MAINTENANCE MANUAL
VHF REAR COVER ASSEMBLY
19C337097G1 - G3

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DESCRIPTION

The Rear Cover Assembly consists of the VHF RF Board, die-cast aluminum case and the associated hardware.

The RF Board assembly includes soldered-in modules, integrated circuits and surface-mounted components. This double-sided printed-wire board is surrounded by a die-cast "eggcrate" aluminum casting and mounted in the rear cover case. This arrangement provides excellent RF shielding between the various circuits and the outside environment. A cover shield provides shielding between the RF Board and the digital circuits located in the front cover.

Table 1 - Applications

RF BAND (MHz)	REAR COVER ASSEMBLY	RF BOARD	PRODUCT
136 - 150.8	19C337097G1	19D902735G1	M-PA
146 - 162	19C337097G2	19D902735G3	M-PA, MTL
157 - 174	19C337097G3	19D902735G5	M-PA, MTL

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CIRCUIT ANALYSIS

The RF Board is electrically connected to the Control Board by two single-in-line connectors. Power supplies include 7.5 Vdc (battery power) and a regulated 5.4 Vdc supply from the Control Board located in the Front Cover Assembly.

Logic inputs from the Control Board include serial synthesizer loading data, power-save, and a switched 5.4 Vdc source to enable the transmitter and disable the receiver circuits. Other siguals from the Control Board include modulating audio and the transmitter power level set line when a transmission is enabled.

The RF Board provides the FM demodulated audio and synthesizer lock status to the Control Board. During transmitter operation RF power appears at the top antenna jack or the UDC jack if an appropriate adapter is inserted.

ANTENNA SWITCH AND LOW-PASS FILTER

The antenna switch, located at the top of the RF Board, serves to select the top mounted antenna or a UDC antenna option. A spring-loaded contact in the switch normally connects the low-pass filter to the top mounted antenna. When a UDC accessory (or an RF test plug) that utilizes the UDC antenna jack is installed, RF is routed to/from the UDC antenna jack instead of the top jack. Connecting an accessory to the UDC jack pushes the small gold plated center pin inside the unit, switching the filter from the top antenna jack to the UDC antenna jack.

Low-pass filter consists of capacitors C 1 - C 7 and inductors L1 - L4. L1 provides a dc path to ground for the antenna. This LC network rejects unwanted harmonics in the received and transmitted signal. The network has a insertion loss of 0.3 dB and a rejection of more than 65 dB at the second harmonic in the stopband. The filter has input and output impedances of 50 ohms.

T/R SWITCH DIODES

Antenna T/R switch diodes connect the transmitter's output or the receiver's input to the low-pass filter (and antenna) during transmit and receive modes respectively. Two pin diodes are biased by the TX 5.4V line to route the RF properly.

When the radio is transmitting, the diodes are forward-biased by a high level (5.4 Vdc) on the TX 5.4V line. RF power from the transmitter (Power Controller module pin 14) passes through D1 to the low-pass filter network and the antenna. Forward-biased D2 prevents any transmit RF from entering the receiver by providing a low impedance path to ground at the receivers input. Network C36, C37 and L9 serves to attenuate transmitter power before it reaches D2. The two diodes are forward biased by the following dc path: TX 5.4V line, R53, R1, LS, D1, L9, D2 and ground.

In receive mode, with TX 5.4V low (both diodes off), RF from the antenna is routed to the receiver's front-end.

TRANSMITTER

The VHF transmitter circuit includes the Power Amplifier IC, the Power Controller module and support circuitry for these components. The Power Controller module regulates the radio's RF power by sampling the power being delivered to the antenna from the PA IC, and controlling the PA accordingly.

In order to transmit, the Control Board in the front cover must supply the following siguals to the RF Board:

- J102 pin 4 (5.4V ENABLE) must be high (5.4 Vdc)
- synthesizer must be loaded and locked with the proper TX frequency data via STROBE, DATA and ENABLE
- J101 pin 5 (TX 5.4V) must be high (5.4 Vdc)
- J101 pin 1 (PWR SET) must be set to a level corresponding to the programmed power level (high or low)
- modulating audio must be present on J102 pin 1

Power Amplifier IC U4

Power Amplifier IC U4 is a three-stage device mounted to the "eggcrate" casting. The casting serves as a heat sink. U4 provides approximately 36 dB gain for the transmitter. RF drive is applied to pin 1 from the VCO. The IC's output is on pin 6.

Battery power for the PA is sourced from the 7.5V BATT line via L6, L7, L8, L16, Q1 and Q4. The associated LC networks provide decoupling for the supplies.

Transistor Q4 saturates (turns on) when the radio is transmitting to supply 7.5 Vdc (±20) to U4 pin 2 and 4. Transistor Q5, which is driven by TX 5.4V, turns on Q4 when TX 5.4V is high.

Transistor Q1 supplies dc power to U4 pin 3. This transistor operates in a linear mode and is driven by the Power Controller IC to regulate RF power.

Power Controller Module Al

Power Controller Al regulates the RF output power as set by the programmed power level. This module maintains constant output power despite battery voltage variations or temperature related gain variations of the PA. Operating power for this module is supplied from the TX 5.4V line when a transmission is enabled.

