

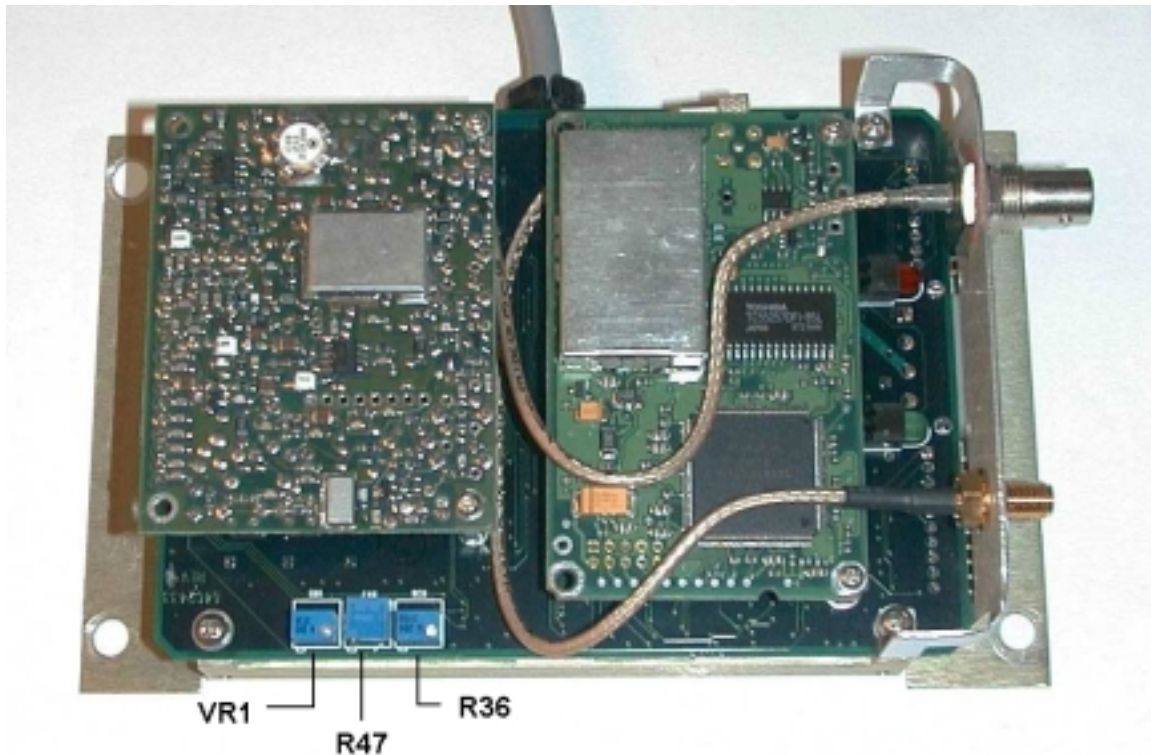
## 8.0 Alignment Procedures and Performance Testing

### 8.1 General

Receiver or transmitter alignment may be necessary if repairs are made that could affect tuning. Alignment/adjustment and measurement points for the VTU Digital Baseband Board are depicted in Figure 8-1 with procedures described in Section 8. Mid range channel frequencies shall be utilized per RF deck selection. Alignments/ adjustments shall only be made by the manufacturer or by approved service or maintenance personnel.

Alignment procedures and performance testing directly related to the RF deck (part number 242-3474-xxx has been extracted from the Johnson Data Radio Company Service Manual.

**Figure 8-1 VTU Digital Baseband Board Alignment Points**



### 8.2 Digital Baseband Board Carrier Detect Alignment

Carrier Detect thresholding must be set to result in a high state under no signal conditions. All adjustments points are on the Digital Baseband Board as depicted in Figure 8-1.

- a) With VTU cover off, connect 12VDC power source and signal generator to UHF radio antenna input.

b) Set signal generator output for receiver channel frequency at a level of  $-112$  dBm, modulated with 1kHz at  $\pm 3$  kHz deviation. If no signal generator is available, verify that no transmissions are present at the receiver frequency so that a standard UHF antenna receives only ambient noise. Connect UHF antenna to UHF radio antenna input of VTU under alignment.

c) Using DC voltmeter or oscilloscope measure RSSI volt from RF deck (Digital Baseband Board pin 3 of U10). Voltage should be between  $+0.5$  volts and  $+1.0$  volt.

d) Connect DC voltmeter or oscilloscope to pin 6 of U10 and adjust R47 until Pin 6 shows  $+0.25$  volts above the previously measured RSSI voltage.

