

## **Test and Alignment Procedure HUM1200CS/HUM1250CS**

### **1. Recommended Test Equipment**

- 1.1 HP8920A Communication Test Set
- 1.2 Fluke 50S Digital Thermometer
- 1.3 Fluke 77 Digital Voltmeter
- 1.4 Power Supply

### **2. Test Preparation**

- 2.1 Connect a 6.0Vdc power source to the positive terminal input point and the negative battery input point (GND) for negative terminal.
- 2.2 Connect a communication test set capable of at least five watts RF to antenna test point.
- 2.3 Connect a 1 watt 16ohm resistor from speaker +SP to -SP.
- 2.4 Test point +SP should be connected to Audio In HI of the HP8920A.
- 2.5 Test point -SP should be connected to Audio In LO of the HP8920A.

### **3. Voltage Regulator Test**

- 3.1 Connect a voltmeter to output of regulator TP29 (Bvout) and measure the voltage. The DC value must be between 3.725 and 3.875Vdc.

### **4. Temperature Compensation Alignment**

- 4.1 Connect a voltmeter to TP19 (TEMP\_DET).
- 4.2 Record the current ambient temperature (TA).
- 4.3 From the temperature compensation alignment table, determine the target voltage (Vtemp) based on the ambient temperature (TA).
- 4.4 Adjust VR1 until the voltmeter reading equal to the target voltage (Vtemp).

### Temperature Compensation Alignment Table

A.Temp	Voltage		
	low	nominal	high
15°C	1.130	1.150	1.172
16°C	1.089	1.108	1.130
17°C	1.050	1.069	1.089
18°C	1.011	1.030	1.050
19°C	0.974	0.992	1.011
20°C	0.937	0.955	0.974
21°C	0.903	0.920	0.937
22°C	0.869	0.885	0.903
23°C	0.836	0.852	0.869
24°C	0.804	0.820	0.836
25°C	0.774	0.789	0.804
26°C	0.745	0.759	0.774
27°C	0.716	0.730	0.745
28°C	0.689	0.702	0.716
29°C	0.662	0.675	0.689
30°C	0.636	0.649	0.662
31°C	0.612	0.623	0.636
32°C	0.588	0.599	0.612
33°C	0.566	0.576	0.588
34°C	0.545	0.555	0.566
35°C	0.522	0.533	0.545

## 5. Battery Detect Alignment

- 5.1 Connect a voltmeter to TP20 (BATT\_DET).
- 5.2 Adjust power supply to 4.80Vdc +/- 10mV.
- 5.3 Select one resistor from R208 to R210 until the voltmeter reading is close to 1.60Vdc +/- 40mV.

## 6. Battery Level Test

- 6.1 Adjust power supply to 5.5Vdc +/- 50mV.
- 6.2 Cycle power by turning the unit Off then On.
- 6.3 Check 3 segments of the battery level icons are solid.
- 6.4 Adjust power supply to 4.7Vdc +/- 50mV.
- 6.5 Cycle power by tuning the unit Off then On.
- 6.6 Check 2 segments of the battery level icons are solid.
- 6.7 Adjust power supply to 4.4Vdc +/- 50mV.
- 6.8 Cycle power by tuning the unit Off then On.
- 6.9 Check 1 segments of the battery level icons are solid.
- 6.10 Adjust power supply to 4.1Vdc +/- 50mV.
- 6.11 Cycle power by tuning the unit Off then On.
- 6.12 Check only shell of the battery level icons are solid.
- 6.13 Readjust power supply to 6.0Vdc.

## 7. Crystal Select

- 7.1 Crystal X1 are marked with red, blue, green or orange colour marks.
- 7.2 All crystal select resistors R202 to R205 are installed during SMT. During PCBA alignment, two of resistors must be removed depending on the crystal colour marking as shown in the crystal selection table.

**Crystal Selection Table**

Rank	Colour	R202	R203	R204	R205
A	Red	DNI	Insert	DNI	Insert
B	Blue	DNI	Insert	Insert	DNI
C	Green	Insert	DNI	DNI	Insert
D	Orange	Insert	DNI	Insert	DNI

## **8. VCO Alignment**

- 8.1 Set unit to Channel 1 and connect a voltmeter to TP9.
- 8.2 Press the PTT switch so unit is in transmit mode.
- 8.3 Adjust VC1 until the voltmeter read 0.6Vdc +/- 0.1V. VC1 is located under the VCO shield can and is accessible through the hole cut-out.
- 8.4 Release the PTT switch and observe the voltage on TP9. The voltage should be in the range of 0.5 to 1.0Vdc.
- 8.5 Set unit to channel 14 and connect a voltmeter to TP9.
- 8.6 Press the PTT switch and observe the voltage on TP9. The voltage should be between 0.8 to 1.6Vdc.
- 8.7 Release PTT and observe the voltage on TP9. The voltage should be between 1.0 to 1.8Vdc.