RF enters Al at pin 1 and exits at pin 14 at a loss of 0.1 dB. A microstrip directional-coupler inside the module samples the RF power. This signal is then rectified and compared to the PWR SET line from the Control Board; an error signal is produced which drives transistor Ql to control the PA IC's gain. This feedback method of power control maintains constant RF output power as set by the digital-to-analog converter on the Control Board.

The PWR SET signal from J101 pin 1 is decoupled by R3l, C76 and C65 and applied to the PowerController at pin 12. This dc reference level varies from approximately 1 Vdc (low power) to 4 Vdc (high power). In receive mode, PWR SET is 0 Vdc.

NOTE

Outline and schematic diagrams for the modules are shown in the Service Section. The modules are not serviceable; schematics and outlines are given as a troubleshooting aid only.

Harmonic Filter

Transmit VCO drive from A4 is connected to the PA by a harmonic filter network. L14 and C69 - C71 form a filter which has a rejection of more than 30 dB in the stopband. Capacitor C 15 couples the drive to the PA module.

RECEIVER

The receiver utilizes the dual-conversion superheterodyne technique to recover the desired signal. High-side injection from the synthesizer circuit produces a high IF frequency of 45 MHz at the output of the first mixer. The second mixer uses high-side injection from a crystal oscillator to produce the desired second IF of 455 kHz. LC and crystal filters are incorporated throughout the receiver circuit. This arrangement produces excellent sensitivity, selectivity and image rejection.

Front-End

Capacitor C35 couples RF from the low-pass input filter and T/R switch circuit to Notch Filter A3. A3 is a passive LC network that provides front-end image frequency protection. The filter has an insertion loss of less than 0.5 dB in the passband. Capacitors C67 and C68 couple RF to FLI.

Bandpass Filter FLI is a three-pole LC device. This filter is factory tuned to cover the operating frequency range of the radio. The filter has a maximum passband loss of 2.8 dB and input/output impedances of 50 ohms.

RF from FLI enters double balanced First Mixer U5 at pin 1. Synthesized VCO injection (at 7 dBm) from A4 pin 9 is applied to U5 pin 8. The 45 MHz converted signal appears on pins 3 and 4 at a maximum conversion loss of 5.3 dB. Impedances at all ports is 50 ohms. C45 and Ll3, series tuned to 45 MHz, couple the converted signal to the High IF Amp.

High IF Amp, Crystal Filter and Buffer

High IF Amplifier A2 is a single transistor, common-base, non-tunable transistor amplifier module. Center frequency is 45 MHz and the IF signal is introduced on pin 2. This module has input and output impedances of 50 ohms. The amplified signal is applied to FL2 by pin 5.

High IF Filter FL2 is a monolithic crystal filter with a center frequency of 45 MHz. It has a 3 dB bandwidth of ±7.5 kHz minimum and terminal impedances of 50 ohms. Loss in the passband is 4 dB maximum. The filter's output is coupled to IF Buffer Amp Q3 by C10. The LC network (L12//C57//Cl0) at pin 2 is tuned to the IF frequency.

High IF Buffer Amp Q3 is a common-base nontunable amplifier stage. This stage matches the low impedance output of FL2 to the high impedance input of U6.

Back-End

The back-end circuits perform second conversion and demodulation of the FM signal. Capacitor C56 couples the 45 MHz IF signal from Q3 to pin 16 of U6.

Integrated circuit U6 is a 16-pin DIP IC that contains an oscillator, mixer, limiter, demodulator and audio amplifier. Using external crystal Y1, a 45.455 MHz signal is generated in the IC for the second mixer high-side injection. Alignment for this 2nd LO is provide by coil T1.

The mixer's output from U6 pin 3 passes through 455 kHz filter FL3. This filter has an input and output impedances of approximately 1500 ohms with a stopband attenuation of 35 dB minimum. It has an insertion loss of 4 dB and a center frequency of 455 kHz ± 1.5 kHz. The 455 kHz output signal from FL3 is returned to U6's limiter input pin 5.

The limiter stage in U6 is internally connected to the demodulator stage. Alignment for the internal quadrature detector is provided by coil T2. The recovered audio is available on U6 pin 9. Audio is applied to J101 pin 4 for passage to the audio circuits in the Front Cover Assembly.

SYNTHESIZER

The microprocessor-controlled phased-locked loop (PLL) synthesizer produces the transmitter's drive and the receiver's first mixer injection. Primary components include a stable reference oscillator, a voltage-controlled oscillator (VCO), a dual-modulus prescaler chip and a serially-loaded synthesizer chip. A PLL filter module integrates the analog error signal from the synthesizer chip before it is passed to the VCO.

Reference Oscillator U3

Reference Oscillator U3 produces a 13.2 MHz crystal reference frequency for the synthesizer chip. Capacitors C 16 and C54 couple this reference signal to the synthesizer chip. The synthesizer chip phase compares this reference signal to the divided VCO signal; it produces an error signal which tunes the VCO. During a transmission, low-frequency audio signals from TX AUDIO are buffered by Q6 and Q7 and ac coupled to U3 via C30. These low-frequency audio signals frequency modulate the 13.2 MHz signal. Modulation Balance potentiometer R18 is adjusted for best low-frequency response with a 20 Hz, 1 Vp-p square-ware TX AUDIO input. TX AUDIO is also coupled to the VCO to provide modulation.

Regulated 5.4 Vdc is applied to pin 3 by R12. Capacitor C27 provides the necessary supply decoupling for the oscillator.

