MAINTENANCE MANUAL

AEGIS™ M-PA™ UHF SERVICE SECTION

TABLE OF CONTENTS

Page

DESCRIPTION 3

TEST EQUIPMENT 3

GENERAL. 3
SPECIALIZED 3
PROGRAMMING 4

FRONT COVER TEST ACCESSORY KIT 4

DISASSEMBLY / REASSEMBLY 4

TOOLS REQUIRED 4
FRONT AND REAR COVER SEPARATION 5
RF BOARD ACCESS 5
CONTROL BOARD ACCESS 6
SPEAKER, MICROPHONE AND FLEX CIRCUIT ACCESS 6
UDC flex/UDC/Monitor Button/HT Switch Assembly Removal 7
Earlier Front Cover Assembly Keypad Flex Removal 7
Later Front Cover Assembly Keypad flex Removal 7
Speaker Flex Removal 7
LCD BOARD ACCESS 7

ALIGNMENT PROCEDURES 8

SET-UP PROCEDURE 8
TRANSMITTER ALIGNMENT 8
Reference Oscillator 9
Modulation Adjustments 9
Transmitter Distortion Test 10
RECEIVER ALIGNMENT 10
2nd Local Oscillator 10
Quadrature Detector 10
12 dB SINAD and Distortion Tests 10

TRACKING AND CHANNEL DATA 11

TROUBLESHOOTING 11

REAR COVER ASSEMBLY 12

ERICSSON

TABLE OF CONTENTS (CONTINUED)

PAGE

Transmitter Troubleshooting....12
Receiver Troubleshooting....14
Synthesizer Troubleshooting....15
FRONT COVER ASSEMBLY....15
COMPONENT REPLACEMENT....16
SURFACE MOUNTED COMPONENTS....16
SURFACE MOUNTED COMPONENT....16
SURFACE MOUNTED COMPONENT....16
SURFACE MOUNTED INTEGRATEDCIRCUIT REPLACEMENT....17
MODULE REPLACEMENT....17
WEATHERPROOF INTEGRITY....17
BATTERY PACKS....17
CHARGING THE BATTERY PACKS....19
REDUCED CAPACITY CONDITION....19
CONTROL KNOB STOP PLATE....19
STOP PLATE REPOSITIONING....20
FIELD RF RETUNING PROCEDURES....20
SET-UP PROCEDURE....21
SYNTHESIZER RETUNING....21
RECEIVER RETUNING....21
Network Analyzer Method....22
Spectrum Analyzer And Best Quieting Methods....22
IC DATA....23

Copyright©,May 1995, Ericsson Inc.

DESCRIPTION

This manual outlines service procedures for the Aegis M-PA UHF portable radios. Information includes radio disassembly and reassembly procedures, RF alignment and RF component-level troubleshooting steps. Information is also included for tracking and channel data, surface mounted component replacement, weatherproofing procedures, RF retuning procedures, and service data on the batteries. Module and integratedcircuit data sheets for the RF Board components are listed at the end of this manual.

In order to perform many of the following alignments, tests and troubleshooting checks, it will be necessary to (re)program the radio. Further programming information can be found in the Programming Manual and software.

NOTE

See LBI-39157 for service information on the Control Board. See LBI-38834 for service information on the Front Cover Assembly.

TEST EQUIPMENT

The following is a list of test equipment which may be required to troubleshoot and/or align the portable radio.

GENERAL.

- RF Signal Generator
- RF Wattmeter with 10-Watt capability
- Audio Distortion Analyzer with Vu Meter
- Oscilloscope with x1 and x10 Probes
- Audio Oscillator
- Frequency Counter
- Modulation Analyzer
- SINAD Meter
- Regulated DC Power Supply, 5 - 9 Vdc adjustable, 5 amperes maximum
- Digital Muitimeter

SPECIALIZED

• K19/A4WX01542	RF Test Cable (UDC mount)
• K19/A4WX01543	Battery Eliminator ("Dummy Battery")
• K19/A4WX01544	RF/Logic Extender Cable
• K19/A4WX01604	Discharge Analyzer (checks battery pack capacity and battery chargers)
• LBI-38518	Front Cover Test Accessory Kit Manual
• SPK9010	Front Cover Test Accessory Kit:
• 19D902562P5	Front Cover Test Cable
• 19D902562P1	LCD Extender Plate & Clamp
• 19D902562P2	LCD Test Cable
• 19D902562P6	Test Program Diskette
• SPK9011	Front Cover Test Accessory Kit:
19D902562P3	Adapter Board
19D902562P4	Control Board Extender
• ST3559	RF Antenna Adapter (top jack to BNC female)
• TQ-0609	Test Box (simulates all external UDC options)
19B219079P1	Alignment Tool, 0.1" slotted (metal) tips
19B801640P1	Alignment Tool, 0.1" slotted tips.

In addition to the above listed equipment, Aegis operational tests will require the appropriate test equipment and a second Aegis portable or mobile radio. Also, radios will require access to a local trunked site and a second portable or mobile (trunked) radio to test trunked mode operation.

PROGRAMMING

- IBM PC Compatible Computer
- TQ-3364 EDACS Programming Manual and Software (includes 5 1/4" and 3 1/2" disks)
- TQ-3370 PC Programming Adapter (Serial Adapter Box and PC-to-Adapter Box Interface Cable)
- TQ-3311 Radio Programming Cable (Adapter Box-to-Radio Cable)

FRONT COVER TEST ACCESSORY KIT

A Front Cover Test Accessory Kit is available for exercising and troubleshooting the circuits in the front cover. Connection to an IBM PC or compatible computer (parallel printer port) allows all of the circuits in the front cover, less Control Board, to be exercised via the PC computer.

An adapter and extender board in the kit allows the Control Board to be extended out of the case for troubleshooting access. See the **TEST EQUIPMENT** section of this manual for a breakdown of the kit.

The LCD Board and Keypad Flex can be exercised without the Control Board while still in the radio's case. All of the switches and the logic circuitry can be tested via the PC connection. Status of the switches is displayed on the PC. The LCD Board can be fully exercised by sending it various patterns to display from the PC. LCD/Keypad backlighting can also be toggled on and off. Test points are provided for the volume control and microphone audio. A resistor network on the Front Cover Test Cable provides a dc bias to the mic in the absence of the Control Board's bias.

DISASSEMBLY / REASSEMBLY

In the event internal service is required, disassemble the radio in accordance with the following outlined steps. See Figures 1 - 5.

Reassemble the unit by following the steps in reverse order. Observe screw lengths and do not over tighten the screws when reassembling the unit. Torque specifications are listed in Table 1.

CAUTION

Always remove the battery pack before disassembling the unit to avoid blowing the fuse or causing other component damage.

This radio contains CMOS ICs that can be damaged by static electricity. Observe static handling precautions.

Table 1 - Torque Specifications

LOCATION	LB-IN.
Rear/Front Cover Assembly Screws	5.0
Rear Cover Assembly	
Antenna Insert	10.0
UDC RF Connector	10.0
RF Board/Eggcrate Screws	4.0
PA Support Screws	10.0
Antenna Switch (SWI) Screw	1.5
Front Cover Assembly	
Knob Set Screws (earlier)	3.0
Knob Set Screws (later)	5.0
Group/Channel and Volume Nuts	8.0
UDC Ground Screw	4.0
All M1.6 and M2 Screws	3.0

TOOLS REQUIRED

- TORX® T6 Driver
- M1 .5 Hex Driver or Wrench
- Needle-Nose Pliers
- Small Flat-Blade Screwdriver
- Spanner Wrench (top antenna jack)
- Spanner Wrench (UDC antenna jack)

Spanner Wrench (volume control and group/channel switch)

FRONT AND REAR COVER SEPARATION

Lay the radio face down and loosen the four (4) TORX® screws (A) on the back of the radio; complete screw removal is not necessary. See Figure 1. Separate the covers by carefully lifting the Rear Cover Assembly straight-up to avoid bending the connector pins between the RF and Control Boards.

When reassembling the unit, verify the rubber gasket surrounding the perimeter of the cover is in good condition and it is in the groove. Also verify the connector pins align properly. For proper operation, the screws should be tightened so there is no gap between the covers. It is recommended that the top screws be tightened first while squeezing the radio together to ensure the gap is completely closed. The bottom screws can then be tightened.

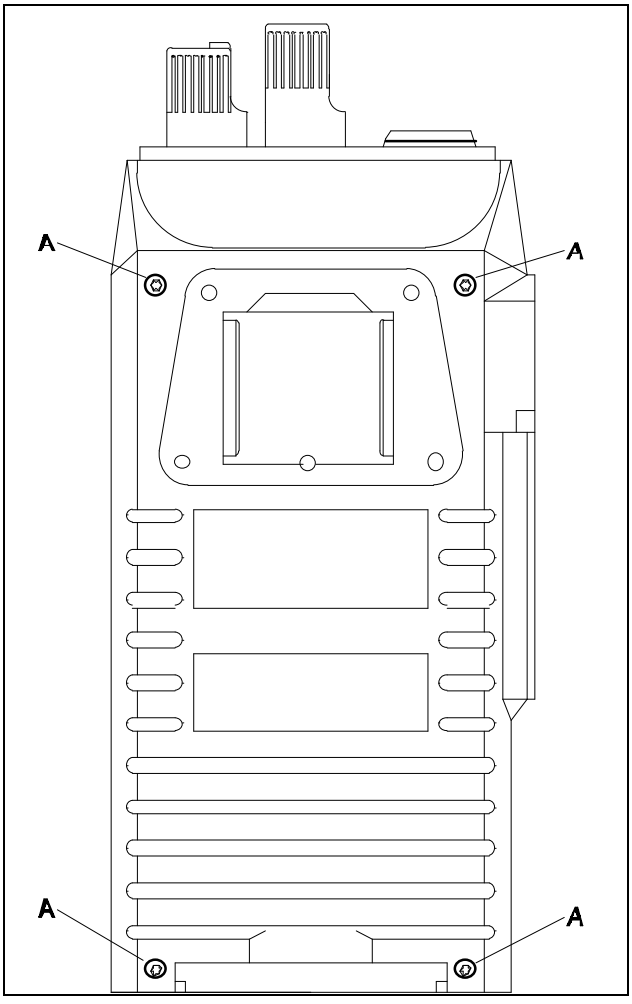


Figure 1 - Front and Rear Cover Separation

RF BOARD ACCESS

Holes are located in the RF Board shield for alignment of the Reference Oscillator (U3), Modulation Balance pot (R18), VCO Modulation pot (R19), 2nd Local Oscillator Adjustment (T1), and the Quadrature Detector Adjustment (T2). See Figure 2. To align these items, shield removal is not necessary.

If removal of the RF Board from the case is necessary, first remove the UDC antenna jack and the top RF antenna jack with appropriate spanner wrenches. Next, remove the five (5) Torx screws (B) that secure the shield then lift and remove the shield. Remove the two (2) remaining Torx screws (C) near the Power Amplifier Module. The RF Board and eggcrate casting can now be lifted from the Rear Cover to gain access to the chip component side of the board.

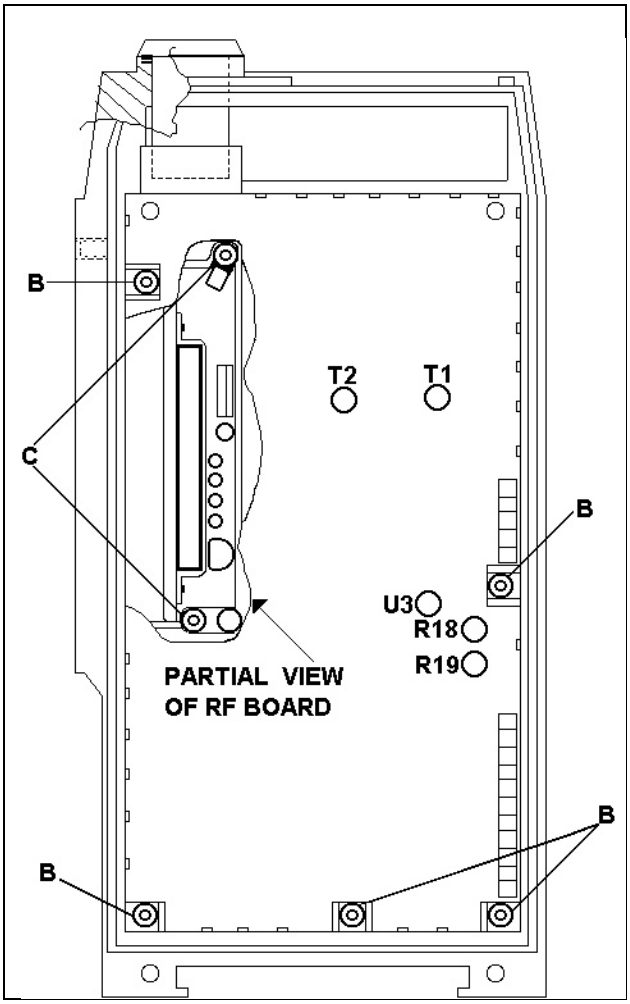


Figure 2 - RF Board Access

If necessary, the RF Board can be separated from the eggcrate casting. Remove the two (2) Torx screws that secure the Power Amplifier Module and remove the four (4) screws on the chip component side of the board that secure it to the casting.

