

## 6. MX800 Base Station Fault Finding Procedure

The following test equipment may be required for the following tests:

- ◆ MXTOOLS (MX800 Base Station Programming Utility)
- ◆ MXTOOLS User Manual
- ◆ RF Test Set (eg HP 8920 or equivalent)
- ◆ CRO (Cathode Ray Oscilloscope)
- ◆ RF Power Meter (capable of measuring in Watts)
- ◆ Multimeter
- ◆ +13.8V DC Power Supply
- ◆ Network Analyser

### 6.1 MX800 Base Station

(The following tests will help diagnose faulty modules)

- ◆ Check voltage supply to the MX800 by measuring both sides of Fuse 1 located on the Microcontroller PCB. Replace fuse if necessary.
- ◆ Check that the power LED is lit. If not then go to section 6.2.
- ◆ Using MXTOOLS check that the frequency tables and configuration settings are correct. Refer to the MXTOOLS User Manual.

#### 6.1.1 Transmitter Section

- ◆ Connect the output of the Power Amplifier Module to a comms test set or RF power meter.
- ◆ Check the Exciter locking voltage is between 2 – 18 V on the TX VCO TP on the Microcontroller PCB.
- ◆ If the locking voltage is out of spec then go to section 6.4
- ◆ Key up the transmitter using the software PTT in MXTOOLS or by connecting pin 12 of the 15-way connector at the rear of the radio.
- ◆ If the output power of the PA is low then check the RF level out of the Exciter module.
- ◆ If the RF power out of the Exciter module is less than +23 dBm (200 mW), then go to section 6.4 else go to section 6.5.
- ◆ Inject a 1 kHz tone via the MX800 test jig and check for 1.5 kHz / 3 kHz peak to peak demodulated deviation.
- ◆ If the audio deviation is incorrect then go to the Exciter Alignment procedure section 5.2.1.



- ◆ If there is no audio modulation then check the audio level on pin 13, IC11 on the Microcontroller PCB.
- ◆ If there is no audio on the above test point then go to section 6.2 else go to section 6.4

### 6.1.2 Receiver Section

- ◆ Check the Rx locking voltage is between 2 – 18 V at the RX VCO TP on the Microcontroller PCB.
- ◆ If the Rx locking voltage is out of spec then go to section 6.3.
- ◆ Inject a –60 dBm RF test signal set to CF and modulated with a 1kHz 1.5 kHz / 3 kHz tone into the receiver BNC input connector.
- ◆ Check for an audio signal on the MX800 test jig.
- ◆ Inject the test signal directly into the RX module and re-test for an audio signal on the MX800 test jig.
- ◆ Replace the RX input coax cable if faulty.
- ◆ Check for an audio signal on pin 5 of IC 41 on the Microcontroller PCB.
- ◆ If there is no audio signal on the above test point then go to section 6.3 else go to section 6.2.

## 6.2 Microcontroller PCB

Check pin 21 of IC1 is LOW when PTT is on. If OK, then check the output at pin 17 of IC7 is HIGH. If OK, then PA may be faulty. Go to section 6.5

Check all jumpers and switch settings are in the correct position for your requirements.

The Microcontroller PCB requires specialized test software to check all the hardware input and output ports. Please return the Microcontroller PCB to your nearest Customer Service Centre.

## 6.3 Receiver Module

### 6.3.1 VCO Locking.

- ◆ Check the value of X3 (13 MHz or 14.4 MHz) is the same as the Rx Reference Freq in the 'Hardware Settings' in MXTOOLS' configuration menu.
- ◆ Connect a DVM (digital voltmeter) to the RX VCO TP and check the RX locking voltage is between 2 – 18 V at the RX VCO TP on the Microcontroller PCB.
- ◆ If the RX locking voltage is out of spec then slowly adjust CT1 on the RX VCO a full 360°, and check for a change in the locking voltage.
- ◆ If there is a change in the locking voltage then realign the VCO voltage to 9V at the centre frequency.



- ◆ If there is no change in the RX VCO locking voltage, then check that the VCO supply voltage at SKU-3 is greater than 7V and with a CRO check the TCXO is oscillating on pin 8 of IC10.
- ◆ If all the above tests pass then the VCO or IC10 may be faulty. Return the Receiver Module to your Service Centre.