U3 has a small opening on the top which provides access to an internal frequency adjustment. This oscillator is factory aligned and it is highly stable. It should not normally need alignment in the field.

Voltage-Controlled Oscillator Module A4

VCO module A4 is the largest and most complex module on the RF Board. This module has separate internal TX and RX oscillators which generate the transmitter drive and receiver first LO injection signals. When TX 5.4V is high, the TX oscillator is enabled and the RX oscillator is disabled. Output frequency for both oscillators is controlled by the tuning voltage on pin 5.

A regulated power supply of 5.4 Vdc is delivered to A4 pin 7. This supply is developed from the regulator circuit in A5B. R32 and C52 decouple this supply.

The VCO also requires a negative power supply for operation. This supply is generated from the OSC OUTput of UI. On the positive cycle of OSC OUT, C47 charges through R34 and D3 (pins 1 - 3). When OSC OUT returns low, C47 charges C48 via R34 and D3 (pins 2 and 3). R35 and C49 provide additional filtering. Approximately -3.7 Vdc is present on A4 pin 6.

In transmit mode the VCO is phased-locked to the TX channel's frequency. RF drive from A4 pin I is approximately 9.5 dBni. Table 2 lists tuning voltage data.

Table 2 - VCO Tuning Voltage Vs. VCO Output Frequency

Tuning Voltage (A4 pin 5)		1.0 Vdc	2.5 Vdc	4.0 Vdc
Tolerance		+ 2/-5 MHz	±0.5 MHz	+ 5/-2 MHz
136-150.8 MHz	TX	136.0 MHz	143.4 MHz	150.8 MHz
	RX	181.0 MHz	188.4 MHz	195.8 MHz
146-162 MHz	TX	146.0 MHz	154.0 MHz	162.0 MHz
	RX	191.0 MHz	199.0 MHz	207.0 MHz
157-174 MHz	TX	157.0 MHz	165.5 MHz	174.0 MHz
	RX	202.0 MHz	210.5 MHz	219.0 MHz

TX AUDIO frequency modulates the VCO. VCO Modulation potentiometer R19 sets the modulation level into the VCO from the TX AUDIO line. The pot is aligned so a 1 kHz, 600 mV rms TX AUDIO input will produce a deviation of 5.0 kHz.

In receive mode, the VCO is phased-locked 45 MHz above the RX channel's frequency. This LO signal is applied to the mixer and prescaler IC via pins 9 and 8 respectively. Table 2 lists tuning voltage data.

Prescaler Stage

The VCO signal is buffered by common base configured Q2 and applied to prescaler chip U2 via C20. Q2 prevents loading of the VCO by the prescaler chip. This dual-modulus prescaler divides the VCO signal by 64 or 65 according to the logic signal on the modulus control input (MC, pin 1). This modulus is controlled by U 1; the chip divides-by 64 when the MC is high.

Synthesizer IC Ul

Integrated circuit UI contains a reference frequency divider, variable frequency dividers and phase detectors for the synthesizer circuitry. This IC has an analog and a digital phase detector. The analog detector is incorporated in the main PLL and the digital detector output indicates lock status. Reference and variable frequency dividers are serially loaded by the clocked data line from the microprocessor. This IC controls the dividing factor of the prescaler by its modulus control (MC, pin 8) output.

Serial data from the microprocessor is shifted into UI by the DATA line, J102 pin 10. Clocking is provided on the STROBE line, J102 pin 11, and the data is latched with the ENABLE pulse on Jl02 pin 9. When UI pin 13 (LE) is high, data is transferred from the internal shift registers to the dividers; low inhibits the internal transfers. The tuning error signal from the analog phase detector appears on AN OUT, UI pin l7. This error signal is routed to PLL Filter A5A for additional filtering before it is applied to the VCO.

