T830 Series II

Base Station Equipment

Service Manual

Preliminary Issue

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(Not For Resale)

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About This Manual

Scope

This manual contains preliminary servicing information on T830 Series II 25W, 50W and 100W base stations which comprise the following equipment:

25W base station	T835 receiver T836 25W transmitter
50W base station	T835 receiver T837 exciter T838 50W power amplifier
100W base station	T835 receiver T837 exciter T839 100W power amplifier

Contents

Part A contains information on the following procedures:

- changing the operating frequency
- retuning the module after changing frequency
- configuring the audio processor
- T838/839 user information

Parts B to G contain the following PCB information:

- parts lists
- grid reference indexes
- PCB layout diagrams
- test points & options diagrams
- circuit diagrams

Part H contains the following information on the T800-22-0000 rack frame:

- general information
- circuit operation
- parts lists
- PCB layout diagrams

Technical Information

Any enquiries regarding this manual or the equipment it describes should be addressed in the first instance to your nearest approved Tait Dealer or Service Centre. Further technical assistance and copies of this manual may be obtained from the Customer Support Group, Radio Infrastructure Division, Tait Electronics Ltd, Christchurch, New Zealand.

Date Of Issue

T830 Series II Preliminary Service Manual published August 1997

Table Of Contents

Using The Parts Lists

In this manual there are separate parts lists for each product type. The table below shows which lists to use for each product type.

To refer to the parts list for a . . .	use the following sections . . .	
	T835/T836/T837	T838/T839
T83X-10	D83X-10-001 XE83X-10-001	D83X-10-0300 XE83X-10-0300
T83X-13	D83X-13-001 XE83X-13-001	
T83X-15	D83X-15-001 XE83X-15-001	
T83X-20	D83X-20-001 XE83X-20-001	D83X-20-0300 XE83X-20-0300
T83X-23	D83X-23-001 XE83X-23-001	
T83X-25	D83X-25-001 XE83X-25-001	
T83X-1X VCO	XE83XV10	
T83X-2X VCO	XE83XV20	

Overview

Introduction

When you receive the T800 module it will be run up and working on a particular frequency. Sometimes you may want to change the operating frequency. In some cases, when you change the operating frequency, it will also be necessary to re-tune the radio to ensure correct operation.

Purpose of this document

It is the purpose of this document to familiarise you with the procedures that must be carried out to check that the radio is still operating correctly, and how to re-tune the radio when this is not the case.

In this section

This section covers the following topics:

How to change the operating frequency

Description

There are two possible ways of changing the operating frequency:

Method 1	**By using a computer running PGM800Win and** • Changing the default channel in the existing setup or • Reprogramming the radio channel frequencies and then selecting a default channel NOTE: Please refer to the T830 service manual and the PGM800WIN programming manual for further instruction.
Method 2	**By selecting a new channel using the DIP switch on the rear of the PCB Backplane or some other form of installed channel change switch i.e. BCD, Internal DIP switch.**

After changing the operating frequency

Having changed the operating frequency of the T830 there are two different scenarios you will be faced with:

- You will change the frequency and the T830 will continue to operate correctly. In this case you have changed to a frequency within the switching band of the radio.
- You will change the frequency and the T830 will not operate or will not operate correctly. In this case you have changed to a frequency outside of the switching band.

Note: The radio must now be re-tuned (see next section "How to re-tune the T835" & "How to re-tune the T836/837").

What is the switching band

Because of the high RF performance of the T800 series there is a limit to the amount of frequencies that the radio can switch to before re-tuning must occur. The limit is referred to as the switching bandwidth.

- The T830 Rx can switch up to 3MHz.
- The T830 Tx can switch up to 8MHz.

So if the T830 is optimally tuned to a centre frequency (which is often the case when sent from the factory) then the Rx or Tx will be able to switch half the switching band either side of that frequency.

Example

A T830 receiver has been tuned optimally for 460MHz. Therefore, it's switching range is 460-1.5MHz to 460+1.5MHz. i.e. 458.5MHz to 461.5MHz.

How to re-tune the T835

Equipment required

You will need:

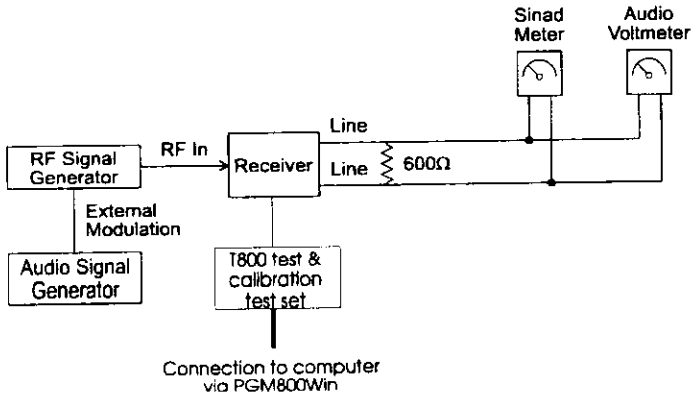
Computer with PGM800Win installed
T800 programming kit
T800 test & calibration unit
Digital multimeter
Audio signal generator
RF signal generator
Audio voltmeter
Sinad meter

or

Computer with PGM800Win installed
T800 programming kit
T800 test & calibration unit
RF test set

Before you start

- Remove the top cover of the module (the side closest to the handle).
- Set up the test equipment as shown below.



- Set the jumpers in the audio section of the module as required (see section "Configuring the Audio Processor").
- Connect the computer to the module using the PGM800Win programming kit.

How to re-tune the T835 cont..

Steps involved

The service manual has a section which describes a full Initial Tuning and Adjustment procedure. This must be used if a repair has been made or some other major characteristic has been changed. If the only adjustment made has been to switch to a channel outside the switching band, then the following steps should be followed.

- Change the operating frequency
- Lock the VCO
- Align the front end
- Set the noise mute
- Set the line output level

The procedure is described below.

Procedure

Follow the steps below to retune the T835 if the frequency has been changed and the radio stops operating.

Step	Action
Lock the VCO	
1	Connect a high impedance voltmeter to the long lead of L1 in the VCO (this measures the synthesiser loop voltage.
2	**Single channel** Tune VCO trimmer C6 for a synthesiser loop voltage of 10V. **Multichannel** Tune VCO trimmer C6 for a synthesiser loop voltage of 10V on the middle channel. If there is no middle channel, tune C6 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.

Align the front end Settings are first given for wide band sets, followed in brackets by settings for narrow band [ ]. For multichannel operation the receiver should be aligned on a middle frequency.	
Frequency range	136-156MHz: With the power supply switched off, solder bridge links SL405, 410, 415, 430, 435, 440 and link B in the front end 148-174MHz: Solder bridge link A and ensure links SL405, 410, 415, 430, 435, 440 linkB are not connected.
1	Inject a strong on-channel RF signal with 3kHz deviation [1.5kHz] at 1kHz into the antenna socket and adjust L410, L420, L460 & L470 to give best sinad.
2	Continually decrease the RF level to maintain 12dB SINAD.
3	Readjust the front end doublets (L410, L420, L460 & L470 to give best sinad.
4	The receiver sensitivity should be better than -117dBm, assuming that the audio levels are not being overdriven (refer to Line Amplifier Output below).
Set the noise mute	
1	Connect pins 1&2 of PL250 to enable the noise mute.
2	Set the RF level to -105dBm with 3kHz deviation [1.5kHz] at 1kHz.
3	Set RV230 (gate sensitivity) fully anticlockwise.
4	Adjust RV330 to close the mute (if necessary turn off the RF signal and then turn it on again).
5	Rotate RV330 anticlockwise until the mute just opens.
6	Adjust RV230 (gate sensitivity) on the front panel for the required opening sinad.
Set the line output level	
1	Apply an on-channel signal from the RF generator at a level of -70dBm with 3kHz deviation [1.5kHz] at 1kHz.
2	Adjust the front panel line level pot. (RV210) to give an output of +10dBm on the 600 ohm line.
3	Set the line level to the required output level.

How to re-tune the T836/837

Equipment required

You will need:

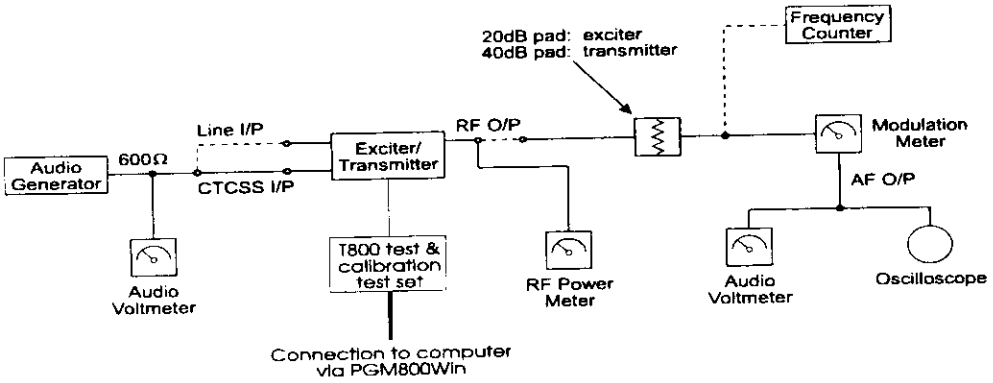
Computer with PGM800Win installed
T800 programming kit
T800 test & calibration unit
Digital multimeter
Oscilloscope (digital preferred)
Audio signal generator
Audio voltmeter x 2
RF power meter
Modulation meter
20dB pad

or

Computer with PGM800Win installed
T800 programming kit
T800 test & calibration unit
RF test set

Before you start

- Remove the top cover of the module (the side closest to the handle).
- Set up the test equipment as shown below.



- Set the jumpers in the audio section of the module as required (see section "Configurring the Audio Processor").
- Connect the computer to the module using the PGM800Win programming kit.

How to re-tune the T836/837 cont..

Steps involved

The service manual has a section which describes a full Initial Tuning and Adjustment procedure. This must be used if a repair has been made or some other major characteristic has been changed. If the only adjustment made has been to switch to a channel outside the switching band, then the following steps should be followed.

- Change the operating frequency
- Lock the VCO to produce the output frequency
- Adjust the output power
- Set the dual point modulation
- Set the FM deviation
- Reset the line-in level

The procedure is described below.

Procedure

Follow the steps below to retune the T836 or T837 if the frequency has been changed and the radio stops operating.

Step	Action
Lock the VCO to produce the output frequency	
1	Connect a high impedance voltmeter to the long lead of L1 in the VCO (this measures the synthesiser loop voltage.
2	**Single channel** Tune VCO trimmer C6 for a synthesiser loop voltage of 10V. **Multichannel** Tune VCO trimmer C6 for a synthesiser loop voltage of 10V on the middle channel. If there is no middle channel, tune C6 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.

Adjust the Output power (T856 only)	
1	Connect an RF power meter to the output socket and key the transmitter
2	Set power control RV320 fully clockwise
3	Adjust CV451 for maximum output power and check that this exceeds 30W
4	Adjust power control RV320 for required power output
5	Readjust CV451 to reduce the supply current by up to 0.5A.
Set the dual point modulation (to maximise the modulation response). Settings are first given for wide band sets, followed in brackets by settings for narrow band [ ]	
Multiple channels	• To optimise the modulation response across the switching band repeat steps 1-4 for each channel that will be used (usually only needed for data applications). • For usage where the modulation response is less critical (e.g. voice use only) follow steps 1-4 on the middle channel and then cut and paste the value for all other channels.
1	Inject an audio signal of 600Hz 1.5Vrms (+5dBm) into the CTCSS input (D-range pin 8). Key the transmitter.
2	Adjust the output from the audio generator to obtain +/-3kHz [+/-1.5kHz] deviation at 600Hz.
3	Change the input frequency to 120Hz and using PGM800Win, adjust the "Reference modulation" (by using the mouse **or** up and down arrow keys) to obtain +/-3kHz [+/-1.5kHz] deviation.
4	Change the input frequency back to 600Hz. Repeat steps 2 and 3 above until the deviations achieved at the two input frequencies are within 0.2dB of each other. This will need to be done at least four time.
5	Sweep the audio between 50 and 300Hz for peaks. A peak indicates a fault condition (incorrect setup or modulation circuitry fault). The specification window is +/-1dB relative to 150Hz from 65 to 260Hz.

Set the FM deviation (limiter adjustment)	
1	Inject 1kHz at -10dBm into the line input (D-range pins 1 & 4; pins 2 & 3 shorted).
2	Adjust RV210 (line sensitivity) fully clockwise and earth the key line. Using PGM800Win, adjust the "Deviation" (by using the mouse **or** up and down arrow keys) to set the peak deviation to $^{+}$/-4.7kHz [$^{+}$/-2.3kHz].
3	Sweep the audio frequency from 100Hz to 4kHz and ensure that the maximum deviation does not exceed 4.7kHz [2.3kHz]. Re-adjust "Deviation" if necessary. Note: • If the radio is to be used over the whole switching bandwidth (8MHz) the deviation should be set for each channel. • If the frequencies to be switched over is less than 1MHz then the deviation can be set on the middle channel and this value used for all other channels using the "fill" option in PGM800Win.
Reset the line-in level	
1	Set the injected signal at the line input to the required line level (typically -10 to -20dBm).
2	Adjust RV210 (line sensitivity to provide $^{+}$/-3kHz [$^{+}$/-1.5kHz] deviation.

Configuring the Audio Processor

Introduction

There are a number of links in the T835, 836 & T837 that can be changed to configure the audio processor in various ways. The linking options are given below for each of the T830 modules followed by a block diagram of the audio processor and link configurations.

T835 audio processor links

Use the table below to set up the audio processor as you require it.

General

Plug	Link	Function
PL210	1 - 2 2 - 3	de-emphasised response flat response
PL220	1 - 2 2 - 3	flat response de-emphasised response
PL230	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	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 P250
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
Options should be selected before alignment of the receiver is attempted.		

Configuring the Audio Processor cont..

T835 audio processor links cont..

For CTCSS

The audio processor links must be appropriately connected for the CTCSS option used as shown in the table below.

CTCSS Option	PL230	PL240
standard, no CTCSS	2 - 3	2 - 3
received CTCSS tone + speech 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

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 -55dB

received CTCSS + 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

- decoding performed in receiver
- audio bandwidth 400Hz to 3kHz
- hum & noise -30dB with 250.3Hz tone present

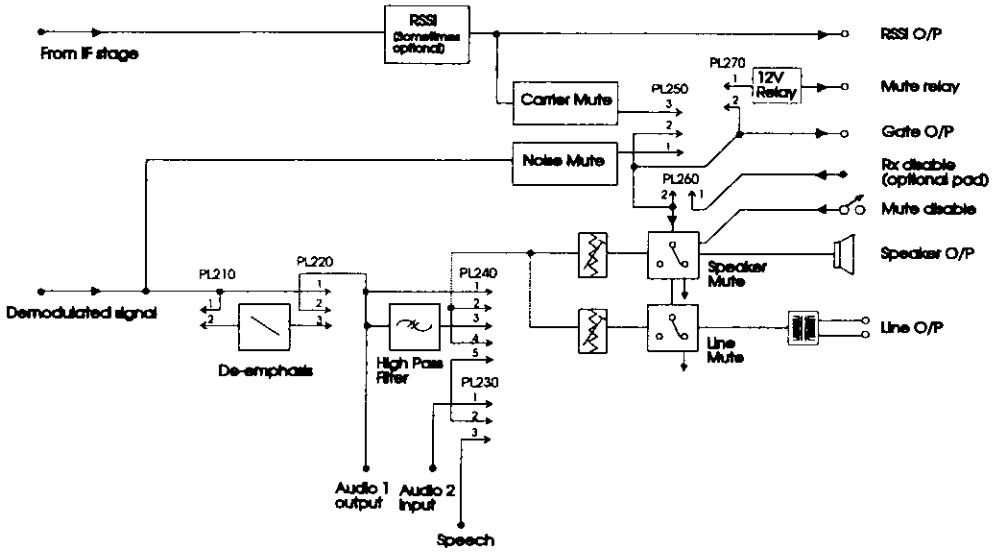
external CTCSS

- decoding performed through the receiver (but externally) by T310-05 or similar
- speech injected back into receiver via "audio 2" and sent down 600 ohm line

Note:

1) Audio 2 is available via D range connector PL100 Pin7 via the link resistor R160. PL100 Pin7 is already assigned to serial com. but this can be disabled by removing R808.

2) External CTCSS units can be connected in series with audio via Audio 1 and Audio 2.



T835 Audio processor block diagram showing link options

Configuring the Audio Processor cont..

T836/T837 audio processor links

Use the table below to set up the audio processor as you require it.

