

## 10. RPM-150 ALIGNMENT PROCEDURE

### 10.1 RECOMMENDED TEST EQUIPMENT

- 1) 0 to 15 VDC, 10 Amp current-limited power supply
- 2) FM service monitor (to 174 MHz)
- 3) Oscilloscope (to 20 MHz)
- 4) FM deviation meter
- 5) RF Wattmeter, 50 Watts full scale
- 6) Frequency counter (to 174 MHz)
- 7) VTVM or DMM
- 8) Square wave reference generator
- 9) SINAD measuring device.
- 10) Service programming key (red plug)

### 10.2 RADIO PREPARATION

- 1) Carefully pull the volume knob off of the front panel.
- 2) Remove the three #6 screws from the bottom of the case.
- 3) Remove the front and back panels.
- 4) Remove the nut that holds the on/off volume control to the case.
- 5) Slide the radio PC board and front panel out of the radio case through the back.
- 6) Connect the power supply (@ approx. +13.0 VDC) to the 2-pin power connector on the back of the unit.
- 7) Connect an RF signal generator to the antenna connector on the back of the unit.
- 8) For operation in the band from 150 to 165 MHz, program the channels below as indicated.

<u>CHANNEL</u>	<u>RX/TX FREQUENCY</u>	<u>QUIET CALL TONE OR SPCL. FEATURE</u>	<u>QUIET CALL CODE OR SPCL. FEATURE</u>
1	150.330 MHz	none	none
2	157.320 MHz	none	none
3	165.330 MHz	none	none
4	157.320 MHz	97.4 Hz	11
5	157.320 MHz	203.5 Hz	32
6	157.320 MHz	071 (DQC)	071
7	157.320 MHz	349 Hz/832.5 Hz (PQC)	44144
8	157.320 MHz	Low Power	91122

If another user's carrier signal causes interference, an alternate frequency within 1 MHz may be used.

**NOTE:** To program for a different 15 MHz band, substitute frequencies at the low, mid and high ends of the band for the frequencies given above.

**RADIO PREPARATION (CONT.)**

- 9) Turn off the RPM-150. Remove the programming key or place it in the storage position of the programming socket. Switch on the radio to place it in operating mode.

**10.3****SYNTHESIZER**

The synthesizer control voltage should not need re-adjustment unless you change the 15 MHz operating band or replace a key component in the synthesizer. Key components do not include the synthesizer reference crystal or the synthesizer IC. Synthesizer alignment errors cause poor operation at temperature extremes.

- 10) Select channel 1.
- 11) Connect a high impedance voltmeter or oscilloscope to Z501.
- 12) The voltage at this point should measure +5.0 VDC (+/- 0.2 Volts).

IF SO:

Select channel 2 and measure the same point. The voltage should then read approx. +8 Volts (+/- 0.8 VDC). Next, select channel 3 and check the voltage, which should measure approx. +12 Volts. If these readings are correct, skip steps 13 and 14. If not, continue with step 13.

IF NOT:

Proceed with steps 13 and 14.

- 13) Turn off the mobile and carefully turn the holddown tabs on the synthesizer box until the lid can be removed. Remove the lid. Switch the unit back on and select channel 1.
- 14) Note the exact position of VCO coil L301. Adjust L301 until the voltage at Z501 is +5.0 Volts. A small adjustment (a quarter turn) should produce a large change in voltage.

IF THE VOLTAGE ADJUSTS FOR +5.0 VOLTS:

Select channel 2 and measure the same point. The voltage should then read about +8 Volts (+/- 0.8 VDC). Next, select channel 3 and check the voltage, which should measure approx. +12 Volts. If your adjustments produce the correct voltages, replace the synthesizer shield lid and proceed with the next step. Do not secure the holddown tabs, since the lid will be removed in subsequent steps.

IF THE VOLTAGE DOES NOT ADJUST:

Rotate L301 back to its original position before troubleshooting.

**10.4****REFERENCE FREQUENCY**

- 15) Select channel 1.
- 16) Set the service monitor receiver to 139.630 MHz (receiver L.O. frequency = receive frequency - 10.7 MHz). The monitor should be able to receive the L.O. signal with a short antenna.
- 17) Align C308 to center the frequency. (C308 may be adjusted through a hole in the synthesizer lid.)

