# 6 Tuning & Adjustment

This Section details procedures for tuning and adjustment of T2000 series II radios. This is normally only required during product manufacture or after major servicing.

The following topics are covered in this Section:



 

# 6.1 Tuning Precautions

Refer to Section 4.1 for a list of test equipment required and a suggested test set-up. The following precautions must be observed when carrying out the alignment procedures in this Section.

- The microprocessor shield must remain in place throughout the alignment procedure, with its 3 retaining screws torqued down to 8in.lbf (0.9Nm).

  To gain access to the alignment test points and adjustment controls, it is only necessary to remove the top cover and logic PCB mounting screws (refer to Section 3.2.1).

- For accurate tuning, the test cable connecting the signal generator or power meter to the T2000 must be as short as practical and fitted with a 'mating' BNC connector.

  Do not use adaptors, 'sniffer' couplings, etc., which introduce changes to cable impedance and errors in test results.

- Non-metallic tuning tools must be used for the alignment of all coil slugs. The use of metallic tools will result in tuning errors.

  Tuning tools need to be of correct size to avoid the damage to coil slugs.

- The RF PA and audio output IC have a direct unswitched supply, and are therefore not controlled by the control head on/off switch. This switch removes power only from the regulated supplies.

**Caution: Under certain circumstances the microprocessor can key the transmitter. Ensure that all instruments are protected from accidental PTT at all times.**

# 6.2 Tuning & Adjustment Points

The following table lists tuning and adjustment points, and Figure 6.1 shows their position on the RF and TCXO / Tx audio PCBs.

The PCB layouts in Section 7 have all relevant logic PCB test and adjustment points marked.

| **Tuning/Adjustment Point:** | | |
|---|---|---|
| **Designator** | **Function** | **Location** |
| RV153 | internal squelch control | RF PCB |
| RV222 | dual point modulation control | |
| RV324 | high power control | |
| CV212 | x4 multiplier<br>(only used in T2000-800) | |
| L104 to L106 | front end tuning<br>(not used in T2000-800) | |
| L114 & L116 | IF tuning | |
| L119 | quad coil | |
| L203 | x3 / x4 multiplier<br>(not used in T2000-200) | |
| RV906 | CTCSS deviation control | TCXO / Tx audio PCB |
| RV907 | deviation control | |
| RV923 | frequency control | |
| RV507 | low power control | logic PCB |
| #RV508 | T2010, T2015 & T2020:<br>signalling adjust (not fitted as standard) | |
| #RV599 | T203X, T2040, T2050 & T2060:<br>FFSK adjust | |
| **Test Points:** | | |
| **Designator** | **Function** | **Location** |
| TSP901 | dual point modulation test point | TCXO / Tx audio PCB |
| TP601 | Rx audio (detected) | logic PCB |
| TP602 | Tx CTCSS | |
| TP603 | Rx CTCSS | |
| TP604 | Rx audio | |
| TP605 | Tx audio | |
| TP606 | ALC audio | |
| TP607 | pre-amp output | |