General

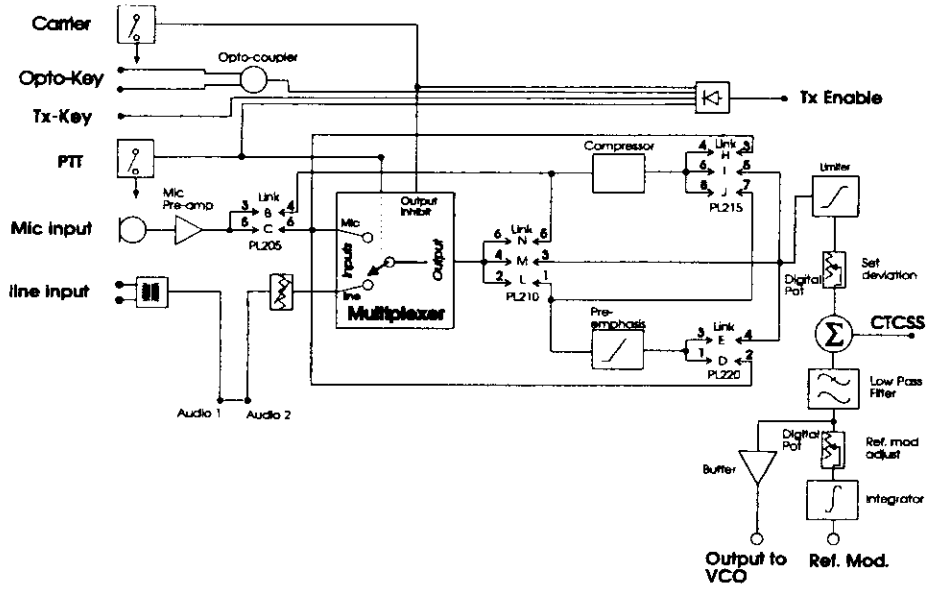
Plug	Link	Function
PL205	(A) 1 - 2 (B) 3 - 4 (C) 5 - 6	not connected microphone pre-amp. output to compressor input microphone pre-amp. output to multiplexer input
PL210	(L) 1 - 2 (M) 3 - 4 (N) 5 - 6	multiplexer output to pre-emphasis input multiplexer output to limiter input multiplexer output to compressor input
PL215	(G) 1 - 2 (H) 3 - 4 (I) 5 - 6 (J) 7 - 8 (K) 9 - 10	not connected compressor output to multiplexer input compressor output to limiter input compressor output to pre-emphasis input not connected
PL220	(D) 1 - 2 (E) 3 - 4 (F) 5 - 6	pre-emphasis output to multiplexer input pre-emphasis output to limiter input not connected

Typical options

	PL205	PL210	PL215	PL220
microphone pre-amp. compressed and pre-emphasised; line input pre-emphasised (standard set-up)	(B) 3 - 4	(L) 1 - 2	(H) 3 - 4	(E) 3 - 4
microphone pre-amp. compressed and pre-emphasised; line input unprocessed	(B) 3 - 4	(M) 3 - 4	(J) 7 - 8	(D) 1 - 2
line and microphone compressed and pre-emphasised	(C) 5 - 6	(N) 5 - 6	(J) 7 - 8	(E) 3 - 4
microphone pre-amp compressed; line and microphone flat response;	(B) 3 - 4	(M) 3 - 4	(H) 3 - 4	(F) 5 - 6

Configuring the Audio Processor cont..

T836/T837 audio processor links cont..



T836/837 Audio processor block diagram showing link options

How to determine if the T835/836/837 is still operating

Introduction

If the radio was working fine and you want to check that it is still operating correctly, after changing the operating frequency, follow the steps listed below.

Procedure

Follow the steps below to perform a quick check of correct operation.

Step	Action
1	Remove the top cover of the module (the side closest to the handle).
2	Connect a high impedance voltmeter to the long lead of L1n the VCO (this measures the synthesiser loop voltage.
3	Ensure the measured DC voltage is between 5 & 15V

Note: If the T835 Receiver is not operating this will be indicated by a slow flashing of the Green Supply light. This should be used as a visual check followed by the more definitive check given above.

Operating the power amplifiers

Introduction

The T838/839 power amplifiers are designed to operate at 50 Watts and 100 Watts respectively at ambient temperatures up to 60 degC. Operation at higher power or higher temperature will result in decreased service life.

We have designed two safeguards into the equipment. Please read about them below and note the warning when you install the equipment.

Equipment safeguards.

Maximum power clamp

This is to prevent over-dissipation in the power modules resulting in excess temperature rise. The level is factory preset and should not need field adjustment.

Warning: Should adjustment be necessary you must follow the procedure outlined next to prevent damage to the module. Turn front panel power control up full, adjust clamp potentiometer for 120W (T839) 60W (T838) and readjust front panel power control for 100W (T839) 50W (T838).

Multi point temperature sensed power turn down

In addition to the usual temperature sensor that controls the fan (T839), the heat-sink temperature of each power module is also sensed. Should the temperature rise excessively, by mis-adjustment or poor airflow, the output power will automatically reduce until the temperature is reduced.

Important

In all installations it important to ensure good airflow to ensure ambient temperature does not exceed 60 degC on any units in the rack. Rack mounted fans are recommended, particularly where several channels are installed in one cabinet.

2.9 T837 Exciter Drive Amplifier

(Refer to Figure 2.2 and the exciter circuit diagram (sheet 3) in Section 6.3.)

A two-stage, wide band amplifier (Q365, Q370) provides an output level of approximately 800mW (+29dBm) for an input of 170mW (+22dBm) from the VCO. IC330 pins 5, 6 & 7, Q310, and Q315 provide a 10.5V regulated supply for the exciter.

To reduce the spurious output level when the synthesiser is out-of-lock, the Tx-Reg. and Lock-Detect signals are gated to inhibit the exciter control circuit and to switch off the RF signal at the input to the drive amplifier. This is achieved by a PIN switch attenuator (D340, D350, D360).

Cyclic keying control is provided by additional circuitry consisting of several time delay, ramp and gate stages:

- Q305, IC330 pins 5, 6 & 7 — power ramping
- Q340, Q345 — Tx-Reg. and $\overline{\text{Lock-Detect}}$ gate
- Q320, Q325, Q330, Q335 — delay and PIN switch drive.

This is to allow the RF power circuits (both exciter and PA) to ramp up and down in a controlled manner so that minimal adjacent channel interference is generated during the transition.

R359, R360 and R362 form a 6dB attenuator to provide good VCO/drive amplifier isolation.

The output attenuator (R392, R390, R394, R396) assists in reducing exciter/PA interaction while also ensuring a good match for Q370.

Note: The exciter provides a DC control signal to the PA via the RF coax. This is injected via L390.

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EXCITER: 2.983 (d)(ic)

T830 Series II

Base Station Equipment

136-174MHz

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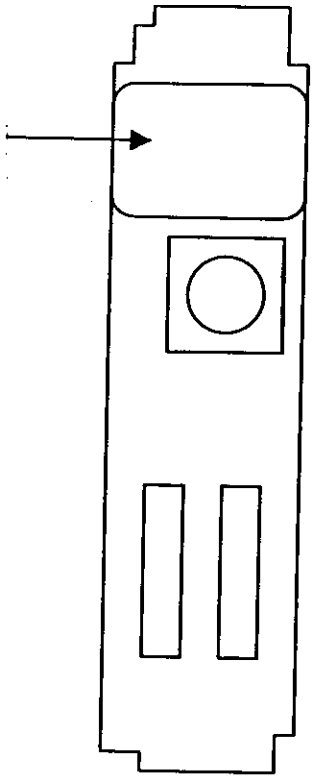
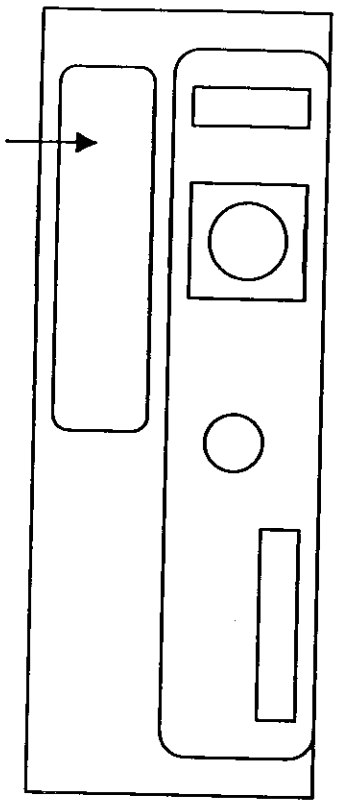
Receiver/Transmitter/Exciter



PA



Part C T836 Transmitter & T837 Exciter

This part of the manual is divided into six sections, as listed below. There is a detailed table of contents at the start of each section.

1.1 Introduction

The T836 is a synthesised, microprocessor controlled FM base station transmitter designed for single or multichannel operation in the 136 to 174MHz frequency range with a standard power output of 25W. The RF section of the transmitter comprises a frequency synthesiser which provides 170mW of frequency modulated RF drive to a two stage, wide band output driver followed by a 25W power amplifier. A thermal shutdown feature is provided in the T836 in case operating temperatures exceed acceptable levels.

The T837 is a synthesised, microprocessor controlled FM base station exciter designed for single or multichannel operation in the 136 to 174MHz frequency range. With a standard power output of only 800mW, the exciter is designed for use with the T838 50W or T839 100W power amplifiers. The RF section of the exciter comprises a frequency synthesiser which provides 170mW of frequency modulated RF drive to a two stage, wide band output amplifier.

A wide selection of audio characteristics may be obtained from the audio processor. Optional circuit blocks are an audio compressor and a pre-emphasis stage. They can be bypassed or linked to one or both audio inputs, and then back into the remaining audio circuitry in almost any combination. All audio processor options are link selectable.

The synthesiser frequency is programmed via the serial communications port. Eight channel select lines are accessible via an optional D-range connector (D-range 2 - T800-03-0000) at the rear of the set.

All components except those of the VCO are mounted on a single PCB. This is secured to a die-cast chassis which is divided into compartments to individually shield each section of circuitry. Access to both sides of the main circuit board is obtained by removing each of the chassis lids. There is provision within the chassis to mount small option PCBs.

The front panel controls include line sensitivity, microphone socket and carrier switch. This switch turns on the carrier (unmodulated) as an aid to servicing.

The T836 and T837 are both 60mm wide and each occupies a single space in a Tait rack frame, which has the ability to accommodate up to seven standard modules.

Dimensions:

Height	.. 183mm
Width	.. 60mm
Length	.. 320mm

Weight	.. 2.1kg
Time-Out Timer (optional)	.. 0 to 5 minutes adjustable in 10 second steps
Tail Timer	.. 0 to 5 seconds adjustable in 100ms steps
Transmit Key Time	.. <30ms
Transmit Lockout Timer	.. 0 to 1 minute adjustable in 10 second steps

1.2.3 RF Section

Frequency Range	.. 136-174MHz (refer to Section 1.4 and Section 1.5)
Modulation Type	.. FM
Frequency Increment	.. 5 or 6.25kHz
Switching Range	.. 8MHz
Load Impedance	.. 50 ohms
Frequency Stability (see also Section 1.4 and Section 1.5)	.. ±2.5ppm, -30°C to +60°C

Adjacent Channel Power (full deviation):

Wide Bandwidth (WB) (±25kHz/15kHz B/W)	.. -75dBc
Mid Bandwidth (MB) (±20kHz/12kHz B/W)	.. -70dBc
Narrow Bandwidth (NB) (±12.5kHz/7.5kHz B/W)	.. -65dBc

Transmitter Side Band Noise:
(no modulation, 15kHz bandwidth)

At ±25kHz	.. -95dBc
At ±1MHz	.. -105dBc

1.2.4.2 Modulation Characteristics

Frequency Response (below limiting)	.. flat or pre-emphasised (optional)
Line And Microphone Inputs:	
Pre-emphasised Response-	
Bandwidth	.. 300Hz to 3kHz (WB & MB)
	.. 300Hz to 2.55kHz (NB)
Below Limiting	.. within +1, -3dB of a 6dB/octave pre-emphasis characteristic
Flat Response	.. within +1, -2dB of output at 1kHz
Above Limiting Response	.. within +1, -2dB of a flat response (ref. 1kHz)
Distortion	.. 2%
Hum And Noise:	
Wide Bandwidth	.. -55dB (300Hz to 3kHz [EIA]) typical
Mid Bandwidth	.. -53dB (CEPT)
Narrow Bandwidth	.. -50dB (CEPT)
Compressor (optional):	
Attack Time	.. 10ms
Decay Time	.. 800ms
Range	.. 50dB

1.2.4.3 CTCSS

Standard Tones	.. all 37 EIA group A, B and C tones plus 13 commonly used tones
Frequency Error (from EIA tones)	.. 0.08% max.
Generated Tone Distortion	.. 1.2% max.
Generated Tone Flatness	.. flat across 67 to 250.3Hz to within 1dB
Modulation Level	.. adjustable
Modulated Distortion	.. <5%

1.2.5 Microcontroller

Auxiliary Ports:	
Open Drain Type	.. capable of sinking 2.25mA via 2k2Ω
V_{ds} max.	.. 5V

1.3 Product Codes

The three groups of digits in the T830 Series II product code provide information about the model, type and options fitted, according to the conventions described below.

The following explanation of T830 Series II product codes is not intended to suggest that any combination of features is necessarily available in any one product. Consult your nearest Tait Dealer or Subsidiary for more information regarding the availability of specific models, types and options.

Model

The Model group indicates the basic function of the product, as follows:

T83X-XX-XXXX	T835 receiver T836 25W transmitter T837 exciter T838 50W power amplifier T839 100W power amplifier

Type

The Type group uses two digits to indicate the basic RF configuration of the product.

The first digit in the Type group designates the frequency range:

T83X-**X**X-XXXX	'1' for 136-156MHz '2' for 148-174MHz

The second digit in the Type group indicates the channel spacing:

T83X-X**X**-XXXX	'0' for wide bandwidth (25kHz) '3' for mid bandwidth (20kHz) '5' for narrow bandwidth (12.5kHz)

Options

T83X-XX-**XXXX**	The Options group uses four digits and/or letters to indicate any options that may be fitted to the product. This includes standard options and special options for specific customers. '0000' indicates a standard Tait product with no options fitted. The large number of options precludes listing them here.

1.5 T837 Standard Product Range

The following table lists the range of standard T837 types (i.e. no options fitted) available at the time this manual was published. Consult your nearest Tait Dealer or Subsidiary for more information.

Frequency Range (MHz)		136-156			
Deviation (kHz)		2.5	2.5	4	5
TCXO[a]	±2.5ppm -30°C to +60°C	•	•	•	•
Exciter Type: T837-		16-0000[b]	15-0000	13-0000	10-0000

Frequency Range (MHz)		148-174			
Deviation (kHz)		2.5	2.5	4	5
TCXO[a]	±2.5ppm -30°C to +60°C	•	•	•	•
Exciter Type: T837-		26-0000[b]	25-0000	23-0000	20-0000

a. A TCXO with a stability of ±1ppm (0°C to +60°C) is available to suit specific requirements. Contact your nearest authorised Tait Dealer or Subsidiary for further details.

b. United States market only.

You can identify the exciter type by checking the product code printed on a label on the rear of the chassis (Figure 1.1 in Part A shows typical labels). You can further verify the exciter type by checking the placement of an SMD resistor in the table that is screen printed onto the PCB (refer to Section 6.1 for more details).

2 T836/837 Circuit Operation

This section provides a basic description of the circuit operation of the T836 transmitter and T837 exciter.

Note: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 2.00 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. The parts list and diagrams for the VCO PCB are in Part E.

The following topics are covered in this section.

2.1 Introduction

The individual circuit blocks which make up the T836 and T837 are:

- synthesiser
- VCO
- audio processor
- drive amplifier
- power amplifier (T836 only)
- voltage regulators.

Each of these circuit blocks is set in its own shielded compartment, formed as an integral part of the main chassis.

The configuration of the circuit blocks may be seen on a functional level in Figure 2.1 and Figure 2.2. Refer to the circuit diagrams in Section 6.2 (T836) or 6.3 (T837) for more detail.