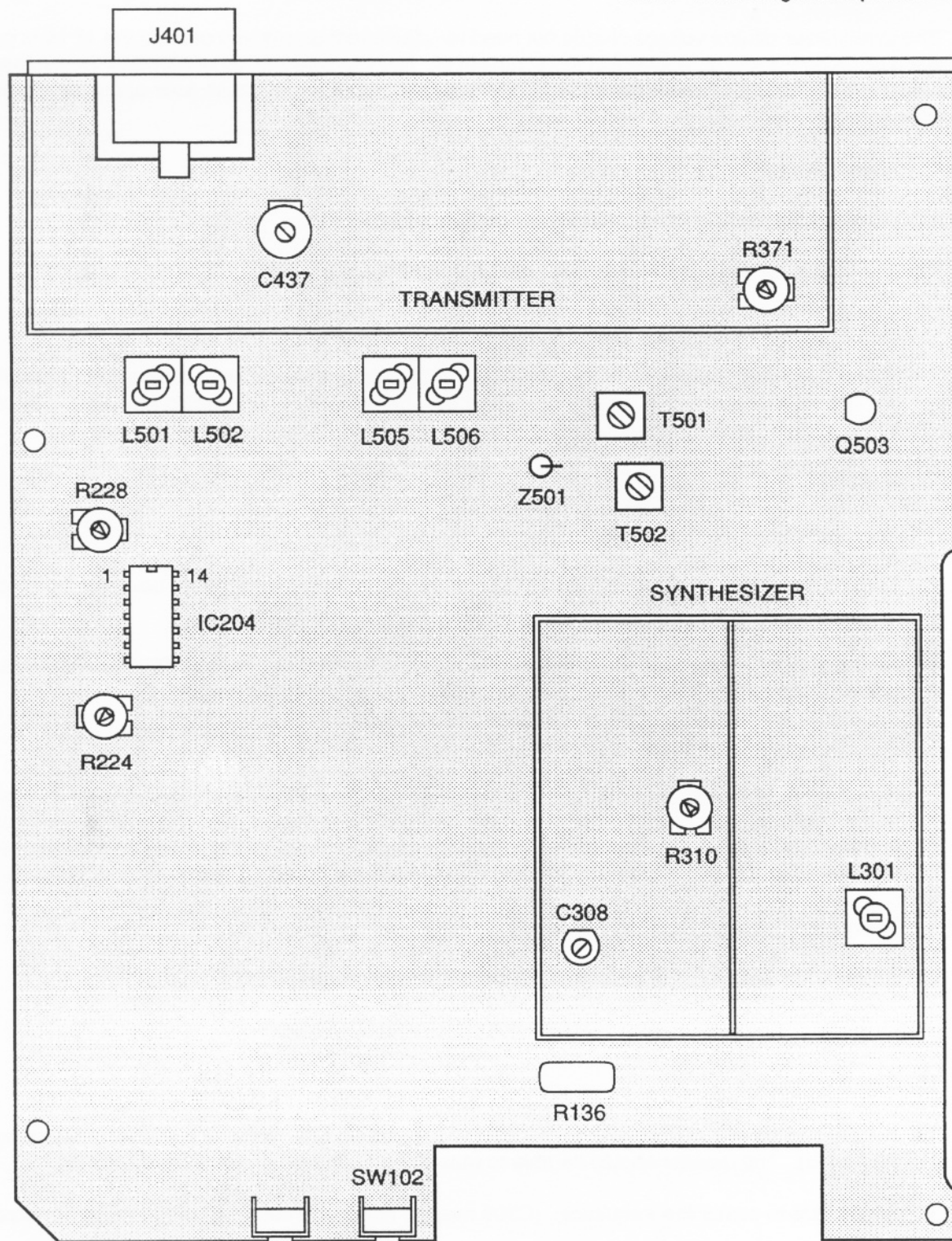
## RPM-150

PCB #17031003

TOPSIDE VIEW

L301 = VCO Voltage  
 C308 = Reference Frequency/  
 RX L.O. Frequency  
 R224 = Voice Modulation  
 R228 = Sub-audible/Digital Modulation

R310 = Modulation Balance Control  
 C437 = TX Output Power  
 R371 = TX Reduced Power  
 L501, L502, L505, L506 = RX Sensitivity  
 R136 = Squelch Adjust  
 T501 = 10.7 MHz Bandpass Adjust  
 T502 = 1 KHz Signal Amplitude Adjust



