MAINTENANCE MANUAL
RF BOARD
19D902123G20

TABLE OF CONTENTS

DESCRIPTION

RF Board 19D902123G20 is used in the MDR Dual Mode Mobile Radio. Circuitry for this 800 MHz board includes the frequency synthesizer, transmit exciter, power amplifier, PA power control stages, receiver front end, IF amplifier, FM detector and voltage regulators.

The RF Board mounts in the bottom of the radio frame assembly. Transmitter and receiver adjustments are accessible from the top of the board. Chip components on the bottom of the board are accessible by removing the friction fit bottom shield. Sealed modules provide RF and mechanical protection for sensitive circuitry. These modules are not serviceable and should be replaced if damaged or found to be defective.

CIRCUIT ANALYSIS

SYNTHESIZER CIRCUIT

The synthesizer generates all transmit and receive RF frequencies for the mobile radio. A block diagram of the frequency synthesizer circuit is shown in Figure 1. When the radio transmit circuit is transmitting, the phase-locked synthesizer circuit locks the Voltage Controlled Oscillator circuit (VCO) on the actual transmit frequency. The VCO output signal is buffered by two (2) common-emitter amplifier circuits and applied to the input of the exciter module. When the radio is transmitting on a standard trunking channel, the drive from the VCO ranges from 806.0125 - 824.9875 MHz. When the radio transmit circuit is transmitting on a talk-around channel, the VCO output is band-shifted to a frequency band between 851.0125 - 869.9875 MHz. When the radio receive circuit is receiving, (851.0125 - 869.9875 MHz) the synthesizer operates 45 MHz below the receive frequency. This provides the required low-side injection for the receiver first mixer circuit.

The synthesizer output signal is generated directly by VCO module U201 and buffered to a level of +8 dBm (6 mW) by transistors Q201 and Q205. This +8 dBm signal direct drives the receive circuit mixer and is attenuated to +3 dBm by resistor R201 to feed the transmit exciter module.

Synthesizer frequency is controlled by the microprocessor on the Logic Board. Frequency stability is maintained by temperature compensated crystal controlled oscillator (TCXO) module U204 operating at 12.8 MHz. The oscillator has a stability of 1.5 PPM (0.00015%) over the temperature range of -30°C to 85°C and determines the overall frequency stability of the radio.

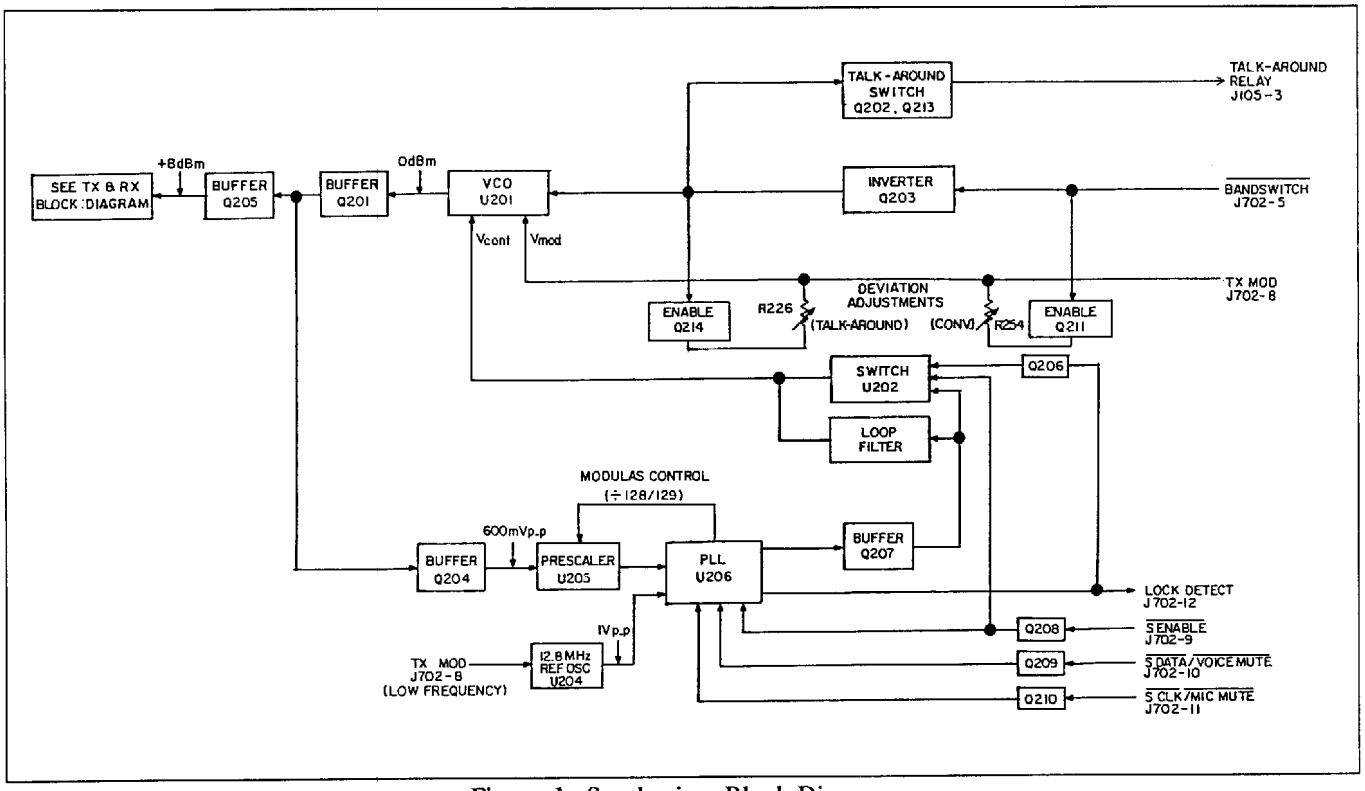

Figure 1 - Synthesizer Block Diagram

The buffered VCO output from Q201 is further buffered by transistor Q204 to feed divide-by 128/129 dual modulus prescaler U205. The prescaler feeds the FIN input of the synthesizer chip U206. Within U206, the prescaler signal is further divided down to 12.5 kHz to be compared with a reference signal. This reference signal is derived from the 12.8 MHz TCXO module U204. U206 divides the 12.8 MHz signal down to the 12.5 kHz reference frequency.