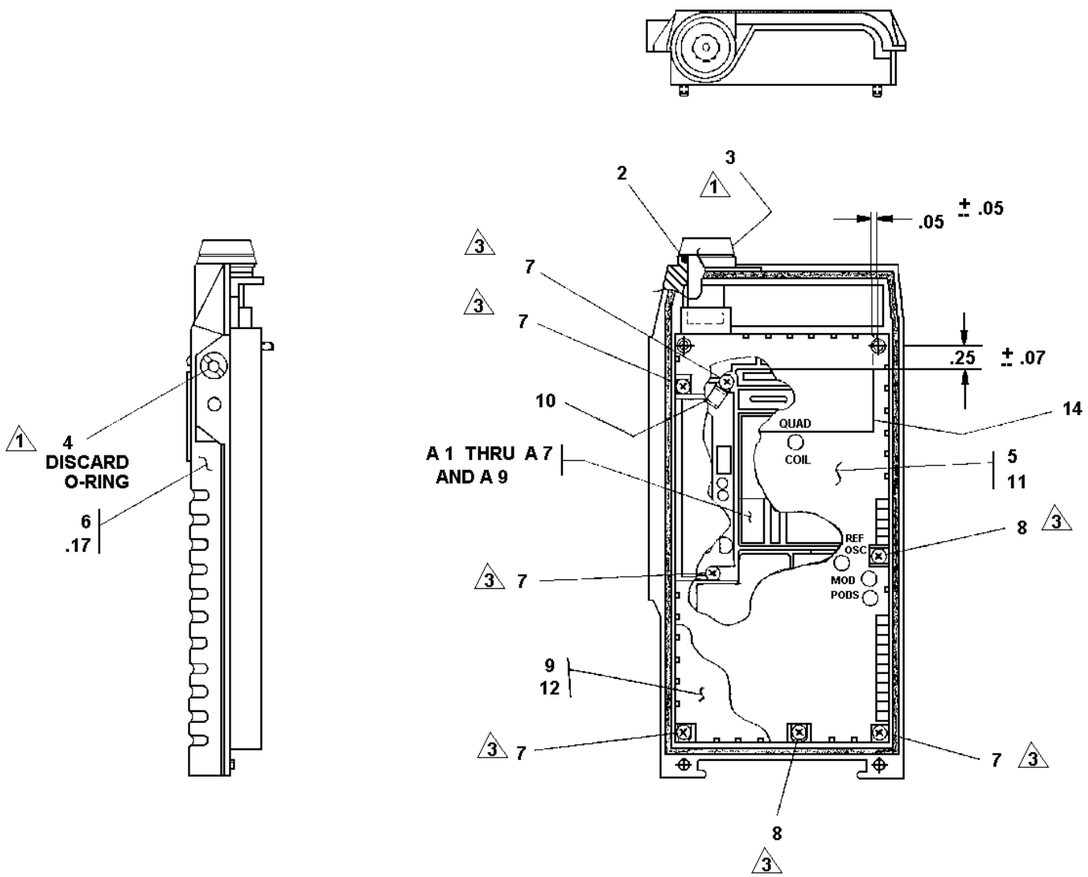
The digital phase detectors output on pin 9 is sent to the Control Board via 7Jl02 pin 8, LOCK DETECT. The microprocessor checks this output to prevent transmission when the VCO is not locked. During an unlocked condition, LOCK DETECT is low or pulsing.

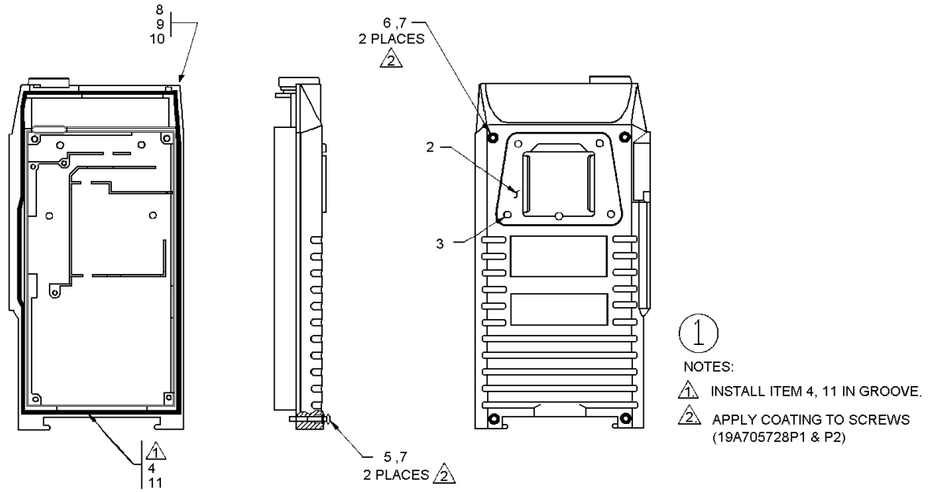
Voltage Regulator I Loop Filter Module A5

Module A5 has two functions. It provides switched supplies to the RF Board and it contains circuitry which provides additional filtering for the VCO tuning signal. Regulated 5.4 Vdc from J102 pin 6 is applied to A5 pin 7 and 7.5 Vdc ±20% (battery power) is applied to pin 11.

Section A5B senses the 5.4V ENABLE line from the Control Board for power-save operation. When 5.4V ENABLE is high, A5B supplies regulated 5.4 Vdc to the synthesizer's circuitry and the back-end circuits via pins 9 and 10 respectively. Switched 7.5 Vdc is also supplied to IF Amp A2 via A5B pin 12 when 5.4V ENABLE is high.

Section A5A provides further filtering of the tuning error signal from the synthesizer chip before it is applied to the VCO. Inside the module, an active filter circuit integrates the tuning error signal from synthesizer chip. Pin 4 is driven by the ENABLE line. When high, the response time of the filter circuit is decreased. This allows the synthesizer to lock quickly when new data is loaded into Ul. Capacitor C25 is the primary integrating capacitor and C26 on A5A's output provides further integration of the tuning error signal before it is applied to the VCO.





1

NOTES:

1. INSTALL ITEM 4, 11 IN GROOVE.
2. APPLY COATING TO SCREWS (19A705728P1 & P2)

1

NOTES:

1. APPLY LOCKTITE THREAD LOCKER 425 (ITEM 15) ON EXTERNAL THREADS AND TORQUE ITEM 3 TO 10 LB-IN AND TORQUE ITEM 4 TO 5 LB-IN.
3. TORQUE ITEMS 7 & 8 TO 4 LB-IN.