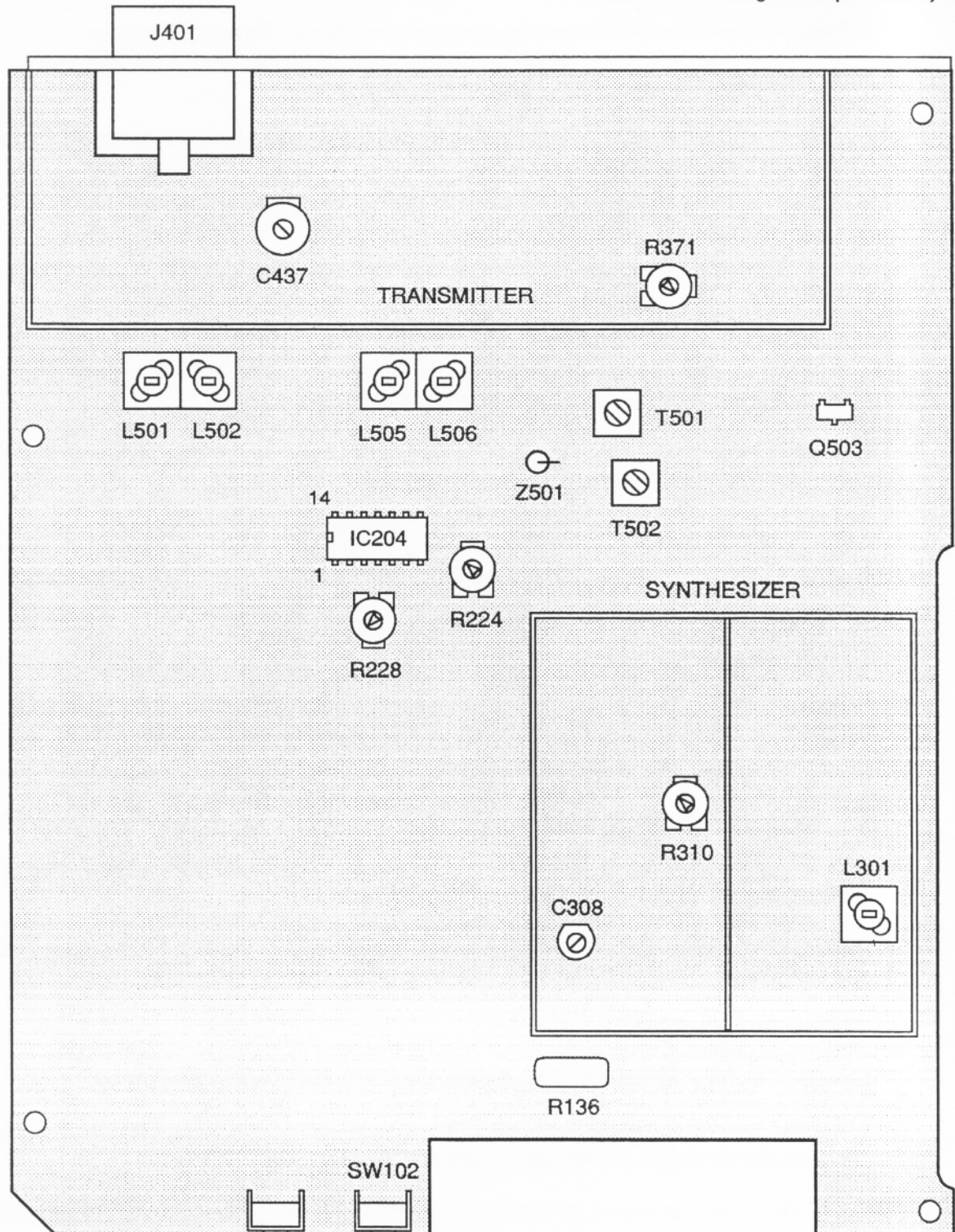


# RPM-150 ALIGNMENT PROCEDURE REFERENCE DIAGRAMS (CON'T.)

**RPM-150**  
**PCB #1730050A**  
**TOPSIDE VIEW**

L301 = VCO Voltage  
C308 = Reference Frequency/  
RX L.O. Frequency  
R224 = Voice Modulation  
R228 = Sub-audible/Digital Modulation

R310 = Modulation Balance Control  
C437 = TX Output Power  
R371 = TX Reduced Power  
L501, L502, L505, L506 = RX Sensitivity  
R136 = Squelch Adjust  
T501 = 10.7 MHz Bandpass Adjust  
T502 = 1 KHz Signal Amplitude Adjust



## 10.6

**MODULATION BALANCE CONTROL**

Normally, the balance control should not require re-alignment. The purpose of the balance adjustment is to prevent sub-audible (Quiet Call) and DQC (Digital Quiet Call) encode signals from being distorted.

- 18) Rotate both R224 (voice modulation) and R228 (sub-audible/digital modulation) fully counter-clockwise.
- 19) Switch off the radio and remove the synthesizer shield lid. Turn on the mobile.
- 20) Set R310 about midway.
- 21) Connect a 10 K $\Omega$  resistor in series with a 22  $\mu$ F electrolytic capacitor between IC204B pin 13 and a square wave reference generator.
- 22) Set the square wave generator to 30 Hz, 0.2 V<sub>p-p</sub>.
- 23) Connect an appropriate 50  $\Omega$  load to the mobile's antenna port (J401).
- 24) Set the service monitor receiver to 157.320 MHz.
- 25) Switch the mobile to channel 2. Press and hold the microphone PTT to transmit. The mobile's TX/Busy LED should light when the transmitter is activated.
- 26) Observe the received waveform on the service monitor. Adjust modulation balance control R310 (inside the synthesizer shield) for the "best" square wave.