Alignment will result in signals  $-110$ dBm or greater to cause the Carrier Detect to go to a low state. With signals  $-114$ dBm and lower the Carrier Detect will go to a high state.

### 8.2.1 GMSKIN DC Bias

Received audio signals presented to MXCOM909 demodulator IC must  $+2.7$  DC biased. All adjustments points are on the Digital Baseband Board as depicted in Figure 8-1.

- a) With VTU cover off, connect 12VDC power source and RF signal generator to UHF radio antenna input.
- b) Adjust R47 so that Carrier Detect is in high state. Remember to readjust R47 for proper Carrier Detect thresholding after GMSKIN DC bias alignment is complete.
- c) Set RF signal generator set to the receiver channel frequency with a 1kHz modulation,  $\pm 3$  kHz deviation and  $-50$ dB RF input.
- d) Connect an oscilloscope to TP3 (pin 8 of U10).
- e) Adjust R36 to achieve a  $+2.7$  signal bias.

If no signal generator is available then with dummy load on UHF antenna adjust R36 to achieve a  $+2.5$  volt signal bias.

### 8.2.2 Modulated Audio DC Bias

Modulated audio signals presented to the RF deck by the Digital Baseband Board require a  $+2.5$  DC bias level into Pin 2 of JP1. All adjustments points are on the Digital Baseband Board as depicted in Figure 8-1.

- a) With VTU cover off and connect 12VDC power source.

- b) Connect DC voltmeter or oscilloscope to TP5.
- c) Adjust VR1 to achieve a +2.5 volts DC at TP5 when the transmitter is not transmitting.

### 8.3 Data Transceiver

## SECTION 6

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### ALIGNMENT PROCEDURE AND PERFORMANCE TESTS

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#### 6.1 GENERAL

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Receiver or transmitter alignment may be necessary if repairs are made that could affect tuning. Alignment points diagrams are located in Figure 6-3 or component layouts are located in Section 8.

Fabricate test cables by referring to Section 2.2, Interfacing with Data Equipment. This cable should include power and ground, a transmit keying switch that shorts the keying line to ground, data input and data output. The test setup must apply the various supply voltages and load the synthesizer with channel information.

#### 6.2 DL3474 TRANSCEIVER ONLY

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##### 6.2.1 FREQUENCY AND CONTROL LINE VOLTAGE CHECK

1. Connect the test setup shown in Figure 6-1. Set the power supply for +7.5V DC.
2. Load the synthesizer with the channel frequency (see Section 3.2).
3. Connect a DC voltmeter at the junction of R808/C815 to measure the VCO control line voltage for a meter reading of  $\geq 0.50$  -  $\leq 4.90$ V DC (see Figure 6-3).
4. Key the transmitter.
5. Measure the VCO control line voltage for a meter reading of  $\geq 0.75$  -  $\leq 5.00$ V DC
6. Unkey the transmitter.

##### 6.2.2 2W TRANSMITTER POWER ALIGNMENT

1. Connect the test setup shown in Figure 6-1. A DC ammeter capable of measuring up to 1.5A should be installed in the supply line.
2. Load the synthesizer with the center channel frequency.
3. Key the transmitter and make sure that the supply voltage at the RF board is 7.5V.  
**(Do not transmit for extended periods.)**
4. Adjust C553 counterclockwise for minimum current.
5. Connect a voltmeter to the junction of R542/R543.

6-1

Part No. 001-3474-002



## ALIGNMENT PROCEDURE AND PERFORMANCE TESTS

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6. Adjust R542 clockwise for 2.30V DC ( $\pm 0.1V$  DC).
7. Readjust C553 counterclockwise for minimum current.
8. Tune C527 clockwise for maximum power.
9. Tune C553 clockwise for 2.0W ( $\pm 0.1W$ ). Current should be less than 900 mA. (Power output should be 1.6-2.4W and current less than 900 mA from 403-512 MHz.)
10. Monitor the frequency with a frequency counter and adjust TCXO (Y801) for the channel frequency  $\pm 100$  Hz.

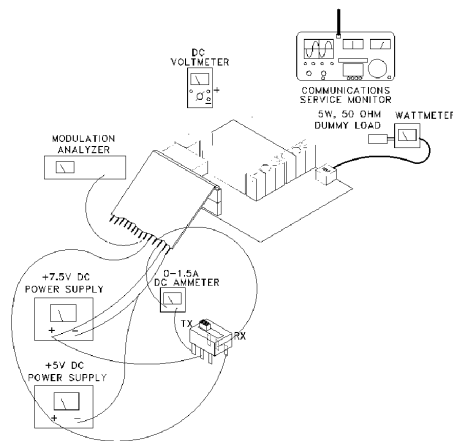


**Figure 6-1 TRANSMITTER TEST SETUP**

### 6.2.3 LOW POWER ALIGNMENT

1. Connect the test setup shown in Figure 6-1.
2. Load the synthesizer with the center channel frequency.
3. Connect a voltmeter to the junction of R542/R543.
4. Adjust R542 clockwise for -1.5V DC ( $\pm 0.1V$  DC).
5. Tune C527 clockwise for maximum power.

