3 T885 Initial Tuning & Adjustment

Caution: **This equipment contains CMOS devices which are susceptible to damage from static charges. Refer to Section 1.2 in Part A for more information on anti-static procedures when handling these devices.**

Note: To ensure that the T885 will continue to meet its performance specifications, you must tighten the bottom cover screws to the correct torque, and in the correct order, as described in Section 2.4 in Part A.

The following section describes both short and full tuning and adjustment procedures and provides information on:

- channel programming
- selecting the required audio links
- synthesiser alignment
- receiver front end and IF alignment
- noise and carrier level mute adjustment
- setting the line and monitor output levels
- setting up the RSSI.

Note: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 3.00 and later of the software.

Refer to Section 6 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components and test points on the main PCB.

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3.1 Introduction

When you receive your T885 receiver it will be run up and working on a particular frequency (the "default channel")[1]. If you want to switch to a frequency that is within the 6MHz switching range (i.e. ±3MHz from the factory programmed frequency), you should only need to reprogram the receiver with the PGM800Win software (refer to the PGM800Win programming kit and Section 3.2 below).

However, if you want to switch to a frequency outside the 6MHz switching range, you will have to reprogram and re-tune the receiver to ensure correct operation. In this case you should carry out the short tuning procedure described in Section 3.4.

If you have carried out repairs or other major adjustments, you must carry out the full tuning and adjustment procedure described in this section (except for Section 3.4).

3.2 Channel Programming

You can program up to 128 channel frequencies into the receiver's EEPROM memory (IC820) by using the PGM800Win software package and an IBM™ PC. You can also use PGM800Win to select the receiver's current operating frequency (or "default channel").

If the receiver is installed in a rack frame, you can program it via the programming port in the speaker panel. However, you can also program the receiver before it is installed in a rack frame as follows:

- by using a T800-01-0010 calibration test unit;
- via D-range 1;
- via D-range 2 (standard T800-03-0000 auxiliary D-range only);
- via SK805 (internal Micromatch connector).

If you do not use the T800-01-0010, you will have to connect the PC to the receiver via a module programming interface (such as the T800-01-0004).

For a full description of the channel programming procedure, refer to the PGM800Win programming software user's manual.

Note: When an auxiliary D-range kit (D-range 2 - T800-03-0000) is fitted, you can also select a channel with an external switch, such as the DIP switch on the rack frame backplane PCB. Refer to Part C in the T800 Series Ancillary Equipment Service Manual (M800-00-101 or later issue) or consult your nearest Tait Dealer or Customer Service Organisation for further details.

1. Use the "Read Module" function in PGM800Win to find out what the default channel is.

3.3 Test Equipment Required

You will need the following test equipment:

- computer with PGM800Win installed
- T800 programming kit
- module programming interface (e.g. T800-01-0004 - optional)
- 13.8V power supply
- digital multimeter
- audio signal generator
- RF signal generator
- audio voltmeter
- sinad meter

} or RF test set (optional)

- oscilloscope
- distortion meter

} not needed for short tuning procedure

- T800-01-0010 calibration test unit (optional)
- 4Ω speaker (not needed if the calibration test unit is used)

Figure 3.1 and Figure 3.2 show typical test equipment set-ups (with and without a T800-01-0010 calibration test unit).

