

# ALIGNMENT PROCEDURE

Models: T5600/T56200

## 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 4.5Vdc power source to the positive terminal input point and the negative battery input point (GND) for negative terminal.
- 2.2 Connect a communications service monitor capable of at least two watt RF to antenna test point.
- 2.3 Connect a 1/2watt 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 Bvout and measure the voltage. The DC value must be between 2.94 and 3.06Vdc.

## 4. Temperature Compensation Alignment

- 4.1 Connect a voltmeter to TP18 (THERM\_DET).
- 4.2 Record the current ambient temperature (TA).
- 4.3 From the temperature compensation alignment table, determine the target voltage (Vthem) based on the ambient temperature (TA).
- 4.4 Select one resistor from R303 to R305 until the voltmeter reading is close to the target voltage (Vthem). R306 is used to fine tune the voltage (Vthem).

Temperature Compensation Alignment Table

Temp/C	Vthem/V	Temp/C	Vthem/V
15	0.908	26	0.599
16	0.875	27	0.576
17	0.844	28	0.554
18	0.813	29	0.533
19	0.783	30	0.512
20	0.754	31	0.492
21	0.726	32	0.473
22	0.699	33	0.455
23	0.673	34	0.438
24	0.647	35	0.421
25	0.623		

## 5. Battery Low Alignment

- 5.1 Connect a voltmeter to TP17 (BATT\_DET).
- 5.2 Adjust power supply to 3.60Vdc +/- 50mV.
- 5.3 Select one resistor from R300 to R302 until the voltmeter reading is close to 2.4Vdc +/- 100mV.

## 6. **Battery Low Test**

- 6.1 Connect 3<sup>rd</sup> \_TERM to GND.
- 6.2 Adjust power supply to 3.45Vdc +/- 50mV.
- 6.3 Cycle power by turning the unit Off then On.
- 6.4 Insure the battery low does not alert.
- 6.5 Adjust power supply to 3.35Vdc +/- 50mV.
- 6.6 Cycle power by turning the unit Off then On.
- 6.7 Insure the battery low does alert.
- 6.8 Readjust power supply to 4.5Vdc.

## 7. **VCO Alignment**

- 7.1 Set unit to Channel 15 and connect a voltmeter to TP16 (VCO PD).
- 7.2 Press the PTT switch so unit is in transmit mode.
- 7.3 Adjust VC1 until the voltmeter reads 0.8V. VC1 is located under the VCO shield can and is accessible through the hole cut-out.
- 7.4 Release the PTT switch and observe the voltage on TP16 (VCO PD). The voltage should be in the range of 0.4 to 1.0Vdc.
- 7.5 Set unit to channel 14 and connect a voltmeter to TP16 (VCO PD).
- 7.6 Press the PTT switch and observe the voltage on TP16 (VCO PD). The voltage should be between 1.0 to 2.0Vdc.
- 7.7 Release PTT and observe the voltage on TP16 (VCO PD). The voltage should be between 1.0 and 2.0Vdc.

## 8. **Transmitter Frequency Alignment**

- 8.1 Press the PTT switch so unit is in transmit mode.
- 8.2 Adjust VC2 such that the output frequency is equal to the channel frequency with a maximum error +/- 200Hz (QC limit of +/- 500Hz). VC2 is located near the crystal unit of X1.

## 9. **Transmitter Output Power Check**

- 9.1 Set unit to channel 1.
- 9.2 Connect 3<sup>rd</sup> \_TERM to GND.
- 9.3 Press the PTT switch so unit is in transmit mode.
- 9.4 Transmit power should be between 24dBm +/- 2
- 9.5 Set unit to channel 14.
- 9.6 Press the PTT switch so unit is in transmit mode. Ensure that Tx Power is between 24dBm +/- 2
- 9.7 Set unit to channel 1.
- 9.8 Disconnect 3<sup>rd</sup> \_Term from GND. Leave 3<sup>rd</sup> \_Term open.
- 9.9 Reduce battery voltage from 4.5Vdc to 3.6Vdc.
- 9.10 Press the PTT switch so unit is in transmit mode.
- 9.11 Transmit power should be between 24dBm +/- 2
- 9.12 Set unit to channel 14.
- 9.13 Press the PTT switch so unit is in transmit mode. Ensure that Tx Power is between 24dBm +/- 2
- 9.14 Reset battery voltage to 4.5Vdc.