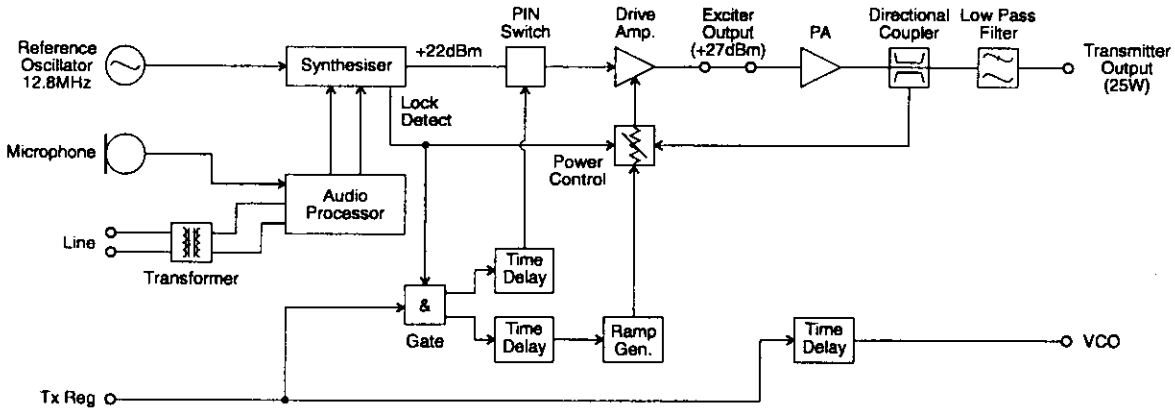


Figure 2.1 T836 High Level Block Diagram

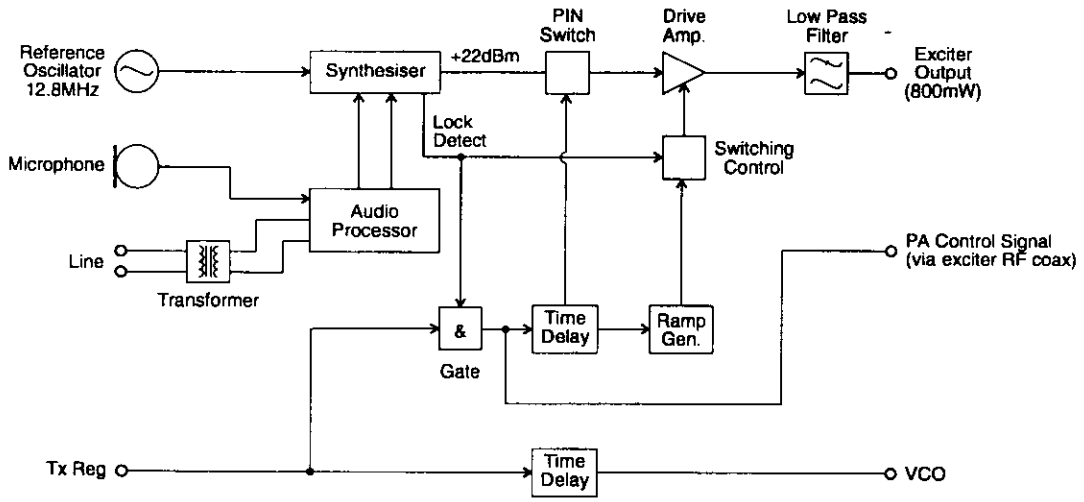


Figure 2.2 T837 High Level Block Diagram

2.3 Synthesised Local Oscillator

(Refer to the synthesiser circuit diagram (sheet 7) in Section 6.2 or 6.3 and the VCO circuit diagram in Part E.)

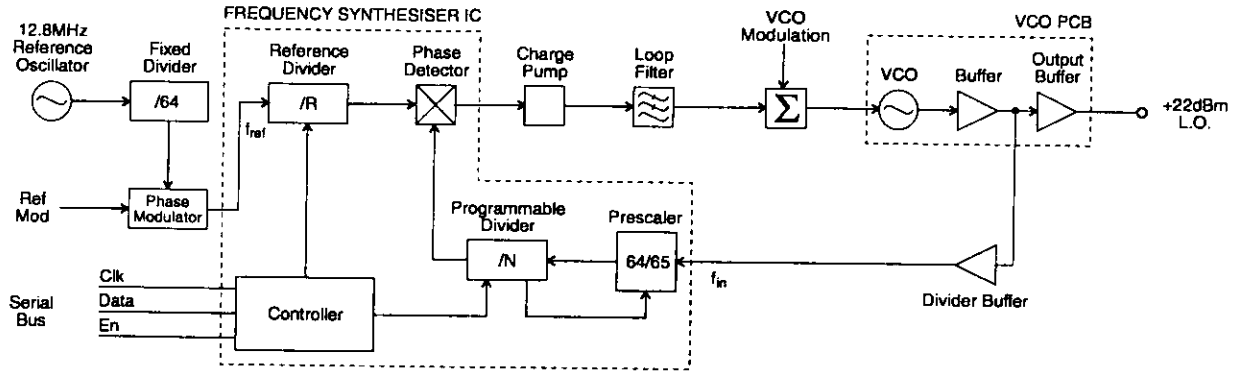


Figure 2.4 T836/837 Synthesiser Block Diagram

The synthesiser (IC740) employs a phase-locked loop (PLL) to lock a voltage controlled oscillator (VCO) to a given reference frequency. The synthesiser receives the divider information from the control microprocessor via a 3 wire serial bus (clock, data, enable). When the data has been latched in, the synthesiser processes the incoming signals from the VCO buffer (f_{in}) and the phase modulator (f_{ref}).

A reference oscillator at 12.8MHz (IC700) is buffered (IC710 pins 3 & 4) and divided down to 200kHz (IC730). This 200kHz square wave is then summed with the modulating audio and passed to an integrator (IC720 pins 9 & 8, Q710, Q720). This produces a ramping waveform which is centred around a DC level determined by the incoming audio. IC720 pins 5 & 6 perform as a comparator, ultimately producing a phase-modulated 200kHz square wave. This is followed by another phase shifting stage (IC720 pins 3 & 4, Q730, Q740), before being divided down to 6.25kHz or 5kHz within the synthesiser IC (IC740).

A buffered output of the VCO (Q795) is divided with a prescaler and programmable divider which is incorporated into the synthesiser chip (IC740). This signal is compared with the phase modulated reference signal at the phase detector (also part of the synthesiser chip). The phase detector outputs drive a balanced charge pump circuit (Q760, Q770, Q775, Q780, Q785) and active loop filter (IC750 pins 5, 6 & 7) which produces a DC voltage between 0V and 20V to tune the VCO. This VCO control line is further filtered to attenuate noise and other spurious signals. Note that the VCO frequency increases with increasing control voltage.

If the synthesiser loop loses lock, a pulsed signal appears at LD (pin 2) of IC740. This signal is filtered and buffered by IC750 pins 1, 2 & 3, producing the Lock-Detect signal used to shut off the power supply to the drive amplifier. IC750 pin 1 is at 20V when the synthesiser is out of lock.

2.4 VCO

(Refer to the VCO circuit diagram in Part E.)

The VCO transistor (Q1) operates in a common source configuration, with an LC tank circuit coupled between its gate and drain to provide the feedback necessary for oscillation. The VCO control voltage from the loop filter (IC750 pin 7) is applied to the varicaps (D1-D4) to facilitate tuning within an 8MHz band of frequencies. A trimcap (CV1) is used for coarse tuning of the VCO. The output from the oscillator circuit drives a cascode amplifier stage (Q2, Q3) which supplies +10dBm (typically) to a further stage of amplification, Q5. This is the final amplifier on the VCO PCB, and delivers +22dBm (typically) to the exciter drive amplifier.

A low level "sniff" is taken from the output of Q3 and used to drive the divider buffer (Q795) for the synthesiser (IC740).

The VCO operates at the actual output frequency of the exciter, i.e. there are no multiplier stages. The VCO is modulated by superimposing the audio signal onto the control voltage and by phase modulating the reference signal.

2.4.1 VCO Supply

The VCO is supplied from two switched +9V supplies under the control of the Tx-Reg. supply.

The VCO (Q1) and buffer amplifier (Q2 & Q3) are supplied from one +9V switched supply by Q540 via the capacitor multiplier (Q550, C550).

The output amplifier is supplied from the other +9V supply by Q520, Q530, and Q510.

A delay circuit holds the VCO on for a short time after the Tx-Reg. supply has been switched off. This is to allow the RF power circuits (both exciter and PA) to ramp down in the correct manner before the VCO is switched off.

2.5.3 Keying Inputs

There are four ways to key the exciter:

- pulling the Tx-Key line low (pin 13 on D-range 1 [PL100]) at the rear of the set);
- pushing the "Carrier" button on the front panel - this will inhibit all audio;
- using the PTT button on the local microphone, disabling audio from the line;
- via the opto-key inputs (pins 11 and 12 on D-range 1 [PL100]) when electrical isolation is required. This features a constant current sink (Q270) to ensure reliable activation of the opto-coupler (IC250) at low keying voltages.

2.5.4 Compressor (Automatic Level Control (ALC))

The input signal is fed via a current controlled attenuator (Q230, Q220) to a high gain stage (IC230) from which the output signal is taken. This signal is passed to a comparator (IC230) which toggles whenever the audio signal exceeds a DC threshold determined by RV220. Thus, the comparator produces a square wave whose mark-space ratio is determined by the amplitude of the audio signal. This square wave pumps up the reservoir capacitor (C233) which controls the attenuator (Q230, Q220), thus completing the feedback loop.

The compression level is set by adjustment of the comparator threshold (RV220).

Note: Although the high dynamic range of the compressor allows the use of very low audio signal levels, such conditions will be accompanied by a degradation of the signal-to-noise ratio. Very low audio input levels should therefore be avoided where possible.

2.5.5 Outputs To Modulators

The output signal from the limiter (IC210, IC230) is added with a CTCSS tone at a summing amplifier (IC260). The signal is then low pass filtered (IC260) and split to supply the two modulators.

Since the VCO modulator is a true frequency modulator, its audio is simply buffered (IC260). The reference modulator, however, is a phase modulator and its audio must first be integrated (IC210).

It is vital that the audio levels to the modulators are accurately set, ***relative to each other.*** Hence the inclusion of level adjustment in the reference modulator path. Once set, adjustments to absolute deviation may be made only via the deviation digital pot. (IC220 - adjustable via PGM800Win).

2.7 Transmit Timers

The transmit tail timer, transmit timeout timer and transmit lockout timer can all be set from PGM800Win. The fields for setting these are found on the system information page. These three timers operate as follows (refer also to Figure 2.8):

Timer	Function	Adjustment
Transmit Tail	Sets the tail time during which the transmitter stays keyed after the external key source has been removed.	0-5 seconds in 100ms steps
Transmit Timeout	Sets the maximum continuous transmission time. Once the timer has timed out, the transmitter must be keyed again, unless prevented by the transmit lockout timer.	0-300 seconds in 10 second steps
Transmit Lockout	Sets the period of time that must elapse after a timeout before the transmitter can re-transmit. Once the timer has timed out, the transmitter can be keyed again.	0-60 seconds in 10 second steps

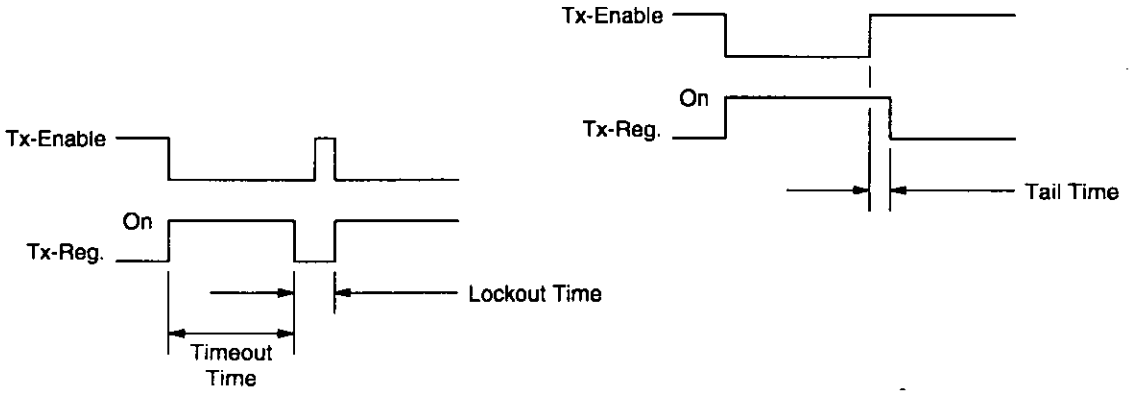


Figure 2.8 T836/837 Transmit Timers

2.9 T837 Exciter Drive Amplifier

(Refer to Figure 2.2 and the exciter circuit diagram (sheet 3) in Section 6.3.)

A two-stage, wide band amplifier (Q365, Q370) provides an output level of approximately 800mW (+29dBm) for an input of 170mW (+22dBm) from the VCO. IC330 pins 5, 6 & 7, Q310, and Q315 provide a 10.5V regulated supply for the exciter.

To reduce the spurious output level when the synthesiser is out-of-lock, the Tx-Reg. and Lock-Detect signals are gated to inhibit the exciter control circuit and to switch off the RF signal at the input to the drive amplifier. This is achieved by a PIN switch attenuator (D340, D350, D360).

Cyclic keying control is provided by additional circuitry consisting of several time delay, ramp and gate stages:

- Q305, IC330 pins 5, 6 & 7 — power ramping
- Q340, Q345 — Tx-Reg. and $\overline{\text{Lock-Detect}}$ gate
- Q320, Q325, Q330, Q335 — delay and PIN switch drive.

This is to allow the RF power circuits (both exciter and PA) to ramp up and down in a controlled manner so that minimal adjacent channel interference is generated during the transition.

R359, R360 and R362 form a 6dB attenuator to provide good VCO/drive amplifier isolation.

The output attenuator (R392, R390, R394, R396) assists in reducing exciter/PA interaction while also ensuring a good match for Q370.

Note: The exciter provides a DC control signal to the PA via the RF coax. This is injected via L390.

3 T836/837 Initial Tuning & Adjustment

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

- channel programming
- selecting required audio links
- synthesiser alignment
- PA alignment (T836 only)
- modulator adjustment
- limiter adjustment
- setting line level
- compressor adjustment
- timer adjustment.

Note: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 2.00 and later of the software.

Refer to Figure 4.4 and Figure 4.5 which show the location of the main tuning and adjustment controls. Refer also 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. The parts list and diagrams for the VCO PCB are in Part E.

3.1 Introduction

When you receive your T836 transmitter or T837 exciter 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 8MHz switching range (i.e. ±4MHz from the factory programmed frequency), you should only need to reprogram the transmitter/exciter 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 8MHz switching range, you will have to reprogram and re-tune the transmitter/exciter 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 transmitter/exciter's EEPROM memory (IC820) by using the PGM800Win software package and an IBM™ PC. You can also use PGM800Win to select the transmitter/exciter's current operating frequency (or "default channel").

If the transmitter/exciter is installed in a rack frame, you can program it via the programming port in the speaker panel. However, you can also program the transmitter/exciter 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 transmitter/exciter 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 Subsidiary for further details.

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

3.4 Short Tuning Procedure

Use this procedure only if you want to reprogram the T836/837 to a frequency outside the 8MHz 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 PL4-1 or the junction of L1 & R1 in the VCO (this measures the synthesiser loop voltage).
- Key the transmitter by earthing the Tx-Key line.
- **Single Channel** Tune VCO trimmer CV1 for a synthesiser loop voltage of 9V.

  Multichannel Tune VCO trimmer CV1 for a synthesiser loop voltage of 9V on the middle channel.

  If there is no middle channel, tune CV1 so that the channels are symmetrically placed around a loop voltage of 9V.

  All channels should lie within the upper and lower limits of 13V and 5V respectively.

  Do not attempt to program channels with a greater frequency separation than the specified switching range of 8MHz.

3.4.3 Output Power Adjustment (T836 Only)

Connect an RF power meter to the output socket and key the transmitter.

Turn RV320 (power adjust) fully clockwise.

Tune CV451 (output power trim) for maximum output power and check that this is >30W.

Adjust RV320 for the required output power (between 5 and 25W).

Readjust CV451 to reduce the supply current by up to 0.5A.

Adjust RV210 (line sensitivity) fully clockwise and key the transmitter by earthing the Tx-Key line. Adjust "deviation" via PGM800Win to set the peak deviation to ±4.7kHz (±3.8kHz) [±2.3kHz] (you can use either the mouse or up and down arrow keys).

Sweep the audio frequency from 100Hz to 4kHz and ensure that the maximum deviation does not exceed 4.7kHz (±3.8kHz) [2.3kHz]. Readjust "deviation" if necessary via PGM800Win.

3.4.6 Line-in Level Adjustment

Set the injected signal at the line input to the required line level (typically -10 to -20dBm).

Adjust RV210 (line sensitivity) to provide ±3kHz (±2.4kHz) [±1.5kHz] deviation.

3.6 Synthesiser Alignment

- Ensure that the T836/837 has been programmed with the required frequencies using PGM800Win software.

- **Single Channel** Select a channel using PGM800Win.

  Multichannel Select the middle channel via PGM800Win.

- Connect a high impedance voltmeter to PL4-1 or the junction of L1 and R1 in the VCO (this measures the synthesiser loop voltage).

- Key the transmitter by earthing the Tx-Key line.

  Single Channel Tune VCO trimmer CV1 for a synthesiser loop voltage of 9V.

  Multichannel Tune VCO trimmer CV1 for a synthesiser loop voltage of 9V on the middle channel.

  If there is no middle channel, tune CV1 so that the channels are symmetrically placed around a loop voltage of 9V.

  All channels should lie within the upper and lower limits of 13V and 5V respectively.

  Do not attempt to program channels with a greater frequency separation than the specified switching range (8MHz).

- Check that the exciter output power is:

T836	500mW +200, -100mW
T837	800mW ±200mW.

- Measure the exciter output frequency and adjust the TCXO (IC700) trimmer if required.