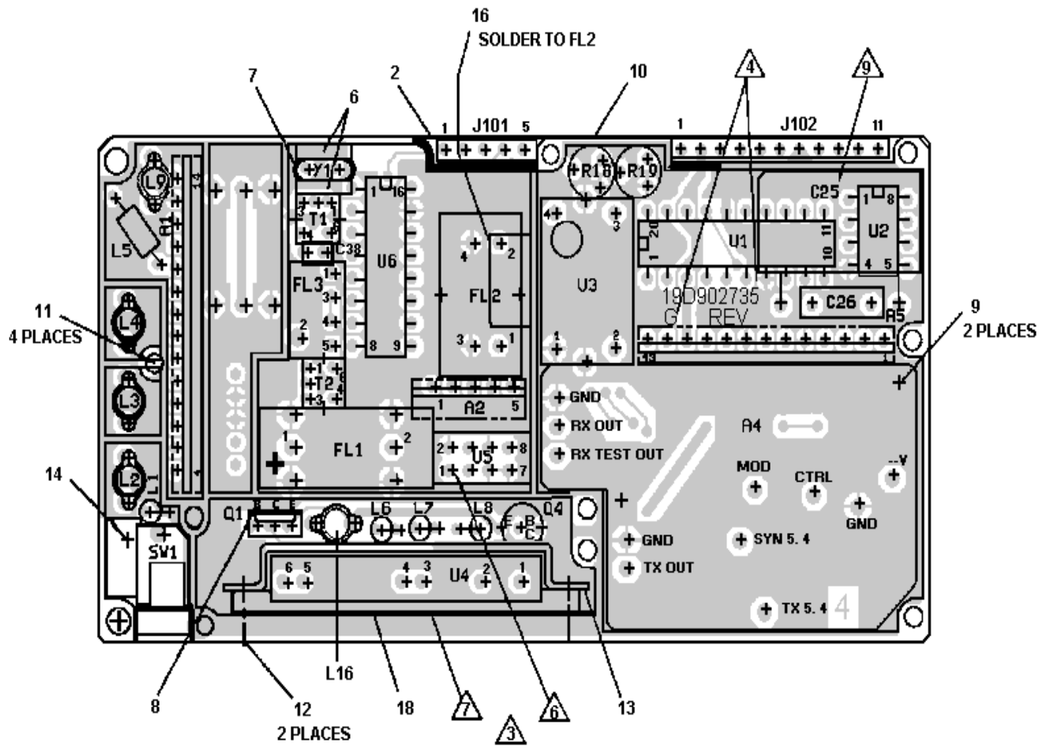
REAR COVER ASSEMBLY 19C337097G1 - G3

(19C337097, Sh. 1, Rev. 9)

REAR COVER 19B801598G1

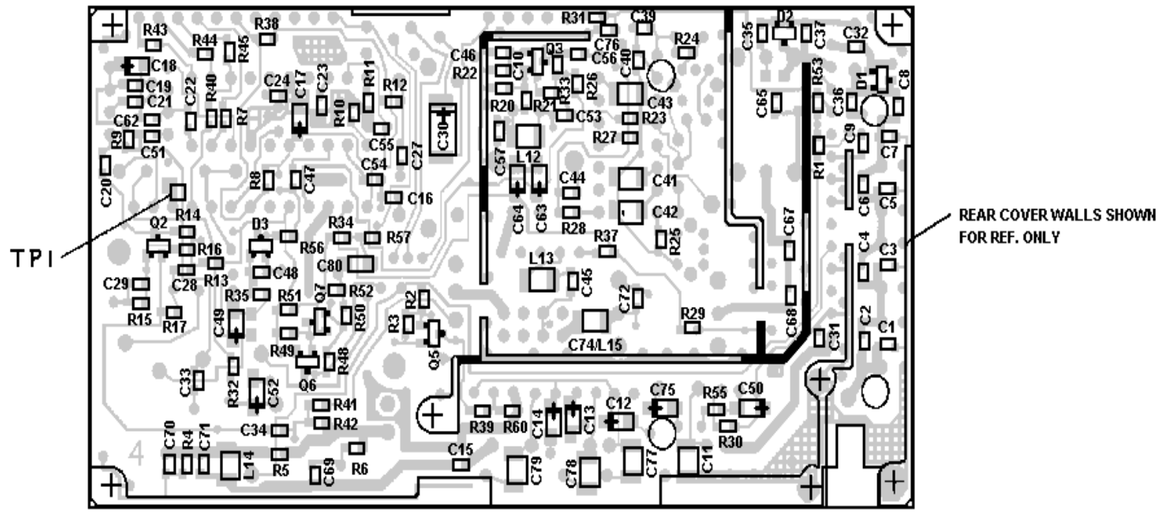
(19B801598, Sh. 1, Rev. 7)

COMPONENT SIDE



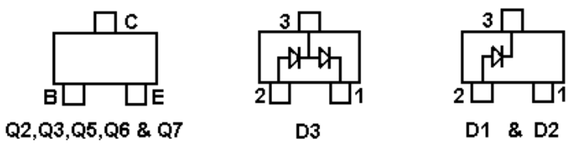
(19D902735, Sh. 1, Rev. 7)
(19D902652, Component Side, Rev. 4A)

SOLDER SIDE



(19D902735, Sh. 1, Rev. 7)
(19D902652, Solder Side, Rev. 4A)