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

A LOCK DET signal from U206 is applied to the microprocessor for processing to prevent transmission when the VCO is not on frequency and to provide an error message to the user.

The $\overline{\text{BANDSWITCH}}$ logic line from the microprocessor is normally high. This high turns on transistor Q211 to activate potentiometer R254. This pot provides transmit modulation adjustment for the standard trunking channels (non-talk-around). It attenuates the TX MOD signal that is applied to the VCO when the radio transmit circuit is transmitting on a normal channel.

Radios, with the talk-around option installed, can be band-switched to allow the transmitter to operate in the 851 to 870 MHz range. BANDSWITCH switches low during transmit talk-around. This cause Q211 to turn off, disabling pot R245. At the same time, transistor Q214 turns on and activates potentiometer R226 to provide deviation adjustment for talk-around channels. Transistor Q214 is turned on by the inverting action performed by Q203. The collector of Q203 is pulled high when the BANDSWITCH line is low. In addition to driving Q214, the collector of Q203 also feeds the VCO band-switch logic input and Q213. When BANDSWITCH is low, Q213 and Q214 are on. Transistor Q213 then turns Q202 on to apply switched A+ power to J105-3. This switched power is applied to the Talk-Around Board to switch the transmit RF path to the receiver side of the Duplexer.

NOTE

Operating a radio not equipped with the talk-around option in a talk-around mode may damage the unit.

TRANSMITTER CIRCUIT

The transmitter consists of a fixed tuned, 200 milliwatt exciter module, a 20 watt PA module, power control and T/R switching circuitry (see Figure 2).

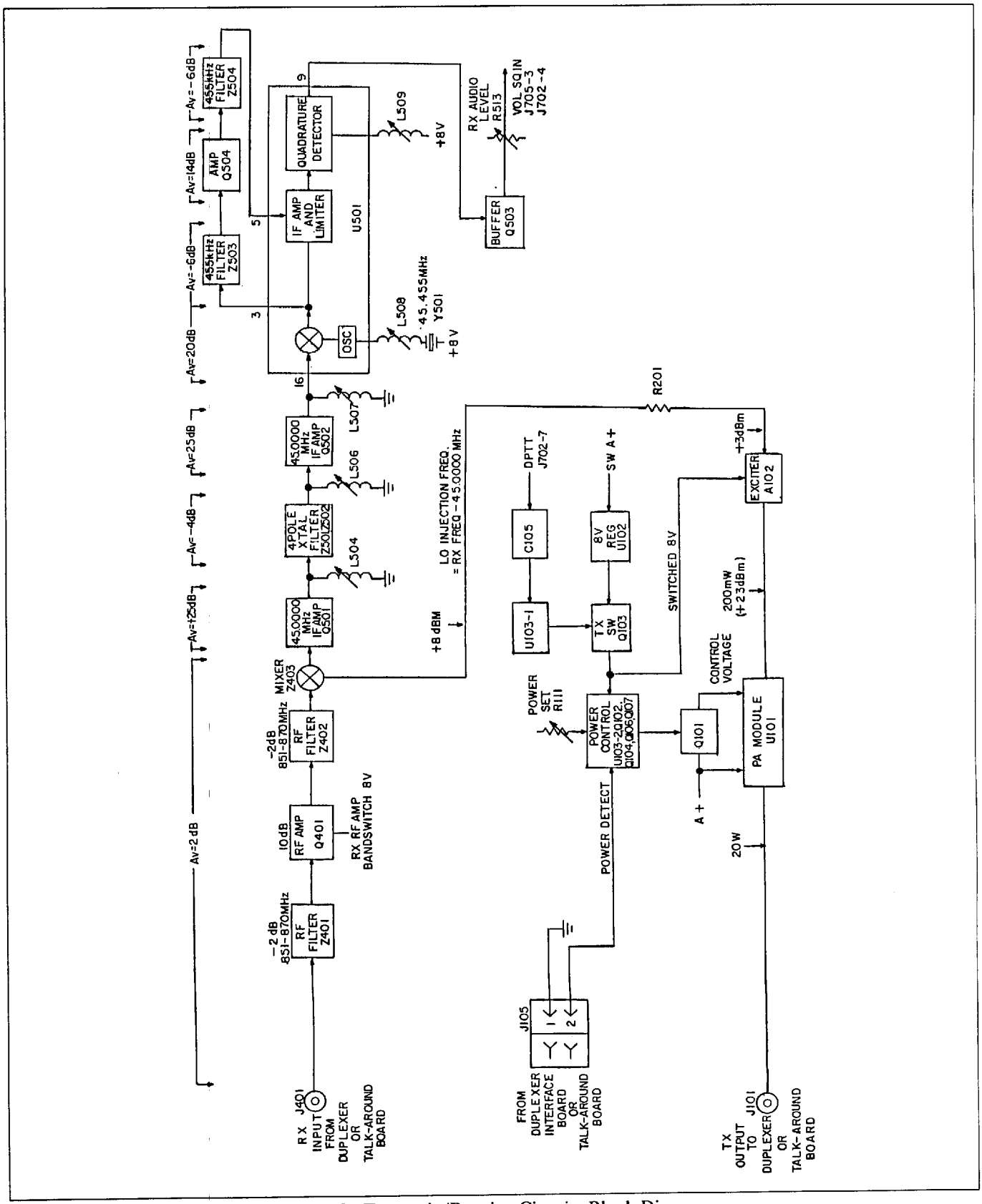

Figure 2 - Transmit/Receive Circuits Block Diagram

Exciter Module

Exciter Module A102 operates from a switched 8 volt supply. The exciter module bandwidth is sufficiently wide that both the 806 to 825 MHz and 851 to 870 MHz bands are allowed. 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 milliwatts of 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 20 watts output. The module mounts to the rear heatsink. Input and output impedances are 50 ohms. The module output at J101 has a SMB connector for cabling the output to the Duplexer Interface Board (non talk-around radios) or the Talk-round Board (radios equipped with the talk- around option).