Caution: **This trimmer is susceptible to physical damage. Do not exert a downward force of more than 500g (1lb) when adjusting.**

3.9 Audio Processor

3.9.1 Two Point Modulation

The T836 and T837 utilise two point modulation to obtain a wide audio bandwidth independent of the synthesiser loop filter response. This is achieved by simultaneously frequency modulating the VCO and phase modulating the synthesiser reference frequency. The relative signal levels fed to the two modulators are quite critical and cause interaction when setting up.

Both modulating signals require readjustment when the exciter is shifted in frequency greater than the switching range (i.e. $\Delta F > \pm 4MHz$).

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

Note 2: Reference modulation and limiter adjustment are controlled by PGM800Win. Electronic potentiometers (256 step) are used to allow channel-by-channel adjustment of deviation and two point modulation.

Note 3: To optimise the modulation response across the switching range, repeat steps 1-4 below for each channel that will be used (usually needed only for data applications). In applications where the modulation response is less critical (e.g. voice use only), carry out steps 1-4 below on the middle channel and cut and paste the value to all other channels.

3.9.2 Modulator Adjustment

1. Inject an audio signal of 600Hz 1.5V rms (+5dBm) into the CTCSS input (D-range 1 (PL100) pin 8).

   Key the transmitter by earthing the Tx-Key line.

2. Adjust the output from the audio generator to obtain ±3kHz (±2.4kHz) [±1.5kHz] deviation at 600Hz.

3. Change the input frequency to 120Hz and adjust "reference modulation" via PGM800Win to obtain ±3kHz (±2.4kHz) [±1.5kHz] deviation.

4. Change the input frequency back to 600Hz.

   Repeat steps 2 and 3 above until the deviations achieved at the two input frequencies are within 0.2dB of each other. You will need to do this at least four times.

5. Sweep the audio between 50 and 300Hz for peaks.

Note: A peak between 50 and 300Hz will indicate a fault condition, i.e:

- incorrect set-up

or - modulation circuitry fault.

The specification window is ±1dB relative to 150Hz from 65 to 260Hz.

Check that ±3kHz (±2.4kHz) [±1.5kHz] deviation is still available.

Slowly increase the audio input level until the demodulated waveform shows significant signs of clipping (approximately ±4.5kHz (±3.6kHz) [±2.3kHz] deviation).

Adjust RV220 anticlockwise until the demodulated waveform is just clipping (approximately ±4kHz (±3.2kHz) [±2kHz] deviation).

Increase the input level to -10dBm and check that the test tone is still held just into clipping. The input line level should be typically -10 to -20dBm.

3.9.5.2 Compressor On Microphone Input Only

Key the transmitter by earthing the Tx-Key line and plug a microphone jack into the front panel socket.

Adjust RV220 (compression level) fully clockwise.

Acoustically couple the microphone to a tone box (1kHz) and close the PTT switch.

Increase the audio level until the demodulated waveform shows significant signs of clipping (approximately ±4.5kHz (±3.6kHz) [±2.3kHz] deviation).

Adjust RV220 anticlockwise until the demodulated waveform is just clipping (approximately ±4kHz (±3.2kHz) [±2kHz] deviation).

Increase the audio level by 10dB and verify that the test tone is held just into clipping.

Whistle steadily into the microphone, checking that approximately ±4kHz (±3.2kHz) [±2kHz] deviation is produced. The modulated waveform should be basically sinusoidal.

Speak into the microphone, checking that the modulation peaks reach about ±5kHz (±4kHz) [±2.5kHz] deviation.

As the line is to be used without compression, set RV210 (line sensitivity) as described in Section 3.9.4.

3.9.5.3 Compressor On Both Line & Microphone Inputs

Set up as described in Section 3.9.5.1.

4 T836/837 Functional Testing

The following test procedures will confirm that the T836/837 has been tuned and adjusted correctly and is fully operational.

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

Note 2: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 2.00 and later of the software.

Refer to Figure 4.4 and Figure 4.5 for the location of the main tuning and adjustment controls, and to Section 3.3 for the test equipment set-up. Refer also 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. The parts list and diagrams for the VCO PCB are in Part E.

The following topics are covered in this section.

4.1 Current Consumption

Connect the T836/837 to a 13.8V power supply.

Connect an RF power meter to the T836/837 output socket.

Check that the current in the 13.8V power cable is less than 150mA.

Key the T836/837 by earthing the Tx-Key line (the carrier "On" LED should light).

T836 Only: Adjust RV320 (power adjust) to obtain 25W output power.

Check that the current is as follows:

T836	<4.5A
T837	<600mA.

4.2 Output Power

Connect an RF power meter to the T836/837 output socket.

Key the T836/837 by earthing the Tx-Key line.

Check that:

T836	the output power adjusts to >30W with RV320 (power adjust) turned fully clockwise
T837	the output power is 800mW ±200mW.

4.3 Output Frequency

Connect the T836/837 output to a frequency counter via an attenuator pad:

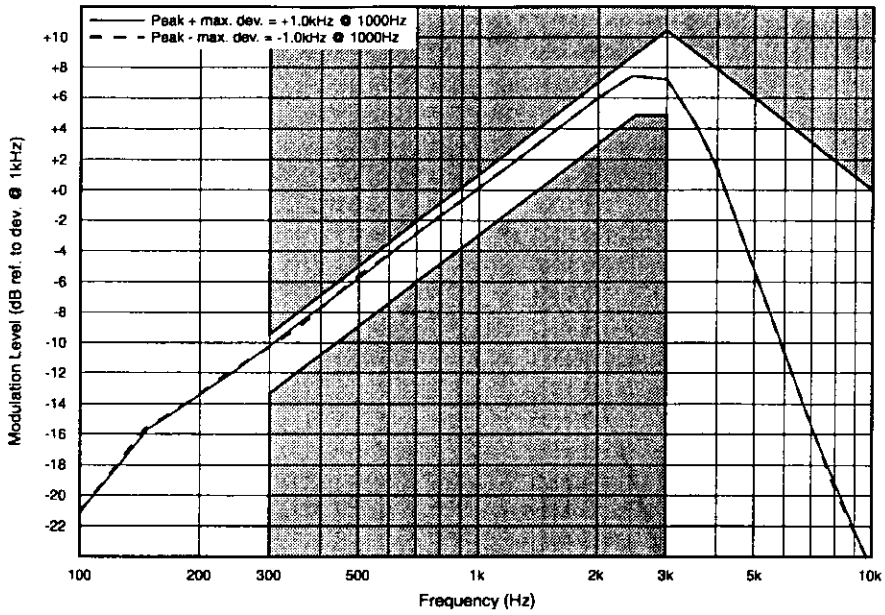
T836	40dB pad
T837	20dB pad.

Measure the output frequency and, if necessary, adjust the TCXO (IC700) to trim to the nominal frequency (±100Hz).

4.4 Timers

The transmit tail timer, transmit timeout timer and transmit lockout timer can all be set from PGM800Win. The fields for setting these are found on the system information page. These three timers operate as follows (refer also to Figure 4.1):

Wide Bandwidth



Mid Bandwidth

The mid bandwidth graph is the same shape as the wide bandwidth graph. The deviation figures are as follows:

peak + max. deviation = +0.8kHz
peak - max. deviation = -0.8kHz.

Narrow Bandwidth

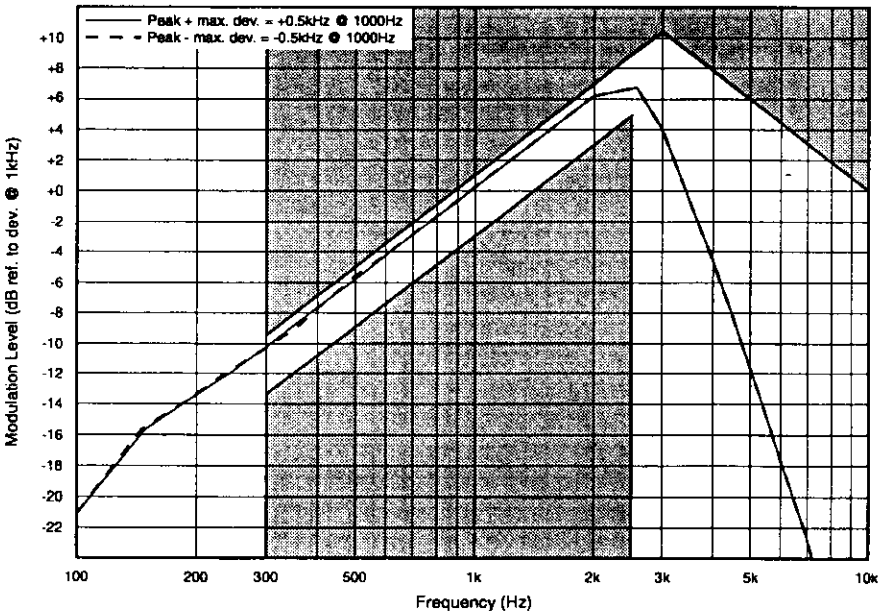


Figure 4.2 T836/837 Pre-emphasis Response

4.6 Audio Level Input Sensitivity

- Adjust RV210 (line sensitivity) fully clockwise.
- Check that the input sensitivities are better than those specified below:

Line Input	600 ohms, ±3kHz (±2.4kHz) [±1.5kHz] deviation at 1kHz:	
	with compressor	-50dBm
	without compressor	-30dBm
Microphone Input	600 ohms, ±3kHz (±2.4kHz) [±1.5kHz] deviation at 1kHz:	
	with compressor	-75dBm
	without compressor	-55dBm
CTCSS Input	1kHz deviation at 150Hz	500mV rms

Note: A degraded signal to noise ratio can be expected with the compressor selected. The extent of the degradation is dependent on the audio input level.

4.7 CTCSS Encoder

Program a CTCSS tone on the set channel using PGM800Win.

Key T836/837 with the front panel "Carrier" switch.

Adjust RV805 (CTCSS level adjust) to give 10% system deviation.

Reset the maximum deviation as per Section 3.9.3.

5 T836/837 Fault Finding

The following test procedures and fault finding flow charts may be used to help locate a hardware problem, however they are by no means a complete fault finding procedure. If you still cannot trace the fault after progressing through them in a logical manner, contact your nearest Tait Dealer or Subsidiary. If necessary, you can get additional technical help from the Customer Support Group, Radio Systems Division, Tait Electronics Ltd, Christchurch, New Zealand (full contact details are on page 2).

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

Note 2: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 2.00 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. The parts list and diagrams for the VCO PCB are in Part E.

The following topics are covered in this section

5.1 Visual Checks

Remove the covers from the T836/837 and inspect the PCB for damaged or broken components, paying particular attention to the surface mounted devices (SMD's).

Check for defective solder joints. If repair or replacement is considered necessary, refer to Section 3 of Part A.

5.2 Component Checks

If you suspect a transistor is faulty, you can assess its performance by measuring the forward and reverse resistance of the junctions. Unless the device is completely desoldered, first make sure that the transistor is not shunted by some circuit resistance. Use a good quality EVM (e.g. Fluke 75) for taking the measurements (or a 20k ohm/V or better multimeter, using only the medium or low resistance ranges).

The collector current drawn by multi-junction transistors is a further guide to their performance.

If an IC is suspect, the most reliable check is to measure the DC operating voltages. Due to the catastrophic nature of most IC failures, the pin voltages will usually be markedly different from the recommended values in the presence of a fault. The recommended values can be obtained from either the circuit diagram or the component data catalogue.

5.3 Front Panel LED Indicator

The green "Supply" LED on the T836/837 front panel will flash according to the conditions described in the following table:

Flash Rate		Condition
fast – – – – – – – – –	(⅓ sec. on/⅓ sec. off approx.)	T836/837 is linked with PGM800Win
unequal – – – – – –	(⅓ sec. on/1 sec. off approx.)	microcontroller has detected an internal communications error - refer to Section 5.7.1

Where two or more conditions occur at the same time, the precedence is in the order shown above (i.e. T836/837 linked has the highest priority, followed by internal error).

5.5 RF Checks

In-circuit RF levels may be measured with an RF probe on which the earth lead has been shortened to a minimum (i.e. 13mm). Refer to the circuit diagrams for typical levels.

Figure 5.1 shows a suitable RF probe circuit..

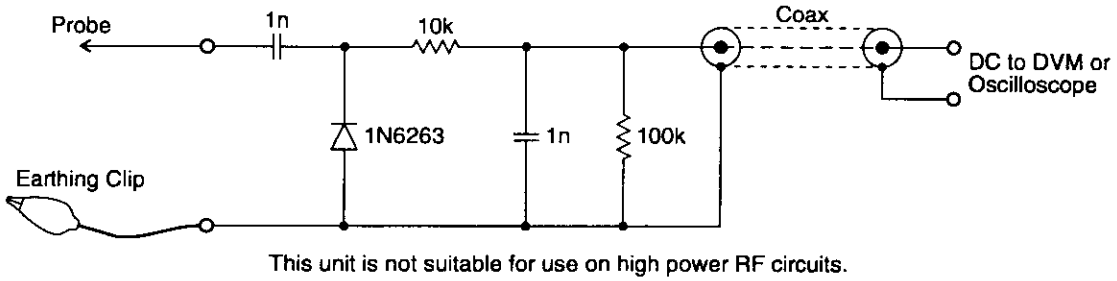


Figure 5.1 RF Diode Probe Circuit

5.5.1 T836 Drive Power

Refer to the drive amplifier fault finding chart (Section 5.7.4).

Ensure that the VCO locks (refer to Section 5.4.2).

Connect the drive output to a power meter and key the transmitter.

Check that the output power is between 600 and 1000mW.

Note: If the synthesiser is out of lock, the lock detector (synthesiser IC740 and comparator IC750) will prevent the RF signal from reaching the PA by switching the supply to the exciter amplifier (Q340, Q345).

5.5.2 T836 PA Output Power

Reconnect the drive output to the PA input.

Connect the PA to a power meter and key the transmitter.

Check that the output power is >30W with RV320 (power adjust) adjusted fully clockwise.

5.5.3 T837 Output Power

Refer to the exciter drive amplifier fault finding chart (Section 5.7.6).

Ensure that the VCO locks (refer to Section 5.4.2).

5.6 PGM800Win Generated Errors

The following errors are those most likely to occur using PGM800Win. Refer to the PGM800Win software user's manual for a complete list of error messages.

Channel Switch Set

The programmed default channel change was not accepted by the base station because a channel is selected externally. Try turning the external channel switch off to change the default channel in PGM800Win.

Synth Out Of Lock

The synthesiser received incorrect data, or the data was corrupted. Enter a frequency within the VCO switching range, or tune the VCO.

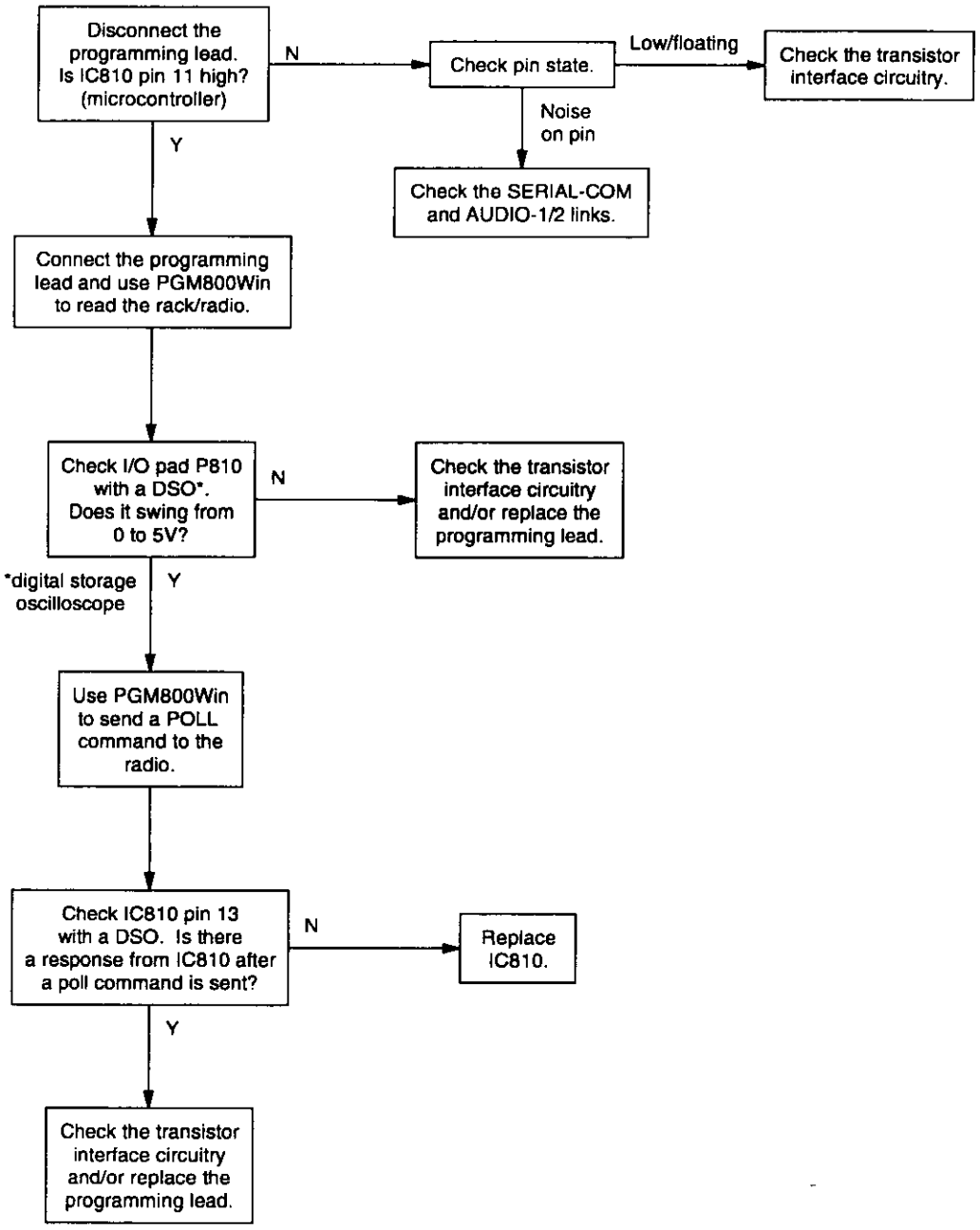
Internal Error

Data could not be read from the base station due to an internal error. Check for shorts or open circuits on the SDA, SCK, SYNTH and EPOT lines. The SDA, SCK and SYNTH are normally high, and the EPOT is normally low.