Reassemble the unit in reverse order. Observe screw lengths.

CONTROL BOARD ACCESS

To gain partial access to the Control Board, remove the five (5) screws (D) securing the shield and board. An earlier Front Cover Assembly has an additional screw located just below connectors J4/P4 (DD). See Figure 3. Remove the shield.

Many of the test points on the Control Board are accessible at this point; however, the Front Cover Assembly should not be powered-up without first reinstalling the screw into the lower right-hand hole to ground the board. Also, the three (3) screws securing the top flex connectors need to be reinstalled for good flex connections. USE CAUTION: Installation of screws that are longer than the originals may damage the LCD Board, flex circuits or the threads.

To remove the Control Board, remove the Torx screw (E) in the lower left-hand corner that supplies battery power to the board. An earlier Front Cover Assembly has an additional screw located just below connectors J1/PI (EE). Lift the board and carefully unplug Speaker Flex plug P3 from J3 on the Control Board. Avoid bending this or any other flex circuits at sharp angles. The Control Board can now be removed. Note the battery power and groundconnections at the bottom of the board where the screws have been removed.

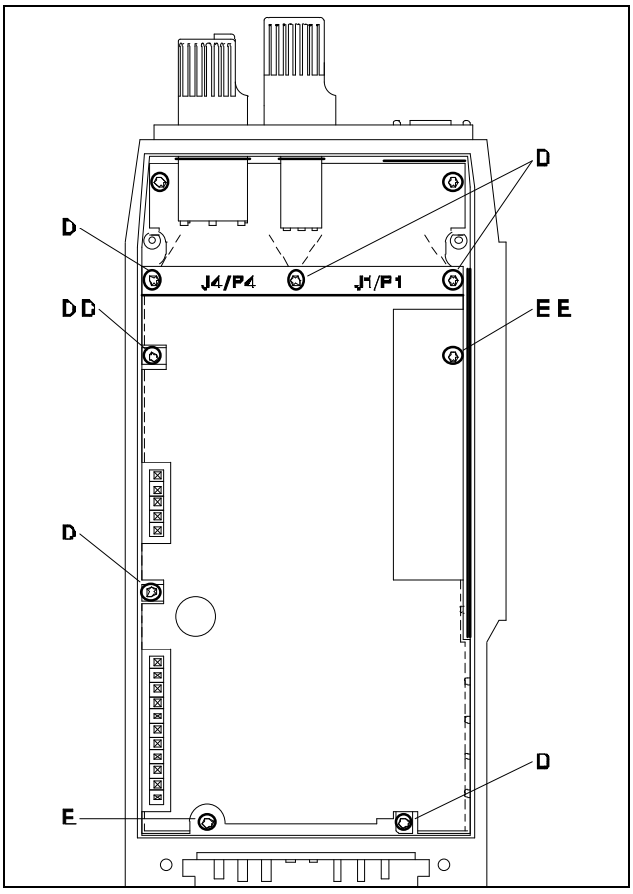


Figure 3 - Control Board Access

SPEAKER, MICROPHONE AND FLEX CIRCUIT ACCESS

Remove the Control Board as previously stated and then remove the six (6) Torx screws that secure the die-cast shield. Remove the die-cast shield by lifting the top end first and sliding it towards the top of the radio. The internal speaker, microphone, Keypad and UDC Flex circuits are now partially accessible. See Figure 4.

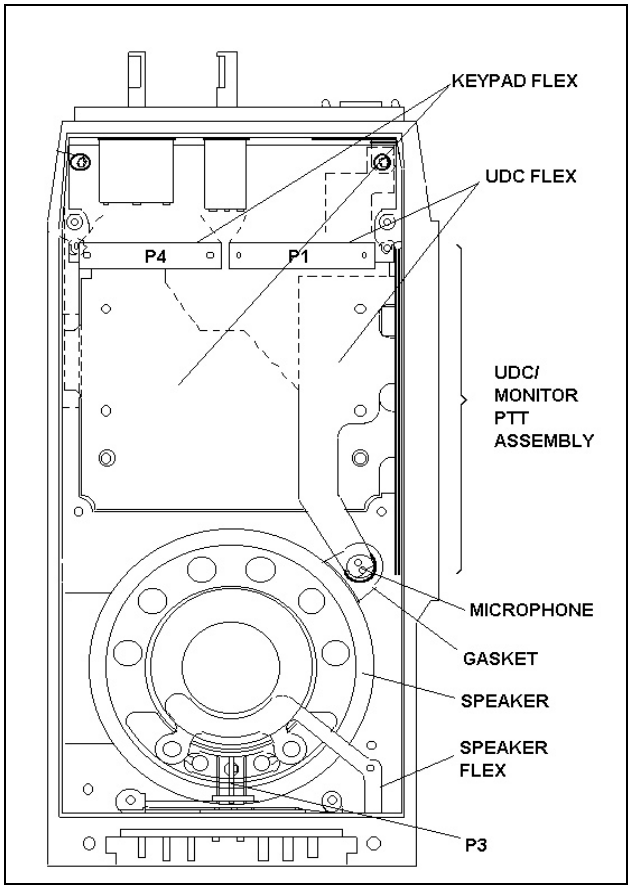


Figure 4 - Speaker, Microphone and Flex Circuit Access

UDC flex/UDC/Monitor Button/HT Switch Assembly Removal

If UDC Flex/UDC/Monitor Button/PTT Switch assembly removal is necessary, first unsolder the microphone. With a spanner wrench, remove the UDC securing screw (the UDC ground pin). Remove the insulator (foam or plastic type) on the inside side-rail of the case. Lift the UDC/Monitor Button/PTT Switch assembly from the side of the case and slide the flex through the slot.

Earlier Front Cover Assembly Keypad Flex Removal

To remove the Keypad Flex, first remove the UDC Flex/UDC/Monitor Button/PTT Switch assembly as previously stated. Next remove the knobs using the hex driver. Unscrew the two (2) screws securing the top panel and lift and remove the panel. Lift the Emergency Button Board by carefully unplugging J6 from P6. With a spanner wrench, remove the nuts securing the volume and channel controls and carefully slide the controls inside the radio. Unscrew the two (2) screws (G and GG) and remove the J10/P10 Zebra strip securing plate (HH). See Figure 5. The Keypad Flex is now free for removal.

Later Front Cover Assembly Keypad flex Removal

To remove the Keypad Flex, first remove the UDC Flex/UDC/Monitor Button/PTT Switch assembly as previously stated. Next remove the screw securing the emergency switch support (G) then remove the support. Remove the knobs using the hex driver. With a spanner wrench, remove the nuts securing the volume and channel controls and carefully slide the controls inside the radio. Unscrew the two (2) screws that secure the J10/P10 connection at the bottom of the LCD Board. Remove the screws, the plate and the rubber pad. The Keypad Flex is now free for removal.

Speaker Flex Removal

In order to replace the Speaker Flex, it must be unsoldered from the speaker and the Battery Plate.

LCD BOARD ACCESS

To remove the LCD Board, partial removal (actually repositioning of the top areas) of the Keypad Flex is required. UDC Flex/UDC/Monitor Button/PTT Switch assembly removal is not necessary.

After the top areas of the Keypad Flex have been freed as previously outlined, the LCD Board can be removed. At this point is the disassembly process an earlier Front Cover Assembly has two (2) screws on the left side as viewed from the back (J and JJ) and a later assembly has a single screw in the upper left-hand side (J). See Figure 5.

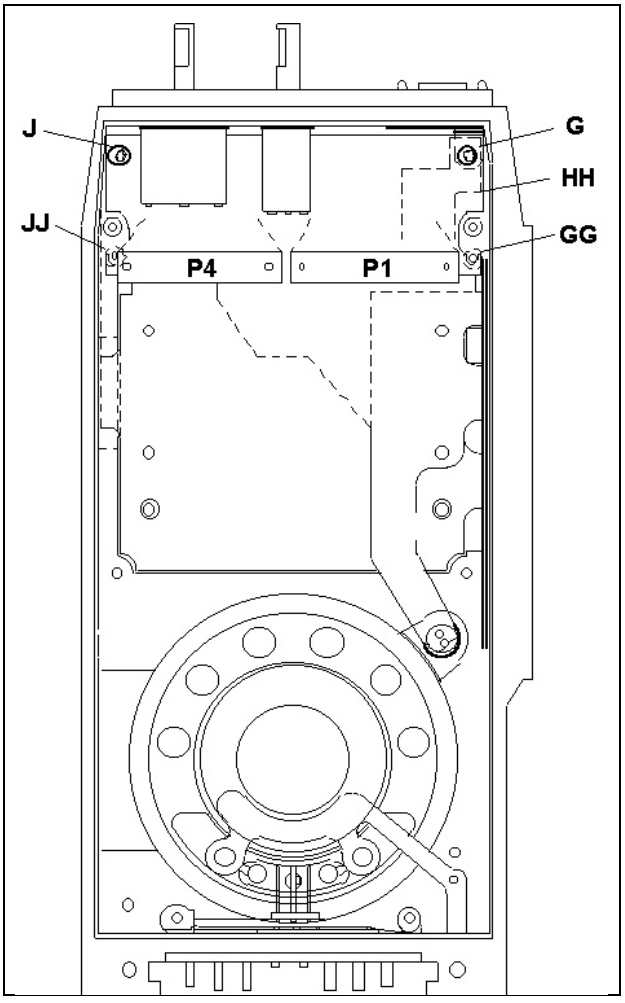


Figure 5 - Keypad Flex and LCD Board Access

ALIGNMENT PROCEDURES

This section outlines alignment procedures for the UHF RF Board located in the Rear Cover Assembly. Alignment procedures must be performed in the order presented to insure proper radio operation. Several test procedures are presented which will help isolate a problem if it exists. The circuits in the Front Cover Assembly contain no adjustments and therefore no alignment is necessary.

SERVICE NOTES

Throughout the service procedures presented in this manual, the following information should be observed:

- The bench power supply should be set for 7.5 ±0.1 Vdc (unless otherwise noted) during troubleshooting procedures presented in this manual. If a battery pack is used, it should be fully charged. Typical battery pack voltage will be 7.5 Vdc ±20% over its full discharge cycle.
- Logic Levels:
- Logic 1 = high = greater than 4.5 Vdc Logic 0 = low = less than 0.5 Vdc
- The modules are not field repairable. Schematics and outline diagrams for the modules are presented in this manual as a troubleshooting reference only.
- The Front Cover Test Accessory Kit allows the Control Board to be extended out of the case for troubleshooting access. The LCD and Keypad circuits can be tested in the case via a PC computer connection.
- The personality information stored in the radio should be backed-up on the PC computer before any service procedure is performed.

SET-UP PROCEDURE

1. Separate the Front and Rear Cover Assemblies and connect the RF/Logic Extender cable between the RF Board and the Control Board. See Figure 6.

2. Slide the Dummy Battery onto the Front Cover and connect the audio output leads to the distortion analyzer. Place the Dummy Battery's on/off switch in the OFF position to direct the speaker audio to its speakers leads and to the distortion analyzer. Connect the PC Programmer to the UDC.

3. Set the power supply to 7.5 ±0.1 Vdc and connect the Dummy Battery supply leads to the power supply.

4. Program the radio with the LOW, MIDDLE and HIGH-side test channels listed in Table 2. To fully test the transmitter, program a channel pair for each frequency, one at high-power and one at low-power. It may be desirable to program more test channels into the unit.

5. Remove power from the radio and replace the PC programming cable with the TQ-0609 Test Box.

6. Connect the radio to the wattmeter using the RF Antenna Adapter. Couple a small amount of the RF signal to the frequency counter.

NOTE

LBI-38203 contains detailed information on the TQ-0609 Test Box.

Table 2 - RF Test Channels

RF BAND	TEST FREQUENCY (MHz)		
403-423 MHz	403.025	412.875	422.975
450-470 MHz	450.025	460.025	469.975
470-492 MHz	470.025	480.875	491.975
485-505 MHz	485.0125	500.000	504.9875
492-512 MHz	492.025	501.900	511.975

TRANSMITTER ALIGNMENT

The following information can be used to test and align the transmitter's output frequency and its modulation characteristics. Completion of these tests/alignments will verify a near 100% operating synthesizer and transmitter stages.