The PA module output power is controlled by varying the DC voltage to the module's first stage.

Power Control Circuit

The power control circuitry maintains a constant power level across the band by sampling the power detect output from the Duplexer and Talk-around boards. **POWER DETECT** is supplied to the power control circuitry through J105-2. Thermistors are used to lower the power level when the heatsink temperature exceeds approximately +80°C. This circuit controls the supply voltage to the exciter module A102.

The DC **POWER DETECT** level from the directional coupler feeds the (-) input of amplifier U103.2. Power set potentiometer R111 determines the DC level to the (+) input of U103.2. Amplifier 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 transistors Q101 and Q102. 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 U103.2 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.

Thermistors R118 and R129, buffered by transistors Q106 and Q107, reduce the DC level to the (+) input of U103.2 above 80°C. Transistor Q104, capacitor C123 and resistor R105 improve the transient stability of the power control loop when the transmitter is keyed.

Transmit Switch

During transmit, the Audio/Logic Board microprocessor pulls the **DPTT** line low which is buffered by transistor Q105 before feeding U103.1. The output of U103.1 goes low to turn on transistor Q103 which supplies **SWITCHED 8V** to the exciter module and the power control circuit.

RECEIVER CIRCUIT

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

Front End Section

RF enters the 50 ohm input of the receive circuit from the receiver side of the duplexer through J401. The receive circuit is always on. RF selectivity is provided by two filters Z401 and Z402 on the input and output of RF amplifier transistor Q401. The filters are fixed tuned, 3-pole dielectric resonators with a bandwidth greater than 20 MHz to cover the 851 to 870 MHz band. About 2 dB of passband ripple is typical for this filter pair. Fifty ohm impedance levels exist at the input and output ports of the filters.

RF Amplifier transistor Q401 is a low noise bipolar transistor biased with DC feedback. The feedback allows a stable operating point of about 10 milliamperes, while allowing direct emitter grounding. Input matching is obtained with stripline L402. The amplifier load is primarily filter Z402. Capacitors C404, C405, C410 and stripline L403 provide a low Q match to the filter.

Mixer Z403 is a doubly balanced diode mixer. This mixer is driven by a local oscillator signal from the synthesizer at +8 dBm to provide good intermodulation performance, spurious performance and local oscillator isolation. The mixer conversion loss is typically 6 dB.

45 MHz IF

The RF Board uses a 45 MHz IF. The first 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 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 amplifier transistor Q502. This port is also tuned by inductor L506 and loaded to provide the proper source termination.

Transistor Q502 is a dual gate FET operating at a bias current of about 10 milliamperes. The output of Q502 is tuned by inductor L507 for maximum gain at 45 MHz and is loaded by the second mixer in the U501 chip. This Q502 stage has a relatively high input and output impedance and has high isolation within the active device.

Converter/IF/Detector IC

IF Amplifier/Detector U501 is a MC3361 IC. Pins 1 and 2 connect to an internally biased oscillator transistor. Crystal Y501 and other external circuitry form a 45.4550 MHz third mode oscillator with the frequency adjusted by inductor L508. The oscillator drives the internal balanced mixer. The 45.0000 MHz IF signal is translated to 455 kHz and appears at Pin 3 of U501. This IF signal is filtered by 2-element ceramic filter Z503, amplified by Q504 and filtered by 9-element ceramic filter Z504. This 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 feedthrough. Buffer amplifier Q503 drives audio potentiometer R513 to set the amplitude of the **VOL/SQ HI** signal for proper system operation.

POWER DISTRIBUTION

The 13.8 Vdc source voltage is supplied to the RF Board through connectors J704 and feeds power control transistor Q101, PA module U101 and 20V transient suppressor D105. Diode D105 provides reverse polarity protection and protection from noise spikes and other overvoltage transients appearing on the input power cable.

Switched 13.6 volts (**SW A+**) is supplied to the RF Board through J704 and J705 and feeds regulators U102, U207, Q202 and U502. Regulator U102 supplies 8 volts to the transmitter switch, synthesizer 5 volt regulator U203 and to Audio/Logic Board A1 through J702. Regulator U207 supplies 8.3 volts to the synthesizer. Transistor Q202 provides 13.8 volts to the Talk-around board. Regulator U502 supplies 8 volts to the receiver.

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.
5. Resolder the five leads and trim excess lead length.

ERICSSON

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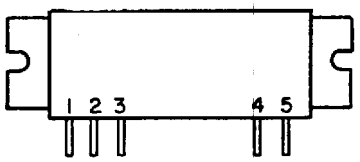
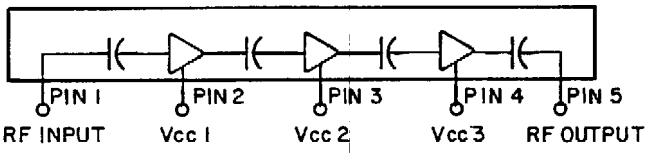
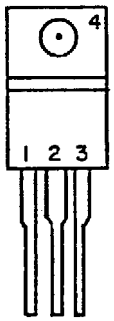
PA MODULE U101
19A143904P2