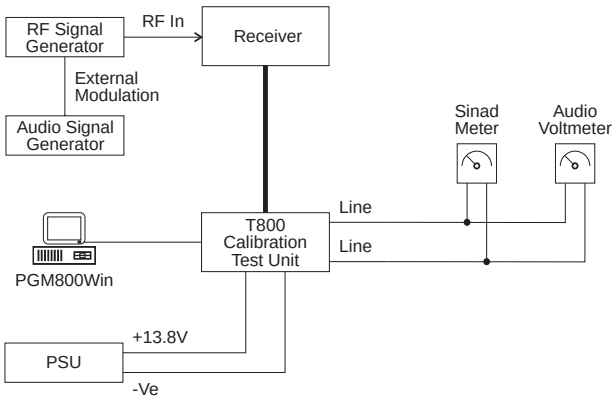

Figure 3.1 T885 Test Equipment Set-up For Short Tuning Procedure

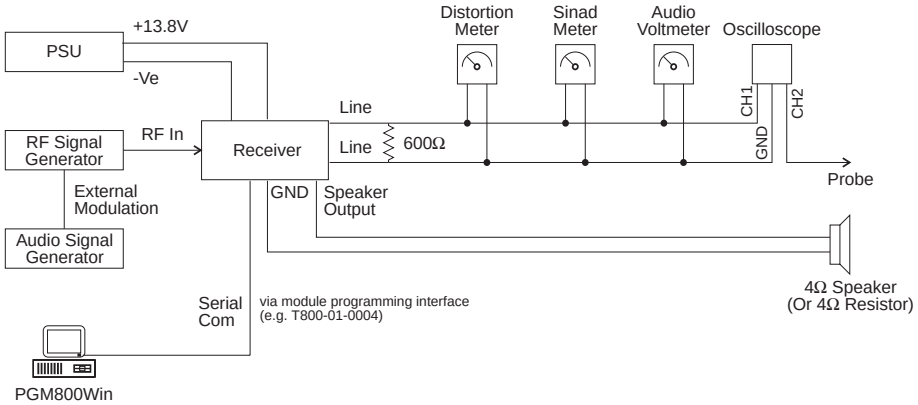

Figure 3.2 T885 Test Equipment Set-up For Full Tuning & Adjustment Procedure

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3.4 Short Tuning Procedure

Use this procedure only if you want to reprogram the receiver to a frequency outside the 6MHz switching range and do not intend to carry out any other major adjustments or repairs.

3.4.1 Introduction

Reprogram the operating frequency as described in the PGM800Win programming kit (refer to Section 3.2).

Remove the top cover (nearest the handle).

Set up the test equipment as described in Section 3.3.

Set the links in the audio processor section as required (refer to Section 3.5).

3.4.2 Synthesiser Alignment

- Connect a high impedance voltmeter to the via next to R520 in the VCO cavity (this measures the synthesiser loop voltage).

- **Single Channel** Tune VCO trimmer CV500 for a synthesiser loop voltage of 10V.

  Multichannel Tune VCO trimmer CV500 for a synthesiser loop voltage of 10V on the middle channel.

  If there is no middle channel, tune CV500 so that the channels are symmetrically placed around a loop voltage of 10V.

  All channels should lie within the upper and lower limits of 16V and 3V respectively.

  Do not attempt to program channels with a greater frequency separation than the specified switching range of 6MHz.

3.4.3 Front End Alignment

Note 1: In this and following sections deviation settings are given first for wide bandwidth sets, followed by settings in brackets for narrow bandwidth sets [ ].

Note 2: For multichannel operation align the receiver on a frequency in the middle of the required band.

Set RV230 (front panel gating sensitivity) fully clockwise.

Inject a strong on-channel RF signal with ±3kHz deviation [±1.5kHz] at 1kHz into the antenna socket and adjust the helical resonators (#H900, #H400 and #H401) to give best sinad.

Continually decrease the RF level to maintain 12dB sinad.

Readjust #H900, #H400 and #H401 to give best sinad.

With PL210 and PL220 connected for de-emphasised audio response, the receiver sensitivity should be better than -117dBm, assuming that the audio levels are not being overdriven (refer to Section 3.4.5).

3.4.4 Mute Adjustment

3.4.4.1 Noise Mute

Connect pins 1 & 2 of PL250 to enable the noise mute.

Set the RF level to -105dBm with ±3kHz deviation [±1.5kHz] at 1kHz.

Set RV230 (front panel gating sensitivity) fully anticlockwise.

Adjust RV346 (noise mute gain) fully anticlockwise to close the mute (if necessary turn off the RF signal and then turn it on again).

Rotate RV346 clockwise until the mute just opens.