CHIP IDENTIFICATION
TOP VIEW



RF BOARD
19D902735G1, G3, G5

PART	G1 136 -150.8MHZ	G2 146 - 162MHZ	G3 157 - 174MHZ
C1	16P	12P	12P
C2	0.5P	4.7P	4.7P
C3	27P	18P	18P
C4	3.3P	6.8P	6.8P
C6	3.9P	15P	15P
C7	12P	8.2P	8.2P
C69	18P	15P	15P
C70	15P	16P	16P
C71	5.6P	3.0P	3.0P
C72	10P	10P	5.6P
C74	---------	---------	0.1U
L2	6.5T	3.5T	3.5T
L3	6.5T	4.5T	4.5T
L4	5.5T	3.5T	3.5T
L14	39NH	47NH	47NH
L15	39NH	39NH	----------

RF BOARD
19D902735G1, G3, G5

(19D902741, Rev. 4)

PARTS LIST

REAR COVER ASSEMBLY
19C337097G1 136 - 150 .8 MHz
19C337097G2 146 - 162 MHz
19C337097G3 157 - 174 MHz

ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		RF BOARD 19D902735G1 136 - 150 .8 MHz 19D902735G3 146 - 162 MHz 19D902735G6 157 - 174 MHz
		---------- MODULES ----------
A1	19C337063G1	Power Control Module.
A2	19C336876G1	IF Amplifier Module.
A4	19D902280G5	VCO Module. (Used in G1).
A4	19D902280G1	VCO Module. (Used in G3).
A4	19D902280G3	VCO Module. (Used in G5).
A5	19C852056G1	PLL Lowpass Filter / Regulator Module.
		---------- CAPACITORS ----------
C1	19A702236P31	Ceramic: 16 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C1	19A702236P28	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G3 and G5).
C2	19A702236P1	Ceramic: 0.5 pF ±.1 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C2	19A702236P17	Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G3 and G5).
C3	19A702236P36	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C3	19A702236P32	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G3 and G5).
C4	19A702236P13	Ceramic: 3.3 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C4	19A702236P21	Ceramic: 6.8 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM/°C. (Used in G3 and G5).
C5	19A702236P36	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C6	19A702236P15	Ceramic: 3.9 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C6	19A702236P30	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G3 and G5).
C7	19A702236P28	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C7	19A702236P23	Ceramic: 8.2 pF ±.25 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G3 and G5).
C8 and C9	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C10	19A702236P52	Ceramic: 120 pF ±5%, 50 VDCW.
C11	19A702052P26	Ceramic: 0.1 uF ± 10%, 50 VDCW.
C12 thru C14	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C15	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C16	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C17 and C18	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C19	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C20 and C21	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C22	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C23	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C24	19A702052P8	Ceramic: 3300 pF ± 10%, 50 VDCW.
C25	19A703902P4	Metal: 0.56 uF +10%, 50 VDCW.
C26	19A703902P3	Metal: 0.047 uF +10%, 50 VDCW.
C27 and C28	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C29	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C30	19A705205P6	Tantalum: 10 uF, 16 VDCW; sim to Sprague 293D.
C31	19A702236P17	Ceramic: 4.7 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C32 and C33	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C34	19A702236P42	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C35	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C36 and C37	19A702236P32	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C38	19A700227P20	Ceramic: 5.6 pF, 100 VDCW.
C39 and C40	19A702061P21	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C41 thru C43	19A702052P26	Ceramic: 0.1 uF ± 10%, 50 VDCW.
C44	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C45	19A702061P31	Ceramic: 24 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C46 thru C48	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C49 and C50	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C51	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C52	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C53	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C54	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C55 and C56	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C57	19A702236P25	Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C.
C62	19A702236P54	Ceramic: 150 pF ±5%, 500 VDCW, temp coef 0 ±30 PPM/°C.
C63 and C64	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C65	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C67 and C68	19A702052P14	Ceramic: 0.01 uF ± 10%, 50 VDCW.
C69	19A702236P32	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C69	19A702236P30	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G3 and G5).
C70	19A702236P30	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C70	19A702236P31	Ceramic: 16 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G3 and G5).
C71	19A702236P19	Ceramic: 5.6 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1).
C71	19A702236P12	Ceramic: 3.0 pF, 50 VDCW. (Used in G3 and G5).
C72	19A702236P25	Ceramic: 10 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G1 and G3).
C72	19A702236P19	Ceramic: 5.6 pF ±.5 pF, 50 VDCW, temp coef 0 ±30 PPM/°C. (Used in G5).
C74	19A702052P26	Ceramic: 0.1 uF ± 10%, 50 VDCW. (Used in G5).
C75	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C76	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C77 thru C79	19A702052P26	Ceramic: 0.1 uF ± 10%, 50 VDCW.
C80	19A702052P33	Ceramic: 0.1 uF, 50 VDCW.
D1 and D2	19A702525P2	Silicon, PIN: sim to MMBV3401. low profile.
D3	19A705377P4	Silicon, Hot Carrier: sim to HSMS - 2802.
		---------- FILTERS ----------
FL1	19A149624G3	Bandpass: 136-150.8 MHz. (Used in G1).
FL1	19A149624G1	Bandpass: 146-162 MHz. (Used in G3).
FL1	19A149624G2	Bandpass: 157-174 MHz. (Used in G5).
FL2	19A705328P3	Monolitic Crystal: 45,000 MHz., sim to Toyocom 45E2BU.
FL3	19B801021P1	Bandpass: 455 kHz ± 1.5 kHz; sim to Murata CFW - 455D.
		---------- JACKS ----------
J101	19A149614P1	Connector: 5 Sockets; sim to DuPont 69755-005.
J102	19A149614P2	Connector: 11 Sockets; sim to DuPont 69755-011.
		---------- INDUCTORS ----------
L1	19A700024P19	Coil, RF: 3.3 uH ± 10%.