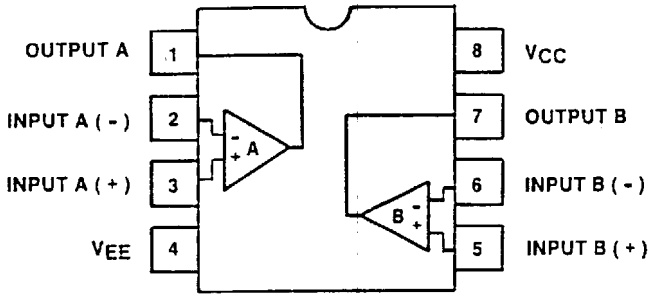


VOLTAGE REGULATOR U102
19A134717P3

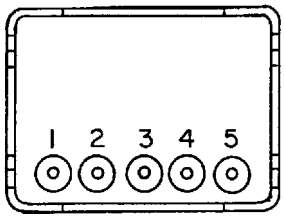


1. INPUT
2. COMMON
3. OUTPUT
4. TAB COMMON

DUAL OP AMP U103
19A701789P2

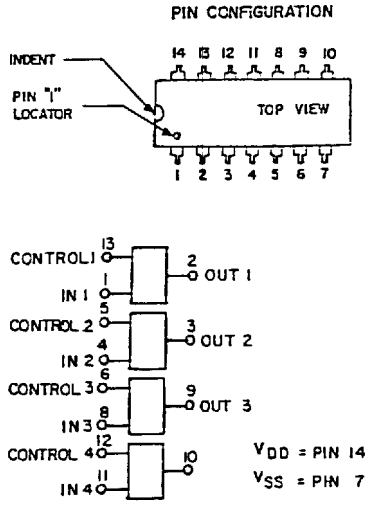


VCO U201
19A704902P1

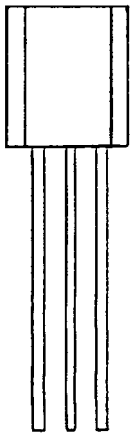


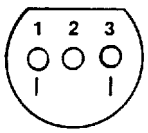
PIN	FUNCTION
1	SWITCH
2	MOD
3	CONTROL
4	Vcc
5	OUTPUT

QUAD BILATERAL SWITCH U202
19A700029P44



VOLTAGE REGULATOR U203
19A704971P11



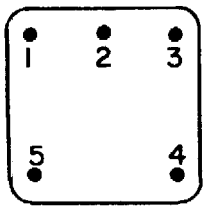


BOTTOM VIEW

PIN INDENTIFICATION

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

TCXO U204
19B801351P21

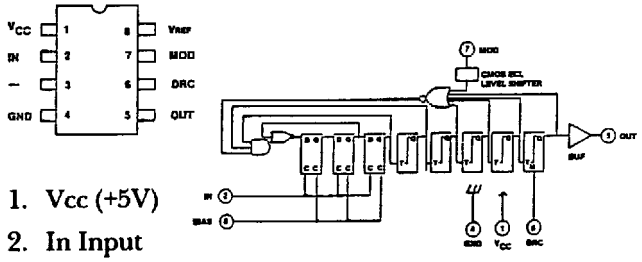


Pin Connections

1. +Vcc
2. Output
3. Common & Case
4. Common & Case*
5. Common & Case

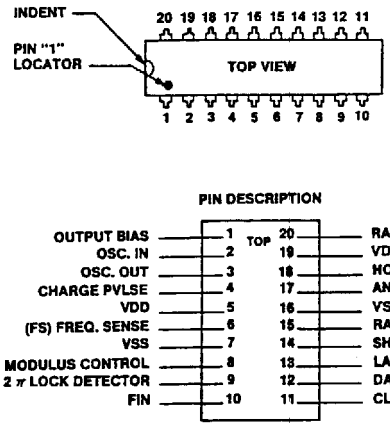
*Pin 4 is Permissible but not necessary for operation

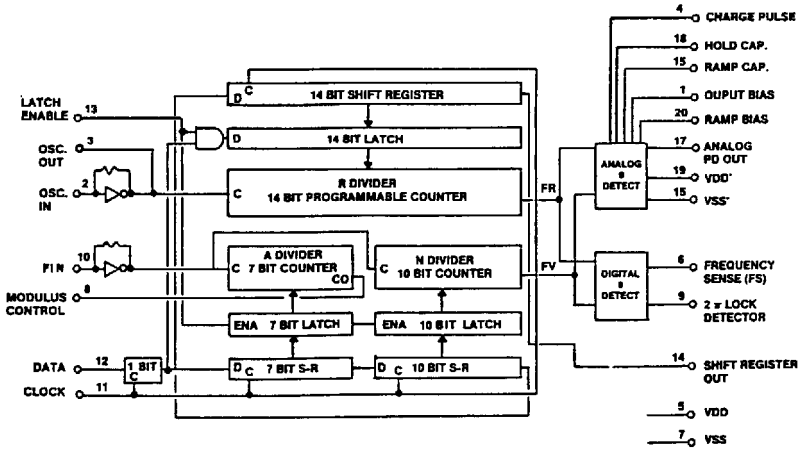
DIVIDER U205
19A704740P1



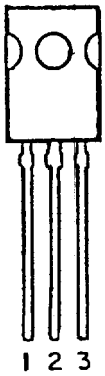
1. Vcc (+5V)
2. In Input
3. No Connection
4. GND Ground
5. Out Output
6. DRC Division Ratio Controls (Vcc: 64/65, Open128/129)
7. MOD Modulus Control Input
8. V_{REF} Reference Bias Input