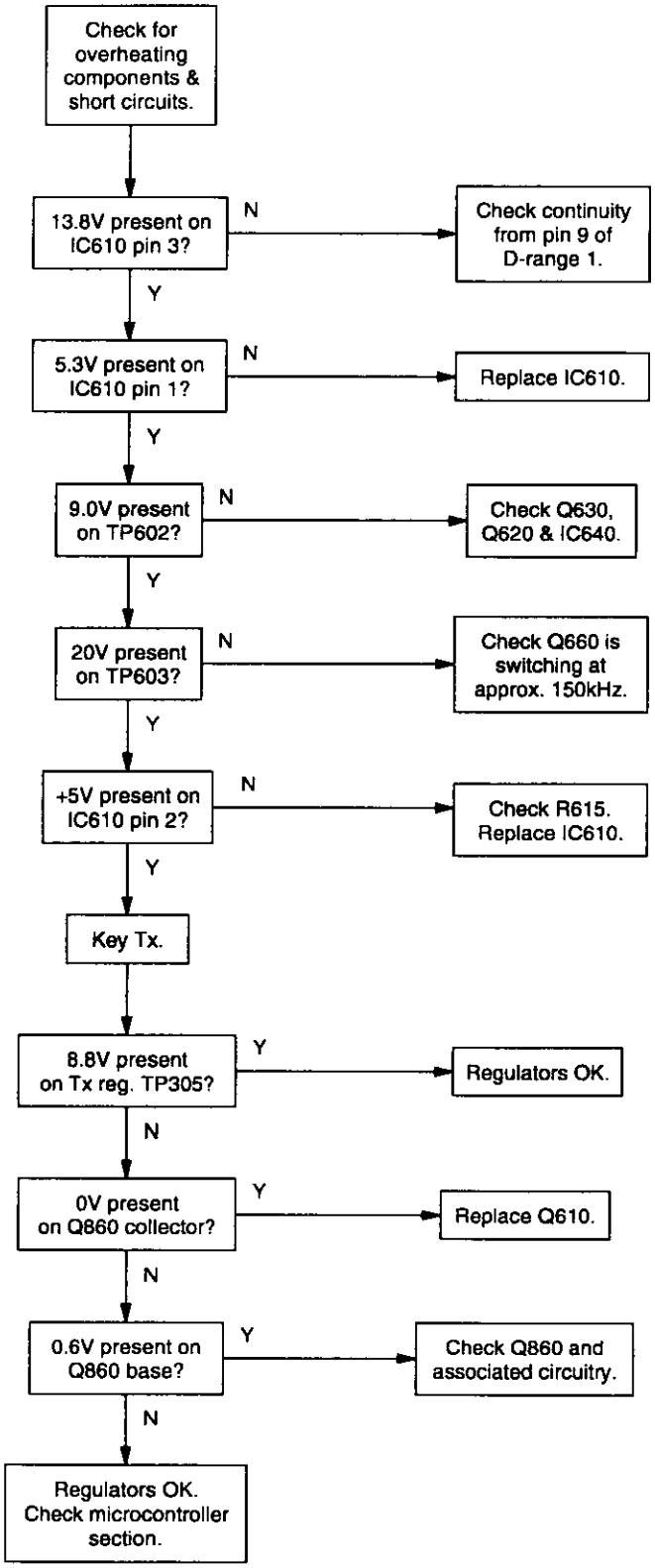
Write/Read To An Unlinked Module

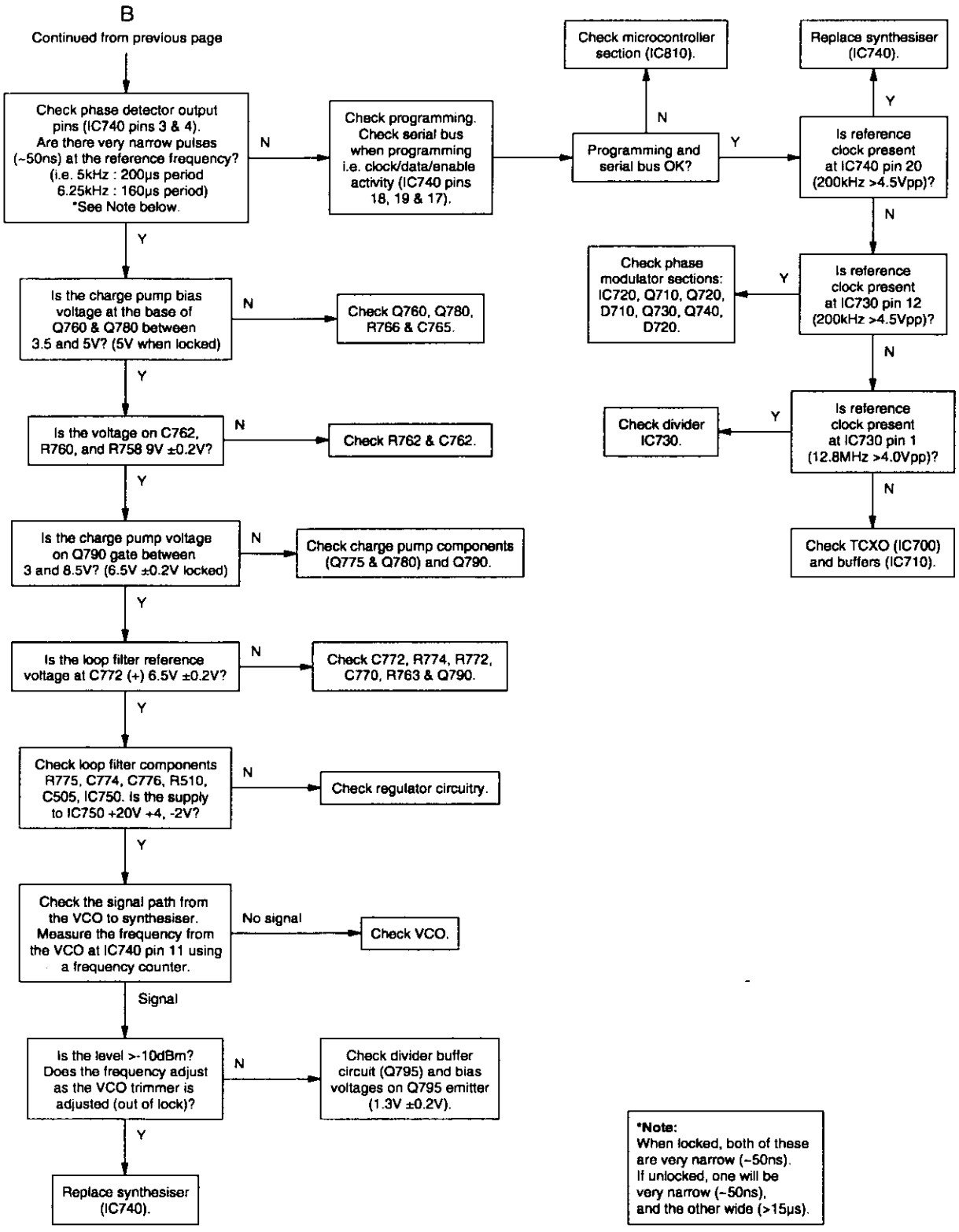
The link to the module does not exist. Undefined error.

5.7.1.2 Serial Communication

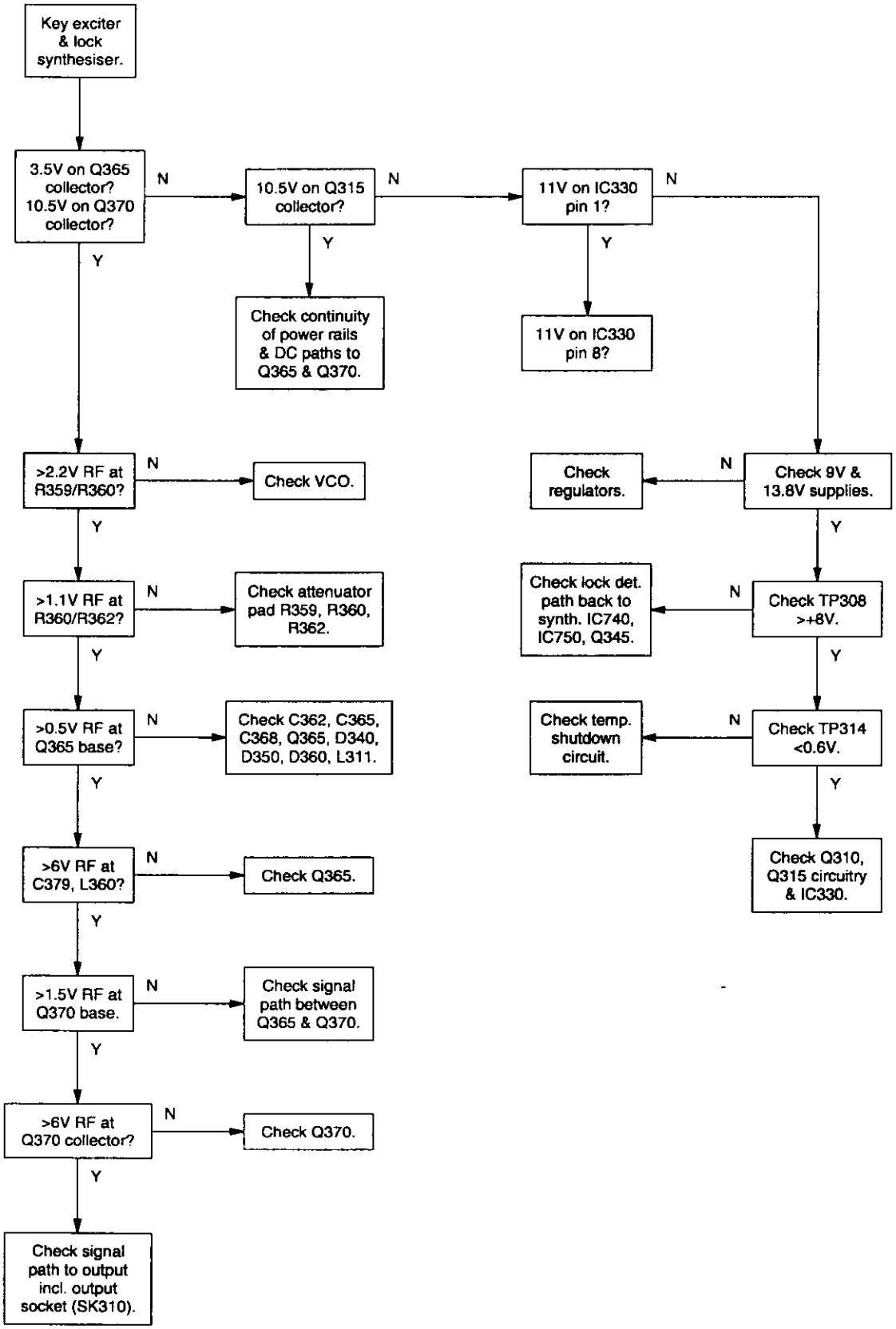


5.7.2 Regulator

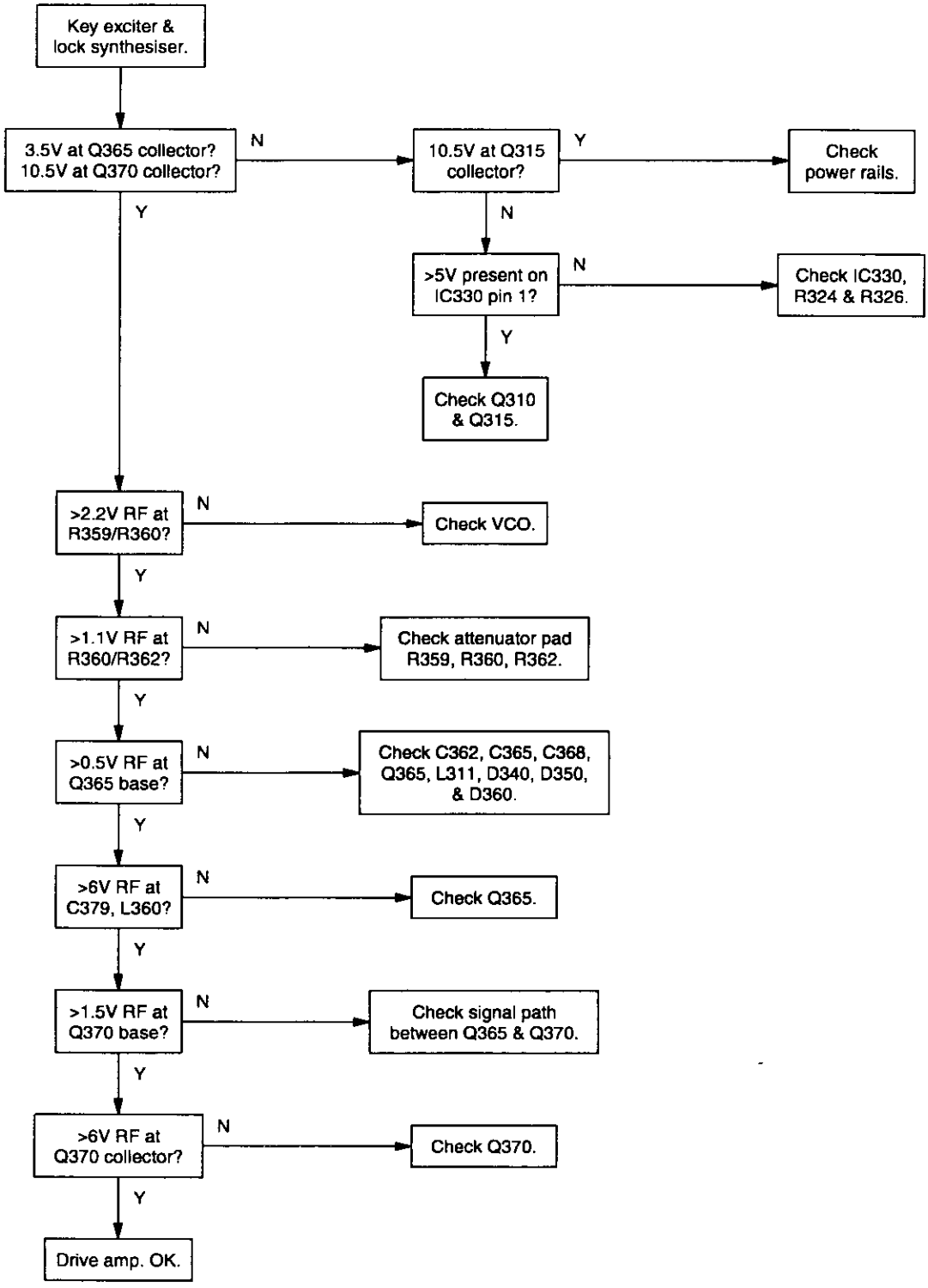



B
Continued from previous page
Check phase detector output pins (IC740 pins 3 & 4). Are there very narrow pulses (~50ns) at the reference frequency? (i.e. 5kHz : 200µs period 6.25kHz : 160µs period) *See Note below.
N
Check programming. Check serial bus when programming i.e. clock/data/enable activity (IC740 pins 18, 19 & 17).
Check microcontroller section (IC810).
Programming and serial bus OK?
N
Y
Replace synthesiser (IC740).
Y
Is reference clock present at IC740 pin 20 (200kHz >4.5Vpp)?
N
Y
Is reference clock present at IC730 pin 12 (200kHz >4.5Vpp)?
Check phase modulator sections: IC720, Q710, Q720, D710, Q730, Q740, D720.
N
Y
Is reference clock present at IC730 pin 1 (12.8MHz >4.0Vpp)?
Check divider IC730.
N
Y
Check TCXO (IC700) and buffers (IC710).
Is the charge pump bias voltage at the base of Q760 & Q780 between 3.5 and 5V? (5V when locked)
N
Check Q760, Q780, R766 & C765.
Y
Is the voltage on C762, R760, and R758 9V ±0.2V?
N
Check R762 & C762.
Y
Is the charge pump voltage on Q790 gate between 3 and 8.5V? (6.5V ±0.2V locked)
N
Check charge pump components (Q775 & Q780) and Q790.
Y
Is the loop filter reference voltage at C772 (+) 6.5V ±0.2V?
N
Check C772, R774, R772, C770, R763 & Q790.
Y
Check loop filter components R775, C774, C776, R510, C505, IC750. Is the supply to IC750 +20V +4, -2V?
N
Check regulator circuitry.
Y
Check the signal path from the VCO to synthesiser. Measure the frequency from the VCO at IC740 pin 11 using a frequency counter.
No signal
Check VCO.
Signal
Is the level >-10dBm? Does the frequency adjust as the VCO trimmer is adjusted (out of lock)?
N
Check divider buffer circuit (Q795) and bias voltages on Q795 emitter (1.3V ±0.2V).
Y
Replace synthesiser (IC740).
*Note:
When locked, both of these are very narrow (~50ns).
If unlocked, one will be very narrow (~50ns), and the other wide (>15µs).