Reset the signal generator for the required opening sinad and adjust RV230 clockwise until the mute just opens.

3.4.4.2 Carrier Level Mute

Connect pins 2 & 3 of PL250 to enable the carrier mute and disable the noise mute.

Apply an on-channel signal from the RF generator at the required mute opening level with ±3kHz deviation [±1.5kHz] at ±1kHz.

Adjust RV235 (carrier mute) anticlockwise to close the mute (if necessary, momentarily turn off the RF), then slowly adjust it clockwise until the mute just opens. The mute should now open at this preset level.

3.4.5 Line Amplifier Output

Apply an on-channel signal from the RF generator at a level of -70dBm with ±3kHz deviation [±1.5kHz] at 1kHz.

Adjust RV210 (front panel line level) to set the line level to the required output level.

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3.4.6 CTCSS

3.4.6.1 Decoder Operation

Program a CTCSS tone on the default channel using PGM800Win.

Set the RF signal generator output to -70dBm.

Modulate the generator with both:

- a 1kHz tone at ±3kHz deviation [±1.5kHz]
- and a CTCSS tone at the programmed frequency at ±500Hz deviation [±300Hz].

Check that the receiver gate opens and the front panel "Gate" LED is on.

3.4.6.2 Opening Sinad

Adjust RV230 (front panel gating sensitivity) fully clockwise.

Reduce the RF signal level to -110dBm.

Observe the sinad meter and reduce the RF level until the receiver mute closes.

Slowly increase the signal level until the receiver mute just opens and stays open.

With PL240 pins 1 & 2 linked (high pass filter bypassed), check that the sinad is less than 6dB.

Reset the signal generator for the required opening sinad, adjust RV230 fully anti-clockwise, then clockwise until the mute just opens.

3.4.6.3 High Pass Filter

Set the audio processor links as follows:

Plug	Link	Function
PL210	1 - 2	de-emphasised response
PL230	2 - 3	audio from internal CTCSS speech filter
PL240	4 - 5	audio input via PL230 or I/O pad

Reset the RF signal generator output to -70dBm and note the line level (measurement A).

Reduce the 1kHz generator to zero output and measure the line level again (measurement B).

Check that measurement B is at least 30dB below measurement A.

3.4.7 RSSI (If Used)

Apply an on-channel signal from the RF generator at a level of -110dBm with ±3kHz deviation [±1.5kHz] at 1kHz.

Adjust RV345 (RSSI level) to give 2.0V RSSI output on pin 5 of D-range 1 (PL100) when measured with a high impedance DMM.

3.5 Audio Processor Links

3.5.1 General

Use the following table to set up the audio processor to the configuration you require. You should set the audio processor links before carrying out the receiver alignment. The factory settings are shown in brackets [ ].

Plug	Link[a]	Function
PL210	[1 - 2] 2 - 3	de-emphasised response flat response
PL220	1 - 2 [2 - 3]	flat response de-emphasised response
PL230[b]	1 - 2 [2 - 3] 3 - 4	audio input via AUDIO-2 pad audio from internal CTCSS speech filter audio input via I/O pad P250
PL240[b]	1 - 2 [2 - 3] or 3 - 4 4 - 5	bypass high pass filter 300Hz high pass filter in circuit audio input via PL230 or I/O pad
PL250	[1 - 2] 2 - 3	noise mute carrier mute
PL260	1 - 2 [2 - 3]	RX-DISABLE link not connected
PL270	[1 - 2] 2 - 3	relay link not connected

a. Pin 1 is identified by the number "1" screen printed onto the PCB beside each set of links.

b. Refer to Section 3.5.2 for further details.

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3.5.2 Audio Processor Linking Details For CTCSS

You must connect the audio processor links correctly according to the CTCSS option used, as shown in the table below.