**NOTE:** Many service monitors and oscilloscopes do not have sufficient low-frequency response to reproduce a 30 Hz square wave accurately, and instead display a waveform that has a "ramped" appearance. If your equipment exhibits this limitation, adjust R310 for minimum "overshoot" on the leading edge of the square wave. This will give the correct setting.

- 27) Replace the synthesizer shield lid, secure the holddown tabs and proceed with the transmitter alignment.

## 10.7

**TRANSMITTER**

- 28) Connect a Wattmeter to the antenna port (J401).
- 29) Press and hold the microphone PTT to key the transmitter. The TX/Busy LED should light.
- 30) Switch off power to the mobile and remove the screws that hold the transmitter shield lid to the heat sink. Lift away the lid. Restore power to the radio.
- 31) Using a non-metallic alignment tool (Sprague-Goodman #GTT-5 or similar), adjust C437 for maximum output power.
- 32) Unkey the transmitter.
- 33) Select channel 4 (remember that channel 4 is programmed with a 97 Hz tone).
- 34) With the transmitter keyed, apply a loud continuous voice to the microphone while adjusting R224 for +/- 4.6 KHz deviation, as indicated on the deviation meter.
- 35) With the transmitter keyed and no sound applied to the microphone, adjust R228 for 600 Hz deviation.

**TRANSMITTER (CON'T.)**

36) Unkey the transmitter.

**NOTE:** To set power for all "reduced power" channels with one adjustment, select any channel programmed for low power (CH 8). With the transmitter keyed, adjust R371 until the Wattmeter reads the desired value. The output level for "high power" channels will remain unchanged.

37) Switch off the radio and install the transmitter shield lid. Switch on the unit again.

**10.8****RECEIVER**

**NOTE:** THE RECEIVER CANNOT BE ALIGNED UNTIL THE SYNTHESIZER CONTROL VOLTAGE (STEPS 10-14) IS CORRECT.

38) Connect a SINAD measuring device to the speaker terminals on the front panel.

39) Select channel 2.

40) Set the service monitor receiver for 146.620 MHz to check the receiver L.O. frequency (receiver L.O. frequency = receive frequency - 10.7 MHz). Adjust C308 (through a hole in the synthesizer lid) for the correct frequency.

41) Adjust L501, L502, L505 and L506 to position the aluminum core of each coil at the top.

42) Set the service monitor RF signal generator to 157.320 MHz.

43) Set the generator to modulate the signal with 1KHz @ 3KHz deviation. Set the generator output to 1000  $\mu$ V.

44) Adjust R136 fully counter-clockwise to "open" squelch.

45) At this point, a 1 KHz tone should be heard in the speaker.

46) Decrease the generator output and adjust L501, L502, L505 and L506 for best SINAD.

47) Set the generator output to 2000  $\mu$ V.

48) Frequency modulate the generator with a 15 Hz signal, and set the deviation to  $\pm 15$  KHz.

49) Connect the 15 Hz signal directly to the HORIZONTAL input of an oscilloscope, and set the horizontal sweep to EXTERNAL.

50) Connect the VERTICAL input of the oscilloscope to Test Point 43 (collector of Q503).

51) Adjust T501 for a 10.7 MHz bandpass waveform.

52) Set the signal generator for a frequency modulated 1KHz sine wave at  $\pm 7.5$  KHz deviation. Set the output for 2000  $\mu$ V.

53) Connect the oscilloscope to the radio speaker on the front panel.

54) Adjust T502 for a maximum amplitude of the 1 KHz sine wave.

55) Decrease the deviation of the modulated 1 KHz signal to  $\pm 3$  KHz.

**RECEIVER (CON'T.)**

- 56) Decrease the signal generator output and adjust L501, L502, L505 and L506 for best 12dB SINAD. The 12 dB SINAD should be 0.30  $\mu$ V worst case.
- 57) Press and release the monitor button (SW102).
- 58) Set the generator output for a reading of 12 dB SINAD.
- 59) Turn R136 clockwise until no signal is heard in the speaker.
- 60) Slowly rotate R136 counter-clockwise until a signal is heard in the speaker.
- 61) Check for 12 dB Sinad sensitivity at the low (150.330 MHz - channel 1) and high (165.330 MHz - channel 3) ends of the frequency range. The sensitivity should be at least 0.30  $\mu$ V for each channel.

**CAUTION:** RITRON surface mount products require special servicing techniques. Improper servicing techniques can cause permanent damage to the printed circuit board and/or components, which is not covered by RITRON's warranty.