5.7.4 T836 Drive Amplifier



5.7.6 T837 Exciter Drive Amplifier



5.8 To Replace The T836 PA Transistors (Q415 & Q425)

Caution: **Failure to comply with the following procedure can result in failure of the device due to poor heatsinking, or worse, can endanger the health of the assembler if the beryllium oxide die carrier is smashed during assembly.**

Caution: **As the location of certain components in the PA is critical to performance, it is important that any components removed or disturbed are refitted in *exactly* the same position.**

Caution: **Before attempting to remove a transistor, note the position, type and value of each capacitor and resistor so that it can be replaced in *exactly* the same position (refer to Figure 5.2).**

Caution: **Do not apply too much heat or pressure to the PCB pads and tracks as you may damage them or lift them from the PCB, causing permanent damage to the transmitter.**

Remove the resistors and/or chip capacitors from around the transistor.

Desolder the transistor tabs by heating with a soldering iron and lifting away from the PCB with a screwdriver or thin stainless steel spike. Unscrew the transistor stud nut and remove the device.

Remove any excess solder from the PCB pads with solder wick.

Trim the tabs of the replacement transistor so that the device sits neatly on the PCB pads provided.

Lightly tin the underside of the transistor tabs.

Apply a small amount of heatsink compound (Dow-Corning 340 or equivalent) to the transistor mounting surface. Sufficient compound should be used to ensure an even film over the entire mounting surface.

Place the transistor on the PCB in the correct orientation and ensure the tabs are flush to the surface. Lightly solder one tab to the PCB. Torque down the retaining nut to the correct torque (0.7Nm/6lb-in.).

Caution: **Do not solder all the tabs before torquing down otherwise the device may be broken.**

Solder all transistor tabs to the PCB.

6 T836/837 PCB Information

This section provides the following information on the T836 transmitter and T837 exciter:

- parts lists
- grid reference indexes
- mechanical assembly drawings
- PCB layouts
- test points & options connections drawings
- circuit diagrams.

6.1 Introduction

Product Type Identification

You can identify the transmitter or exciter type by checking the product code printed on a label on the rear of the chassis (product codes are explained in Section 1.3 in this Part of the manual, and Figure 1.1 in Part A shows typical labels). You can further verify the product type by checking the placement of an SMD resistor in the table that is screen printed onto the top side of the PCB, similar to the example drawn below (this table also appears in the resist layer on the bottom side of the PCB). In this example, the resistor indicates that the product was built as a T836-10-XXXX.

836-	
836-	
836-	
PRODUCT TYPE	

PRODUCT TYPE			
	836-10		836-20
	836-13		836-23
	836-15		836-25

Note: The only function of this resistor is to indicate the product type. It has no effect on the circuitry or operation of the transmitter or exciter.

PCB Identification

All PCBs are identified by a unique 10 digit "internal part number" (IPN), e.g. 220-12345-00, which is screen printed onto the PCB (usually on the top side), as shown in the example below:

The last 2 digits of this number define the issue status, which starts at 00 and increments through 01, 02, 03, etc. as the PCB is updated. Some issue PCBs never reach full production status and are therefore not included in this manual. A letter following the 10 digit IPN has no relevance in identifying the PCB for service purposes.

Note: It is important that you identify which issue PCB you are working on so that you can refer to the appropriate set of PCB information.

Variant Components

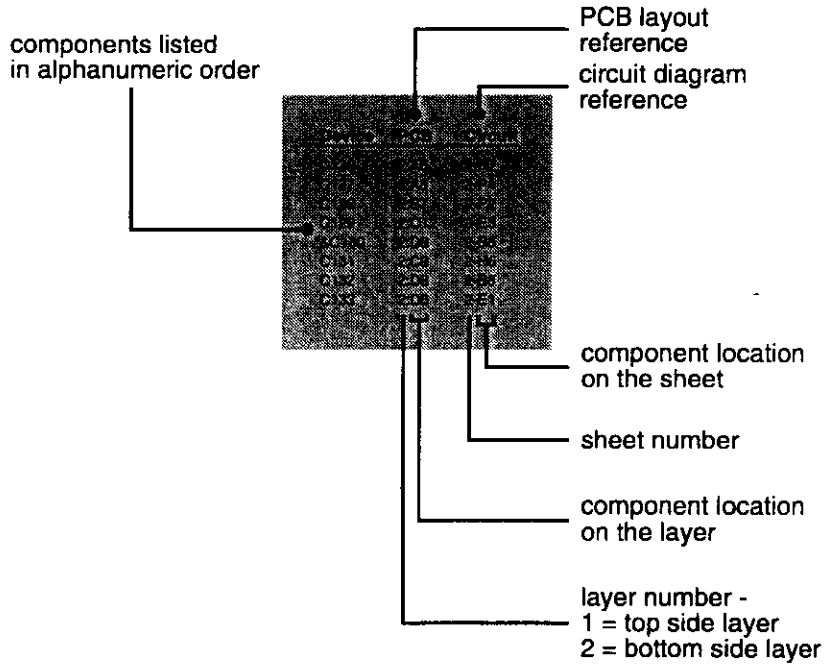
A variant component is one that has the same circuit reference but different value or specification in different product types. Where two products share the same PCB, the term "variant" is also used to describe components unplaced in one product. Variant components have a character prefix, such as "&", "=" or "#", before the circuit reference (e.g. &R100).

The table below explains the variant prefixes used in T800 Series II products:

If the variant prefix is. . .	the component will. . .
&	change according to channel spacing
=	change according to frequency stability
#	change according to frequency range
%	be placed or unplaced for special applications
*	be unplaced in one product (where two products share the same PCB)

Grid Reference Index

This section contains a component grid reference index to help you find components and labelled pads on the PCB layouts and circuit diagrams. This index lists the components and pads in alphanumeric order, along with the appropriate alphanumeric grid references, as shown below:



6.3 T837 Exciter PCB

This section contains the following information.

T837 Parts List (IPN 220-01390-02)

How To Use This Parts List

The components listed in this parts list are divided into two main types: those with a circuit reference (e.g. C2, D1, R121, etc.) and those without (miscellaneous and mechanical).

Those with a circuit reference are grouped in alphabetical order and then in numerical order within each group. Each component entry comprises three or four columns: the circuit reference, variant (if applicable), IPN and description. A number in the variant column indicates that this is a variant component which is fitted only to the product type listed. Static sensitive devices are indicated by an (S) at the start of the description column.

The mechanical and miscellaneous section lists the variant and common parts in IPN order. Where possible, a number in the legend column indicates their position in the mechanical assembly drawing.

The Parts List Amendments box below lists component changes that took place after the parts list and diagrams in this section were compiled. These changes (e.g. value changes, added/deleted components, etc.) are listed by circuit reference in alphanumeric order and supersede the information given in the parts list or diagrams. Components without circuit references are listed in IPN order.

Parts List Amendments

IC710	Changed from 74HCV04 to 74HC04 (IPN 002-74900-04) to increase the gain of the TCXO buffer (710312).	
L360	Changed from 3.5T/4.0mm (052-08140-35) to 3.5T/3.5mm (052-08135-35)	
L365	Changed from 1.5T/3.0 (IPN 052-08130-15) to 1.5T/3.5 (IPN 052-08135-15) to improve power output evenly at the top and bottom of the 136-174MHz frequency range (710333).	
L385	136-156MHz (-10, -13 & -15): changed from 3.5T/4.0 (052-08140-35) to 3.5T/4.5 (IPN 052-08145-35) to improve the output power (710332).	
R221, R239	Changed from 680Ω (036-13680-00) to 1k5 (036-14150-00)	To improve power at 174MHz (710028).
R235, R545	Changed from 2k2 (036-14220-00) to 4k7 (036-14470-00)	
R290	Changed from 560Ω (036-13560-00) to 680Ω (036-13680-00) to reduce the level of side bands generated (710028).	
R304	Changed from 15k (036-15150-00) to 2k7 (036-14270-00)	To improve power at 174MHz (710028).
R332	Changed from 22k (036-15220-00) to 47k (036-15470-00)	
R364, R372	Changed from 1k0 (036-14100-00) to 1k5 (036-14150-00)	
R368	Changed from 1k0 (036-14100-00) to 10k (036-15100-00)	
R677	Changed from 1k0 (036-14100-00) to 47k (036-15470-00)	

Ref	Var	IPN	Description
C830		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C838		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C841		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C844		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C910		015-02120-06	CAP CER 1210 12P NPO500VGRM42
C920		015-02270-06	CAP CER 1210 27P NPO500VGRM42
C930		015-02120-06	CAP CER 1210 12P NPO500VGRM42
D111		001-00011-60	S) DIODE SR2607 -- USE MR750
D220		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23
D230		001-00010-40	S) DIODE ZENER 33V 1.3W
D240		001-10000-56	S) DIODE SMD BAW56 D-SW SOT23
D250		001-10000-56	S) DIODE SMD BAW56 D-SW SOT23
D260		001-10000-56	S) DIODE SMD BAW56 D-SW SOT23
D270		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23
D340		001-10000-18	S) DIODE SMD BAT18 S-SW SOT23
D350		001-10000-18	S) DIODE SMD BAT18 S-SW SOT23
D360		001-10000-18	S) DIODE SMD BAT18 S-SW SOT23
D610		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23
D620		001-10000-70	S) DIODE SMD BAV70 D-SW SOT23
D630		001-10000-70	S) DIODE SMD BAV70 D-SW SOT23
D635		001-10065-00	DIODE BAT65 SCHOTTKEY SOD123
D640		001-10000-70	S) DIODE SMD BAV70 D-SW SOT23
D710		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23
D720		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23
D730		001-10065-00	DIODE BAT65 SCHOTTKEY SOD123
D740		001-10065-00	DIODE BAT65 SCHOTTKEY SOD123
D810		001-10065-00	DIODE BAT65 SCHOTTKEY SOD123
IC210		002-10003-24	S) IC SMD 324 4X O-AMP SO14
IC220		002-10126-70	S) IC SMD DS1267S10K 2XDIG POT
IC230		002-10003-24	S) IC SMD 324 4X O-AMP SO14
IC240		002-10040-53	S)MC14053B SMD BREAK B4 MAKE
IC250		002-00020-50	S) IC 4N25A OPTOCOUPLER
IC260		002-10003-24	S) IC SMD 324 4X O-AMP SO14
IC330		002-00012-40	S) IC 358 DUAL O-AMP
IC610		002-00014-58	S) IC 78L05 5V 100MA REG TO92
IC630		002-00014-62	S) IC 317L 100MA REG 3TER TO92
IC640		002-10003-58	S) IC SMD LM358 DUAL O-AMP
IC650		002-10012-32	SMD DS1232LPS-2 LP RESET&W-DOG
=IC700		539-00010-41	TCXO 12.8MHZ +-2.5PPM -30 +70C
IC710		002-74910-04	S) IC SMD 74HCU04 6X INV
IC720		002-74910-04	S) IC SMD 74HCU04 6X INV
IC730		002-10045-20	S) IC SMD 74HC4520T 2XCTR 4BIT
IC740		002-14519-10	S) IC MC145191F SMD SYNTH
IC750		002-10330-78	S) IC MC33078D 2X AMP LO NOISE
IC810		002-08951-20	S) IC AT89C51 PLCC44 MIC 12MHZ
IC820		002-12416-00	S)IC SMD AT24C16N-10SC EEPROM
IC830		002-10003-24	S) IC SMD 324 4X O-AMP SO14
LED1		008-00013-32	S) LED 3 RED LO CURRENT NO MTG
LED2		008-00013-35	S) LED 3 GRN LO CURRENT NO MTG
L335		056-00021-04	IND FXD 330NH AX
L340		056-00021-04	IND FXD 330NH AX
L345		052-08135-25	COIL A/W 2.5T/3.5MM HOR 0.8MM
L350		052-08125-15	COIL A/W 1.5T/2.5MM HOR 0.8MM
L355		056-00021-01	IND FXD 1.5UH AX
L360		052-08135-35	COIL A/W 3.5T/3.5MM HOR 0.8MM
L365		052-08130-15	COIL A/W 1.5T/3.0MM HOR 0.8MM
L370		065-00010-08	BEAD FERR 4S3 3X0.7X10MM RED
L375		065-00010-04	BEAD FERR F8 4X2X5MM
L380		056-00021-01	IND FXD 1.5UH AX
L385		052-08140-35	COIL A/W 3.5T/4.0MM HOR 0.8MM
L390		056-00021-04	IND FXD 330NH AX
L750		056-10068-00	IND FXD SMD 68NH 3.2*2.5*1.6
L910		052-08140-35	COIL A/W 3.5T/4.0MM HOR 0.8MM
L920		052-08140-35	COIL A/W 3.5T/4.0MM HOR 0.8MM
PL100		240-00010-55	PLUG 15 W D RANGE W/W PNL MT
PL205		240-00020-67	HEADER 6W 2X3 PCB MTG STD
PL210		240-00020-67	HEADER 6W 2X3 PCB MTG STD
PL215		240-00020-44	HEADER 10W X2R PCB MTG 5*2
PL220		240-00020-67	HEADER 6W 2X3 PCB MTG STD
Q210		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q220		000-10008-17	S) XSTR SMD BC817-25 NPN SOT23
Q230		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q240		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q250		000-10008-17	S) XSTR SMD BC817-25 NPN SOT23
Q260		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q270		000-00011-91	S) XSTR BD139 NPN AF PWR TO126
Q305		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q310		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q315		000-00012-15	S) XSTR BD234 PNP AF PWR TO126
Q320		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q325		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q330		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q335		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q340		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q345		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q365		000-00031-96	S) XSTR 3866 NPN T092 SWITCH
Q370		000-00022-30	S) XSTR 2N4427 NPN T039 VHF DR
Q510		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q520		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q530		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q540		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q550		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q610		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q620		000-00012-15	S) XSTR BD234 PNP AF PWR TO126
Q630		000-50011-30	S) XSTR AI BC557B PNP TO92 AF
Q660		000-10008-17	S) XSTR SMD BC817-25 NPN SOT23
Q670		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q710		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q720		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q730		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q740		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q750		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q760		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q770		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q775		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q780		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q785		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q790		000-10003-12	S) XSTR SMD BFR31 N JFET SOT23
Q795		000-10057-10	S) XSTR SMD BR571 NPN SOT23
Q810		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q820		000-10008-17	S) XSTR SMD BC817-25 NPN SOT23
Q830		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q840		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q850		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q860		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
R160		036-12100-00	RES M/F 0805 10E 5%
R201		036-13560-00	RES M/F 0805 560E 5%
R202		036-14100-00	RES M/F 0805 1K 5%
R204		036-14220-00	RES M/F 0805 2K2 5%
R205		036-13220-00	RES M/F 0805 220E 5%
R206		036-14100-00	RES M/F 0805 1K 5%
R207		036-14390-00	RES M/F 0805 3K9 5%
R208		036-13560-00	RES M/F 0805 560E 5%
R209		036-15100-00	RES M/F 0805 10K 5%
R210		036-14220-00	RES M/F 0805 2K2 5%
R212		036-16100-00	RES M/F 0805 100K 5%
R213		036-15100-00	RES M/F 0805 10K 5%
R214		036-14820-00	RES M/F 0805 8K2 5%
R215		036-16100-00	RES M/F 0805 100K 5%
R216		036-16100-00	RES M/F 0805 100K 5%
R217		036-14100-00	RES M/F 0805 1K 5%
R218		036-16150-00	RES M/F 0805 150K 5%
R219		036-14220-00	RES M/F 0805 2K2 5%
R221		036-14150-00	RES M/F 0805 1K5 5%
R223		036-17100-00	RES M/F 0805 1M 5%
R224		036-14680-00	RES M/F 0805 6K8 5%
R225		036-17100-00	RES M/F 0805 1M 5%
R226		036-15100-00	RES M/F 0805 10K 5%
R227		036-14220-00	RES M/F 0805 2K2 5%
R229		036-16470-00	RES M/F 0805 470K 5%
R230		036-16100-00	RES M/F 0805 100K 5%
R231		036-15100-00	RES M/F 0805 10K 5%
R232		036-16330-00	RES M/F 0805 330K 5%
R233		036-16100-00	RES M/F 0805 100K 5%
R235		036-14470-00	RES M/F 0805 4K7 5%
R237		036-15470-00	RES M/F 0805 47K 5%
R238		036-15470-00	RES M/F 0805 47K 5%
R239		036-14150-00	RES M/F 0805 1K5 5%
R241		036-14470-00	RES M/F 0805 4K7 5%
R242		036-14220-00	RES M/F 0805 2K2 5%
R244		036-15100-00	RES M/F 0805 10K 5%
R245		036-16100-00	RES M/F 0805 100K 5%
R247		036-15100-00	RES M/F 0805 10K 5%
R248		036-16100-00	RES M/F 0805 100K 5%
R249		036-16100-00	RES M/F 0805 100K 5%
R251		036-16100-00	RES M/F 0805 100K 5%
R253		036-16100-00	RES M/F 0805 100K 5%
R254		036-16100-00	RES M/F 0805 100K 5%
R255		036-15100-00	RES M/F 0805 10K 5%
R256		036-15470-00	RES M/F 0805 47K 5%
R257		036-16330-00	RES M/F 0805 330K 5%
R258		036-16150-00	RES M/F 0805 150K 5%
R259		036-15220-00	RES M/F 0805 22K 5%
R260		036-15470-00	RES M/F 0805 47K 5%
R262		036-15470-00	RES M/F 0805 47K 5%
R263		036-14470-00	RES M/F 0805 4K7 5%
&R264	10	036-15220-00	RES M/F 0805 22K 5%
&R264	13	036-15220-00	RES M/F 0805 22K 5%
&R264	15	036-15270-00	RES M/F 0805 27K 5%
&R264	20	036-15220-00	RES M/F 0805 22K 5%
&R264	23	036-15220-00	RES M/F 0805 22K 5%
&R264	25	036-15270-00	RES M/F 0805 27K 5%
&R265	10	036-15150-00	RES M/F 0805 15K 5%
&R265	13	036-15150-00	RES M/F 0805 15K 5%
&R265	15	036-15180-00	RES M/F 0805 18K 5%
&R265	20	036-15150-00	RES M/F 0805 15K 5%
&R265	23	036-15150-00	RES M/F 0805 15K 5%
&R265	25	036-15180-00	RES M/F 0805 18K 5%
&R266	10	036-15470-00	RES M/F 0805 47K 5%
&R266	13	036-15470-00	RES M/F 0805 47K 5%
&R266	15	036-15560-00	RES M/F 0805 56K 5%
&R266	20	036-15470-00	RES M/F 0805 47K 5%
&R266	23	036-15470-00	RES M/F 0805 47K 5%
&R266	25	036-15560-00	RES M/F 0805 56K 5%
R267		036-14220-00	RES M/F 0805 2K2 5%
R268		036-13100-00	RES M/F 0805 100E 5%
R269		036-15100-00	RES M/F 0805 10K 5%
R270		036-13470-00	RES M/F 0805 470E 5%
R271		036-16390-00	RES M/F 0805 390K 5%