SYNTHESIZER U206
19B800902P4





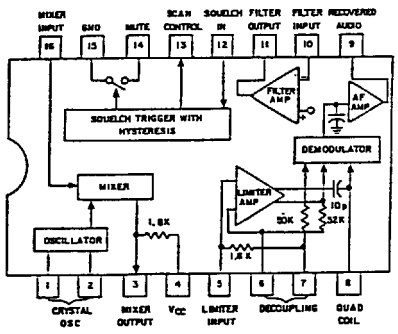
VOLTAGE REGULATOR U207, U503
344A3820



Pin Identification

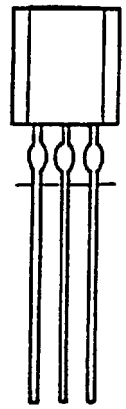
Pin 1 - Input
Pin 2 - Ground
Pin 3 - Output

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



BLOCK DIAGRAM

VOLTAGE REGULATOR U502
19A704073P2



BOTTOM VIEW

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

RF BOARD
19D902123G20
ISSUE 1

SYMBOL	PART NO.	DESCRIPTION
		---------- ASSEMBLIES ----------
A102	19C851708G1	CPNT BD ,EXC
		---------- CAPACITORS ----------
C1 and C2	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 or -30 PPM.
C3	19A702061P8	Ceramic: 3.9 pF ± 0.5 pF, 50 VDCW, temp coef 0 ± 120 PPM.
C4	19A702061P77	Ceramic: 470 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C5	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C6	19A702061P7	Ceramic: 3.3 pF ± 0.5 pF, 50 VDCW, temp coef 0 ± 120 PPM.
C7 and C8	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C9	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C10	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
		---------- INDUCTORS ----------
L1 and L2		##PART OF PWB
L3	19B800891P2	Coil, RF Choke: sim to Paul Smith SK-890-1.
		---------- TRANSISTORS ----------
Q1	19A704708P2	Silicon, NPN: sim to NEC 2SC3356.
Q2	19A705436P1	Silicon, NPN: sim to Motorola RF0211L.
Q3	19A701940P3	Silicon, NPN: sim to SRF-5116.
		---------- RESISTORS ----------
R1	19B801251P471	Metal film: 470 ohms ±5%, 1/10 w.
R2	19B801251P272	Metal film: 2.7K ohms ±5%, 1/10 w.
R3	19B801251P330	Metal film: 33 ohms ±5%, 1/10 w.
R4	19B801251P331	Metal film: 330 ohms ±5%, 1/10 w.
R5	19B801251P392	Metal film: 3.9K ohms ±5%, 1/10 w.
R6	19B800607P330	Metal film: 33 ohms ±5%, 1/8 w.
R7	19B801251P471	Metal film: 470 ohms ±5%, 1/10 w.
R8	19B801251P332	Metal film: 3.3K ohms ±5%, 1/10 w.
R9 and R10	19B800607P470	Metal film: 47 ohms ±5%, 1/8 w.
		---------- MISCELLANEOUS ----------
2	19C851707P1	BD PW
3	19C851708G2	CPNT BD EXC
		---------- CAPACITORS ----------
C105	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C107	19A701534P8	Tantalum: 22 µF ±20%, 16 VDCW.
C108	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C109 and C110	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C111	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C113 thru C115	19A702061P33	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C117	19A702052P22	Ceramic: 0.047 µF ± 10%, 50 VDCW.
C118	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C119	19A702061P61	Ceramic: 100 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C122	19A702052P28	Ceramic: 0.022 µF ±10%, 50 VDCW.
C123	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C125	19A702061P33	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C126	19A702236P38	Ceramic: 33 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C133 thru C139	19A702061P33	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C141	19A702052P26	Ceramic: 0.1 µF ± 10%, 50 VDCW.
C143	19A702052P26	Ceramic: 0.1 µF ± 10%, 50 VDCW.
C144	19A705205P19	Tantalum: 2.2 µF ±20%, 10VDCW; sim to Sprague 293D.
C145 thru C147	19A702052P26	Ceramic: 0.1 µF ± 10%, 50 VDCW.
C201 thru C203	19A702061P61	Ceramic: 100 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C204	19A702061P49	Ceramic: 56 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C205	19A703314P2	Tantalum: 220 µF, -10+50%, 10 VDCW.
C206 and C207	19A702061P49	Ceramic: 56 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C208	19A702052P26	Ceramic: 0.1 µF ± 10%, 50 VDCW.
C209	19A702061P5	Ceramic: 2.2 pF ± 0.5 pF, 50 VDCW, temp coef 0 ± 120 PPM.
C210	19A702061P49	Ceramic: 56 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C211	19A702061P9	Ceramic: 4.7 pF ± 0.5 pF, 50 VDCW, temp coef 0 ± 60 PPM.
C212 and C213	19A702061P49	Ceramic: 56 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C214	19A702061P25	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C215	19A700004P1	Metallized polyester: 0.068 µF ± 10%, 63 VDCW.
C216	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C217	19A700004P11	Metallized Polyester: 1.0 µF ± 10%, 63 VDCW.
C218	19A702061P49	Ceramic: 56 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C220	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C221	19A702052P26	Ceramic: 0.1 µF ± 10%, 50 VDCW.
C222	19A702061P99	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C223	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C224	19A702061P77	Ceramic: 470 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C225	19A702061P99	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C226	19A701534P17	Tantalum: 47 µF ±20%, 10 VDCW.
C227	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C228	19A702061P9	Ceramic: 4.7 pF ± 0.5 pF, 50 VDCW, tempcoef 0 ± 60 PPM.