## **9. Transmitter Frequency Alignment**

- 9.1 Press the PTT switch so unit is in transmit mode.
- 9.2 Adjust VC2 such that the output frequency is equal to the channel frequency with a maximum error +/-200Hz. VC2 is located near the crystal unit of X1.

## **10. Transmitter Output Power Check**

- 10.1 Set unit to channel 1 (Low Power Mode).
- 10.2 Press the PTT switch so unit is in transmit mode.
- 10.3 Transmit power should be between 400mW to 500mW.
- 10.4 Set unit to High Power Mode.
- 10.5 Press the PTT switch so unit is in transmit mode.
- 10.6 Transmit power should be 2W +/- 0.3W.
- 10.7 Set unit to channel 14.
- 10.8 Press the PTT switch so unit is in transmit mode.
- 10.9 Transmit power should be between 400mW to 500mW.

*Note:*

*The power can be adjusted from low to high or vice versa when at GMRS channel (1~7, 15~22). The FRS channel(8~14) is fixed at low power.*

## **11. Transmitter Deviation Adjustment**

- 11.1 Connect an audio generator (600ohm) to the microphone test points MIC+ and GND. The audio frequency should be set a 1kHz with a level of 50mV RMS.
- 11.2 Connect an FM deviation meter (communication test set) to antenna test point. Set the deviation meter to read peak to peak maximum deviation. Set Filter 1 to 50Hz HPF. Set Filter 2 to 15kHz LPF.
- 11.3 Set unit to channel 1 with CTCSS code 1. Press the PTT switch so unit is in transmit mode.
- 11.4 Adjust VR2 for 2.15kHz deviation (+/-0.05kHz).
- 11.5 Set unit to channel 1 with CTCSS code 38. Check deviation should be less than 2.5kHz.
- 11.6 Repeat step 11.5 for channel 14 with CTCSS code 1.
- 11.7 Repeat step 11.5 for channel 14 with CTCSS code 38.
- 11.8 Set unit to channel 1 with CTCSS code 0.
- 11.9 Decrease audio generator level until deviation reads +/- 1.5kHz and record generator level. Level should be between 5mV and 15mV.
- 11.10 Set Filter 1 to 300Hz HPF. Set Filter 2 to 3kHz LPF. Make sure to turn on de-emphasis.
- 11.11 Check that transmit audio distortion is less than 5%.
- 11.12 Switch off the audio generator.
- 11.13 Set Filter 1 to 50Hz HPF. Set Filter 2 to 300Hz LPF.
- 11.14 Set unit to channel 1 with CTCSS code 1.
- 11.15 Check that the CTCSS code deviation is in the range between +/- 250 to 500Hz.
- 11.16 Repeat step 11.15 for channel 1 with CTCSS code 38.
- 11.17 Repeat step 11.15 for channel 14 with CTCSS code 1.
- 11.18 Repeat step 11.15 for channel 14 with CTCSS code 38.

## **12. VOX Test**

- 12.1 Connect an audio generator (600ohm) to the accessory connect point and GND. The audio frequency should be set a 1kHz with a level of 0V RMS.
- 12.2 Turn unit ON and set VOX mode ON.
- 12.3 Set VOX to level 5.
- 12.4 Quickly increase the audio generator from 0V RMS to 7mV RMS.
- 12.5 The unit should transmit.
- 12.6 Adjust the audio generator to 4mV RMS.
- 12.7 The unit should not transmit.
- 12.8 Set VOX to level 1.
- 12.9 Quickly increase the audio generator from 0V RMS to 19mV RMS.
- 12.10 The unit should transmit.
- 12.11 Adjust the audio generator to 16mV RMS.
- 12.12 The unit should not transmit.
- 12.13 Connect an audio generator (600ohm) to the microphone test points MIC+ and GND. The audio frequency should be set a 1kHz with a level of 0V RMS.
- 12.14 Repeat 12.3 to 12.13. Check the VOX function is working properly.

## **13. Accessory Test**

- 13.1 Connect an audio generator (600ohm) to the accessory connect point and GND. The audio frequency should be set a 1kHz with a level of 0V RMS.
- 13.2 The unit should be transmitting.
- 13.3 Cycle power by turning the unit OFF and ON.
- 13.4 The unit should not be transmitting.
- 13.5 Press PTT and confirm the unit transmits.
- 13.6 Release PTT.

## **14. Receiver Alignment**

- 14.1 Set Filter 1 to 300Hz HPF. Set Filter 2 to 3kHz LPF.
- 14.2 Set the output level of the RF signal generator for -47dBm. The generator should be set for 1.5kHz deviation at 1kHz modulation.
- 14.3 Set the audio output level for 25-35mW by adjusting volume.
- 14.4 Adjust IFT1 for 1.9Vdc +/- 50mV at DETOUT. IFT1 is located below the 450kHz ceramic filter FL3.
- 14.5 Check RX audio distortion is less than 5%.
- 14.6 Check RX Sensitivity is less than -118dBm by reducing the output level of the RF signal generator until a 12dB SINAD reading is achieved.