## ALIGNMENT PROCEDURE AND PERFORMANCE TESTS

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6. Tune C553 clockwise for minimum power.
7. Adjust R542 for the required power level.
8. Tune C527 for power balance at frequencies which are as close as possible to  $\pm 5$  MHz from the center of the channel frequency.
9. Re-adjust R542 for the power level required if necessary.
10. Monitor the frequency with a frequency counter and adjust TCXO (Y801) for the channel frequency  $\pm 100$  Hz.

### 6.2.4 MODULATION FLATNESS ALIGNMENT

1. Inject a 220 Hz square-wave tone at approximately 0.35V P-P, biased at 2.5V DC on J201, pin 6.
2. Transmit into the modulation analyzer and observe modulation output on the oscilloscope. Set the modulation analyzer high pass filtering off and no less than a 15 kHz low pass filter.
3. Adjust R810 for a flat square-wave on the oscilloscope.
4. Inject a 1 kHz sine-wave on J201, pin 6, biased at 2.5V DC, at the level below according to the bandwidth:

0.200V RMS for 12.5 kHz BW (-X10 Radios)  
0.330V RMS for 20.0 kHz BW (-X20 Radios)  
0.400V RMS for 25.0 kHz BW (-X30 Radios)

5. Switch on TX Modulation. Set the modulation analyzer for 3 kHz low pass filtering.
6. The transmit deviation should measure between:

$\pm 1.2/\pm 1.9$  kHz for 12.5 kHz BW (-X10 Radios)  
 $\pm 1.9/\pm 3.0$  kHz for 20.0 kHz BW (-X20 Radios)  
 $\pm 2.4/\pm 3.8$  kHz for 25.0 kHz BW (-X30 Radios)

7. Set a 0 dB reference on the Audio Analyzer.
8. Input a 100 Hz sine-wave. The level should be within  $\pm 1.5$  dB of the 1 kHz reference.
9. Remove transmit modulation and unkey the transmitter.
10. Connect a DC voltmeter at the junction of R807/R855.
11. Adjust R855 to 2.10V DC ( $\pm 0.05$  V DC).

6-3

Part No. 001-3474-002



## ALIGNMENT PROCEDURE AND PERFORMANCE TESTS

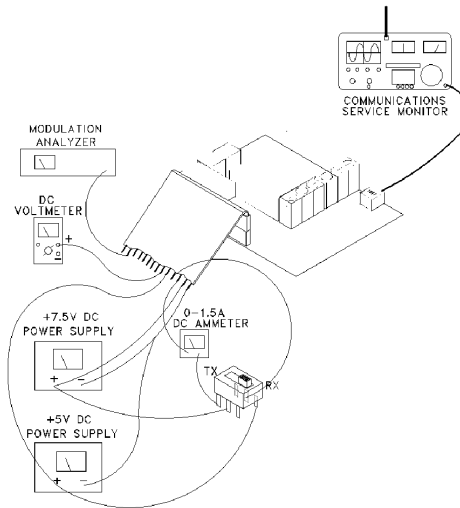


**Figure 6-2 RECEIVER TEST SETUP**

### 6.2.5 RECEIVER ALIGNMENT

**CAUTION:** Do not key the transmitter with the generator connected! Severe generator damage may result.

1. Connect the test setup shown in Figure 6-2. Adjust the power supply for +7.5V DC.
2. Measure the receive current drain. (Typically current should be <80 mA.)
3. Preset tuning slugs of L222/L224 to the full clockwise position (slug in all the way).
4. Preset C232 to center position (slot in-line with axis of part).
5. Readjust L224 counterclockwise 2 turns.

### 6.2.6 IF AND AUDIO ADJUSTMENTS

1. Load the synthesizer with the channel frequency.
2. Set the RF signal generator for this frequency with a 1 kHz tone (modulated output shown below) at a level of -47 dBm (1000  $\mu$ V) and inject into J501.