### 6.3.2 RX Front End

- ◆ Solder a 2-way Berg header onto a flying coax lead. Remove solder link I near the mixer (M1) and then fit solder link J. Inject a RF signal into CN5. Check the sensitivity is better than  $-110$  dBm.
- ◆ If the sensitivity is OK past this point, then check that the supply voltage to IC12 is greater than 4.5 V. If the supply is OK, then replace IC12. If this does not repair the receiver then the alignment may be incorrect or other components on the front end may be faulty. Return the Receiver Module to your nearest Customer Service Centre.

### 6.3.3 IF Section

- ◆ If the Receiver has low sensitivity past this point then increase the RF level to  $-60$  dBm and check the RX DISC voltage is set to 2.55V. Adjust L14 if necessary.
- ◆ Connect a coax lead with a pickup loop around the end from the antenna input on the HP8920A to the case of X1. Set the HP8920 to TX test, change the Tune Mode to Manual and change the centre frequency of the comms test set to 44.545MHz for A to B Band and 89.545MHz for C Band and above.
- ◆ If CT1 cannot be adjusted to match the above frequencies then X1 may be faulty.
- ◆ Set the centre frequency of the HP8920A to the RX freq + 45MHz for A to B band or RX freq + 90MHz for C to J Band or RX freq - 90MHz for K band and above.
- ◆ Adjust the TCXO to within  $\pm 20$ Hz. (Check that the VCO deviation is set to 127 using MXTOOLS when adjusting the local oscillator)
- ◆ If the RX centre frequency cannot be adjusted the TCXO may be faulty.
- ◆ Adjust T1 and T2 for minimum distortion, less than 1%.
- ◆ If the distortion is high then FL3A, FL3B or FL4 may be faulty.
- ◆ If the sensitivity is still bad then return the Module to your Service Centre.

## 6.4 Exciter Module

### 6.4.1 VCO Locking.

- ◆ Check the reference frequency of X3 (13 MHz or 14.4 MHz) is the same as the TX Reference Freq in the 'Hardware Settings' in MXTOOLS' configuration menu.



- ◆ Connect a DVM to the TX VCO TP and check the Tx locking voltage is between 2 – 18 V on the TX VCO TP on the Microcontroller PCB.
- ◆ If the Tx locking voltage is out of spec then slowly adjust CT1 on the TX VCO a full 360°, and check for a change in the locking voltage.
- ◆ If there is a change in locking voltage, then realign the VCO voltage to 9V at centre frequency.
- ◆ If there is no change in the TX VCO locking voltage then check the VCO supply voltage at SKU-3 is greater than 7V and with a CRO check the TCXO is oscillating on pin 8 of IC 10.
- ◆ If all the above tests pass then the VCO or IC10 may be faulty. Return the Receiver Module to your nearest Customer Service Centre.

### 6.4.2 RF Power

- ◆ Check the output power is greater than +23 dBm.
- ◆ If the Exciter power is low then check for the +8 V supply voltage at the outputs of IC2 and TR4.
- ◆ Use a RF probe to check for gain through IC2 and TR4.
- ◆ Lift R2 and solder a flying lead to the junction of R1 and R2, check the output power of the VCO is greater than 7 dBm.
- ◆ If all the above tests pass, then return the Exciter Module to your nearest Customer Service Centre.

### 6.5 Power Amplifier

- ◆ First do a visual check of all the components on the PA looking for any damaged components.
- ◆ Check the output power of the Exciter Module is greater than +23dBm.
- ◆ With PTT off measure the +13.8 V supply at the collector of the output transistor.
- ◆ Key up the PA and check the supply voltage on the hybrid module. Refer to your circuit diagram for test points.
- ◆ Lift the RF output lead of the hybrid and solder a flying lead to the lifted leg. Connect the earth of the flying lead to the earth of the PA.
- ◆ Check that the output of the hybrid is greater than 5W.
- ◆ The hybrid may be faulty if it has an output of less than 5W and the output transistor may be faulty if the hybrid has an output power of greater than 5W.