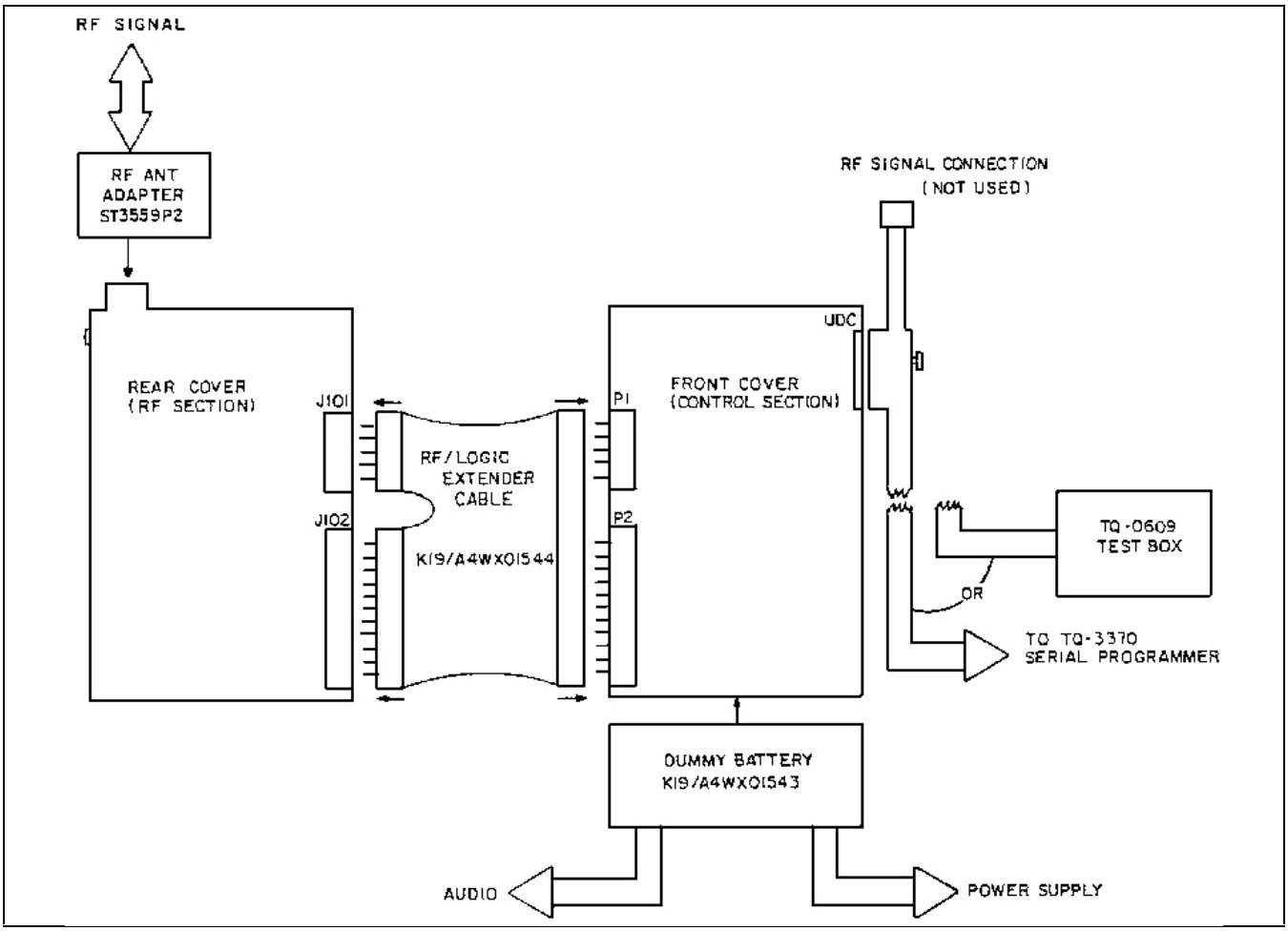


Figure 6 - Test Setup

Reference Oscillator

NOTE

Reference Oscillator U3 is factory adjusted and should not normally need readjustment Use a **recently calibrated and stable frequency counter to determine if oscillator alignment is needed.** This test/alignment should be done at a room temperature of 25° C ±5°C.

1. On the TQ-0609 Test Box, select UDC switch position 6 and apply power to the radio. This enables the radio's control circuits for an external microphone and its internal speaker amplifier.

2. Channel the unit to the MIDDLE test channel listed in Table 2 (low-power) and key the transmitter using the TQ-0609. DO NOT apply any modulation at this time.

3. Monitor transmitter frequency and adjust Reference Oscillator U3 to a frequency reading of within 50 Hz (a small trimmer hole is located on top of module). If the ±50 Hz maximum error (at room temperature) cannot be established, Reference Oscillator replacement may be necessary. Table 3 list maximum transmitter errors for the specified temperature range.

4. Check all TX test channels for an error of less than ±50 Hz.

Modulation Adjustments

1. To align R18 and R19 it will be necessary to modify the RF/Logic Extender cable as follows:

   - Add two 10K ohm resistors in series from 5.5 Vdc (J102 pin 6) to ground (J102 pin 7).

- Break the connection at TX MOD, J102/P2 pin 1.

- Bias TX MOD into the RF Board to 2.7 Vdc by connecting the junction of the 10K resistors to J102 pin 1.

2. Using a 100 μF (or greater) capacitor, couple a 1 kHz, 600 mV rms audio signal into TX MOD, J102 pin 1.

NOTE

Modulation adjustments should only be necessary if changes in the Tracking Data values will not compensate deviation levels to within specifications. Adjustment of R18 and R19 will obsolete all Tracking and Channel Data modulation values. See the TRACKING AND CHANNEL DATA section in this manual for further details.

The following procedure balances and "course aligns" the VCO and the Reference Oscillator deviation levels. The Audio Processor IC will perform "fine level adjustment" of TX deviation adjustment via the Tracking and Channel Data.

3. Connect the radio to the modulation analyzer and key the transmitter at the MIDDLE test channel listed in Table 2.

4. Adjust R19 (VCO modulation pot) for a deviation of ± 2.5.0 kHz ± 50 Hz. Unkey the radio.

5. Remove the 1 kHz signal and apply a 20 Hz, 1 Vpp square wave. **NOTE**: The modulation analyzer should have a low-frequency response of less than 1 Hz for this test.

6. Key the transmitter and monitor the demodulated output from the modulation analyzer. Adjust R18 (modulation balance pot) for a good square wave response.

Transmitter Distortion Test

Measure transmitter audio distortion on the LOW, MIDDLE and HIGH-side test channels. Distortion readings should be less than 3% at ±1.5 kHz deviation with a 1000 Hz tone.

RECEIVER ALIGNMENT

The following information can be used to check and align the receiver circuits. Successful completion of these alignment procedures will verify a near 100% operating synthesizer and receiver stages.

2nd Local Oscillator

1. Check Reference Oscillator alignment as outlined in the TRANSMITTER ALIGNMENT section.

2. Channel the radio to MIDDLE test channel listed in Table 2.

3. Set the RF signal generator to corresponding channel at a -20 dBm RF level and no modulation. Apply this signal to the radio.

4. To measure the IF signal, connect a frequency counter to U6 pin 5. Use an appropriate high impedance probe (op-amp).

5. Adjust the signal generator level to achieve accurate counting of the IF signal. The RF signal generator should be set 10 dBm above the lowest level which gives accurate counting.

6. Adjust the 2nd local oscillator via T1 for 455.000 kHz ±90 Hz.

Quadrature Detector

1. Modulate the signal generator with a 1 kHz tone, ±1.5 kHz deviation at the MIDDLE test channel listed in Table 2. Set the RF level to -50 dBm.

2. Adjust T2 for maximum audio level at J101/P1 pin 4.

12 dB SINAD and Distortion Tests

1. Connect the distortion analyzer or SINAD meter to the speaker load (in Dummy Battery).

2. With the RF signal generator and radio set to the MIDDLE test channel listed in Table 2, modulate the generator with a 1 kHz tone at ±1.5 kHz deviation. Measure the 12 dB SINAD sensitivity. This reading should be equal to or better than -116 dBm (0.35 μV).

3. Return the signal level to -50 dBm.

4. Check audio distortion. Readings should be less than 5% at rated audio output. Audio amplitude should be 50-100 mVrms (≅200 mVp-p) at J101/P1 pin 4.

Table 3 - Maximum Transmitter Frequency Errors*
And Typical VCO Tx Tuning Voltages

CHANNEL (MHz)	TOLERANCE*(Hz)	LOWEST (MHz)	HIGHEST(MHz)	VCO TUNING VOLTAGE (TX)
485.012500	±1213	485.011287	485.013713	1.5 Vdc
500.00000	±1250	499.998750	500.001250	2.5 Vdc
504.987500	±1263	504.986237	504.988763	3.5 Vdc
* Based on specified ±2.5 ppm over the entire operating temperature range				

5. Repeat the 12 dB SINAD sensitivity and distortion check for the LOW and HIGH-side test channels. See Table 2.

TRACKING AND CHANNEL DATA

The personality memory in the radio includes distinct areas which are reserved for Tracking and Channel Data.

Tracking Data establishes individual radio parameters and tailors the operation of the unit across the band. The parameters are: high RF power, low RF power, modulation level and receiver squelch opening. This data is programmed into the EEPROM on the Control Board at the factory after the front and rear covers are "married". The PC Programmer allows alteration of this data if necessary.

Channel Data is the individual channel information such as TX and RX frequencies, CG information, CCT information, and the four previously mentioned parameters. This data is stored in the EEPROM on a per channel basis as each channel is programmed. The PC Programmer allows alteration of this data on a per channel basis.

Low, middle and high-side of the band values are programmed into the radio for each Tracking parameter. When a channel is added to the radio, the Programmer reads the Tracking Data stored in the radio and calculates necessary values for each parameter using a linear interpolation technique. The Programmer then stores the newly calculated values in the Channel Data area of memory along with the associated channel information. Changing the Tracking Data in the radio will not alter Channel Data of previously programmed channels. Tracking Data should not normally be altered; however, it may be necessary to reprogram some of the values after aligning circuitry, or replacing modules or other components which obsolete the previously programmed values. Settings for each parameter are listed in Table 4. If Tracking Data is altered for the above reason, it will be necessary to reprogram all channels to establish the new default data for each channel. See the Programming Manual for further information on altering Tracking and Channel Data.

Digital values stored for the PWR SET analog voltage are one example of tracking information. As no two transmitter stages are exactly matched, the PWR SET dc voltage will be slightly different with any two radios to produce the same power output. Tracking and Channel Data allows the microprocessor to tailor the PWR SET line for RF stage gain differences from unit-to-unit and across the band.

Table 4 - Tracking Data Parameters

PARAMETER	FACTORY SETTING	HEX VALUE*
High Power	3.0 Watts	81
Low Power	1.0 Watt	3F
Modulation	±2.4 kHz **	15
Squelch Opening	8-10 dB SINAD	A3
* Listed HEX values are approximate; final programmed values will vary from unit-to-unit and will need to be adjusted as such.		
** EXT MIC HI = 1 kHz, 110 mVrms		

TROUBLESHOOTING

Troubleshooting procedures for the Rear Cover Assembly are located in this manual. See the manuals specific to the Front Cover Assembly, the Control Board or the Aegis Module for detailed troubleshooting procedures

on these assemblies. The troubleshooting test setup should be identical to the set-up used in the ALIGNMENT PROCEDURES section of this manual. Table 5 lists common problems and most likely problem areas.

REAR COVER ASSEMBLY

The troubleshooting procedures that follow primarily assume a problem has been narrowed to a problem on the RF Board. Transmitter, receiver and synthesizer symptoms/causes are outlined.

Transmitter Troubleshooting

Inoperative Or Low Power

Power sources and regulated power supplies should be one of the first areas to check before troubleshooting any transmitter problem. The radio's power source, whether it is a battery or a bench power supply, is especially critical when troubleshooting a portable radio. Current consumption is an excellent troubleshooting tip when troubleshooting a dead or weak transmitter. See the Control Board maintenance manual for complete radio current consumption data.

When the synthesizer is not locked the radio will beep and flash "NO LOCK" in the display. If the synthesizer does not lock or stay locked at the start of or during a transmission, I/O Microcontroller will not enable or continue the transmission. Check LOCK DET at J102/P2 pin 8 for a low or pulsing (not locked) condition. See **Synthesizer Troubleshooting** for further details.

1. Check for battery power on l02/P2 pin 2.

2. Check for 5.5 Vdc ±0.1 Vdc at l02/P2 pin 6 with the transmitter enabled. Also check the operation of the TX 5.5V switch to insure 5.5 Vdc is being delivered to the RF Board at J101/P1 pin 5 when the PTT button is pressed.