## 10. Transmitter Deviation Adjustment

- 10.1 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.
- 10.2 Connect an FM deviation meter (communication test set) to antenna test point. Set the deviation meter to read peak to peak divided by two deviation. Set Filter 1 to 50Hz HPF. Set Filter 2 to 15kHz LPF.
- 10.3 Press the PTT switch so unit is in transmit mode.
- 10.4 Adjust VR4 for 2kHz deviation (+/-5%).
- 10.5 Decrease audio generator level until deviation reads +/- 1.5kHz and record generator level. Level should be between 5mV and 15mV.
- 10.6 Set Filter 1 to 300Hz HPF. Set Filter 2 to 3kHz LPF. Make sure to turn on de-emphasis.
- 10.7 Check that transmit audio distortion is less than 5%.
- 10.8 Switch off the audio generator.
- 10.9 Set Filter 1 to 50Hz HPF. Set Filter 2 to 300Hz LPF.
- 10.10 Set unit to channel 1 with CTCSS code 1.
- 10.11 Check that the CTCSS code deviation is in the range between +/- 300 to 450Hz.
- 10.12 Repeat step 10.11 for channel 1 with CTCSS code 38.
- 10.13 Repeat step 10.11 for channel 14 with CTCSS code 1.
- 10.14 Repeat step 10.11 for channel 14 with CTCSS code 38.

## 11 Receiver Alignment

- 11.1 Set Filter 1 to 300Hz HPF. Set Filter 2 to 3kHz LPF.
- 11.2 Set the output level of the RF signal generator for -47dBm. The generator should be set for 1.5kHz deviation at 1kHz modulation.
- 11.3 Set the audio output level for 25-35mW by adjusting volume.
- 11.4 Adjust IFT1 for maximum audio output. IFT1 is located to the right of the 450kHz ceramic filter.
- 11.5 Check that RX audio distortion is less than 5%.
- 11.6 Check that RX Sensitivity is less than -118dBm by reducing the output level of the RF signal generator until a 12dB SINAD reading is achieved.

## 12 Squelch Threshold and Hysteresis

- 12.1 Set CTCSS code to 0.
- 12.2 Reduce signal generator level to its minimum level.
- 12.3 Increase level in 1dB steps until the unit opens squelch and has steady audio output.  
This should occur at or below -120dBm.
- 12.4 Reduce signal generator level until the unit squelches. The difference between generator levels for "open" vs. "squelched" should be 1-5dB.
- 12.5 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.
- 12.6 Set unit to channel 1 with CTCSS code 1.
- 12.7 Verify that the RX Squelch points are the same (within +/- 2dB) as in 12.3 and 12.4.
- 12.8 Set unit and signal generator to channel 1 with CTCSS code 38. Repeat step 12.7.
- 12.9 Set unit and signal generator to channel 14 with CTCSS code 1. Repeat step 12.7.
- 12.9.1 Set unit and signal generator to channel 14 with CTCSS code 38. Repeat step 12.7.

## **13 Audio output power and distortion**

- 13.1 Increase signal generator level to  $-47\text{dBm}$ .
- 13.2 Set Ext Load R to  $16\text{ohm}$ .
- 13.3 With  $1.5\text{kHz}$  deviation at  $1\text{kHz}$  modulation, set volume for maximum audio. Audio power should be between  $150\text{mW}$  and  $250\text{mW}$  across speaker  $+\text{SP}$  and  $-\text{SP}$ .

## **14 Accessory**

- 14.1 Set unit to channel 1.
- 14.2 Connect an audio generator ( $600\text{ohm}$ ) to the accessory connect point and GND. The audio frequency should be set a  $1\text{kHz}$  with a level of  $0\text{V RMS}$ .
- 14.3 The unit should be transmitting on channel 1.
- 14.4 Cycle power by turning the unit OFF and ON.
- 14.5 The unit should not be transmitting.
- 14.6 Press PTT and confirm the unit transmits.
- 14.7 Release PTT.