*Table 6.1 Tuning & Adjustment Point*

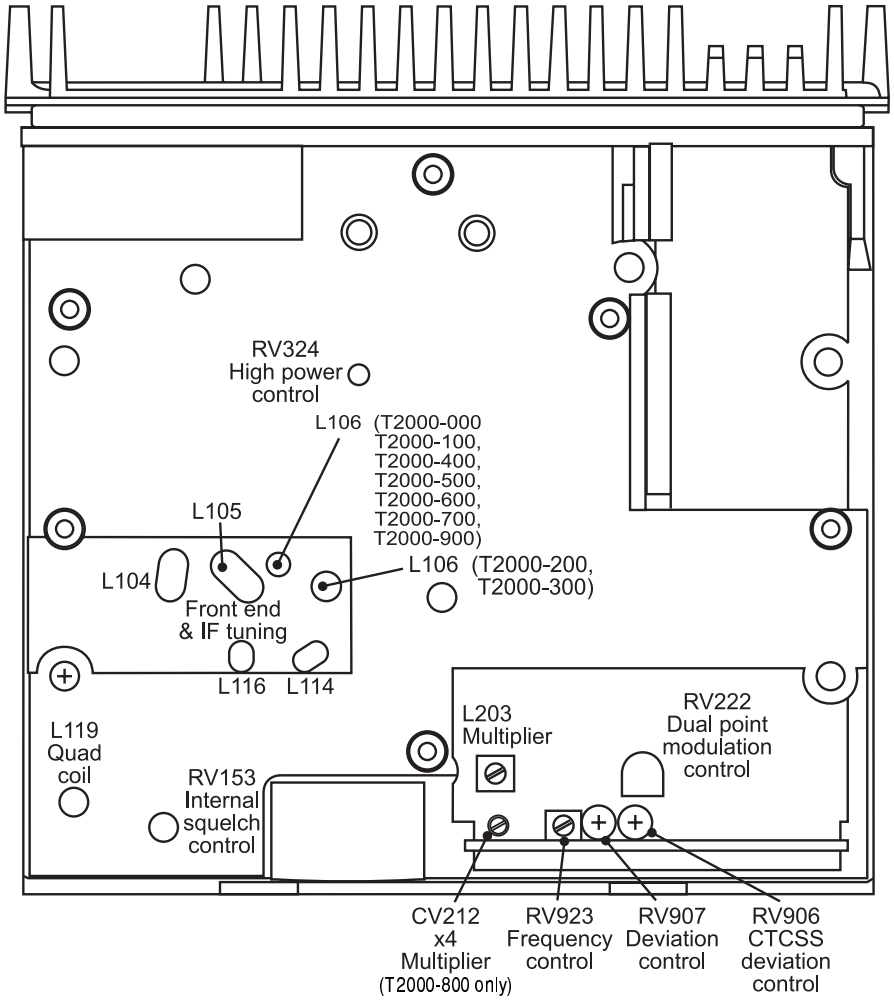


***Figure 6.1 RF & TXCO/Tx Audio PCBs - Tuning & Adjustment Points-***

 

# 6.3 Trunked Radios

The 'test' facility enables T2000 trunked radios to emulate a multichannel radio, using the frequencies reserved for trunking.

For a description of how to put the radio in test mode, refer to Section 5.8 "Trunked Radios: Test Mode". Once the radio is in test mode, tuning and adjustment can be carried out as described in Section 6.4 and Section 6.5.

**Caution:** **When in test mode, connect the antenna socket to a dummy load to prevent interference with trunking systems. Avoid testing on channels in use locally.**

# 6.4 Transmitter Adjustments

In this Section, deviation settings are given first for wide band, followed by settings for medium band in brackets ( ) and settings for narrow band in square brackets [ ].

## 6.4.1 Power Output

Set up the test equipment as shown in Section 4, and close the PTT switch.

Turn RV324 fully clockwise and check that the output power is greater than 30W for all channels.

Select a channel programmed for high power and adjust RV324 for 25W.

Check that the transmit current is approximately the values stated below:

| Model | Current |
|---|---|
| T2000-100 | 6A |
| T2000-200 | 6A |
| T2000-300 | 6A |
| T2000-400 | 6A |
| T2000-500 | 6.5A |
| T2000-600 | 7A |
| T2000-700 / 900 | 6.5A |
| T2000-800 | 6A |

Select a channel programmed for low power and adjust RV507 for the required output power.

 

## 6.4.2 TCXO Alignment

Close the PTT switch and monitor the transmit frequency with a frequency counter.

Adjust RV923 on the TCXO / Tx audio PCB for a channel frequency within ±100Hz at ambient temperature.

## 6.4.3 Dual Point Modulation Adjustment

DC isolate the audio generator from TSP901 using a capacitor (10µF is sufficient).

Set the audio generator to 7kHz and inject the audio into the dual point modulation input TSP901 on the TCXO / Tx audio PCB.

Close the PTT switch and select the **lowest frequency channel**.

Adjust the audio generator level to give a reading of ±5.2kHz deviation on the modulation meter.

Remove any filters selected on the deviation or modulation meter which could give erroneous readings.