C229	19A702061P61	Ceramic: 100 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C231	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C232	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C233 and C234	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW; sim to Panasonic LS Series.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
C235	19A705205P5	Tantalum: 6.8 µF, 10 VDCW; sim to Sprague 293D.
C236	19A702052P28	Ceramic: 0.022 µF ±10%, 50 VDCW.
C237	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C239 and C240	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C242	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C243	19A702061P45	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C244	19A702061P37	Ceramic: 33 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C245	19A702052P3	Ceramic: 470 pF ± 10%, 50 VDCW.
C246	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C247 and C248	19A702052P26	Ceramic: 0.1 µF ± 10%, 50 VDCW.
C249	19A705205P19	Tantalum: 2.2 µF ±20%, 10VDCW; sim to Spargue 293D.
C250		
C403	19A702236P38	Ceramic: 33 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C404	19A702236P1	Ceramic: 0.5 pF ±.l pF, 50 VDCW, temp coef 0 ±30 PPM.
C405	19A702236P21	Ceramic: 6.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM.
C409 and C410	19A702236P9	Ceramic: 1.8 pF ±0.25 pF, 50 VDCW, temp coef 0 ±30 PPM.
C411	19A702236P10	Ceramic: 2.2 pF ±2.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C.
C412	19A702061P33	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C501	19A702061P53	Ceramic: 68 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C502	19A702061P29	Ceramic: 22 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C503	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C504	19A702061P49	Ceramic: 56 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C505	19A702061P12	Ceramic: 8.2 pF ± 0.5 pF, 50 VDCW, temp coef 0 ± 60 PPM.
C506	19A701534P7	Tantalum: 10 µF ±20%, 16 VDCW.
C507 thru C509	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C510	19A702061P6	Ceramic: 2.7 pF ± 0.5 pF, 50 VDCW, temp coef 0 ± 120 PPM.
C511	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C512	19A702061P1	Ceramic: 1 pF ±0.5 pF, 50 VDCW.
C513	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C514 thru C516	19A702061P33	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C517 and C518	19A702052P26	Ceramic: 0.1 µF ± 10%, 50 VDCW.
C519	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C520	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C521	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C522	19A702052P26	Ceramic: 0.1 µF ± 10%, 50 VDCW.
C523	19A702052P14	Ceramic: 0.01 µF ± 10%, 50 VDCW.
C525	19A703314P10	Electrolytic: 10 µF -10+50%, 50 VDCW; sim to Panasonic LS Series.
		---------- DIODES ----------
D101	19A702525P2	Silicon, PIN: sim to MMBV3401.
D105	19A703588P3	Zener, transient suppressor: sim to 1N6278A.
D107	T324ADP1041	Silicon: Rectifier; sim to 1N4004.
D108	19A134587P2	Silicon: 2 diodes, Common Cathode; sim to BAV 70.
D501 and D502	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
		---------- JACKS ----------
J101	19A705512P1	Connector, RF SMB Series: sim to AMP No. 221111-1.
J105	19A704852P31	Connector: 5 contacts; sim to Molex 22-29-2051.
J401	19A705512P1	Connector, RF SMB Series: sim to AMP No. 221111-1.
J501	19A700072P1	Printed wire: 2 contacts rated @ 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 22-27-2031.
J705	19A700072P30	Printed wire: 4 contacts rated at 2.5 amps; sim to Molex 22-27-2041.
		---------- INDUCTORS ----------
L103 thru L106	19A704921P1	Coil.
L402 and L403		##
L501	19A700024P4	Coil, RF: 180 nH ± 10%.
L504	19B801413P4	Coil
L505	19B209420P21	Coil, RF: 4.7 uH ± 5%, 1.20 ohms DC res max; sim to Jeffers 4436-8J.
L506 thru L508	19B801413P4	Coil
L509	19B801415P2	Transformer, 455 KHz.: sim to AEPD 162B3277P17.
		---------- TRANSISTORS ----------
Q101	344A3225P1	Silicon, NPN: sim to MJF3055.
Q102	19A703197P2	Silicon, PNP; sim to MMBT4403 Low Profile Pkg.
Q103	19A704972P1	Silicon, PNP: sim to Motorola 2N4918.
Q104 thru Q107	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q201	19A704708P2	Silicon, NPN: sim to NEC 2SC3356.
Q202	19A702504P2	Silicon, PNP: sim to 2N4403.
Q203	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q204 and Q205	19A704708P2	Silicon, NPN: sim to NEC 2SC3356.
Q206	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q207	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.
Q208	19A700023P2	Silicon, NPN: sim to 2N3904.
Q209 and Q210	19A702064P2	Silicon, NPN: sim to MPS 2369.
Q211 thru Q214	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
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.
Q504	19A134739P2	Silicon, NPN.
		---------- RESISTORS ----------
R103	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w.
R104	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R105	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R107	19B800607P393	Metal film: 39K ohms ±5%, 1/8 w.
R108	19B800607P122	Metal film: 1.2K ohms ±5%, 1/8 w.

