



TriSquare Communications

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Model No: PR245	<b>TITLE:</b>  Test and Alignment Procedures	Drawing No: PR245_TAP_XD0
Base Model:		Rev Date: Dec, 12, 2003



TriSquare Communications

# **Test and Alignment Procedures For PR245**

Compiled By: J. Olsen	Approved by:	First Issued: Sept 12, 2003
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## REVISION SHEET

Revision #	Date	Revision Text	Changed By
XB0	Sep 18, 2003	Initial Release	J. Olsen
XC0	Oct 10, 2003	Add FRS242	J. Olsen
XD0	Dec 12, 2003	Remove FRS242, update TCXO table, added call tone deviation test, changed Channel 14 VCO phase detector voltage spec to 0.5V~2.5V, and added accessory test.	J. Olsen



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## 1.1. RECOMMENDED TEST EQUIPMENT

- 1.1.1. HP8920A Communication Test Set w/ Option 002 (Spectrum Analyzer) or equivalent
- 1.1.2. Fluke 77 Digital Multimeter or equivalent.
- 1.1.3. BK Precision 1710 power supply or equivalent.

## 1.2. TEST PREPARATION

- 1.2.1. Connect a 6.0VDC power source between the positive battery terminal input point and the negative battery input point (GND).
- 1.2.2. Connect a communications service monitor capable of at least one watt RF to test point TP1 (ANT).
- 1.2.3. Connect a 0.5 watt 16 ohm resistor from TP10 (+SP) to TP9 (-SP).
- 1.2.4. Test point TP10 should be connected to **Audio In HI** of the HP8920A.
- 1.2.5. Test point TP9 should be connected to **Audio In LO** of the HP8920A.
- 1.2.6. Select channel 1 (462.5625 MHz).

## 1.3. VOLTAGE REGULATOR TEST

- 1.3.1. Turn the unit's power on.
- 1.3.2. Connect a voltmeter to TP7 (3.3 V REG) and measure the voltage. The DC value must be between 3.234VDC and 3.366VDC.

## 1.4. BATTERY LOW TEST

- 1.4.1. Adjust power supply to 4.41VDC.
- 1.4.2. Cycle power by turning the unit OFF then ON.
- 1.4.3. Insure the battery low does not alert.
- 1.4.4. Adjust power supply to 4.00VDC.
- 1.4.5. Cycle power by turning the unit OFF then ON.
- 1.4.6. Insure the battery low does alert.
- 1.4.7. Re-adjust the power supply to 6.0VDC.



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### 1.5. CRYSTAL SELECT

1.5.1. X300 crystal units are marked with red, blue, green, or black color marks. All crystal oscillator components are installed during SMT. During PCBA alignment some of the oscillator parts must be removed depending on the crystal color marking. The following table shows which parts must be removed for each crystal color.

GROUP	COLOR	C320	C321	C325	C326
B	RED	2p	1p	Remove	Remove
C	BLUE	2p	Remove	2p	Remove
D	GREEN	2p	Remove	2p	Remove
E	BLACK	Remove	1p	Remove	3p

### 1.6. VCO ADJUSTMENT

1.6.1. All measurements in this section should be made with the VCO can hole cover not installed.

1.6.2. Set unit to Channel 1 and connect a voltmeter to TP5 (VCO\_PD).

1.6.3. Ensure that the unit's antenna is connected to a 50 Ohm load.

1.6.4. Press the PTT switch so the unit is in transmit mode.

1.6.5. Immediately adjust L50 until the voltmeter reads 1.0V (+/- 0.15V). L50 is located under the VCO shield can and is accessible through the hole cut-out.

1.6.6. Release PTT and ground TP8.

1.6.7. Observe the voltage on TP5 (VCO\_PD). The voltage should be in the range of 0.1 to 1.5 VDC.

1.6.8. Set unit to channel 14 and connect a voltmeter to TP5 (VCO\_PD).

1.6.9. With TP8 still grounded, observe the voltage on TP5 (VCO\_PD). The voltage should be in the range of 0.5 to 2.5 VDC. Unground TP8.

1.6.10. Press the PTT switch and observe the voltage on TP5 (VCO\_PD). The voltage should be in the range of 0.5 to 2.5 VDC.

1.6.11. Solder the VCO can hole cover in place.

### 1.7. TRANSMITTER FREQUENCY ALIGNMENT

1.7.1. Press the PTT switch so the unit is in transmit mode.

1.7.2. Adjust RV300 variable resistor such that the output frequency is equal to the channel frequency with a maximum error of +/- 200 Hz (QC limit of +/- 500 Hz). RV300 is located near the upper left corner of U300.



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## 1.8. TRANSMITTER OUTPUT POWER CHECK

- 1.8.1. Set unit to channel 1.
- 1.8.2. Press the PTT switch so the unit is in transmit mode.
- 1.8.3. The transmit power should normally be between 800mW and 1000mW (maximum limit of 700mW to 1200mW).
- 1.8.4. Set unit to channel 14.
- 1.8.5. Press the PTT switch so the unit is in transmit mode. Ensure that TX Power meets spec range of 400mW to 800mW.

