohms ±25%, 100VDCW, 3 w
R516	19B800607P333	Metal film: 33K ohms ±5%, 1/8 w
		— — — INTEGRATED CIRCUITS — — —
U101		NEXT HIGHER ASM
U102	19A134717P3	Linear: 8 Volt Regulator, sim to MC7808CT
U103	19A701789P2	Linear: Dual Op Amp, sim to LM358
U104	19A704695P2	Integrated circuit
U201	19A705616P2	OSC VLTG CONT
U202	19A700029P44	Digital: BILATERAL SWITCH
U203	19A704971P1	Linear: +5 Volt Regulator, sim to MC78L05ACP
U204	19B801351P16	OSC XTAL
U205	19A704740P1	Digital: Divider, sim to Mitsubishi M54475P
U206	19B800902P4	Digital: Synthesizer, CMOS Serial Input
U207	19A701999P4	Linear, (Positive Voltage Regulator): sim to LM317LZ
U501	19A704619P1	Linear: Osc/Mixer/IF/Det/Amp, sim to MC3361AP
U502	19A704073P2	Linear: 8 Volt Regulator, sim to MC78L08CP
		— — — — — — CABLES — — — — — —
W101 and W102		PART OF PWB
		— — — — — — CRYSTALS — — — — — —
Y501	19B233066G14	XTAL
		— — — — — MISCELLANEOUS — — — — —
3	19B233978G3	XTAL
		— — — — — — FILTER — — — — — —
Z401 and Z402	19A04888P2	Filter, bandpass, sim to Murata DFC3R937-P008BTD
Z403	19B801025P2	Balanced Mixer, sim to Mini-Circuits SBL-1X
Z501	19A705613G20	FLT XTAL
		— — — — — MISCELLANEOUS — — — — —
12	19B801556G3	XTAL
13	19A705613G19	FLT XTAL
Z502		PART OF Z501
Z503	19B801021P4	FLT BP
6	19B801490P1	Ground Strap
9	19B801578P1	CLIP SHIELD
10	19D902132G9	CPNT BD RF BD
11	19D902921P1	BD PW
15	19B801863P1	SHIELD RF

COMPONENT SIDE



(19D902132, Sh. 2, Rev. 5)
(19D902921, Sh. 1, Rev. 4)
(19D902921, Sh. 3, Rev. 4)

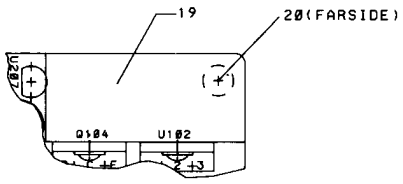
SOLDER SIDE



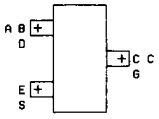
VIEW FROM BACKSIDE

(19D902132, Sh. 2, Rev. 5)
(19D902921, Sh. 3, Rev. 4)

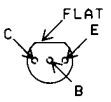
(17) SAME AS PART 12 EXCEPT AS NOTED BELOW



LEAD IDENTIFICATION FOR (SOT) TRANSISTORS AND DIODES



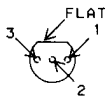
LEAD IDENTIFICATION FOR Q210,Q211,Q212,& Q503



IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

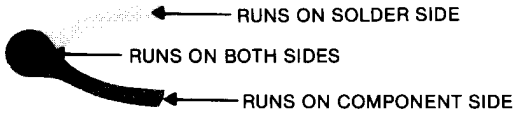
LEAD IDENTIFICATION FOR U203,U207 & U502



IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

RF BOARD
19D902132G3

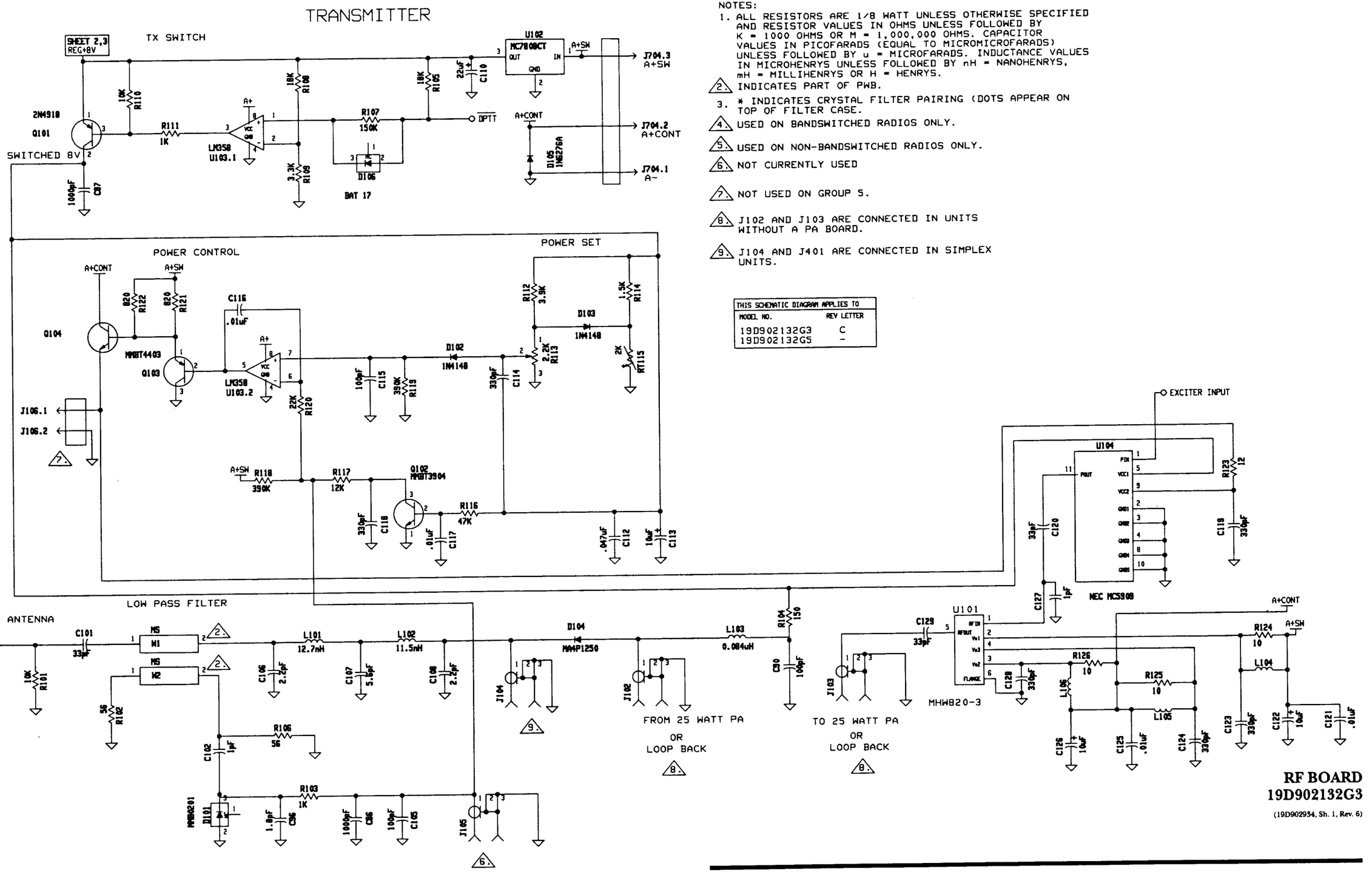


CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

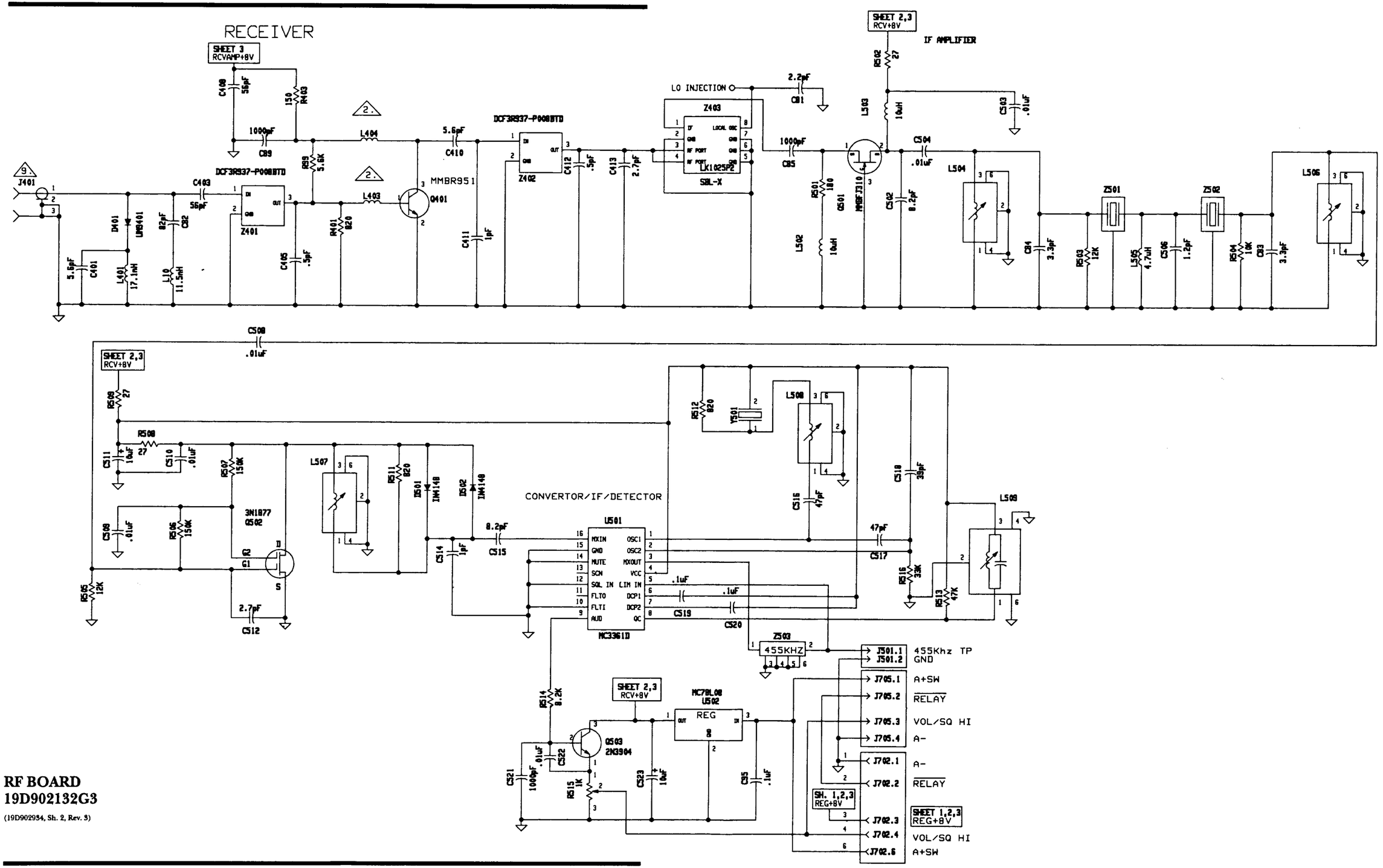
NOTES:

1. ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K = 1000 OHMS OR M = 1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY u = MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY nH = NANOHENRYS, mH = MILLIHENRYS OR H = HENRYS.
2. INDICATES PART OF PWB.
3. * INDICATES CRYSTAL FILTER PAIRING (DOTS APPEAR ON TOP OF FILTER CASE.
4. USED ON BANDSWITCHED RADIOS ONLY.
5. USED ON NON-BANDSWITCHED RADIOS ONLY.
6. NOT CURRENTLY USED
7. NOT USED ON GROUP 5.
8. J102 AND J103 ARE CONNECTED IN UNITS WITHOUT A PA BOARD.
9. J104 AND J401 ARE CONNECTED IN SIMPLEX UNITS.