CTCSS Option	PL230[a]	PL240[a]
standard, no CTCSS	2 - 3	2 - 3
received CTCSS + speech passed to line output	3 - 4	1 - 2
high pass filtered speech, internal CTCSS detection	2 - 3	4 - 5
external CTCSS detection	1 - 2	4 - 5

a. Pin 1 is identified by the number "1" screen printed onto the PCB beside each set of links.

The conditions stated in the above table are defined as follows:

- standard, no CTCSS
  - no CTCSS or other sub-audio signalling used
  - audio bandwidth 300Hz to 3kHz
  - hum & noise -50dB
- received CTCSS tone + speech to line output
  - tone and speech transmitted down 600 ohm line
  - audio bandwidth 10Hz to 3kHz
  - hum & noise -45dB
- high pass filtered speech + internal CTCSS detection
  - 400Hz to 3kHz
  - hum & noise -25dB with 250.3Hz tone present
- external CTCSS detection
  - decoding performed through the receiver (but externally)
  - speech injected back into receiver via "AUDIO-2" and sent down 600 ohm line

Note 1: AUDIO-2 is available on D-range 1 (PL100) pin 7 via the link resistor R160. Although PL100 pin 7 is already assigned to SERIAL-COM, this can be disabled by removing R808.

Note 2: External CTCSS units can connect in series with the audio chain via AUDIO-1 and AUDIO-2.

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3.6 Synthesiser Alignment

- Ensure that the receiver has been programmed with the required frequencies using the PGM800Win software.

- Connect a high impedance voltmeter to the via next to R520 in the VCO cavity (this measures the synthesiser loop voltage).

- **Single Channel** Tune VCO trimmer CV500 for a synthesiser loop voltage of 10V.

  Multichannel Tune VCO trimmer CV500 for a synthesiser loop voltage of 10V on the middle channel.

  If there is no middle channel, tune CV500 so that the channels are symmetrically placed around a loop voltage of 10V.

  All channels should lie within the upper and lower limits of 16V and 3V respectively.

  Do not attempt to programme channels with a greater frequency separation than the specified switching range of 6MHz.

- The TCXO =(IC700) output frequency should be trimmed when the IF is tuned - refer to Section 3.7.

3.7 Alignment Of Receiver Front End And IF

Note: In this and following sections deviation settings are given first for wide bandwidth sets, followed by settings in brackets for narrow bandwidth sets [ ].

Align the synthesiser as instructed in Section 3.6. For multichannel operation align the receiver on a frequency in the middle of the required band.

Set RV230 (front panel gating sensitivity) fully clockwise.

Inject a strong on-channel RF signal with ±3kHz deviation [±1.5kHz] at 1kHz into the antenna socket.

Connect a voltmeter to the RSSI output (D-range 1 [PL100] pin 5 or P238 in the audio processor cavity) and adjust the helicals (#H900, #H400 and #H401) to give maximum RSSI voltage. While adjusting the helicals, decrease the RF level to keep the RSSI voltage below 7V.

Adjust L345 coarsely for maximum line level.

While maintaining a low level unmodulated RF input to the receiver, loosely couple into the first IF an additional high level signal at 45MHz - you will hear a beat note.

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Trim the synthesiser TCXO (=IC700) for zero beat.

Note: If a second oscillator is not available, you can connect a frequency counter to IC710 pin 8 (i.e. after the TCXO buffer) via an oscilloscope probe to measure the TCXO frequency directly (12.8MHz). At this point the voltage level is approximately 4V p-p.

Readjust the front end helicals (#H900, #H400 and #H401) to give the best sinad.

Change the RF signal level to -75dBm and modulate with ±3kHz deviation [±1.5kHz] at 1kHz.

Adjust L345 and then L301 for minimum distortion. If the distortion is still >2%, you may have to adjust L345 and L301 alternately until you reach the true minimum.

Check that the distortion reading is:

wide bandwidth	<2%
narrow bandwidth	<4%.

If required, reconnect plugs PL210 and PL220 to give a de-emphasised audio response and check that the distortion reading is <2% (all bandwidths).