## 1.9. TRANSMITTER DEVIATION ADJUSTMENT

- 1.9.1. Connect an audio generator (600 ohms) to the microphone test points TP3 (MIC+) and TP4 (GND). The audio frequency should be set to 1KHz with a level of 100mV RMS.
- 1.9.2. Connect an FM deviation meter (communications service monitor) to test point TP1 (ANT). Set the monitor to read peak-to-peak divided by 2 [(pk-pk)/2] deviation. Set **Filter 1** to 50Hz HPF. Set **Filter 2** to 15KHz LPF.
- 1.9.3. Press the PTT switch so the unit is in transmit mode.
- 1.9.4. Adjust RV230 for +/- 2.4 KHz deviation (+/- 5 %). RV230 is located near the upper right corner of U230.
- 1.9.5. Decrease audio generator level until deviation reads +/- 1.5 KHz (approximately 10mV) and record the generator level. The level should be between 7 mV and 13 mV.
- 1.9.6. Set **Filter 1** to 300Hz HPF. Set **Filter 2** to 3KHz LPF. Make sure to turn on de-emphasis.
- 1.9.7. Check that transmit audio distortion is less than 5%.
- 1.9.8. Switch ground to TP3 (MIC+) to disable microphone.
- 1.9.9. Set **Filter 1** to < 20Hz HPF. Set **Filter 2** to 300Hz LPF. Make sure to turn on de-emphasis.
- 1.9.10. Set unit to channel 1 with CTCSS code 1.
- 1.9.11. Check that the CTCSS code deviation is in the range between +/- 300 to 700 Hz.
- 1.9.12. Repeat step 1.9.11 for channel 1 with CTCSS code 38.
- 1.9.13. Repeat step 1.9.11 for channel 14 with CTCSS code 1.
- 1.9.14. Repeat step 1.9.11 for channel 14 with CTCSS code 38.



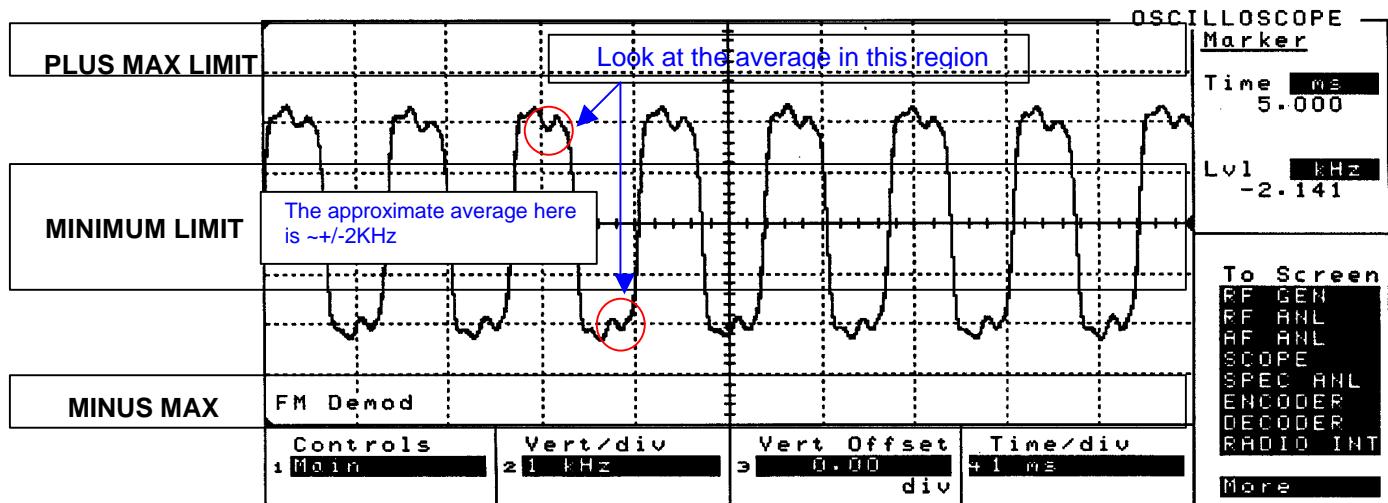
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## 1.10. CALL TONE DEVIATION CHECK

- 1.10.1. Connect an 8920 communications service monitor to test point TP1 (ANT). Set **Filter 1** to <20Hz HPF. Set **Filter 2** to 15KHz LPF.
- 1.10.2. Set 8920 test set to oscilloscope mode. Set Vert/div to 1kHz and Time/div to 1ms.
- 1.10.3. Press the CALL button. As the call tone is transmitted, note the waveform on the oscilloscope display. Approximate the average and it should be a minimum of 1.3 divisions plus and minus the centerline and a maximum of 3.0 divisions plus and minus the centerline.