THIS SCHEMATIC DIAGRAM APPLIES TO	
MODEL NO.	REV LETTER
19D902132G3	C
19D902132G5	-

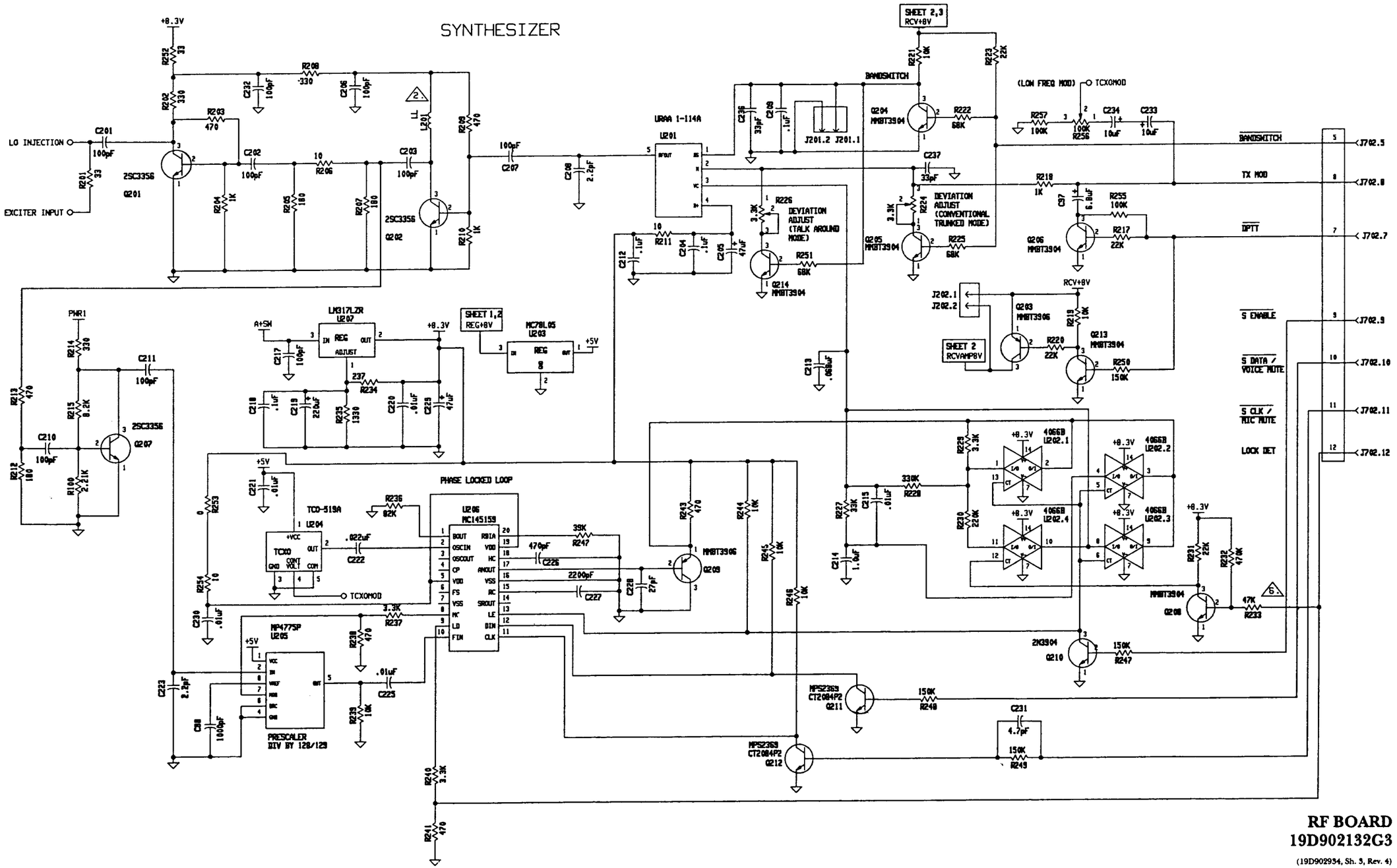


RF BOARD
19D902132G3
(19D902934, Sh. 1, Rev. 6)