L2	19B800937P6	Coil, RF: 0.066 nH; sim to Paul Smith SK-887-1. (Used in G1).
L2	19B800937P3	Coil, RF: 0.033 nH; sim to Paul Smith SK-887-1. (Used in G3 and G5).
L3	19B800937P6	Coil, RF: 0.066 nH; sim to Paul Smith SK-887-1. (Used in G1).
L3	19B800937P4	Coil, RF: 0.043 nH; sim to Paul Smith SK-887-1. (Used in G3 and G5).
L4	19B800937P5	Coil, RF: 0.054 nH; sim to Paul Smith SK-887-1. (Used in G1).
L4	19B800937P3	Coil, RF: 0.033 nH; sim to Paul Smith SK-887-1. (Used in G3 and G5).
L5 thru L8	19A700024P19	Coil, RF: 3.3 uH ± 10%.
L9	19B800937P5	Coil, RF: 0.054 nH; sim to Paul Smith SK-887-1.
L12	19A705470P14	Coil, Fixed: 0.12 uH; sim to Toko 380NB-R12M.
L13	19A705470P21	Coil, Fixed: 0.47 uH; sim to Toko 380NB-R47M.
L14	19A705470P8	Coil, Fixed: 39 nH; sim to Toko 380NB-39nM. (Used in G1).
L14	19A705470P9	Coil, Fixed: 47 nH; sim to Toko 380NB-47nM. (Used in G3 and G5).
L15	19A705470P8	Coil, Fixed: 39 nH; sim to Toko 380NB-39nM. (Used in G1 and G3).
L16	19B800937P10	Coil, RF: 0.115 nH; sim to Paul Smith SK-887-1.
		---------- TRANSISTORS ----------
Q1	19A149542P1	Silicon, PNP: sim to MJD32C-1.
Q2	19A704708P2	Silicon, NPN: sim to 2SC3356.
Q3	19A703654P2	Silicon, NPN: sim to MMBR901.
Q4	19A702504P2	Silicon, PNP: sim to 2N4403.
Q5	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q6	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.
Q7	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
		---------- RESISTORS ----------
R1	19B801251P330	Metal film: 33 ohms ± 5%, 1/10 w.
R2	19B801251P103	Metal film: 10 k ohms ± 5%, 1/10 w.
R3	19B801251P472	Metal film: 4.7 k ohms ± 5%, 1/10 w.
R4	19B801251P181	Metal film: 180 ohms ± 5%, 1/10 w.
R5	19B801251P330	Metal film: 33 ohms ± 5%, 1/10 w.
R6	19B801251P181	Metal film: 180 ohms ± 5%, 1/10 w.
R7	19B801251P222	Metal film: 2.2 k ohms ± 5%, 1/10 w.
R8 and R9	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R10 and R11	19B801251P104	Metal film: 100 k ohms ± 5%, 1/10 w.
R12 and R13	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R14	19B801251P331	Metal film: 330 ohms ± 5%, 1/10 w.
R15 and R16	19B801251P103	Metal film: 10 k ohms ± 5%, 1/10 w.
R17	19B801251P222	Metal film: 2.2 k ohms ± 5%, 1/10 w.
R18 and R19	19B800779P10	Variable: 10 k ohms + 25%, .3 watt.
R20	19B801251P391	Metal film: 390 ohms ± 5%, 1/10 w.
R21	19B801251P223	Metal film: 22 k ohms ± 5%, 1/10 w.
R22	19B801251P103	Metal film: 10 k ohms ± 5%, 1/10 w.
R23	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R24	19B801251P821	Metal film: 820 ohms ± 5%, 1/10 w.
R25	19B801251P183	Metal film: 18 k ohms ± 5%, 1/10 w.
R26	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R27	19B801251P104	Metal film: 100 k ohms ± 5%, 1/10 w.
R28	19B801251P822	Metal film: 8.2 k ohms ± 5%, 1/10 w.
R29	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R30	19B801251P272	Metal film: 2.7 k ohms ± 5%, 1/10 w.
R31	19B801251P102	Metal film: 1 k ohms ± 5%, 1/10 w.
R32	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R33	19B801251P182	Metal film: 1.8 k ohms ± 5%, 1/10 w.
R34	19B801251P102	Metal film: 1 k ohms ± 5%, 1/10 w.
R35	19B801251P104	Metal film: 100 k ohms ± 5%, 1/10 w.
R37	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R38	19B801251P103	Metal film: 10 k ohms ± 5%, 1/10 w.
R39	19B801251P102	Metal film: 1 k ohms ± 5%, 1/10 w.
R40	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R41 and R42	19B801251P681	Metal film: 680 ohms ± 5%, 1/10 w.
R43 thru R45	19B801251P102	Metal film: 1 k ohms ± 5%, 1/10 w.
R48	19B801251P472	Metal film: 4.7 k ohms ± 5%, 1/10 w.
R49	19B801251P104	Metal film: 100 k ohms ± 5%, 1/10 w.
R50	19B801251P103	Metal film: 10 k ohms ± 5%, 1/10 w.
R51 and R52	19B801251P394	Metal film: 390 k ohms ± 5%, 1/10 w.
R53	19B801251P330	Metal film: 33 ohms ± 5%, 1/10 w.
R55	19B801251P103	Metal film: 10 k ohms ± 5%, 1/10 w.
R56	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.
R57	19B801251P103	Metal film: 10 k ohms ± 5%, 1/10 w.
R60	19B801251P103	Metal film: 10 k ohms ± 5%, 1/10 w.
		---------- SWITCHES ----------
SW1A	19B235072P1	Spring, Antenna Switch.
SW1B	19B235072P1	Spring, Antenna Switch.
SW1C	19C337027P1	Housing, Antenna Switch.
		---------- TRANSFORMERS ----------
T1	19A703591P2	IF: sim to Toko America 332PN - T1016Z.
T2	19A703591P1	IF: sim to Toko America P5SVLC - A291EL.
		---------- INTEGRATED CIRCUITS ----------
U1	19B800902P4	Digital: Synthesizer, CMOS Serial Input.
U2	19A703091P1	Digital: ÷64/65 Prescaler: sim to MC12017P.
U3	19B801351P10	Digital: 13.2 MHz Crystal Oscillator.
U4	19A705774P3	Module: 136-155 MHz RF PA; sim to SHW1026. (Used in G1).
U4	19A705774P4	Module: 146-174 MHz RF PA; sim to SHW1027. (Used in G3 and G5).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
U5	19A705706P1	Module: VHF Mixer; sim to TSM-311.
U6	19A704619P1	Linear: Osc/Mixer/IF/Det/Amp; sim to MC3361AP.
		---------- CRYSTALS ----------
Y1	19A705376P5	Fixed Frequency: 45.455 MHz ± 10 PPM/°C.
		---------- RF BOARD MISCELLANEOUS ----------
		(See Drawing 19D902735)
6	19A149008P1	Pad. (Supports Y1).
7	19A149009P1	Pad. (Supports Y1).
8	19A121175P39	Insulator, plate. (Used with Q1).
9	19A705701P104	Screw,Machine: Torx, Pan Head; M2 x 4. (secures Module A4).
10	19D438351P1	Casting, Eggcrate.
11	19A705701P104	Screw,Machine: Torx, Pan Head; M2 x 4. (secures RF Board to Casting).
12	19A705701P206	Screw,Machine: Torx, Pan Head; M2.5 x 6. (secures U4 Support to Casting).
13	19B234990P1	Support, PA Module. (Used with U4).
14	19A705853P1	Screw, Thread Forming. (Secures SW1).
16	19A705871P2	Clip, Ground. (Grounds FL2).
18	19C851898P1	Shim, Ground. (Between D4 and Casting).
		---------- REAR COVER ASSEMBLY MISCELLANEOUS ----------
		(See Drawing 19C337097)
2	19A115983P16	O-Ring, Rubber. (Used under Antenna Insert).
3	19B801618P1	Insert, Antenna.
4	19B235133P2	Connector, RF.
5	19D438535P1	Shield. (Covers RF Board).
6	19B801598G1	Cover, Rear. (See Separate Parts Lists).
7	19A705701P114	Screw,Machine: Torx, Pan Head; M2 x 14. (secures RF Board and Shield)
8	19A705701P104	Screw,Machine: Torx, Pan Head; M2 x 4. (secures RF Board and Shield)
9	19D902326P1	Insulator, Tracking Card.
14	19B234763P17	Pad.