SYMBOL	PART NO.	DESCRIPTION
R109	19B800607P394	Metal film: 390K ohms ±5%, 1/8 w.
R110	19B800607P273	Metal film: 27K ohms ±5%, 1/8 w.
R111	19B800779P4	Variable: 1K ohms ±25%, 100VDCW, .3 w.
R112	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R113	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R114	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R115	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w.
R116	19B800607P183	Metal film: 18K ohms ±5%, 1/8 w.
R117	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R118	19A701864P4	Thermal 10K ohms ±10%, sim to Midwest Components 2H-103.
R119 thru R121	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R122	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R123	19B800607P222	Metal film: 2.2K ohms ±5%, 1/8 w.
R126	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w.
R129	19A701864P4	Thermal 10K ohms ±10%, sim to Midwest Components 2H-103.
R130	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R131	19A702931P51	Metal film: 33.2 ohms ±1%, 200 VDCW, 1/8 w.
R132	19A702931P42	Metal film: 26.7 ohms ±1%, 200 VDCW, 1/8 w.
R133	19A700108P15	Composition: 10 ohms ± 5%, 1/4 w.
R134	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w.
R136	19B801251P470	Metal film: 47 ohms ±5%, 1/10 w.
R137 and R138	19B801251P102	Metal film: 1K ohms ±5%, 1/10 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	19B800607P151	Metal film: 150 ohms ±5%, 1/8 w.
R206	19B800607P390	Metal film: 39 ohms ±5%, 1/8 w.
R207	19B800607P151	Metal film: 150 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	19B801251P330	Metal film: 33 ohms ±5%, 1/10 w.
R212	19B800607P560	Metal film: 56 ohms ±5%, 1/8 w.
R213	19B800607P221	Metal film: 220 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.
R221	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R222	19B800607P333	Metal film: 33K ohms ±5%, 1/8 w.
R223	19B800607P564	Metal film: 560K ohms ±5%, 1/8 w.
R224	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w.
R225	19B800607P683	Metal film: 68K ohms ±5%, 1/8 w.
R226	19B800779P8	Variable, cermet: 4.7K ohms ±25%, .3 w.
R227	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R228	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R229	19B800607P823	Metal film: 82K ohms ±5%, 1/8 w.
R230	19B801251P332	Metal film: 3.3K ohms ±5%, 1/10 w.
R231	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w.
R232	19B800607P683	Metal film: 68K ohms ±5%, 1/8 w.
R233	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w.
R234	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w.
R235	19B800607P683	Metal film: 68K ohms ±5%, 1/8 w.
R236	19B800607P471	Metal film: 470 ohms ±5%, 1/8 w.
R237 thru R239	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R240	19B801251P154	Metal film: 150K ohms ±5%, 1/10 w.
R241 and R242	19B800607P154	Metal film: 150K ohms ± 5%, 1/8 w.
R246	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R247	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R250	19B800779P16	Variable: 100K ohms ±25%, 100 VDCW, .3 watt.
R251	19B800607P683	Metal film: 68K ohms ±5%, 1/8 w.
R252	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R253	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R254	19B800779P8	Variable, cermet: 4.7K ohms ±25%, .3 w.
R255	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R256 thru R258	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R403	19B800607P562	Metal film: 5.6K ohms ±5%, 1/8 w.
R404	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w.
R405	19B800607P151	Metal film: 150 ohms ±5%, 1/8 w.
R501	19B801251P181	Metal film: 180 ohms ±5%, 1/10 w.
R502	19B800607P270	Metal film: 27 ohms ±5%, 1/8 w.
R503	19B800607P333	Metal film: 33K ohms ±5%, 1/8 w.
R504	19B800607P270	Metal film: 27 ohms ±5%, 1/8 w.
R505	19B800607P273	Metal film: 27K ohms ±5%, 1/8 w.
R506	19B800607P333	Metal film: 33K ohms ±5%, 1/8 w.
R507	19B800607P822	Metal film: 8.2K ohms ±5%, 1/8 w.
R508	19B800607P101	Metal film: 100 ohms ±5%, 1/8 w.
R509	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R510	19B800607P270	Metal film: 27 ohms ±5%, 1/8 w.
R511	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R512	19B800607P822	Metal film: 8.2K ohms ±5%, 1/8 w.
R513	19B800779P4	Variable: 1K ohms ±25%, 100VDCW, .3 w.
R514	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w.
R515	19B801251P183	Metal film: 18K ohms ±5%, 1/10 w.
R516	19B801251P182	Metal film: 1.8K ohms ±5%, 1/10 w.
R517	19B801251P222	Metal film: 2.2K ohms ±5%, 1/10 w.
R518	19B801251P181	Metal film: 180 ohms ±5%, 1/10 w.
		..... INTEGRATED CIRCUITS .....
U101	19A143904P2	RF Amplifier; sim to MHW820-1. (Part of next higher assembly; not included with RF Board 19D902123G18.)
U102	19A134717P3	Linear: 8 Volt Regulator; sim to MC7808CT.
U103	19A701789P2	Linear: Dual Op Amp; sim to LM358.
U201	19A704902P1	VCO: DUAL BAND: 806-825 MHz, 851-870 MHz; sim to: ALPS URAA.
U202	19A700029P44	Digital: BILATERAL SWITCH.
U203	19A704971P1	Linear: +5 Volt Regulator; sim to MC78L05ACP.
U204	19B801351P21	Crystal Oscillator: temp. compensated, 15.36 MHz. 1 Vp-p.
U205	19A704740P1	Digital: Divider; sim to Mitsubishi M54475P.
U206	19B800902P4	Digital: Synthesizer, CMOS Serial Input.
U207	344A3820P1	Voltage Regulator: Linear, 8.5 Vdc.; sim to SGS 4885CX.
U501	19A704619P1	Linear: Osc/Mixer/IF/Det/Amp; sim to MC3361AP.
U502	19A704073P2	Linear: 8 Volt Regulator; sim to MC78L08CP.
U503	344A3820P1	Voltage Regulator: Linear, 8.5 Vdc.; sim to SGS 4885CX.
		..... CRYSTALS .....
Y501	19A705376P5	Crystal, Fixed Frequency: 45.455 MHz ±10 PPM.