RF BOARD
19D902132G3

(19D902954, Sh. 2, Rev. 3)



RF BOARD
19D902132G3

(19D902934, Sh. 3, Rev. 4)

ADDENDUM NO. 1 TO LBI-38545B (PCMT,PCDR,PCPM)

This addendum adds Revision Letter information which will be incorporated into the manual at the next printing.

REV. A RF BOARD 19D902132G3
Incorporated into initial shipments.

REV. B RF BOARD 19D902132G3
Incorporated into initial shipments.

REV. C RF BOARD 19D902132G3
Incororated into initial shipments.

REV. D RF BOARD 19D902132G3
To improve second image rejection and receiver sensitivity, the following components were changed.
C515 changed from 8.2 pF (19A702061P12) to 0.01 µF (19A702052P14).
R503 changed from 12K ohms (19B800607P123) to 6.8K ohms (19B800607P682).
R504 changed from 10K ohms (19B800607P103) to 8.2K ohms (19B800607P822).
R505 changed from 12K ohms (19B800607P123) to 8.2K ohms (19B800607P822).
R506 changed from 150K ohms (19B800607P154) to 33K ohms (19B800607P333).
R507 changed from 150K ohms (19B800607P154) to 27K ohms (19B800607P273).
R511 changed from 820 ohms (19B800607P821) to 1K ohms (19B800607P102).

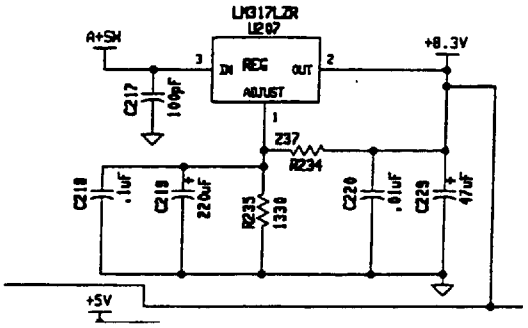
REV. E RF BOARD 19D902132G3
To change sensitivity of RF power detect circuit, C102 changed from 1.0 pF (19A702236P6) to 0.9 pF (19A702236P5).

ADDENDUM NO. 2 TO LBI-38545B

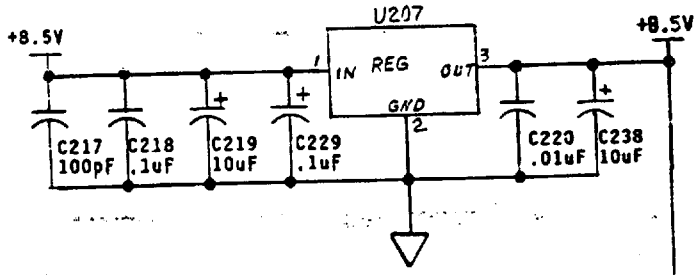
This addendum adds Revision Letter information.

REV. F RF BOARD 19D902132G3
To improve performance during low voltage operation, the following component changes were made:
R234 and R235 deleted.
C219 changed from 220 µF (19A703314P2) to 10 µF electrolytic (19A703314P10).
C229 changed from a 47 µF (19A701534P17) to a 0.1 µF ceramic (19A702052P26).
C238 added: Tantalum, 10 µF, ±20%, 16 VDCW (19A701534P7).
U207 changed from 19A701999P4 to a 8.5V voltage regulator sim to L885CX (344A3820P1).

Changed From



Changed To



ERICSSON
Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

Printed in U.S.A.