Reduce the RF level until 12dB sinad is reached. The receiver sensitivity should be better than -117dBm (de-emphasised) or -111dBm (flat), assuming that the audio levels are not being overdriven (refer to Section 3.12).

3.8 Gating Delay

Two solder links (SL210 & SL220) are provided in the audio processor cavity to allow three gate delay time options, as shown in the table below.

SL210	SL220	Closing Delay
linked	not linked	<50ms*
not linked	linked	<25ms
not linked	not linked	<20ms

*Factory setting.

3.9 Noise Mute Adjustment

Connect pins 1 & 2 of PL250 to enable the noise mute.

Align the receiver as instructed in Section 3.6 and Section 3.7.

Set the RF level to -105dBm with ±3kHz deviation [±1.5kHz] at 1kHz.

Set RV230 (front panel gating sensitivity) fully anticlockwise.

Adjust RV346 (noise mute gain) fully anticlockwise to close the mute (if necessary turn off the RF signal and then turn it on again).

Rotate RV346 clockwise until the mute just opens.

Reset the signal generator for the required opening sinad and adjust RV230 clockwise until the mute just opens.

3.10 RSSI

Align the receiver as instructed in Section 3.6 and Section 3.7.

Apply an on-channel signal from the RF generator at a level of -110dBm with ±3kHz deviation [±1.5kHz] at 1kHz.

Adjust RV345 (RSSI level) to give 2.0V RSSI output on pin 5 of D-range 1 (PL100) when measured with a high impedance DMM.

3.11 Carrier Level Mute

Connect pins 2 & 3 of PL250 to enable the carrier mute and disable the noise mute.

Apply an on-channel signal from the RF generator at the required mute opening level with ±3kHz deviation [±1.5kHz] at ±1kHz.

Adjust RV235 (carrier mute) anticlockwise to close the mute (if necessary, momentarily turn off the RF), then slowly adjust it clockwise until the mute just opens. The mute should now open at this preset level.

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3.12 Audio Processor

3.12.1 Line Amplifier Output

Apply an on-channel signal from the RF generator at a level of -70dBm with ±3kHz deviation [±1.5kHz] at 1kHz.

Adjust RV210 (front panel line level) to give an output of +10dBm on the 600 ohm line.

Check for any clipping or distortion on the oscilloscope.

Set the line level to the required output level.

3.12.2 Monitor Amplifier Output (Speaker Output)

Adjust RV205 (front panel monitor volume) to give an output of 2V rms into a 4 ohm resistive load.

Check for any clipping or distortion on the oscilloscope.

Switch to a 4 ohm speaker and adjust RV205 to the required level.

3.13 CTCSS

3.13.1 Decoder Operation

Program a CTCSS tone on the default channel using PGM800Win.

Set the RF signal generator output to -70dBm.

Modulate the generator with both:

- a 1kHz tone at ±3kHz deviation [±1.5kHz]
- and a CTCSS tone at the programmed frequency at ±500Hz deviation [±300Hz].

Check that the receiver gate opens and the front panel "Gate" LED is on.

3.13.2 Opening Sinad

Adjust RV230 (front panel gating sensitivity) fully clockwise.

Reduce the RF signal level to -110dBm.

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Observe the sinad meter and reduce the RF level until the receiver mute closes.

Slowly increase the signal level until the receiver mute just opens and stays open.

With PL240 pins 1 & 2 linked (high pass filter bypassed), check that the sinad is less than 6dB.

Reset the signal generator for the required opening sinad, adjust RV230 fully anti-clockwise, then clockwise until the mute just opens.

3.13.3 High Pass Filter

Set the audio processor links as follows:

Plug	Link	Function
PL210	1 - 2	de-emphasised response
PL230	2 - 3	audio from internal CTCSS speech filter
PL240	4 - 5	audio input via PL230 or I/O pad

Reset the RF signal generator output to -70dBm and note the line level (measurement A).

Reduce the 1kHz generator to zero output and measure the line level again (measurement B).

Check that measurement B is at least 30dB below measurement A.

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