3. Battery power should be present at the Power Amplifier module pins 2 and 4; if not, suspect Q4 or A1. If current consumption appears normal for both high and low-power modes, the problem may be antenna T/R switch DI/D2, the low-pass filter circuit, or antenna switch SWI. If the low-pass filter circuit or the antenna switch have a problem, generally the receiver will also be weak. A defective pin diode (DI or D2) can cause transmitter and receiver problems.

4. If low RF power is a symptom, check the operation of Power Controller AI and Q1. PWR SET on J101/PI pin 1 should be approximately 1.0 Vdc in low-power mode and 4.0 Vdc in high-power mode. If Q1 is saturated (collector voltage is approximately 7.5 Vdc), troubleshoot the PA for a gain problem. Also check the VCO for low RF drive. Normal VCO power from A4 pin 1 is 8 dBm.

5. Check Tracking and Channel Data. Reprogram if necessary.

Excessive Power Output

Short battery life and possible damage to the PA module may result if a problem occurs in the power controlling circuitry.

1. Check PWR SET from the Control Board. PWR SET on J101/PI pin 1 should be approximately 1.0 Vdc in low-power (1 Watt) mode and 4.0 Vdc in high- power (5 Watts) mode. If incorrect, troubleshoot the D/A converter circuits (in Audio Processor U8) on the Control Board. Check Tracking and Channel Data. Reprogram if necessary.

2. The collector of Q1 should be approximately 3.5 Vdc in low-power mode and 5.5 Vdc in high-power mode. If Q1's collector stays near 7.5 Vdc in receive mode, it is most likely shorted. Temporarily short the emitter and base while monitoring the collector voltage. If the collector voltage falls, there is a problem in Power Controller AI.

Frequency Error

If transmit frequency error exists (greater than 2.5 ppm) when the synthesizer is locked, Reference Oscillator U3 alignment or replacement is necessary. See ALIGNMENT PROCEDURES for details. The I/O Microcontroller will not enable a transmission if the synthesizer is not locked.

Modulation Problems

Modulation problems can be caused by a failures in the audio circuits in the front cover or the modulating circuitry of the RF Board.

1. Verify modulating audio is present on J102/P2 pin 1. A 1 kHz, 600 mV rms TX MOD signal at

Table 5 - General Troubleshooting

SYMPTOM	POSSIBLE CAUSES
Completely inoperative (no audio and no LCD indication)	1. Dead Battery Pack. 2. Fuse blown: Check radio fuse in Battery Plate. 3. Control Board problem: See LBI-39157.
At power up, radio beeps: a. twice (once in addition to power up beep) b. continuously at a 2 Hz rate c. continuously at a 2 Hz rate and "NO LOCK" is displayed	 1a. Weak Battery Pack 1b. Unit is not programmed: Program radio. 1c. Synthesizer is not locked: Check LOCK DET line, synthesizer loading and VCO tuning voltage.
At power up, display: a. flashes "PERS ERR" b. flashes all segments and the radio beeps.	1a. EEPROM problem on Control Board: See LBI-39157. 1b. Interprocessor communication failure on Control Board: See LBI-39157.
Receiver inoperative or weak(clear mode).	1. Squelch levels programmed too high: Press Monitor Button to disable squelch. 2. Channel Guard or Type 99 Enabled: See Operator's Manual. 3. Defective antenna. 4. RF Board problem: Troubleshoot Rear Cover Assembly.
Transmitter inoperative or low range.	1. Power levels programmed low: Check RF output and reprogram unit if necessary. 2. Weak battery. Note "BAT" flag. 3. Defective antenna 4. RF Board problem: Troubleshoot Rear Cover Assembly.
TX and RX inoperative on some channels only	1. Programming incorrect: Reprogram unit. 2. Synthesizer problem (VCO or prescaler): Check LOCK DET line (high = lock), VCO tuning voltage and modulas control line. 3. EEPROM Problem: Troubleshoot Control Board.
TX and RX inoperative on all channels	1. Programming incorrect: Reprogram unit. 2. Synthesizer problem: Check LOCK DET line (high = lock), VCO tuning voltage and modulas control line. 3. Control Board problem: See LBI-39157. 4. Check SW1, and the low pass filter circuit on the RF Board
Trunk Mode Problems (trunked radios only)	1. Modem circuitry problem: Check U19 and associated circuitry on Control Board. 2. Low speed data problem: Troubleshoot the related encode or decode circuitry on the Control Board
Aegis Mode Problems	1. Verify outside addresses and data polarity. 2. If optionally equipped for encryption, verify correct keys are loaded and selected. 3. Verify CUE codes. 4. Problem on Control Board with Aegis circuitry. 5. See "Trunked Mode Problems" above.

this point should produce ±2.5 kHz deviation. Improper modulation from 300 - 3000 Hz points to a VCO modulation problem. Check the VCO pin 4 for the TX MOD signal. Suspect the VCO if the signal is present and incorrect modulation exists.

2. If improper low-frequency modulation exists (trunked mode low-speed data), first check J102 pin 1 for the proper tone. Next check U3 pin 4 for the tone; suspect C30 if the tone is not present. Replace U3 if the tone is present on pin 4 and incorrect low-frequency modulation exists. See the ALIGNMENT PROCEDURES for details.

3. Check Tracking and Channel Data. Reprogram if necessary.

4. See the service information in LBI-39157 on troubleshooting the Control Board.

Distorted Modulation

Check TX MOD for an undistorted signal to the RF Board. The audio signal on J102/P2 pin 1 should appear undistorted at maximum deviation and it should be riding on a 2.5 Vdc bias developed on the Control Board.

1. If TX MOD distortion is minimal and transmitter distortion is excessive, suspect the VCO or the Reference Oscillator on the RF Board.

2. If TX MOD is distorted, suspect a defective microphone, mic amps, modulation limiting, or preemphasis circuitry.

If audio sensitivity is good, the microphone, amplifiers and limiters are probably OK. Regeneration from an open decoupling capacitor may make the unit appear to be too sensitive. See the service information in LBI-39157 on troubleshooting the Control Board.

Receiver Troubleshooting

Inoperative

1. If the synthesizer is not locked the radio should be beeping and flashing "NO LOCK" in the LCD. See Synthesizer Troubleshooting

2. Check **RX DISC** on J101/PI pin 4 for signal and/or noise. With an RF input modulated at 1 kHz, ±1.5 kHz deviation, **RX DISC** should be 100 - 150 mV rms (approximately 350 mV p-p). If the 1 kHz audio is present, troubleshoot the audio circuits in the Front Cover Assembly. Noise levels on **RX DISC** with no RF input should be approximately 700 mV p-p.

3. Check for 7.5 Vdc at RF Amp A6 pin 5 and IF Amp A2 pin 1. Check U6 pin 4 for 5.5 Vdc from A5. Verify TX 5.5V is low in receive mode.

4. Verify mixer injection from the VCO is present at U5 pin 8. Check the VCO output with a frequency counter. The VCO should be running 45 MHz below the **RX** frequency. VCO output power level is typically +8 dBm at U5 pin 8.

5. To test the back-end circuits, follow the below procedure:

- Verify 5.5 Vdc is present on U6 pin 4.

- Connect a frequency counter to U6 pin 5 to monitor the IF. Use a high-impedance probe (or amp).

- Couple a 45 MHz signal (no modulation) from an HF signal generator to the emitter of Q3. Adjust the signal generator level to achieve accurate counting of the IF; the signal generator should be set 10 dBm above the lowest level which provides stable counting of the 455 kHz IF. See ALIGNMENT PROCEDURES if the 2nd IF is in error by more than 90 Hz.

- Modulate the HF signal generator and observe the recovered audio on U6 pin 9 and J101/P1 pin 4.

Low Sensitivity

Low receiver sensitivity and/or failure of a modulation acceptance bandwidth test indicates a receiver gain or selectivity problem in the IF stages. An excessively wide bandwidth will cause unnecessary noise, detracting from the receiver quieting. If the bandwidth is too narrow squelching could occur at the modulation peaks. Suspect a defective IF filter if one of the above symptoms occurs.

A 12 dB SINAD sensitivity of around -90 dBm indicates a problem with High-IF Amp A2. The module provides a nominal gain of around 17 dB.

A 12 dB SINAD sensitivity of around -100 dBm could be caused by a problem with RF Amp A6. This module provides 8 dB of gain.

Squelch Problem

A squelch circuit problem (assuming good signal and/or noise is present at 101/P1 pin 4) indicates a problem with Audio Processor U8 on the Control Board. Troubleshooting should begin at the discriminator output Signal trace through the discriminator amp to the Audio Processor. Check the operation of the noise rectifier to verify the noise is being converted into the proper dc voltage. See LBI-39157 for details.

Excessive Distortion

If the measured distortion exceeds the rated specification signal trace starting at the discriminator output and through the audio stages until the fault is isolated. Signal tracing with an oscilloscope proves very useful in locating the trouble areas.

Synthesizer Troubleshooting

Will Not Lock Or Stay Locked

Each time the channel is changed, the PTT Button is pressed or the PTT Button is released, Synthesizer IC U1 is serially loaded with new TX or **RX** data. If the synthesizer does not lock or stay locked, the following will be observed:

- the radio continuously or intermittently beeps
- "NO LOCK" will flash in the display
- LOCK DET (J102/P2 pin 8) will be low or pulsing to flag the I/O Microcontroller of the unlocked condition

If this condition occurs, the I/O Microcontroller will continue to try to reload U1 with channel data until the synthesizer locks.

1. Verify the 5.5 Vdc supply to the RF Board is within ±0.1 Vdc, 7.5 VBATT is present, and TX 5.5V is low (receive mode only).

2. Monitor STROBE, DATA and ENABLE (on J102 pins 11, 10 and 9 respectively) for pulse activity when the channel is changed. See the service information on the Control Board for specific waveforms.

3. Check A5 pin 9 (output) for 5.5 Vdc to A4, U2, and U6. If this power source is not present, check A5 pins 7 and 13 (inputs) for 5.5 Vdc and check A5 pin II (input) for 7.5 Vdc. Replace A5 if the inputs are good and the output is not.

4. Using a frequency counter with a high impedance probe or amp, check U1 pin 2 for the 13.2 MHz (±100 Hz at 25°C) signal from Reference Oscillator U3. Replace U3 if this signal is not present and U3 pin 3 is 5.5 Vdc. See ALIGNMENT PROCEDURES for oscillator alignment details.

5. If LOCK DET is low and not pulsing, temporarily pull it high by connecting J102/P2 pin 6 to J102/P2 pin 8. If the radio now operates normally on all test TX and **RX** channels, replace U1 - the output on pin 9 is defective.

6. Check the VCO output with a frequency counter at A4 pin 9 or by tuning a service monitor to the radio's local oscillator (VCO) signal and loosely coupling the VCO signal into the service monitor. The VCO should be running 45 MHz below the **RX** frequency. VCO output power level is typically +8 dBm.

7. VCO tuning voltage can be monitored at A4 pin 5. See Table 3 for details. Also check A4 pin 6 for the -3.7 Vdc supply developed from the OSC OUTput from U1, D3 and the associated components.

8. If a synthesizer lock problem cannot be narrowed to a problem in the Rear Cover Assembly, reprogram the inoperative channels and test the unit again. Also see the service information on the Control Board for further details.

Excessive Switching Time

The synthesizer should generally lock within 10 milliseconds after a frequency change.

1. Suspect leaky low-pass filter capacitors C25 or C26 if slow switching time is a symptom. Replace these components with original equipment parts only. See the RF Board parts list for part numbers.

2. Module A5 also influences switching time. Verify the ENABLE pulse is present at A5 pin 4.

FRONT COVER ASSEMBLY

See maintenance manual LBl-39157 for component-level troubleshooting information on the Control Board.

Troubleshooting details on the other assemblies located in the Front Cover Assembly can be found LBI-38834. These assemblies include the LCD Board and the various flex circuits used in the radio.

COMPONENT REPLACEMENT

SURFACE MOUNTED COMPONENTS

Surface mounted "chip" components should always be replaced using a temperature-controlled soldering system. The soldering tools may be either a temperature-controlled soldering iron or a temperature-controlled hot-air soldering station. A hot-air system is recommended for the removal of components on the multi- layer boards utilized throughout the radio. With either soldering system, at a temperature of 700°F (371°C) should be maintained.

The following procedures outline the removal and replacement of surface mounted components. If a hot- air soldering system is employed, see the manufacture's operating instructions for detailed information on the use of your system.

CAUTION

Avoid applying heat to the body of any chip component when using standard soldering methods. Heat should be applied only to the metallized terminals of the components. Hot-air systems do not damage the components since the heat is quickly and evenly distributed to the external surface of the component

CAUTION

As the radio contains many static sensitive components, observe static handling precautions during all service procedures.