1.5 kHz deviation (-X10 12.5 kHz BW Radio)  
 2.4 kHz deviation (-X20 20.0 kHz BW Radio)  
 3.0 kHz deviation (-X30 25.0 kHz BW Radio)

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6-4

Part No. 001-3474-002

## ALIGNMENT PROCEDURE AND PERFORMANCE TESTS

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*NOTE: Maintain these deviation levels throughout the test when measuring AC levels, SINAD and % distortion.*

3. Adjust L242 for 2.5V DC ( $\pm 0.05$ V DC) at the receive audio output.
4. Set the RF signal generator level to -105 dBm, “unmodulated”.
5. Set the generator frequency 3 kHz below channel center (-X10) or 5 kHz below channel center (-X20/-X30).
6. Adjust C232, then L222 for peak RSSI voltage.

*NOTE: Use 2V scale on DVM.*

7. Set the RF signal generator frequency back to channel center at -47 dBm with standard deviation level.
8. Adjust L224 for minimum distortion.
9. Set the RF signal generator to -105 dBm, “unmodulated”.
10. Adjust L222 for peak RSSI voltage.

*NOTE: Use 2V scale on DVM.*

11. Adjust deviation to the level in Step 2. Record the RMS voltage level \_\_\_\_\_ RMS. (Typically 300 mV  $\pm$  50 mV.)
12. Record the percent distortion \_\_\_\_\_. (Typically <3%.)
13. Adjust the RF input level until 12 dB SINAD is measured. (Typically <0.45  $\mu$ V).
14. Adjust the generator RF level to -120 dBm and measure DC (RSSI) voltage on J201, pin 12. (Typically  $\leq$  0.90V DC.)
15. Adjust the generator RF level to -60 dBm and measure DC (RSSI) voltage on J201, pin 12. (Typically  $\geq$  2.40V DC.)

## ALIGNMENT PROCEDURE AND PERFORMANCE TESTS

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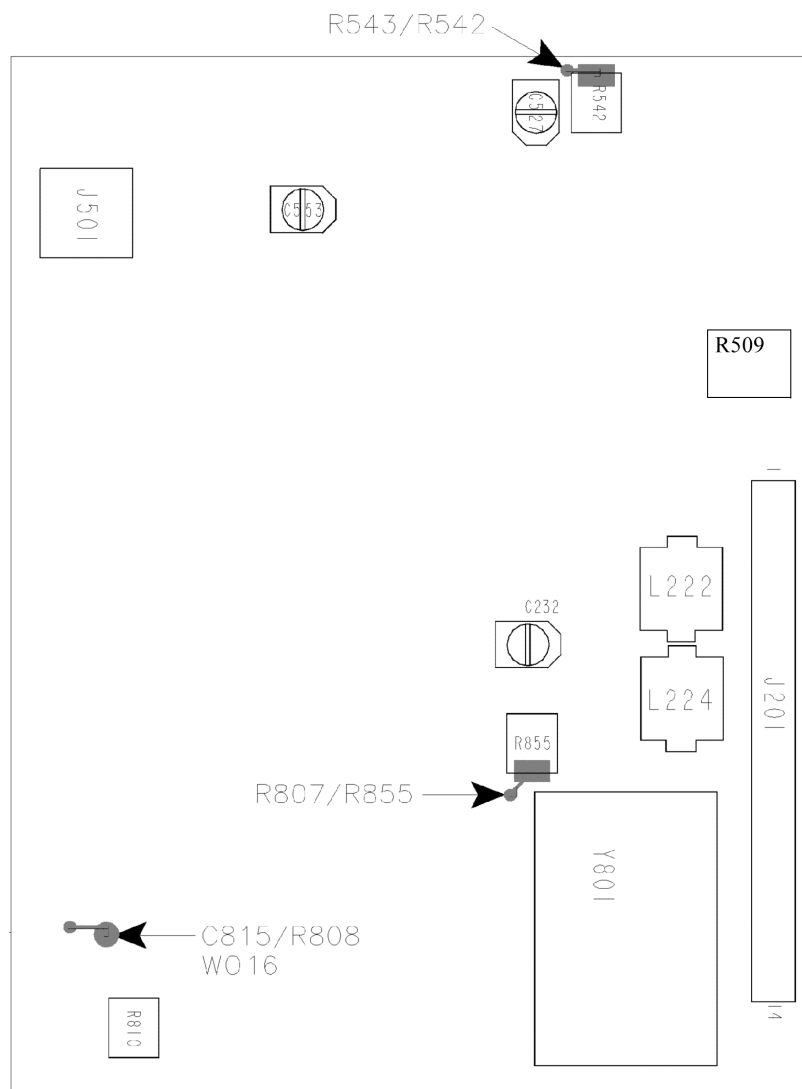


**Figure 6-3 ALIGNMENT POINTS DIAGRAM**