Ref	Var	IPN	Description
R842		036-14220-00	RES M/F 0805 2K2 5%
R843		036-14220-00	RES M/F 0805 2K2 5%
R845		036-13470-00	RES M/F 0805 470E 5%
R846		036-13470-00	RES M/F 0805 470E 5%
R847		036-13470-00	RES M/F 0805 470E 5%
R848		036-14470-00	RES M/F 0805 4K7 5%
R849		036-13470-00	RES M/F 0805 470E 5%
R850		036-13470-00	RES M/F 0805 470E 5%
R853		036-14470-00	RES M/F 0805 4K7 5%
R854		036-14470-00	RES M/F 0805 4K7 5%
R855		036-14470-00	RES M/F 0805 4K7 5%
R859		036-16150-00	RES M/F 0805 150K 5%
R861		036-16150-00	RES M/F 0805 150K 5%
R863		036-16150-00	RES M/F 0805 150K 5%
R865		036-16100-00	RES M/F 0805 100K 5%
R867		036-16100-00	RES M/F 0805 100K 5%
R871		036-15470-00	RES M/F 0805 47K 5%
R872		036-14470-00	RES M/F 0805 4K7 5%
R873		036-15330-00	RES M/F 0805 33K 5%
R874		036-14470-00	RES M/F 0805 4K7 5%
R875		036-15470-00	RES M/F 0805 47K 5%
R876		036-14470-00	RES M/F 0805 4K7 5%
R877		036-14470-00	RES M/F 0805 4K7 5%
R879		036-15100-00	RES M/F 0805 10K 5%
RV210		040-05100-23	POT 10K LOG PCB 15MM SLOT SFT
RV220		042-05470-06	RES PRE 47K CAR 6MM FLAT T/ADJ
RV805		042-05220-07	RES PRE 22K CAR 6MM FLAT D/ADJ
SK205		240-02020-05	SKT STEREO PHONE JACK PCB MTG
SK310		240-02100-44	SKT COAX MINI JACK PCB MT ANG.
SK420		240-02100-44	SKT COAX MINI JACK PCB MT ANG.
SK501		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK502		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK503		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK504		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK505		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK513		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK522		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK531		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK532		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK533		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK534		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK535		240-04021-77	SKT JACK 1.3 PCB MT 64W
SK805		240-10000-07	CONN SMD SKT 16W 2R M-MATCH
SK810		240-04020-42	SKT 44 PIN SMD PLCC
SW230		232-00010-26	SWITCH PUSH SPDT R-ANG PCB MTG
T210		053-00010-17	XFMR T4030 LINE MATCH POTCORE
T610		050-00016-50	COIL TAIT NO 650 455KHZ

T839 Grid Reference Index

Device	PCB	Circuit
*C101	1:E4	1-B8
*C103	1:E4	1-B9
*C105	1:B3	1-D8
*C107	1:B3	1-D9
*C109	1:B3	1-D8
*C111	1:C4	1-D8
*C113	1:B5	1-F8
*C115	1:B5	1-F8
*C117	1:B5	1-F9
*C119	1:B5	1-G8
*C121	1:D4	1-B6
*C123	1:D4	1-B6
*C125	1:C4	1-D7
*C127	1:C4	1-D6
C129	1:B3	1-H5
C131	1:B3	1-J6
C132	1:A3	1-K7
C133	1:B4	1-K8
C137	1:B2	1-K8
C138	1:B2	1-L8
C139	1:B4	1-M6
C141	1:B3	1-M8
C143	1:E3	1-E7
C145	1:E3	1-F7
C147	1:D3	1-F6
C149	1:D3	1-F7
C151	1:C5	1-D5
C153	1:B5	1-D3
C155	1:D3	1-G3
C159	1:B3	1-H2
C161	1:B4	1-K4
C162	1:B3	1-L4
C164	1:B3	1-L4
C165	1:B3	1-M4
C167	1:K3	1-P3
C169	1:K3	1-P3
C171	1:K3	1-Q3
C173	1:D4	1-B0
C174	1:E4	1-B0
C176	1:D4	1-E0
C178	1:C4	1-F0
C179	1:D3	1-G2
C180	1:E2	1-H0
C181	1:D3	1-G0
C182	1:D3	1-H1
C184	1:D4	1-G0
C185	1:D2	1-J1
C186	1:E2	1-J0
C187	1:D3	1-K1
C188	1:C2	1-L1
C189	1:C3	1-M1
C190	1:C3	1-N1
C192	1:B2	1-N1
C193	1:B2	1-P1
C195	1:C2	1-Q1
C201	1:J7	2-N7
*C202	1:H3	2-B9
*C203	1:P7	2-D3
*C204	1:M6	2-E2
C205	1:L7	2-J8
*C206	1:P6	2-D2
C207	1:K7	2-M7
*C208	1:H2	2-C9
*C209	1:C5	2-D9
*C210	1:C5	2-E9
*C212	1:D5	2-H9
*C213	1:D4	2-H9
C215	1:D5	2-K9
C216	1:H5	2-B9
*C217	1:P3	2-E4
C218	1:H5	2-C9
*C219	1:P2	2-E5
C220	1:E5	2-D9
C221	1:E5	2-Q9
C222	1:E5	2-E9
C223	1:D5	2-H9
C224	1:D5	2-N9
C225	1:L6	2-J7
C226	1:D4	2-H9
C227	1:K6	2-K7
C229	1:H6	2-L6
*C230	1:L4	2-J4
*C231	1:L4	2-J3
*C232	1:K4	2-K3
*C233	1:K4	2-M3
*C234	1:J4	2-N3
*C240	1:H4	2-L2
C259	1:F7	2-R5
C261	1:F6	2-R6
C268	1:E6	2-R4
C270	1:D6	2-R4
C271	1:C6	2-R4
C272	1:B6	2-R4
C273	1:B6	2-R4
C294	1:D6	2-R3
C295	1:D6	2-R3
C297	1:C5	2-M9
C298	1:C6	2-M9
D101	1:B3	1-H5
D101	1:B3	1-G5
D103	1:P7	1-K9
D105	1:C2	1-J2
D105	1:C2	1-J2
D107	1:P7	1-K5
D109	1:P6	1-L5
D111	1:C2	1-M1
D111	1:C2	1-M1
D113	1:F7	1-Q2
D201	1:F6	2-R5
D202	1:D4	2-J9
D202	1:D4	2-J9
D203	1:E6	2-R4
IC101	1:D4	1-C6
IC101	1:D4	1-G0
IC101	1:D4	1-B8
IC101	1:D4	1-C0
IC101	1:D4	1-N0
IC103	1:C4	1-D4
IC103	1:C4	1-J8
IC103	1:C4	1-F0
IC103	1:C4	1-J5
IC103	1:C4	1-E3
IC105	1:D3	1-M0
IC105	1:D3	1-P0
IC105	1:D3	1-G2
IC107	1:D3	1-K1
IC109	1:B2	1-N1
*IC201	1:K6	2-J7
*#IC202	1:K4	2-J2
*IC203	1:N5	2-F4
IC204	1:D5	2-H9
IC204	1:D5	2-P9
IC204	1:D5	2-H9
*IC205	1:G5	2-R4
L101	1:K3	1-P3
L103	1:K2	1-Q3
L105	1:E2	1-K0
*L201	1:P7	2-C3
*L202	1:H3	2-C9
L203	1:L7	2-J9
*L204	1:C5	2-D9
L206	1:H5	2-C9
L208	1:E5	2-D9
*L211	1:P2	2-D5
L215	1:L7	2-J8
L217	1:J7	2-L8
*L223	1:J4	2-L3
*L230	1:L4	2-J5
*L231	1:L4	2-J4
L233	1:F6	2-R6
*L236	1:H6	2-N3
L239	1:E5	2-R3
L241	1:D6	2-R4
L243	1:C6	2-R4
L245	1:C7	2-R4
L247	1:C6	2-R4
L248	1:D7	2-R4
L249	1:B6	2-R4
L264	1:C6	2-M9
LINK1	1:D3	1-L0
LINK2	1:P6	1-D1
LINK201	1:D5	2-F9
P101	1:A5	1-R9
P103	1:K3	1-R0
P105	1:K2	1-R0
P201	1:B6	2-R4
PL101	1:L3	1-C2
*Q101	1:C3	1-C9
*Q103	1:B3	1-E8
*Q105	1:C4	1-D7
*Q107	1:B5	1-F8
*Q109	1:A5	1-G9
Q111	1:A3	1-J7
Q113	1:A3	1-K6
Q115	1:A3	1-L7
Q117	1:B4	1-K8
Q119	1:B4	1-L6
Q121	1:B3	1-L8
Q123	1:E3	1-E7
Q125	1:E3	1-F7
Q127	1:D3	1-G7
Q129	1:B4	1-L4
Q131	1:B3	1-M5
Q133	1:D4	1-D0
Q135	1:E2	1-H0
Q136	1:E3	1-H0
Q137	1:D2	1-J0
Q201	1:D5	2-L9
R101	1:E4	1-A8
*R102	1:E4	1-A9
R103	1:E4	1-A8
R104	1:E4	1-B9
*R105	1:D4	1-C8
*R106	1:B3	1-C8
*R107	1:C4	1-D7
*R108	1:B3	1-E9
*R109	1:C3	1-E9
*R111	1:B5	1-E8
*R112	1:B5	1-E9
*R113	1:B5	1-F9
*R114	1:C4	1-A6
*R115	1:C5	1-A6
*R116	1:D4	1-A7
R117	1:C4	1-A6
R118	1:D4	1-B6
R119	1:D4	1-C7
*R121	1:C4	1-C7
*R122	1:C4	1-D6
R123	1:B4	1-H7
R124	1:B4	1-H8
R125	1:B4	1-H8
R126	1:B3	1-H6
R127	1:A3	1-H7
R128	1:A3	1-J7
R129	1:B4	1-J9
R130	1:B4	1-J8
R131	1:A3	1-J7
R132	1:B5	1-J8
R133	1:A3	1-K7
R134	1:B3	1-K6
R135	1:P7	1-K9
R136	1:A3	1-K7
R137	1:B3	1-K6
R138	1:B4	1-L6
R141	1:E3	1-B5
R142	1:E3	1-E7
R143	1:E4	1-F6
R144	1:D3	1-F6
R145	1:E4	1-F7
R146	1:E4	1-G7
R148	1:C5	1-D5
R149	1:C5	1-C4
R150	1:C4	1-F0
R151	1:B5	1-D5
R152	1:B5	1-C3
R153	1:C5	1-F4
R154	1:C5	1-F3
R155	1:D3	1-F2
R156	1:D3	1-F3
R157	1:D4	1-G0
R158	1:C4	1-H3
R159	1:C4	1-H4
R160	1:C3	1-J5
R161	1:B3	1-J3
R162	1:B3	1-K4
R163	1:P7	1-K5
R164	1:B3	1-K4
R165	1:B4	1-K4
R166	1:P6	1-L5
R168	1:E4	1-A1
R169	1:E4	1-A0
R170	1:D4	1-B0
R171	1:E4	1-B0
R172	1:E4	1-B0
R173	1:P6	1-C1
R174	1:P6	1-C1
R175	1:D4	1-C0
R176	1:D4	1-D0
R177	1:D4	1-D0
R178	1:D3	1-E1
R179	1:D4	1-E0
R180	1:D4	1-E0
R181	1:E3	1-F2
R182	1:D4	1-E0
R183	1:D4	1-F1
R184	1:E3	1-G1
R185	1:E2	1-J0
R186	1:D2	1-H1
R187	1:E2	1-H0
R188	1:D2	1-L1
R189	1:D2	1-L1
R190	1:C3	1-M1
R191	1:B2	1-P1
R192	1:B2	1-P1
R193	1:C2	1-Q1
R194	1:D2	1-H0
R195	1:D3	1-J0
R196	1:D3	1-J0
R197	1:D3	1-L1
*R201	1:N6	2-D2
*R202	1:N6	2-D2
R203	1:L7	2-J8
*R204	1:N6	2-E2
R205	1:K7	2-M7
*R206	1:C5	2-E9
R207	1:C5	2-G9
*R208	1:C5	2-G9
R209	1:D5	2-G9
R210	1:D5	2-G9
*R211	1:D4	2-H9
R212	1:D4	2-J9
R213	1:D5	2-F9
R214	1:E4	2-K9
*R215	1:H3	2-B9
*R216	1:P6	2-E4
*R217	1:P6	2-E4
R218	1:E5	2-E9
R219	1:H6	2-B9
R220	1:E5	2-G9
R222	1:D5	2-G9

Device	PCB	Circuit
*R223	1:F2	2-R4
R224	1:D4	2-G9
R225	1:E7	2-R5
R228	1:E4	2-G9
R229	1:D4	2-H9
*R230	1:L4	2-J4
R231	1:F5	2-R4
*R232	1:K4	2-M3
R237	1:C5	2-L9
RV101	1:C4	1-H8
RV103	1:C4	1-H6
RV105	1:C3	1-J5
RV107	1:C3	1-J3
RV109	1:P5	1-C2
*RV111	1:P5	1-D1
RV113	1:C3	1-D0
RV115	1:C3	1-K0
SK101	1:K3	1-A2
SK103	1:B4	1-B2
*SK201	1:N3	2-D4
*SK203	1:N7	2-C2
TH201	1:A7	2-R9
TOPFIDA	1:C2	2-R9
TOPFIDB	1:N7	2-R9
TS202	1:M7	2-R9
*838-10F	1:G2	2-R9
*838-10R	1:G2	2-R9
*838-20F	1:G2	2-R9
*838-20R	1:G2	2-R9
*839-10F	1:G3	2-R9
*839-10R	1:G3	2-R9
*839-20F	1:G2	2-R9
*839-20R	1:G2	2-R9