Select the **highest frequency channel** and check that the deviation is ±4.8kHz.

If not, adjust the audio generator output level so that the average deviation of the two channels is ±5kHz.

**The difference in deviation between the two channels must be less than ±800Hz.**

Select the **lowest frequency channel**, set the audio generator to 70Hz and inject the audio at TSP901.

Adjust RV222 to give ±4.8kHz deviation on the modulation meter.

Select the **highest frequency channel** and check that the deviation is ±5.2kHz.

If not, adjust RV222 so that the average deviation of the two channels is ±5kHz.

**The difference in deviation between the two channels must be less than ±400Hz.**

 

### 6.4.4 CTCSS Modulation Adjustment

The following instructions apply only to those radios with CTCSS activated and must be carried out before any further modulation adjustment can proceed.

Refer to the T2000 Programming Manual for the CTCSS channel programming instructions. The frequency range of the CTCSS tone is 67 to 250.3Hz.

Switch to any channel with CTCSS activated.

Close the PTT switch.

Adjust RV906, on the TCXO PCB, to set the CTCSS tone peak deviation for ±660Hz ±100Hz (±530Hz ±80Hz) [±330Hz ±50Hz] on the modulation meter.

### 6.4.5 LTR Code Deviation Adjustment

Close the PTT switch and set up a continuous call. This can be an LTR Repeater Talkaround call, a Repeater Interconnect Call (RIC) or an on-channel call.

Adjust RV906 on the TCXO PCB to set the LTR code deviation to ±1kHz (±900Hz) [±600Hz].

**Note:** The deviation meter must have a good low frequency response to avoid incorrect readings.

### 6.4.6 Modulation Adjustment

Complete the dual point modulation and CTCSS modulation adjustments (Section 6.4.3 and Section 6.4.4) before commencing the modulation adjustment.

Apply a 3kHz sine wave at a level of -40dBm to the microphone input.

Select a channel with CTCSS activated and close the PTT switch. If CTCSS is disabled, select any channel.

Adjust RV907 for a +5kHz (+4kHz) [+2.5kHz] deviation reading on the modulation meter.

Maintain the same sine wave output level and sweep the audio frequency from 300Hz to 3.3kHz.

Find the frequency of maximum '+' deviation and readjust RV907 for +5kHz (+4kHz) [+2.5kHz] deviation.

Reset the modulation meter to read '-' deviation.

Slowly sweep the audio frequency from 300Hz to 3kHz. If the '-' deviation peak is found to exceed -5kHz (-4kHz) [-2.5kHz], readjust RV907 for a peak deviation of -5kHz (-4kHz) [-2.5kHz] at that frequency.

The peak deviation should not exceed ±5kHz (±4kHz) [±2.5kHz] on any channel.

 

## 6.4.7 Selcall Tone Deviation

This is normally preset at 60% of voice deviation. If adjustment is needed, fit #RV508 (refer to Section 7 for a component description) to the logic PCB, and proceed as follows.

2

Adjust #RV508 for ±3kHz (±2.4kHz) [±1.5kHz] deviation reading on the modulation meter.

Check to ensure that no limiting occurs in IC901.

## 6.4.8 FFSK Adjustment (Trunked Models Only)

### 6.4.8.1 T203X Radios

Enter test mode (refer to Section 5.8, “Trunked Radios: Test Mode”).

Press the front panel **clear** key ⊗ .

Adjust #RV599 for ±3kHz ±200Hz (±2.4kHz ±160Hz) [±1.5kHz ±100Hz] deviation reading on the modulation meter.

### 6.4.8.2 T2040 Radios

Enter test mode (refer to Section 5.8, “Trunked Radios: Test Mode”).

Select test function 10 using the control head.

Adjust #RV599 for ±3kHz ±200Hz (±2.4kHz ±160Hz) [±1.5kHz ±100Hz] deviation reading on the modulation meter.

# 6.5 Receiver Adjustments

In this Section, deviation settings are given first for wide band, followed by settings for medium band in brackets ( ) and settings for narrow band in square brackets [ ].