SURFACE MOUNTED COMPONENT

Removal

1. Grip the component with tweezers or small needle-nose pliers.

2. Alternately heat the metallized terminal ends of the component with the soldering iron. If a hot-air system is used, direct the heat to the terminals of the component. Use extreme care with the soldering equipment to prevent damage to the printed wire board (PWB) and the surrounding components.

3. When the solder on all terminals is liquefied, gently remove the component. Excessive force may cause the PWB pads to separate from the board if all solder is not completely liquefied.

4. It may be necessary to remove excess solder using a vacuum de-soldering tool or Solderwick®. Again, use great care when de-soldering or soldering on the printed wire boards. It may also be necessary to remove the epoxy adhesive that was under the component.

SURFACE MOUNTED COMPONENT

Replacement

1. "Tin" one terminal end of the new component and the corresponding pad on the PWB. Use as little solder as possible.

2. Place the component on the PWB pads, observing proper orientation for capacitors, diodes, transistors, etc.

3. Simultaneously touch the "tinned" terminal end and the "tinned" pad with the soldering iron. Slightly press the component down on the board as the solder is liquefied. Solder all terminals, allowing the component time to cool between each application of heat. Do not apply heat for an excessive length of time and do not use excessive solder.

   With a hot-air system, "tin" all terminals and apply heat until all "tinned" areas are melted and the component is seated in place. It may be necessary to slightly press the component down on the board. Touch-up the soldered connections with a standard soldering iron if needed. Do not use excessive solder.

4. Allow the component and the board time to cool and then remove all flux from the area using alcohol or another approved flux remover.

CAUTION

Some chemicals may damage the internal and external plastic and rubber parts of the radio.

SURFACE MOUNTED INTEGRATED CIRCUIT REPLACEMENT

Surface mounted IC soldering and de-soldering techniques are similar to the above outlined procedures for the surface mounted chip components. Use extreme care and observe static precautions when removing or replacing a defective (or suspect) IC. This will prevent any damage to the printed wire board or the surrounding circuitry.

Replacement of a surface mounted IC is best completed using a hot-air soldering system. The IC can easily be removed and installed using hot air. See the manufacturers instructions for complete details on tip selection and other operating instructions unique to your system.

If a hot-air system is not available, the service technician may wish to clip the pins near the body of the defective IC and remove it. The pins can then be removed from the PWB with a standard soldering iron and tweezers and then the new IC can be installed. It should not be necessary to tin any of the IC pins before the installation process.

The "chip-on-board" ICs used in the radio cannot be replaced. Failure of this type of IC will require board replacement.

MODULE REPLACEMENT

The modules, all of which are located on the RF Board, are very reliable devices. Before replacing any of the modules, check the associated circuitry thoroughly to insure there is not a problem elsewhere. If replacement is necessary, follow the below procedures.

All of the component lead holes for the modules on the RF Board are plated through from the top to the bottom of the board. This allows for easy removal and replacement of the modules as long as appropriate soldering techniques are observed. Always observe static precautions when handling the board.

To remove the PA module, it is first necessary to remove the hardware which supports it. Two (2) Torx screws and a support bracket secure the module to the eggcrate casting. Two (2) Torx screws also secure the VCO to the board.

To remove a module, position the RF Board in a work (face down, chip components up) and remove the solder from the plated-through points at the appropriate pins. If a hot-air system is employed, use an appropriate tip that will localize the heat on the pins and not on surrounding chip components. Solderwick® or a vacuum de-soldering iron will also remove the solder if a hot-air station is not available. When all solder has been removed or liquefied, the module should drop out of the eggcrate casting.

To install a module, clean any solder from the plated- through holes and clean all flux from the board. Next, install the replacement module making sure that all pins align in the proper holes. Resolder the pins to the board. Clean the flux from the board using an approved solvent. Clip any excess lead length.

WEATHERPROOF INTEGRITY

The M-PA radio is designed to meet the MIL-810C & D environmental specifications. The internal circuitry is protected from moisture by appropriate seals. Rear Cover Assembly seals include the Front/Rear Cover Assembly gasket and the antenna insert gaskets. Front Cover Assembly seals include the speaker/microphone seal, the battery plate seal, and the volume and channel control seals. The UDC/Monitor Button/PTT Assembly is also designed to seal out moisture.

These seals should be inspected during any disassembly/reassembly process for cracks and tears. A defective seal warrants replacement. See the Mechanical Parts breakdown drawings and the Parts Lists for locations and part numbers for these seals. When installing a new seal, make sure it is seated properly before reassembly.

BATTERY PACKS

Battery packs available for use with the radio include high and extra high capacity rechargeable units. All of the rechargeable battery packs are factory sealed and are not field serviceable other than properly charging them and cleaning the contacts. Figure 8 outlines a typical battery pack.

Radio contacts located on the top of the pack include switched power, ground, the speaker enabling (shorting) contacts and a continuous power contact. Four (4) charging contacts are located on the rear side of the battery pack. These contacts provide connections to the slip-in type chargers or vehicular chargers/repeaters while the battery pack is still connected to the unit. The battery charging contacts are diode protected from external shorts.

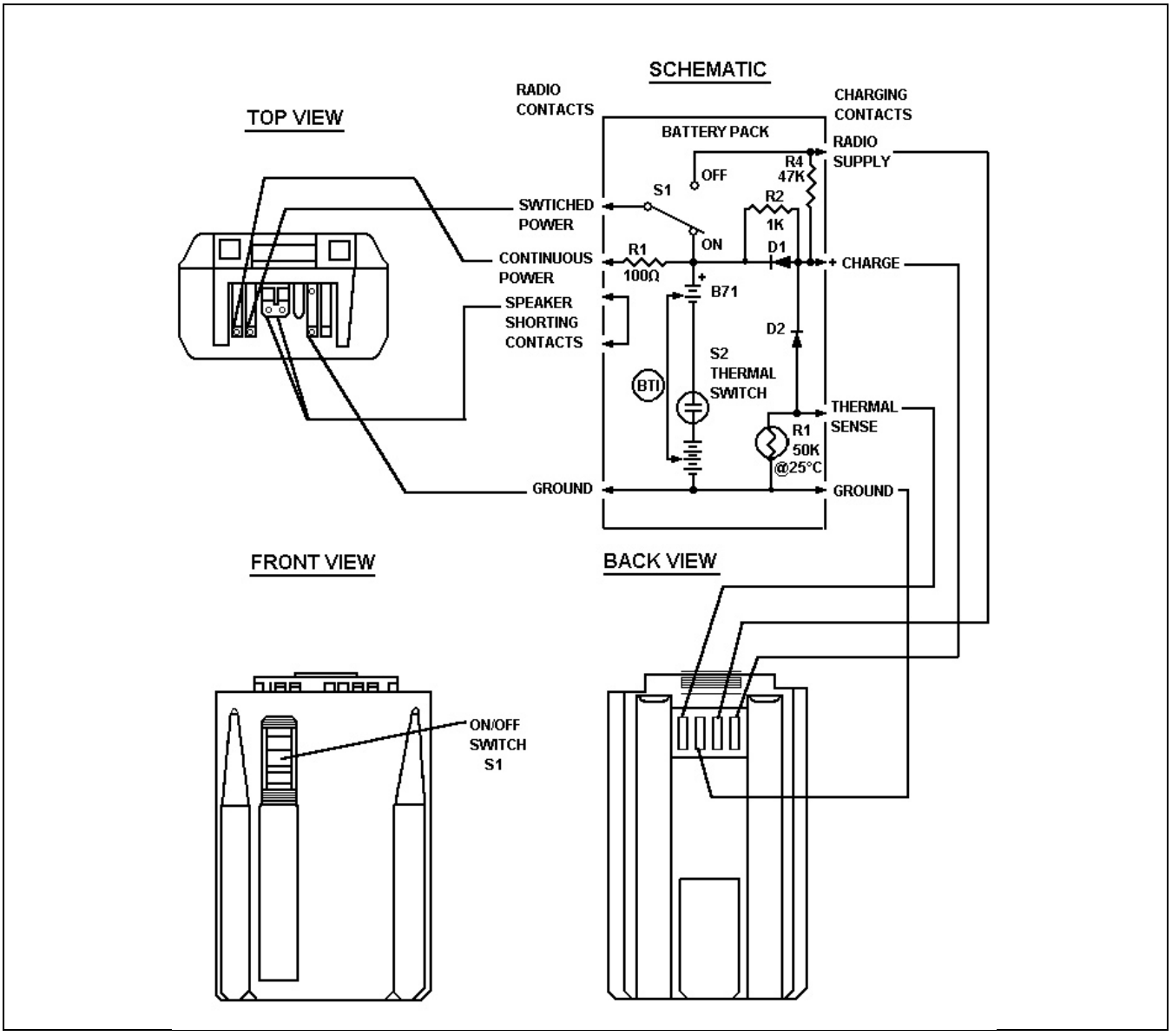


Figure 8 - Battery Packs

CHARGING THE BATTERY PACKS

After receiving a new battery pack from the factory, it should be fully charged before it is placed into service. This also applies to batteries that have been stored for long periods.

Chargers are available with nominal charge times of 1 hour (rapid) and 14 (standard) hours. Combinations include single and multi position standard and rapid charge units. The rapid chargers utilize an internal thermistor in the battery pack to sense temperature and automatically controlcharge rate of the battery. This allows a rapid charger to charge at a maximum rate without overheating the battery. All battery packs can be charged in less than 1 1/2 hours in a rapid charger. Nominal full charge time in a standard charger is 14 hours. For specific instructions for the particular charger, refer to the applicable charger's Operating Manual.

A fully charged battery pack should provide an open terminal voltage greater than 7.5 Vdc (typically 9 Vdc). A fully discharged battery pack should be no less than 6 Vdc. When the battery pack drops below approximately 6.8 Vdc the radio will warn the operator with an alert tone and the "BAT" flag will turn on.

REDUCED CAPACITY CONDITION

Rechargeable batteries can develop a condition of reduced capacity sometimes called "Memory Effect". This condition can occur when a battery is continuously charged for long periods of time or when a regularly performed duty cycle allows the battery to expend only a limited portion of its capacity.

If the battery pack is seldom used and left on a continuous charge for long periods it may develop reduced capacity. On the first discharge cycle, the capacity may be significantly lowered, reducing useful service hours.

The reduced capacity condition should be suspected on any rechargeable battery pack showing signs of reduced capacity. If reduced capacity is in fact a problem, the following procedure may restore useful capacity:

1. Discharge the battery pack at a normal discharge rate until the output voltage is approximately 1 Volt per cell. This equals 6 Volts output for the battery packs. Refer to Figure 9. Note the flatness of the discharge curve from 0% - 90%. Experience shows discharging below the "knee is not necessary.
2. Complete a full charge cycle using an Ericsson charger.
3. Repeat steps 1 and 2. Performing this deep cycle at least twice should be sufficient to restore battery pack capacity.

NOTE

The above procedure is easily completed using Discharge Analyzer 19B801506P9 and Rapid Multi-Charger 19B801506P16 or P18.

RECHARGEABLE BATTERY PACK DISPOSAL

Ni-Cd

Under specific state laws, it may be illegal to dispose of rechargeable batteries, rechargeable batteries packs and/or products powered by rechargeable batteries except in accordance with specific procedures. Special collection systems are in place in certain states. Call Toll Free 1-800-822-9363 for specific procedures for returning rechargeable batteries in your state.

CONTROL KNOB STOP PLATE

A stop plate is normally installed under the Control Knob of the radio at the factory. It is used to limit the maximum number of unique Control Knob positions to less than sixteen (16). The stop plate is normally factory placed for fifteen (15) positions unless sixteen unique factory programmed positions are ordered. This stop plate can be repositioned to limit the maximum number of unique Control Knob positions to match personality programming.

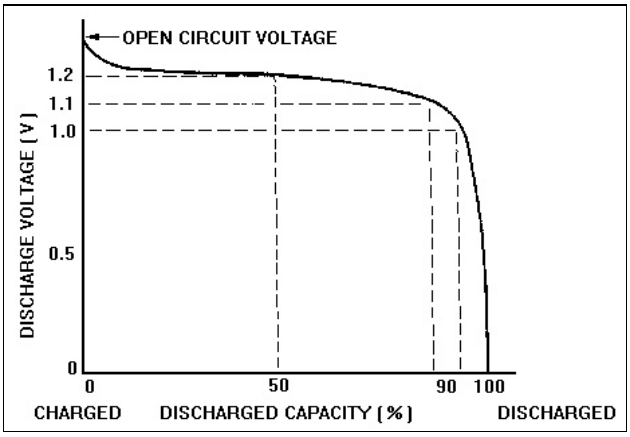


Figure 9 - Typical Cell Discharge Curve

STOP PLATE REPOSITIONING

1. Remove the Control Knob using an M15 hex wrench.

2. Lift the stop plate using small needle-nose pliers.

3. Reposition the stop plate by aligning the raised bar to the channel marking one (1) number higher than the number of positions required. For example, if eight (8) unique positions are required, align the raised bar to the "9". If sixteen (16) positions are required, do not reinstall the stop plate.