## **15. Squelch Threshold and Hysteresis**

- 15.1 Set CTCSS code to 0.
- 15.2 Reduce signal generator level to its minimum level.
- 15.3 Increase level in 1dB steps until the unit opens squelch and has steady audio output. This should occur at or below -120dBm.
- 15.4 Reduce signal generator level until the unit squelches. The difference between generator levels for “open” vs. “squelched” should be 1-5dB. The squelch sensitivity should be between 8 to 16dB SINAD.
- 15.5 Set up the 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.
- 15.6 Set unit to channel 1 with CTCSS code 1.
- 15.7 Verify that the squelch sensitivity is between 8 to 16 dB SINAD.
- 15.8 Set unit and signal generator to channel 1 with CTCSS code 38. Repeat step 13.7.
- 15.9 Set unit and signal generator to channel 14 with CTCSS code 1. Repeat step 13.7.
- 15.10 Set unit and signal generator to channel 14 with CTCSS code 38. Repeat step 13.7.

## **16. Audio output power and distortion**

- 16.1 Increase signal generator level to -47dBm.
- 16.2 Set Ext Load R to 16ohm.
- 16.3 With 1.5kHz deviation at 1kHz modulation, set volume for maximum audio. Audio power should be between 250mW and 350mW across speaker +SP and -SP.

## **17. RSSI Test**

- 17.1 Set the output level of the RF signal generator for -47dBm. The generator should be set for 1.5kHz at deviation at 1kHz modulation. Observe the RSSI display. The antenna symbol plus 4 bars should be visible.
- 17.2 Reduce the RF output of the signal generator slowly until the first bar is no longer visible. This should occur at a level of less than -90dBm +/- 10dB.
- 17.3 Continue to reduce the RF signal generator until the first two bars are no longer visible. This level should be reduced -100dBm +/- 5dB.
- 17.4 Continue to reduce the RF signal generator until the first three bars are no longer visible. This level should be reduced -105dBm +/- 5dB.
- 17.5 Continue to reduce the RF signal generator until the first four bars are no longer visible. This level should be reduced -110dBm +/- 5dB.

## **18. Weather RX Test**

- 18.1 Set unit to Channel 1 in WX mode.
- 18.2 Connect a voltmeter to TP8 and measure the voltage. The voltage should be in the range of 0.5 to 2.0Vdc.
- 18.3 Set 8920A to 162.55MHz.
- 18.4 Set output level of 8920A to  $-47\text{dBm}$ . The generator should be set for 1.5kHz deviation with 1kHz modulation.
- 18.5 Set the audio output level for 25-35mW by adjusting volume.
- 18.6 Set Filter 1 to 300Hz HPF. Set Filter 2 to 3kHz LPF.
- 18.7 Check WX RX audio distortion is less than 5%.
- 18.8 Check WX RX sensitivity is less than  $-116\text{dBm}$  by reducing output level of RF signal generator until a 12dB SINAD reading is achieved.
- 18.9 Set output level of 8920A to  $-47\text{dBm}$ . The generator should be set for 3.5kHz deviation with 1050Hz modulation and output turned off.
- 18.10 Set unit to WX channel 1 and weather alert mode ON and FRS channel 3.
- 18.11 Turn on output of generator.
- 18.12 Check unit switches to WX channel 1, squelch opens and has a steady audio output of 1050Hz.

## **19. Current Test**

- 19.1 Set unit to channel 1 with CTCSS code 0.
- 19.2 Increase signal generator level to  $-47\text{dBm}$ .
- 19.3 With 1.5kHz deviation at 1kHz modulation, set volume to 25-35mW output by adjusting volume control.
- 19.4 Measure "receive current with audio". It should be less than 120mA.
- 19.5 Set RF generator amplitude to OFF.
- 19.6 Press and release PTT switch. Within 10 seconds after releasing PTT switch, measure "receive current without audio". It should be less than 40mA.
- 19.7 Set unit to high power mode.
- 19.8 Press and hold PTT switch.
- 19.9 Measure "transmit current". It should be in the range of 1.0A to 1.5A.
- 19.10 Release PTT. Set unit to low power mode.
- 19.11 Press and hold PTT switch.
- 19.12 Measure "transmit current". It should be in the range of 350mA to 500mA.
- 19.13 Release PTT.



## **20. Compass Test**

- 20.1 Put unit in a stationary test fixture.
- 20.2 Set a magnet on circle around unit.
- 20.3 Turn unit ON. Press and hold Compass button until "CALibr" shows on LCD.
- 20.4 Move magnet through a full circle around unit. (Note: Circle must take at least 3 seconds to complete).
- 20.5 Press and release Compass button.
- 20.6 After button-release, LCD will show "FAIL" or "SUCCEs" for two seconds. Verify LCD shows "SUCCEs"
- 20.7 After compass direction is shown on LCD, slowly move the magnet in a circle around unit again. Verify displayed direction changes as magnet moves around unit. Turn unit OFF.