**Note:** The wave form should be observed at its steady state after settling.  
Ignore switching transients.

## 1.11. RECEIVER ALIGNMENT

- 1.11.1. Set the output level of the RF signal generator for -47 dBm. The generator should be set for 1.5 KHz deviation at 1 KHz modulation.
- 1.11.2. Set the audio output to level 2.
- 1.11.3. Set **Filter 1** to 300Hz HPF. Set **Filter 2** to 3Khz LPF
- 1.11.4. Check that RX audio distortion is less than 5%.
- 1.11.5. Ground TP8 and check that RX Sensitivity is less than or equal to -118dBm (nominally -122dBm) by reducing the output level of the RF signal generator until a 12 dB SINAD reading is achieved.



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## 1.12. SQUELCH THRESHOLD AND HYSTERESIS

- 1.12.1. Set CTCSS code to 0.
- 1.12.2. Reduce signal generator level to below -130dBm.
- 1.12.3. Increase level in 0.1dB steps until the unit opens squelch and has steady audio output. This should occur between 8 – 16 dB SINAD.
- 1.12.4. Reduce signal generator level until the unit squelches. The unit must close squelch.

\* **Refer to the CTCSS Code Table below**

- 1.12.5. Set up the 8920 Signal Generator to channel 1 with **Audio Gen #1** set for 1.5KHz deviation at 1KHz modulation and **Audio Gen #2** set for 300Hz deviation with 67Hz modulation.
- 1.12.6. Set unit to channel 1 with CTCSS code 1.
- 1.12.7. Verify that the Rx Squelch points are the same (within +/- 2dB) as in 1.11.3 and 1.11.4.
- 1.12.8. Set unit and signal generator to channel 1 with CTCSS code 38 (250.3Hz). Repeat step 1.11.7.
- 1.12.9. Set unit and signal generator to channel 14 with CTCSS code 1 (67Hz). Repeat step 1.11.7.
- 1.12.10. Set unit and signal generator to channel 14 with CTCSS code 38 (250.3Hz). Repeat step 1.11.7.

**CTCSS Code Table**

CODE	FREQ (Hz)	CODE	FREQ (Hz)	CODE	FREQ (Hz)
0	no code	13	103.5	26	162.2
1	67.0	14	107.2	27	167.9
2	71.9	15	110.9	28	173.5
3	74.4	16	114.8	29	179.9
4	77.0	17	118.8	30	186.2
5	79.7	18	123.0	31	192.8
6	82.5	19	127.3	32	203.5
7	85.4	20	131.8	33	210.7
8	88.5	21	136.5	34	218.1
9	91.5	22	141.3	35	225.7
10	94.8	23	146.2	36	233.6
11	97.4	24	151.4	37	241.8
12	100.0	25	156.7	38	250.3



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### 1.13. AUDIO OUTPUT POWER AND DISTORTION

- 1.13.1. Increase signal generator level to -47dBm.
- 1.13.2. Set *Ext Load R* to 16 ohms.
- 1.13.3. With 1.5KHz deviation at 1KHz modulation, set volume level to achieve 10% THD (or max volume if less than 10%THD). Audio power should normally be between 200mW and 300mW (limit of 150mW to 400mW) across TP10 (+SP) and TP9 (-SP).

### 1.14. CURRENT TEST

- 1.14.1. With same set-up as in 1.12, set volume to level 2.
- 1.14.2. Measure "receive current with audio". It should be less than 100mA.
- 1.14.3. Set the RF generator amplitude to "OFF".
- 1.14.4. Press and release the PTT switch. Within 10 seconds after releasing the PTT switch, measure "receive current without audio". It should be less than 40mA.
- 1.14.5. Press and hold the PTT switch.
- 1.14.6. Measure "transmit current". It should be in the range from 250mA to 450mA.

### 1.15. ACCESSORY TEST

- 1.15.1. Insert a 2.5mm stereo plug (plug only – not connected to anything) into accessory jack J1 located at the top of the radio unit.
- 1.15.2. Connect a 120k ohm resistor between ground and the mic audio input of the connected stereo jack (the ring connection of the stereo jack), the unit under test should not transmit.
- 1.15.3. Disconnect the 120k ohm resistor and connect a 47k ohm resistor between ground and the mic audio input, the unit under test should transmit.
- 1.15.4. Connect an audio generator (600 ohms) to the accessory test points TP4 (GND) and TP17 (ACC). The unit should be transmitting. The audio frequency should be set to 1KHz. Adjust the audio out level until deviation reads +/- 1.5 kHz (approximately 10mV) and record generator level. Level should be between 7 mV and 13 mV.
- 1.15.5. Disconnect the audio generator and 47k resistor.
- 1.15.6. The unit should not be transmitting.
- 1.15.7. Remove the 2.5mm stereo plug.