4. Replace the Control Knob and torque the set screw per Table 1. The set screw must align on the flat area of the switch shaft Rotate the knob to test for proper operation.

FIELD RF RETUNING PROCEDURES

This section outlines field RF retuning procedures which will be necessary if the factory tuned 20 MHz operating band does not meet needed requirements. Note that the frequency range limits of the RF Board cannot be exceeded. The procedures should be performed in the order presented.

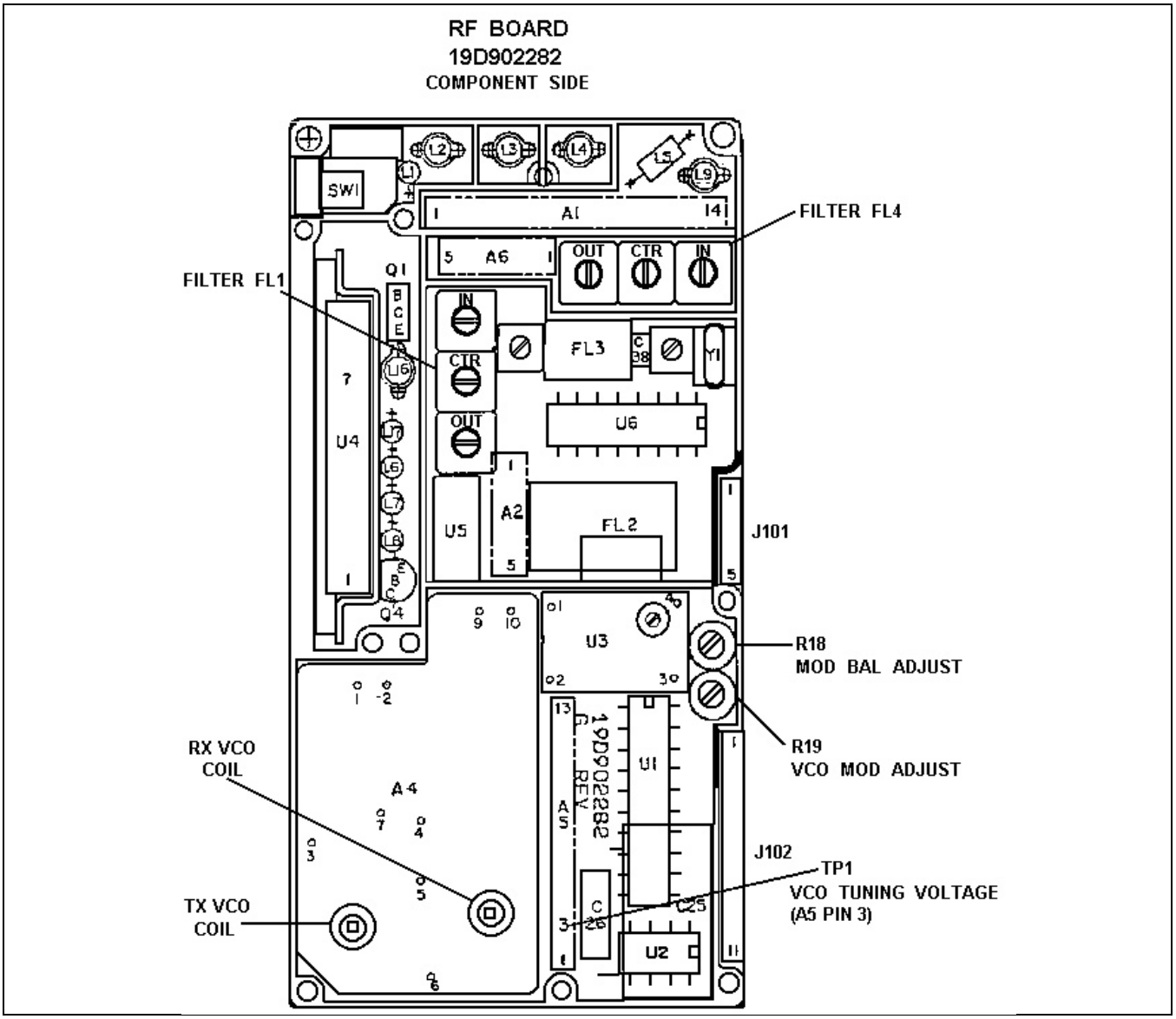


Figure 10 - RF Board Retuning Areas

SET-UP PROCEDURE

1. Program the radio with the low, middle and high-side re tune channels in the desired operating frequency band. The low and high-side channels should be 20 MHz apart and the middle channel should be centered between the two. Do not exceed the frequency range limits for the RF Board.

2. Separate the Front and Rear Cover Assemblies and connect the RF/Logic Extender cable between the RF Board and the Control Board.

SYNTHESIZER RETUNING

1. Set the radio to the middle retune channel. Monitor the VCO tuning voltage at TP1 (A5 pin 3) with a dc voltmeter. Adjust the RX VCO coil should be for a reading of 2.5 Vdc. See Figure 10.

2. Set the radio to the lowest retune channel. The monitored voltage greater than 1.0 Vdc.

3. Set the radio to the highest retuned channel. The monitored voltage should be less than 4.0 Vdc.

4. If the lowest and highest retune channels push the VCO tuning voltage measured at TP1 outside of the specified limits, slightly readjust the **RX** VCO coil to center the low and high retuned channel tuning voltages within or around this 1.0 - 4.0 Vdc window.

5. Repeat steps 1 - 4 for the TX VCO coil with the following exceptions: The radio must be keyed when adjustments are made to the TX VCO coil. Also, connect an appropriate RF load to the antenna before keying.

6. Turn the radio off and connect the PC Programmer to the radio. Power the radio back up. Using the PC Programmer, set the modulation Tracking Data value to OD (hex).

7. Set the radio to the middle, retune channel. 8. Couple a modulation analyzer (with a monitoring oscilloscope) to the RF output of the radio. Set the modulation analyzer's filters as follows: no high-pass filters and 20 kHz low-pass filter. The modulation analyzer should have an almost dc response. If it does not, an alternative is to use a second M-PA monitoring the transmit frequency and monitor the discriminator output from the RF Board with a dc coupled oscilloscope. The monitoring point is J101 pin 4.

9. Apply a 110 mV rms, 1 kHz tone to the TQ-3370's modulation input. Key the radio from the TQ-3370 and adjust R19 on the RF Board for a deviation of 2.5 kHz.

10. Modify the RF/Logic Extender cable so a low-frequency signal can be injected directly into the RF Board. This modification procedure is outlined in the TRANSMITTER ALIGNMENT section of this manual.

11. Using a 100 µF (or greater) capacitor, couple 20 Hz, 1.0 Vpp square wave signal into TX MOD (J102 pin 1).

12. Key the radio and monitor the demodulated output from the modulation analyzer. Adjust R18 (modulation balance pot) for a good square wave response as shown in Figure 11.

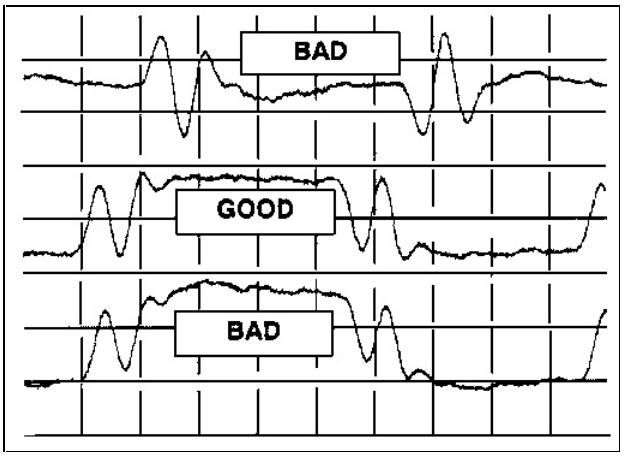


Figure 11 - Typical TX Modulation Low-Frequency Response Curves

RECEIVER RETUNING

Retuning the UHF M-PA receiver involves retuning the two (2) helical filters at the input and output of RF Amplifier module A6. There are three (3) different procedures that can be used to retune the receiver. The most accurate method involves the use of a network analyzer. If a network analyzer is not available, a spectrum analyzer and signal generator can be used, but with less accurate results. Finally, the receiver can be re tuned with some compromise in receiver performance using a best quieting (SINAD) tuning technique.

Network Analyzer Method

1. Remove the solder mask on the solder side of the RF Board at the thin run between the output of FL4 and the input of A6 (A6 pin 1). Cut this run.
2. Solder the center conductor of a small 50-ohm coax cable to FL4's output at the cut run. Solder the coax shield near FL4.
3. Terminate the radio's antenna with a 50-ohm load.
4. Connect the other end of the coax to the network analyzer and tune FL4 (all three sections) for best return loss over the desired receive frequency range.
5. Unsolder the coax cable from the output of FL4 and solder it to the input of A6. Ground the shield near A6.
6. With the network analyzer's output at -30 dBm or lower, adjust FL1 (all three sections) for best return loss over the desired receive frequency range. The receiver must be powered-up during this adjustment.
7. With a small jumper, reconnect the output of FL4 to the input of A6. Test the radio over the new frequency range.

Spectrum Analyzer And Best Quieting Methods

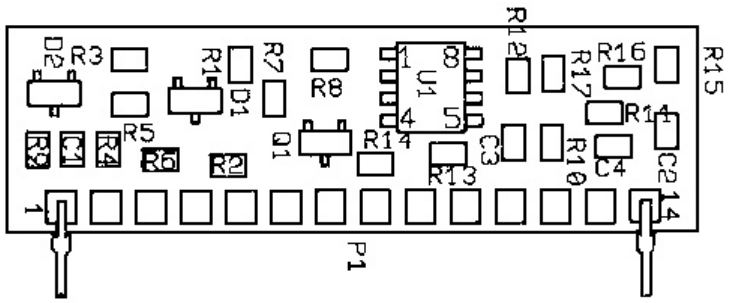
This procedure involves retuning the receiver's helical filters at the low, middle and high-side frequencies. The same frequencies used to retune the VCO can be used.

The preferred method is to connect a small 50-ohm coax to the output of IF crystal filter FL2, ground, and connect this cable to a spectrum analyzer tuned to 45 MHz and set to 2 dB/division.

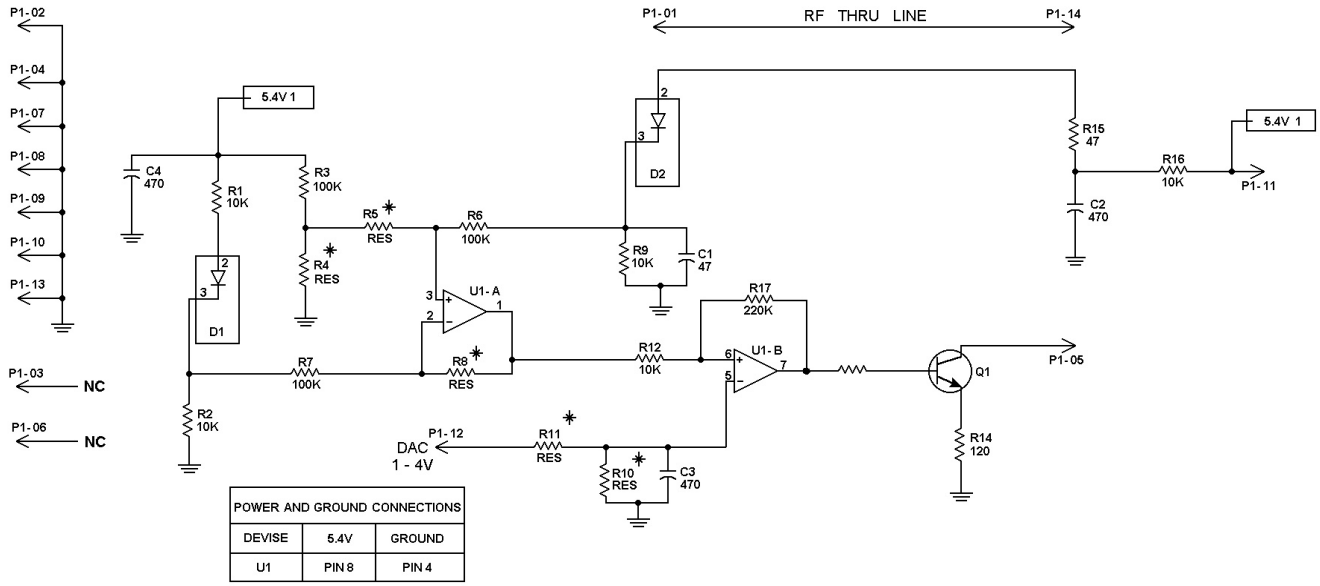
A less desirable alternative using the same tuning sequence can be achieved by varying the signal generator's level and tuning for best quieting (SINAD). No coax cable connections are required using this procedure.