PARTS LIST

REAR COVER
19B801598G1

MECHANICAL PARTS

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		---------- MISCELLANEOUS ----------
2	19B235075P2	Plate, Receptacle.
3	N327P9009Y6	Rivet.
4	19D902730P1	Gasket, Outer Seal.
5	19A705728P1	Screw, Machine: Torx T6 Oval Head; M2.6 x 14. (Secures Front and Rear Cover Assemblies).
6	19A705728P2	Screw, Machine: Torx T6 Oval Head; M2.6 x 23. (Secures Front and Rear Cover Assemblies).
7	19A701365P7	Washer. (Used with above Screw).
8	19C851743G1	Cover.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

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

REV. A - REAR COVER ASSEMBLY 19C337097G1 - 3

Incorporated in initial shipments.

REV. B - REAR COVER ASSEMBLY 19C337097G1 - 3
RF BOARD 19D902735G1, 3, 5

To widen IF filter passband. FL3 changed from 19B801021P2 to 19B801021P1.

REV. C - REAR COVER ASSEMBLY 19C337097G1 - 3
RF BOARD 19D902735G1, 3, 5

Notch filter removed. Was 19C337059G1, 3, 5 for A3.

REV. D - REAR COVER ASSEMBLY 19C337097G2 - 3
RF BOARD 19D902735G3, 5

Improve operation of reference oscillator (Toyocomm version) U3,
C30 was removed and replaced with two 2.2 uF Tantalum capacitors C30
and C83 (19A705205P19).

REV. E - REAR COVER ASSEMBLY 19C337097G2 - 3
RF BOARD 19D902735G3, 5

Improve operation of reference oscillator (Toyocomm version) U3,
820K ohm resistor R61 (19B801251P824) added in parallel with C49.

REV. F - RF BOARD 19D902735G3, 5

Improve operation of reference oscillator (NDK version) U3,
change C30 to 10uF Tantalum (19A705205P6) and remove C83 and R61.