SYMBOL	PART NO.	DESCRIPTION
		---------- FILTER ----------
Z401 and Z402	19A704888P1	Bandpass Filter, 851-871 MHz; sim to: Murata DFC3R861P020BTD.
Z403	19B801025P2	Balanced Mixer. sim to Mini-Circuits SBL-1X.
Z501	19A705328P1	Monolithic Crystal: 45.000 MHz; sim to Toyocom 45E2B2.
Z502		##
Z503	19B801021P6	Bandpass Filter; 455 ± 0.5 kHz, 3 dB BW± 0.5 kHz, 9 dB BW ± 7 kHz; sim to TOKO SHCFM2-455D..
Z504	19B801021P5	Bandpass Filter; 455 ± 1.5 kHz, 3 dB BW ± 6 kHz min; sim to Murata CF2M-455E10.
		--------- MISCELLANEOUS ---------
6	19B801490P1	Ground Strap.
9	19B801566P1	SHIELD ,
18	19B801566P2	SHIELD ,
35	19B801578P1	CLIP ,SHIELD

This addendum adds information on Revision Letter changes to the RF Board. These changes will be incorporated in the next printing of the manual.

REV. A RF BOARD 19D902123G20

To improve prescaler spur rejection, C213 was changed and C238 and C251 were added.
C213 changed from 56 pF (19A702061P49) to 0.01 µF (19702052P14).
C238 added. Ceramic: 56 pF, ±5%, 50 VDCW, temp coef ±30 PPM/°C (19A702061P49).
C251 added. Ceramic: 0.01 µF, ±10%, 50 VDCW (19A702052P14).

REV. B RF BOARD 19D902123G20

To increase tuning range on the RF power set control.
R110 changed from 27K ohms (19B800607P273) to 18K ohms (19B800607P183).
R117 and R130 changed from 10K ohms (19B800607P222) to 6.8K ohms (19B801251P682).
R123 changed from 2.2K ohms (19B801251P103) to 1.5K ohms (19B800607P152).

REV. C RF BOARD 19D902123G20

To eliminate oscillation at the output of the 8.5V regulator C248 changed from 0.1 µF (19A702052P26) to Tantalum: 1 µF, ±20%, 16 VDCW (19A705205P2).

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This addendum documents changes on RF Boards for both models of MDR mobiles to increase the tuning range on the RF power set control. All mobiles built after 3/4/93 must have these changes. The following resistors changed in value as shown in the table. (Board No.s changed are 19D902123G18 & G20)

DWG. I.D.	OLD PART I.D.	NEW PART I.D.
R110	19B800607P273	19B800607P183
R123	19B800607P222	19B800607P152
R117	19B801251P103	19B801251P682
R130	19B801251P103	19B801251P682

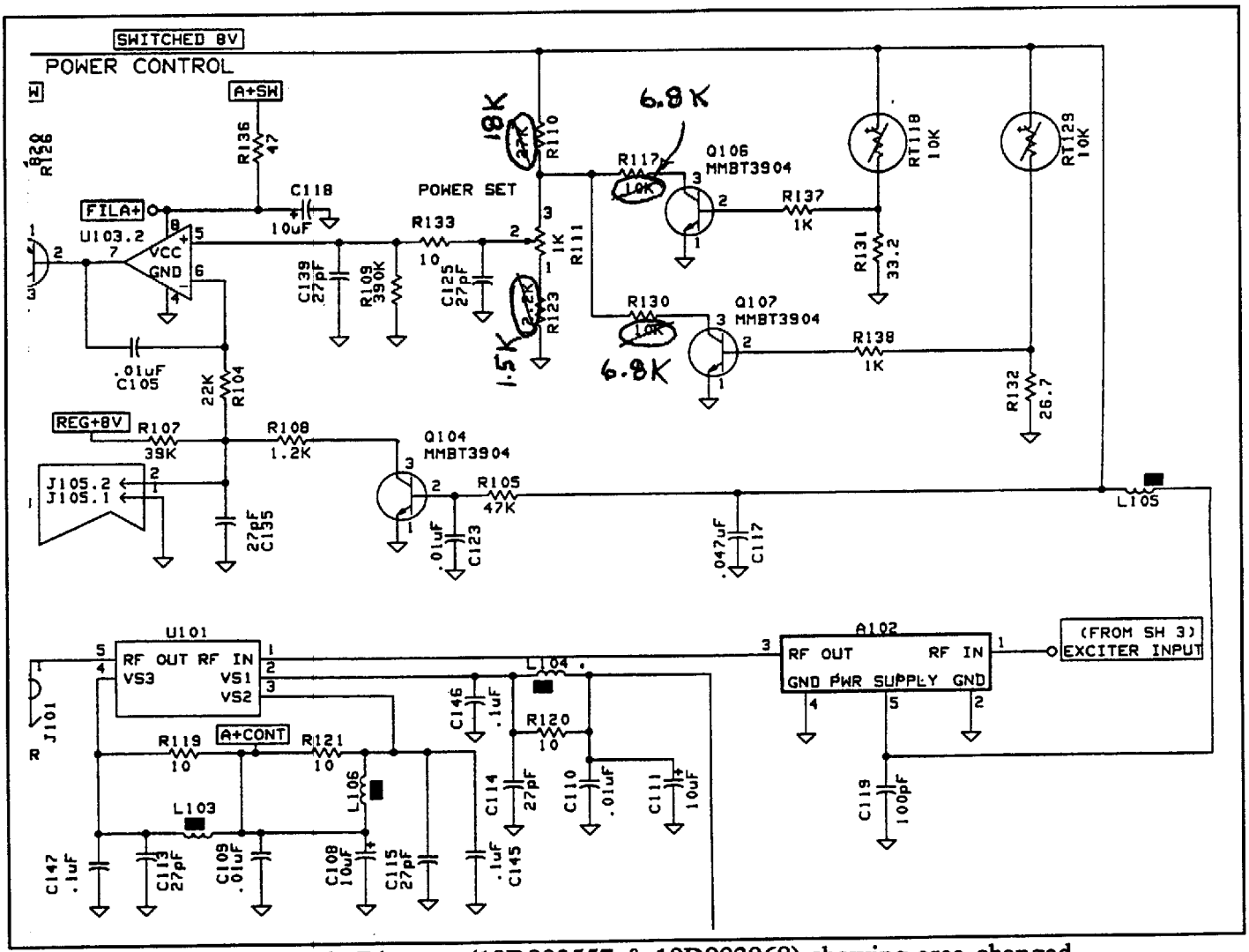

Figure 1 - Partial Schematic Diagram (19D903557 & 19D903968) showing area changed.

ADDENDUM NO. 3 TO LBI-38841 (PCPM)

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

REV. D RF BOARD 19D902123G20

To improve radio performance at temperature extremes, C525 changed from Electrolytic: 10 µF (19A703314P10) to Tantalum: 10 µF (19A701534P7).

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