1. Remove the input and output (outer) tuning cores from both FL1 and FL4 (four cores total).
2. Set the radio and signal generator to the low-side receive frequency.
3. Set the signal generator's level to -30 dBm. If tuning by quieting, set the generator's level for a high receiver noise level.
4. Alternately tune the center cores of FL1 and FL4 for maximum IF signal. If tuning by quieting, tune for best sensitivity and reduce the generator's level as the receiver becomes more sensitive.
5. Set the radio and signal generator to the high-side receive frequency.
6. Reinstall the input tuning cores into FL1 and FL4. Alternately adjust these cores for maximum signal or best quieting.
7. Set the radio and signal generator to the middle receive frequency.
8. Reinstall the output tuning cores into FL1 and FL4. Alternately adjust these cores for maximum signal or best quieting. Under certain circumstances, best tuning may be achieved when certain tuning cores are not reinstalled. This is acceptable. Also, any excessively loose core should be secured with a drop of adhesive.

A1



(19C337063, Rev. 1)

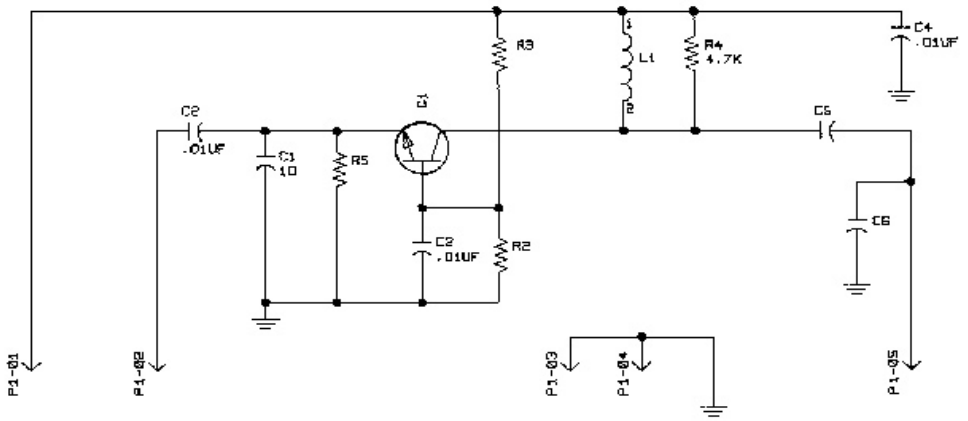


POWER AND GROUND CONNECTIONS		
DEVISE	5.4V	GROUND
U1	PIN 8	PIN 4

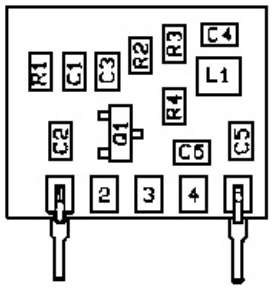
(19C337315, Rev. 1)

POWER CONTROLLER
19C337063

A2



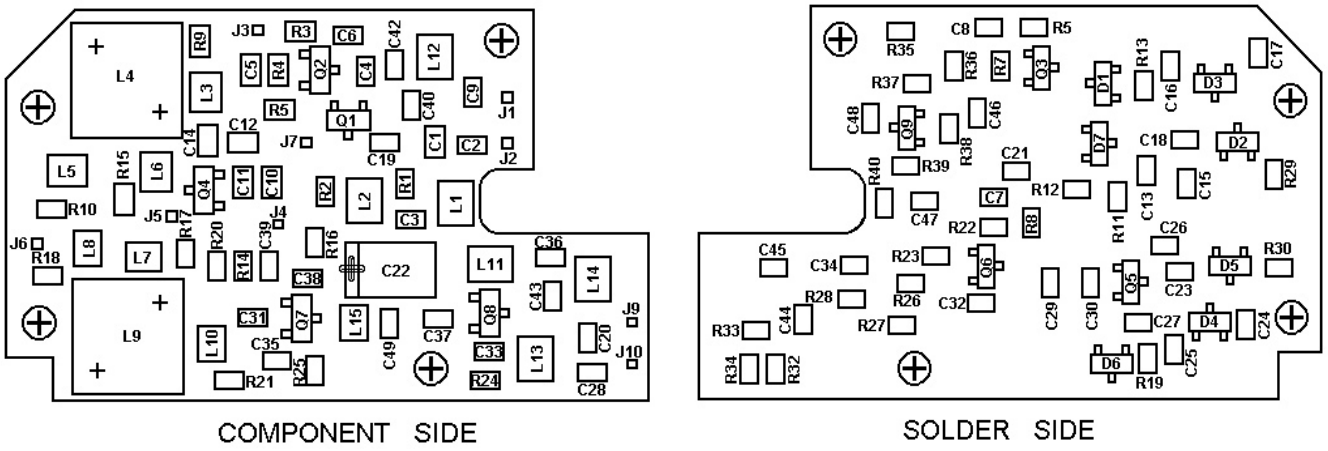
(19C337062, Rev. 2)



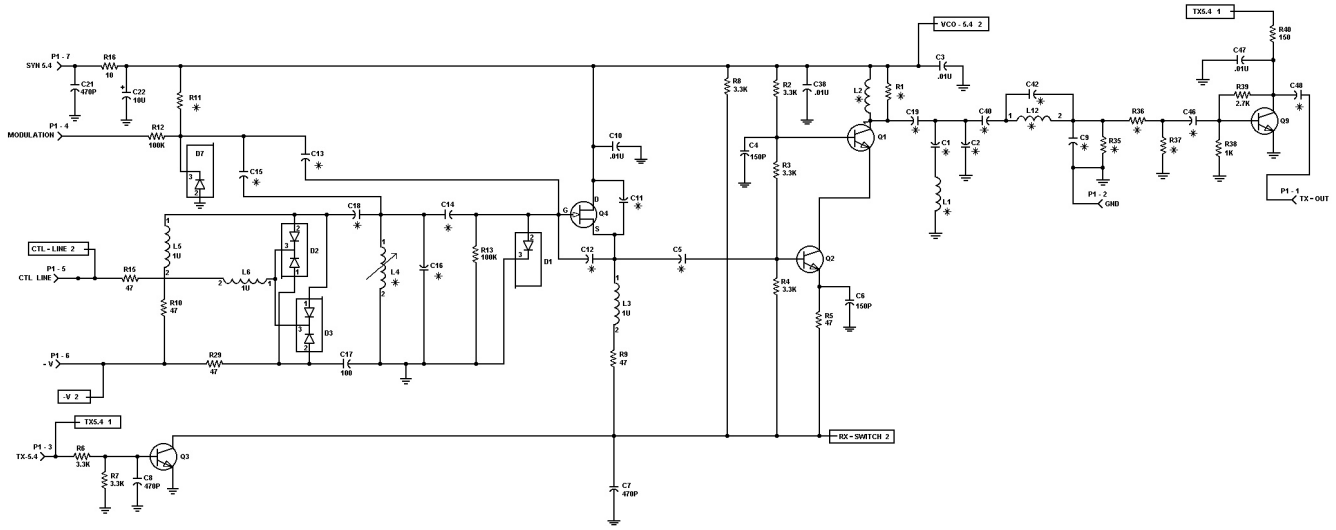
(19C336876, Rev. 0)

IF AMPLIFIER
19C336876G1

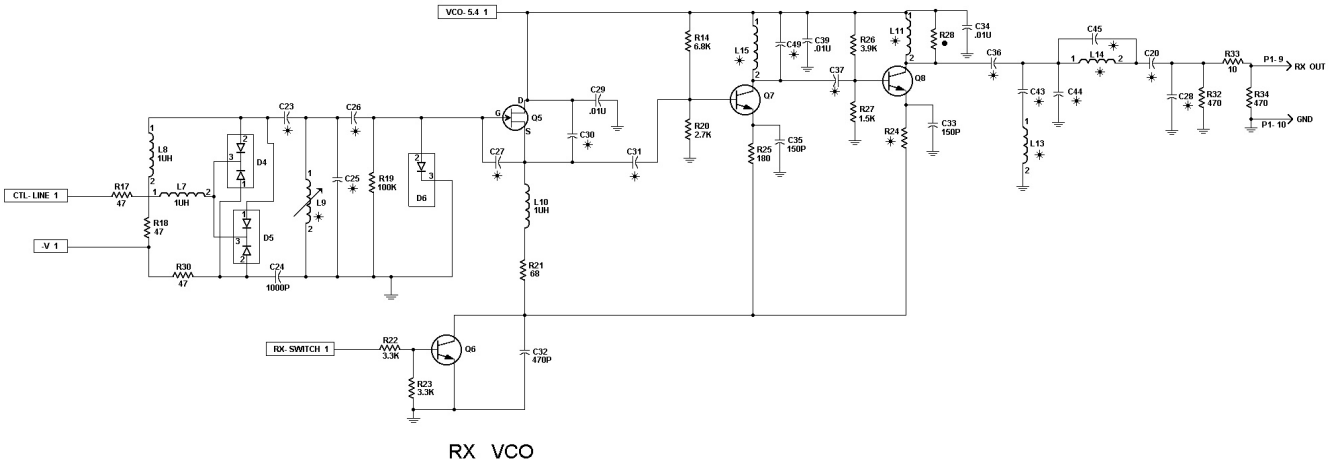
A4



(19D438605, Sh. 1, Rev. 2)



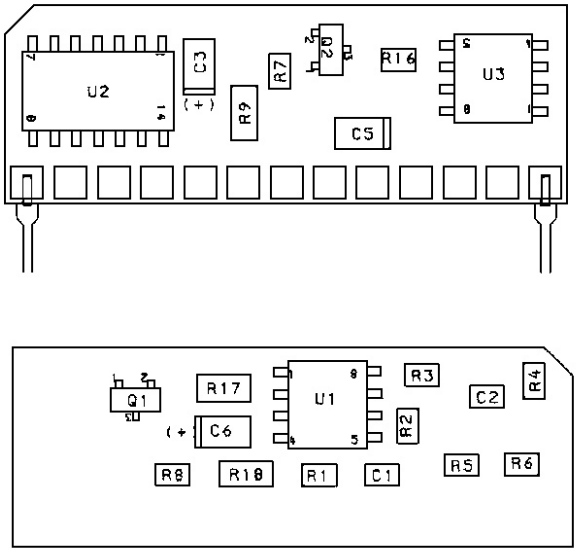
(19D438604, Sh. 1, Rev. 4)



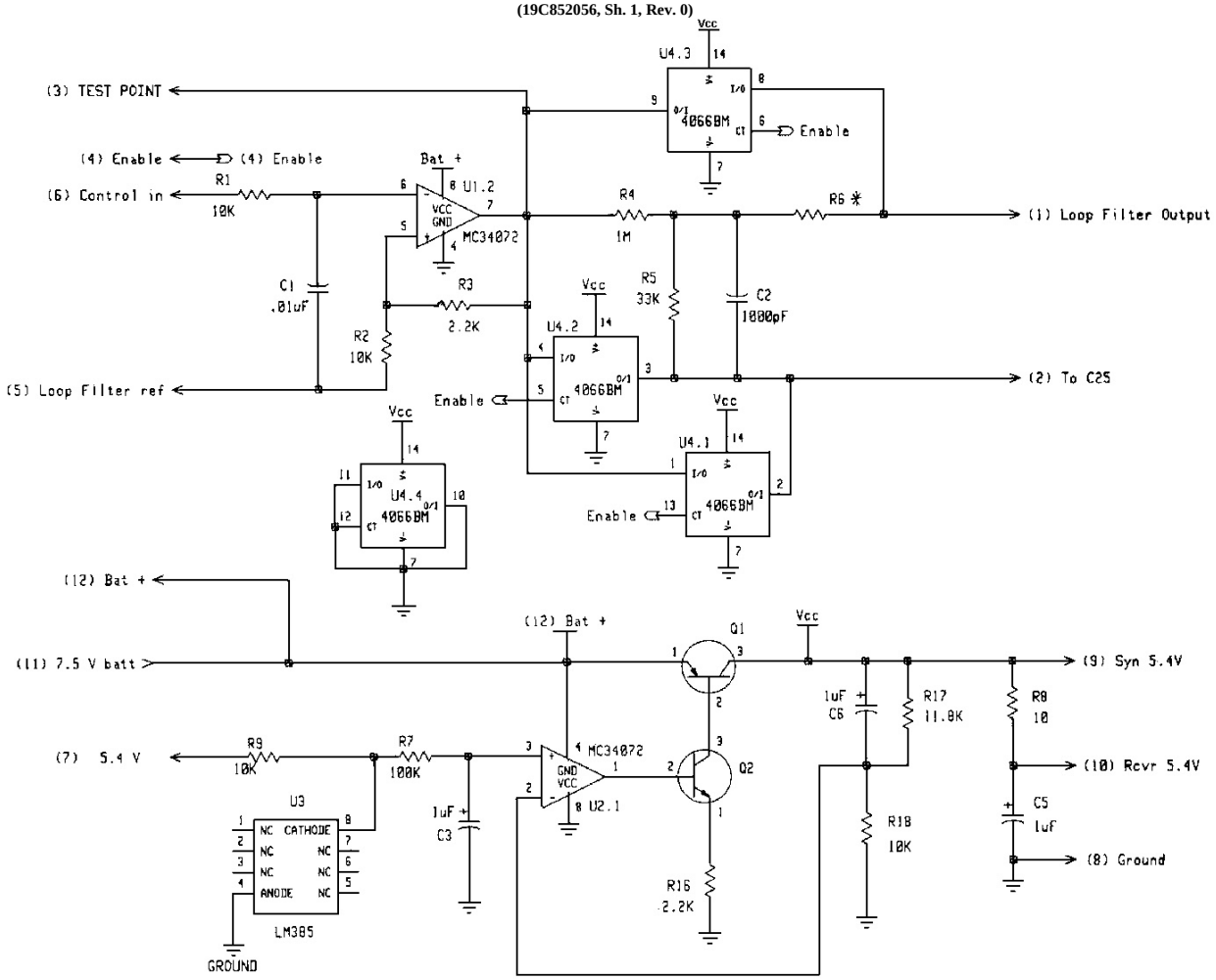
(19D438604, Sh. 2, Rev. 3)