## 6.5.1 RF Alignment

Set up the test equipment as shown in Section 4, and select the **highest possible frequency** in the operating band.

Set the signal generator to the required receive frequency with modulation set for ±3kHz (±2.4kHz) [±1.5kHz] deviation at 1kHz AF and an output level of -100dBm.

Using the receiver tuning amplifier circuit shown in Figure 6.2, adjust RV1 until the voltage of point A equals 3.0V DC, measured on a 1MΩ digital multimeter.

Connect the receiver tuning amplifier to the RSSI output on pin 15 of S14 (logic PCB) and monitor the output on an oscilloscope (1V / division, DC coupled).

If the output on the oscilloscope is 0V DC, increase the RF input level above -100dBm until the output level just starts to rise.

Adjust L104, L106, L105, L114, L116 and L203, in this order, to give maximum amplitude.

**Note:** L203 is not used in the T2000-200.

While tuning the coils, adjust the signal generator output so that the level on the oscilloscope does not exceed 6V DC.

Monitor the audio output at the speaker terminals and adjust L119 for maximum amplitude.

Set the squelch control (RV153) to minimum and connect a sinad meter across the speaker terminals.

Decrease the signal generator output until a 12dB sinad is reached.

The signal generator output should not be greater than -117dBm.

Switch to the **lowest possible frequency** in the operating band, and check that the receiver sensitivity is better than -117dBm.

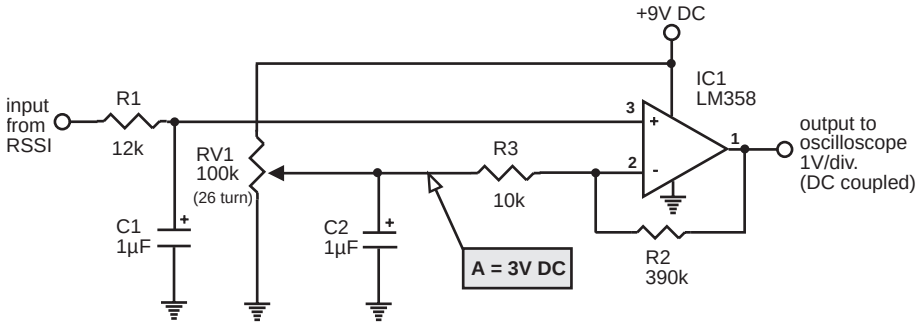


*Figure 6.2 Receiver Tuning Amplifier*

## 6.5.2 Internal Mute Control

If required, the mute setting can be adjusted internally as follows.

Align the receiver, as described in Section 6.5.1.

Adjust RV153 fully clockwise.

Set the signal generator to the required receive frequency.

Set the modulation for ±3kHz (±2.4kHz) [±1.5kHz] deviation at 1kHz AF.

Adjust the signal generator output for 11dB sinad.

Adjust RV153 so that the radio mutes then turn RV153 until the mute gate just opens.

## 6.5.3 RSSI

The T2000 RSSI is non-adjustable and should operate over an approximate 50dB range.

Monitor the RSSI output on pin 15 of S14 on the logic PCB.

Set the signal generator to the required receive frequency with modulation set for ±3kHz (±2.4kHz) [±1.5kHz] deviation at 1kHz AF and an output level of -70dBm.

Decrease the signal generator output in 10dB steps to -120dBm, noting the RSSI output at each step.

The RSSI should have a typical slope of approximately 540mV/10dB, from -120dBm to -70dBm RF input.

### 6.5.3.1 'L' Level Set-Up (Trunked Radios Only)

These levels are factory set at the time of manufacture and will require reprogramming only if the receiver has been realigned or has had parts replaced, or if the logic PCB has been replaced.

Set the signal generator to give an unmodulated RF signal in the centre of the trunking band.

Enter test mode.

**Note:** The T203X will need to use CCTM, as described in Section 5.8.3.

Set the signal generator to -108dBm and program 'L1' (function 61), as described in Section 5.8.5.2.

Set the signal generator to -100dBm and program 'L2' (function 62), as described in Section 5.8.5.2.

 