VCO
19A438605

A5



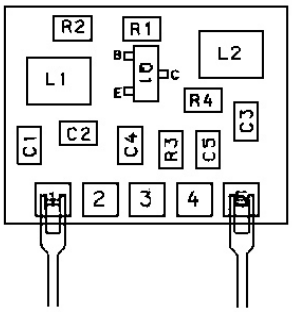
(19C852056, Sh. 1, Rev. 0)



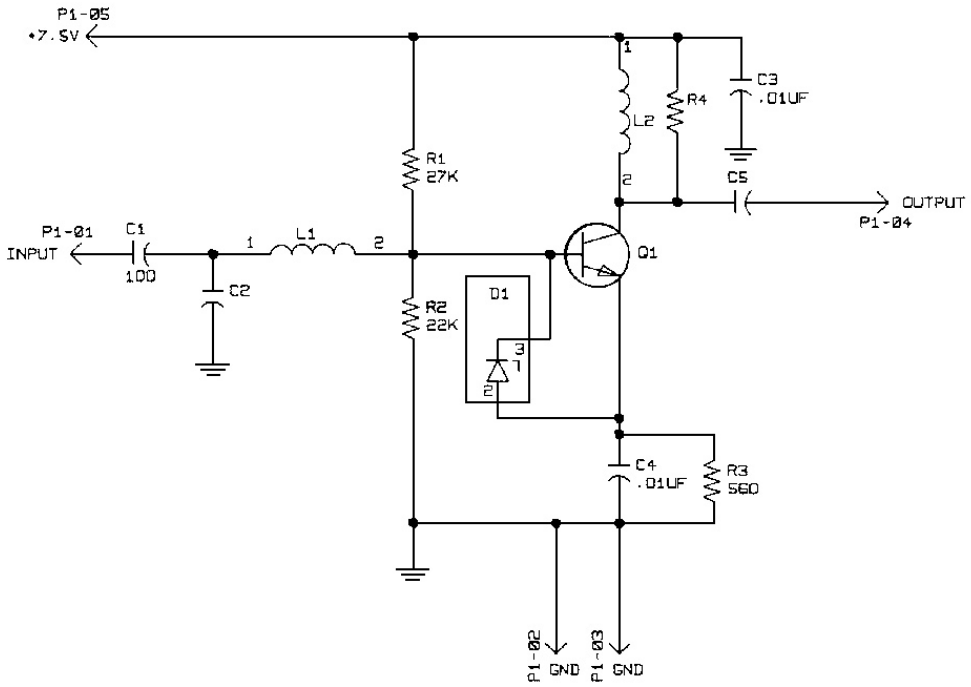
(19C852057, Sh. 1, Rev. 1)

PLL LOW PASS FILTER/REGULATOR
19C852056G1

A6



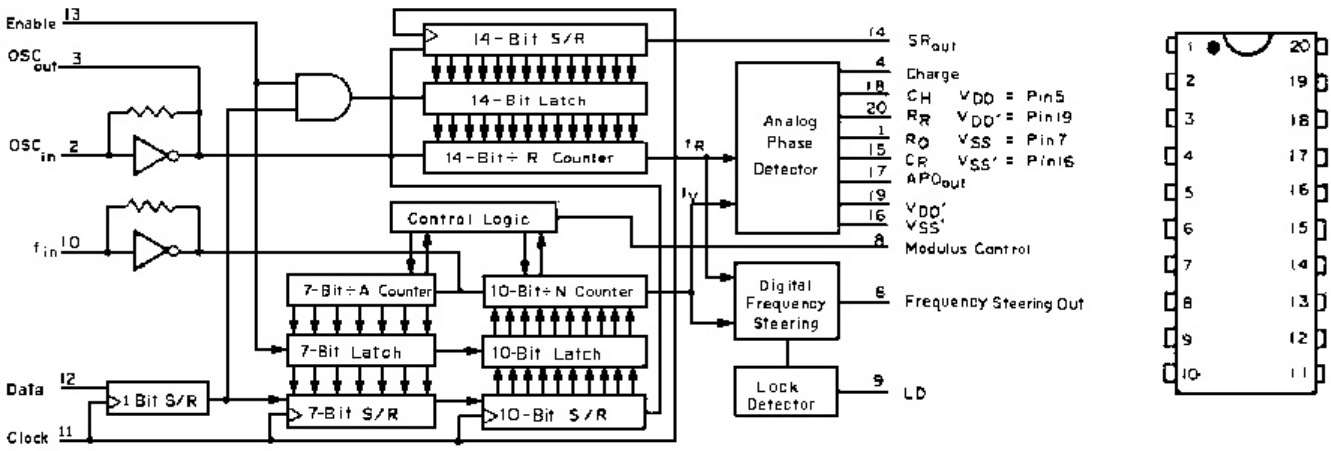
(19B235081, Sh. 1, Rev. 2)



(19C337073, Rev. 1)

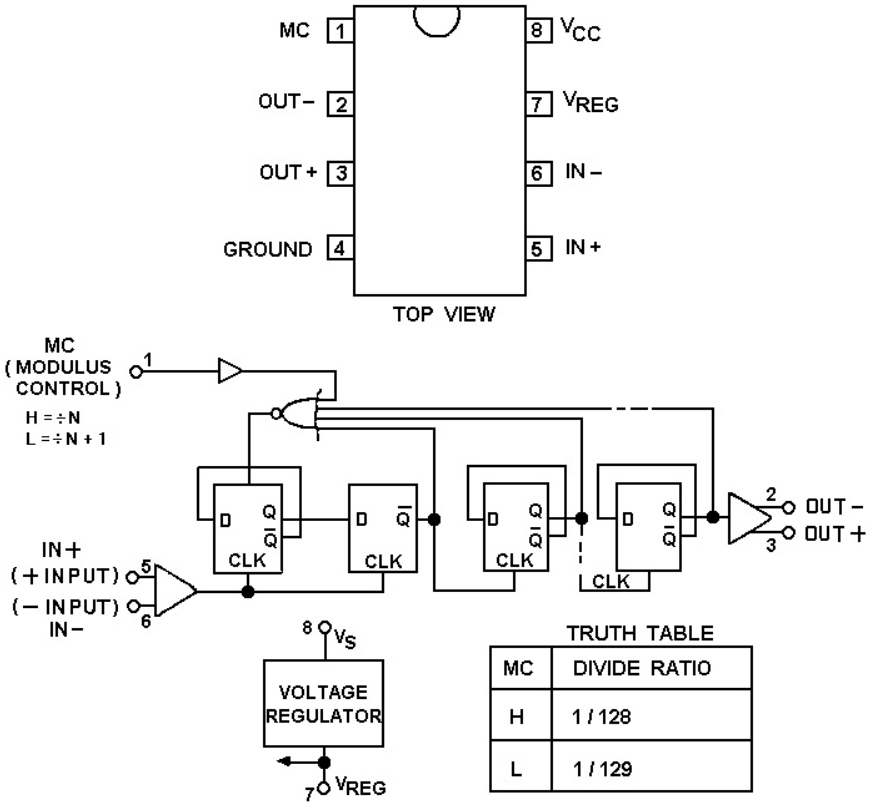
UHF RF AMPLIFIER
19B235081

U1



SYNTHESIZER
19B800902P4

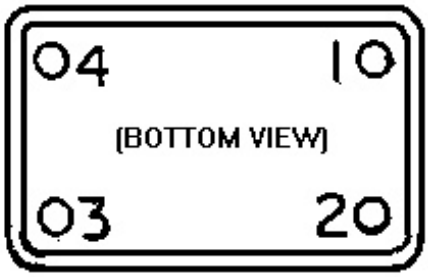
U2



PRESCALER
19A704287P2

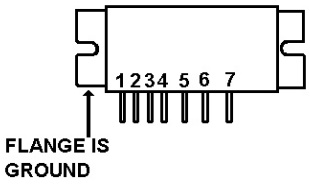
U3

PIN	FUNCTION
1	COMMON (& CASE)
2	13.2 MHz OUTPUT
3	Vcc
4	MODULATION INPUT



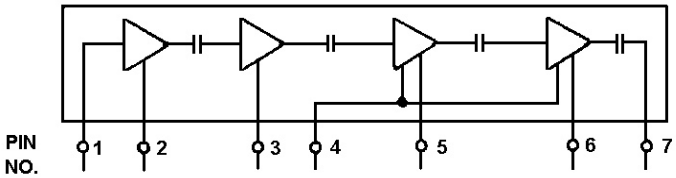
13.2 MHz REFERENCE OSCILLATOR
19B801351P15

U4



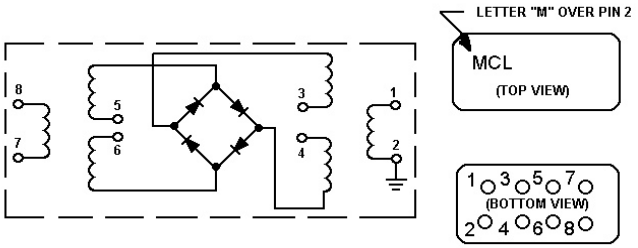
PIN FUNCTION

1. RF INPUT
2. VS1
3. VCONT
4. VS2
5. VS3
6. VS4
7. RF OUTPUT



RF POWER AMPLIFIER
19A705419

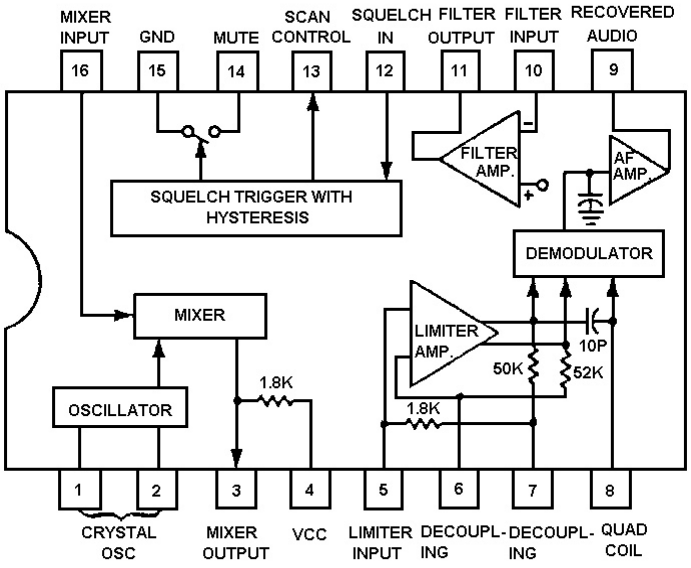
U5



PIN	FUNCTION
1	RF INPUT
2	GROUND (Case)
3	IF OUTPUT
4	IF OUTPUT
5	GROUND
6	GROUND
7	GROUND
8	LO INPUT

MIXER
19A705706P2

U6



RECEIVER BACKEND
19A704619P1

(This page left intentionally blank)

Ericsson Inc.
Private Radio Systems
Mountain View Road
Lynchburg, Virginia 24502
1-800-528-7711 (Outside USA, 804-528-7711)

Printed in U.S.A.