Device	PCB	Circuit

Device	PCB	Circuit

Device	PCB	Circuit

No Ref	,045-06100-05,	ASSY 100K NTC FOR MODULE
No Ref	,369-00010-14,	TIE CABLE NYLON 100*2.6MM
No Ref	,319-30064-00,	SPACER HSINK RF MODULE 869PA
No Ref	,400-00020-30,	HEATSHRINK 3MM
No Ref	,206-00010-11,	COAX 50 OHM RG316-U PTFE
No Ref	,308-13125-00,	HEATSINK T839 COUPLER
No Ref	,308-13122-01,	HEATSINK T839 PA COMPLETE
No Ref	,365-01391-01,	LABEL 30*10.8 T/MARK VOID
No Ref	,258-00010-03,	FAN 12V 119X119X25MM TUBE AX
No Ref	,349-00010-59,	SCRW 6-32 * 3/8 P/PH T/T ZP
No Ref	,240-06010-15,	BLOCK LATCHING 15W D RANGE
No Ref	,219-02591-00,	LOOM RIBBON 8 WAY FOR T839PA
No Ref	,220-01402-02,	PCB T839 TEFLON DIRNL COUPLER
No Ref	,220-01404-02,	PCB T839 PA MODULE DESIGN
No Ref	,065-00010-13,	BEAD FER 7D 1.9*0.9*3.8
No Ref	,201-00030-02,	WIRE T/C WIRE 7/0.2 PVC RED
No Ref	,201-00030-10,	WIRE T/C 7/0.2 PVC BLACK
No Ref	,345-00040-16,	SCRW M3X20MM P/POZ ST BZ
No Ref	,201-00050-26,	AUTO 154 BLACK 41/0.3 PVC
No Ref	,303-23148-00,	COVER BLANKING BNC CONNECTOR
No Ref	,240-00100-43,	PLG COAX MINI PIN CRIMP 1.5D
No Ref	,240-00100-46,	PLUG COAX PNL JACK 24SMC50-2
No Ref	,240-02100-06,	SKT COAX N TYPE PNL MTG OP-TER
No Ref	,240-06010-44,	HOOD CONN UHF & N-TYPE
No Ref	,302-05204-00,	BRKT A3M2314 F/THRU MTG T859
No Ref	,319-01152-00,	SHIELD A3M2250 F/THRU MTG T857
No Ref	,356-00010-03,	TAG SOLDER 3MM LONG M614/3.2
No Ref	,400-00020-07,	SLEEVING 2MM SIL RUBBER
No Ref	,045-06100-05,	ASSY 100K NTC FOR MODULE
No Ref	,240-04020-62,	SKT 2 W RECEP SHORTING LINK
No Ref	,319-01190-01,	SHIELD WALL HARM. FILTER 869PA
No Ref	,319-01202-00,	SHIELD T869PA CONTROL CIRCUIT
No Ref	,201-00050-25,	AUTO 154 RED 41/0.3 PVC
No Ref	,362-00010-07,	GASKET SIL INSULATING TO-220
No Ref	,356-00010-01,	TAG SOLDER 3MM SHORT M6132/3.2
No Ref	,353-00010-10,	WSHR M3 FLAT 7MM*0.6MM ST BZ
No Ref	,352-00010-04,	NUT M2.5 MACH HEX ST BZ
No Ref	,357-00010-45,	CLAMP CABLE 4.8MM P CLIP
No Ref	,356-00010-03,	TAG SOLDER 3MM LONG M614/3.2
No Ref	,349-00020-49,	SCRW T/T M4X35MM P/POZ BZ
No Ref	,349-00020-43,	SCRW T/T M4X12MM P/POZ BZ
No Ref	,362-00010-13,	BUSH INSULATING 1.1MM TOP HAT
No Ref	,356-00010-05,	TAG SOLDER 4MM LONG M6144/4.2
No Ref	,365-00100-20,	LABEL WHITE S/A 28X11MM
No Ref	,349-00020-09,	SCRW T/T 4-40X3/8 IN P/POZ BLK
No Ref	,349-00020-07,	SCRW 4-40 X 5/16 P/POZ T/T BLK
No Ref	,349-00020-08,	SCRW T/T 4-40X3/8 CSK POZI BZ
PL101	,240-00010-55,	PLUG 15 W D RANGE W/W PNL MT
Q111	,000-10008-57,	S) XSTR SMD BCW70 PNP SOT23 SS
Q113	,000-10008-48,	S) XSTR SMD BCW60 NPN SOT23 SS
Q115	,000-10008-57,	S) XSTR SMD BCW70 PNP SOT23 SS
Q117	,000-10008-17,	S) XSTR SMD BC817-25 NPN SOT23
Q119	,000-10008-48,	S) XSTR SMD BCW60 NPN SOT23 SS
Q121	,000-10017-00,	LS) XSTR SMD BF170LT1 SOT23
Q123	,000-10008-57,	S) XSTR SMD BCW70 PNP SOT23 SS
Q125	,000-10008-57,	S) XSTR SMD BCW70 PNP SOT23 SS
Q127	,000-10008-57,	S) XSTR SMD BCW70 PNP SOT23 SS
Q129	,000-10008-17,	S) XSTR SMD BC817-25 NPN SOT23
Q131	,000-10017-00,	LS) XSTR SMD BF170LT1 SOT23
Q133	,000-10008-48,	S) XSTR SMD BCW60 NPN SOT23 SS
Q135	,000-10008-17,	S) XSTR SMD BC817-25 NPN SOT23
Q136	,000-10008-17,	S) XSTR SMD BC817-25 NPN SOT23
Q137	,000-00030-95,	S) XSTR 2N6107 PNP TO220 AF
Q201	,000-10008-48,	S) XSTR SMD BCW60 NPN SOT23 SS
R101	,036-14100-00,	RES M/F 0805 1K 5%
R103	,036-15330-00,	RES M/F 0805 33K 5%
R104	,036-16470-00,	RES M/F 0805 470K 5%
R117	,036-16220-00,	RES M/F 0805 220K 5%
R118	,036-15270-00,	RES M/F 0805 27K 5%
R119	,036-16470-00,	RES M/F 0805 470K 5%
R123	,036-14100-00,	RES M/F 0805 1K 5%
R124	,036-16100-00,	RES M/F 0805 100K 5%
R125	,036-15100-00,	RES M/F 0805 10K 5%
R126	,036-14100-00,	RES M/F 0805 1K 5%
R127	,036-15100-00,	RES M/F 0805 10K 5%
R128	,036-15220-00,	RES M/F 0805 22K 5%
R129	,036-17100-00,	RES M/F 0805 1M 5%
R130	,036-14220-00,	RES M/F 0805 2K2 5%
R131	,036-16180-00,	RES M/F 0805 180K 5%
R132	,036-14100-00,	RES M/F 0805 1K 5%
R133	,036-15100-00,	RES M/F 0805 10K 5%
R134	,036-13470-00,	RES M/F 0805 470E 5%
R135	,036-13680-00,	RES M/F 0805 680E 5%
R136	,036-15100-00,	RES M/F 0805 10K 5%
R137	,036-14220-00,	RES M/F 0805 2K2 5%
R138	,036-15100-00,	RES M/F 0805 10K 5%
R141	,036-15100-00,	RES M/F 0805 10K 5%
R142	,036-15100-00,	RES M/F 0805 10K 5%
R143	,036-15100-00,	RES M/F 0805 10K 5%
R144	,036-15820-00,	RES M/F 0805 82K 5%
R145	,036-15470-00,	RES M/F 0805 47K 5%
R146	,036-14180-00,	RES M/F 0805 1K8 5%
R148	,036-14820-00,	RES M/F 0805 8K2 5%
R149	,036-13470-00,	RES M/F 0805 470E 5%
R150	,036-12220-00,	RES M/F 0805 22E 5%
R151	,036-15100-00,	RES M/F 0805 10K 5%
R152	,036-15100-00,	RES M/F 0805 10K 5%
R153	,036-14680-00,	RES M/F 0805 6K8 5%
R154	,036-14680-00,	RES M/F 0805 6K8 5%
R155	,036-13220-00,	RES M/F 0805 220E 5%
R156	,036-13100-00,	RES M/F 0805 100E 5%
R157	,036-12220-00,	RES M/F 0805 22E 5%
R158	,036-14100-00,	RES M/F 0805 1K 5%
R159	,036-15100-00,	RES M/F 0805 10K 5%
R160	,036-14470-00,	RES M/F 0805 4K7 5%
R161	,036-14100-00,	RES M/F 0805 1K 5%
R162	,036-17100-00,	RES M/F 0805 1M 5%
R163	,036-13680-00,	RES M/F 0805 680E 5%
R164	,036-14220-00,	RES M/F 0805 2K2 5%
R165	,036-14100-00,	RES M/F 0805 1K 5%
R166	,036-13680-00,	RES M/F 0805 680E 5%
R168	,036-15100-10,	RES M/F 0805 10K 1%
R169	,036-14100-00,	RES M/F 0805 1K 5%
R170	,036-14100-00,	RES M/F 0805 1K 5%
R171	,036-14100-00,	RES M/F 0805 1K 5%
R172	,036-15100-10,	RES M/F 0805 10K 1%
R173	,036-13470-00,	RES M/F 0805 470E 5%
R174	,036-13220-00,	RES M/F 0805 220E 5%
R175	,036-16220-00,	RES M/F 0805 220K 5%
R176	,036-15100-00,	RES M/F 0805 10K 5%
R177	,036-14470-00,	RES M/F 0805 4K7 5%
R178	,036-16100-00,	RES M/F 0805 100K 5%
R179	,036-15100-00,	RES M/F 0805 10K 5%
R180	,036-16150-00,	RES M/F 0805 150K 5%
R181	,036-14560-00,	RES M/F 0805 5K6 5%
R182	,036-16100-00,	RES M/F 0805 100K 5%
R183	,036-14470-00,	RES M/F 0805 4K7 5%
R184	,036-14100-00,	RES M/F 0805 1K 5%
R185	,036-03100-02,	RES 100E 1206 200V 250MW RC01
R186	,036-13100-00,	RES M/F 0805 100E 5%
R187	,036-03150-03,	RES 1218 PWR CHIP 150E 20% 1W
R188	,036-13220-00,	RES M/F 0805 220E 5%
R189	,036-12100-00,	RES M/F 0805 10E 5%
R190	,036-12220-00,	RES M/F 0805 22E 5%
R191	,036-14100-10,	RES M/F 0805 CHIP 1K 1%
R192	,036-13220-10,	RES 0805 220E 1%
R193	,036-12100-00,	RES M/F 0805 10E 5%
R194	,036-03220-03,	RES 1218 PWR CHIP 220E 20% 1W
R195	,036-14220-00,	RES M/F 0805 2K2 5%
R196	,036-13100-00,	RES M/F 0805 100E 5%
R197	,036-10000-00,	RES M/F 0805 ZERO OHM
R203	,036-02100-02,	RES 10E 1206 200V 250MW RC01
R205	,036-02100-02,	RES 10E 1206 200V 250MW RC01
R207	,036-15470-10,	RES M/F 0805 47K 1%
R209	,036-14150-10,	RES MF 0805 CHIP 1K5 1%
R210	,036-14470-10,	RES M/F 0805 CHIP 4K7 1%
R212	,036-15100-00,	RES M/F 0805 10K 5%
R213	,036-14390-00,	RES M/F 0805 3K9 5%
R214	,036-14470-00,	RES M/F 0805 4K7 5%
R218	,036-13390-10,	RES MF 0805 CHIP 390E 1%
R220	,036-15470-10,	RES M/F 0805 47K 1%
R222	,036-15470-10,	RES M/F 0805 47K 1%
R224	,036-14150-10,	RES MF 0805 CHIP 1K5 1%
R225	,030-03120-00,	RES FILM 120E 5% 0.25W 7X2.5
R228	,036-14470-10,	RES M/F 0805 CHIP 4K7 1%
R229	,036-15560-10,	RES MF 0805 CHIP 56K 1%
R231	,030-03120-00,	RES FILM 120E 5% 0.25W 7X2.5
R237	,045-04470-00,	RES NTC SMD 4K7 5% 20MW
RV101	,042-04500-05,	RES PRESET SMD 5K CER 4MM SQ
RV103	,042-05500-05,	RES PRESET SMD 50K CER 4MM SQ
RV105	,042-04500-05,	RES PRESET SMD 5K CER 4MM SQ
RV107	,042-05500-05,	RES PRESET SMD 50K CER 4MM SQ
RV109	,044-04200-03,	RES PRE 2K 10 TURN PNL MTG
RV113	,042-06500-05,	RES PRESET SMD 500K CER 4MM SQ
RV115	,042-04220-05,	RES PRESET SMD 2K CER 4MM SQ
SK101	,240-10000-05,	CONN SMD SKT 8W 2R M-MATCH
SK103	,240-10000-05,	CONN SMD SKT 8W 2R M-MATCH

T837 Mechanical & Miscellaneous Parts (220-01390-02)

IPN	Legend	Description
012-04150-01		CAP CER F/THRU 1N5 NO LEAD Fitted to D-range pins.
051-00006-02		SOLDER SPRING 1.3MM A4M1877 Support for front panel LED solder joints.
065-00010-13		BEAD FER 7D 1.9X0.9X3.8 Fitted to D-range pins.
200-00010-05		WIRE T/C 0.5 For ferrite beads.
201-00030-02		WIRE T/C 7/0.2 PVC RED Front panel LEDs.
201-00030-10		WIRE T/C 7/0.2 PVC BLACK Front panel LEDs.
206-00010-11		COAX 50 OHM RG316-U PTFE Connects SK310 to SK420.
220-01176-03	1	PCB T83X VCO
220-01390-02	2	PCB T837 EX SERIES II
232-00020-26	3	BUTTON 232-00010-26 SWITCH
240-00010-55	25	PLUG 15 W D RANGE W/W PNL MT PL100.
240-00100-43		PLG COAX MINI PIN CRIMP 1.5D For coax connecting SK310 to SK420.
240-02100-06	4	SKT COAX N TYPE PNL MTG OP-TER
240-04020-62		SKT 2 W RECEP SHORTING LINK PL205/210/215/220.
303-11169-03	5	CHASSIS PAINTED T800 SERIES
303-23118-00	6	COVER A3M2247 D RANGE
303-50074-00	7	CLIP A3M2246 SPRING CLAMP
303-50078-00	8	CLIP A4M2630 SPR. CABLE CLAMP
308-01007-01	9	HANDLE BASE STATION SERIES II
312-01052-01	10	LID TOP PNTD A1M2364 T800
312-01053-01	11	LID BOTTOM PNTD A1M2364 T800
316-06619-00	12	PNL FRT EX NO EX OUT SER II
319-01152-00	13	SHIELD A3M2250 F/THRU MTG
345-00040-10	14	SCRW M3X6MM P/POZ ST BZ
349-00020-36	15	LIM)SCREW TT M3X8m PANTORX BLK
349-00020-43	16	SCRW T/T M4X12MM P/POZ BZ
349-00020-45	17	SCRW T/T M4X20MM P/POZ BZ
350-00016-42	18	SPACER 5MM HI 8MM ST 2.5MM HO
352-00010-08	19	NUT M3 COLD FORM HEX ST BZ
352-00010-29	20	NUT M4 NYLOC HEX
353-00010-10	21	WSHR M3 FLAT 7MMX0.6MM ST BZ
353-00010-13	22	WSHR M3 S/PROOF INT BZ
362-00010-08		GASKET SIL INSUL TO-5 TO-39 Under Q370.
362-00010-23	23	GASKET SIL TO-220 CLIP MTG.
362-00010-33	24	GROMMET LED MTG 3MM
365-00011-53		LABEL 104X37MM
365-00100-09		LABEL WHITE VINYL 15X11MM S/A
365-00100-20		LABEL WHITE S/A 28X11MM
365-01541-00		LABEL TX/RX/EX TYPE APR/SER NO
400-00020-07		SLEEVING 2MM SIL RUBBER
410-01081-01		CRT T800 SERIES II
410-01082-01		CRTN 10 T800 KIWI 423X410X360

Ref	Var	IPN	Description
R272		036-13560-00	RES M/F 0805 560E 5%
R273		036-15120-00	RES M/F 0805 12K 5%
R274		036-15150-00	RES M/F 0805 15K 5%
R275		036-14270-00	RES M/F 0805 2K7 5%
R277		036-16100-00	RES M/F 0805 100K 5%
R278		036-16120-00	RES M/F 0805 120K 5%
R279		036-17100-00	RES M/F 0805 1M 5%
R280		036-15100-00	RES M/F 0805 10K 5%
R282		036-15560-00	RES M/F 0805 56K 5%
R283		036-15560-00	RES M/F 0805 56K 5%
R284		036-17100-00	RES M/F 0805 1M 5%
R285		036-10000-00	RES M/F 0805 ZERO OHM
R286		036-14220-00	RES M/F 0805 2K2 5%
R287		036-15100-00	RES M/F 0805 10K 5%
R288		036-15150-00	RES M/F 0805 15K 5%
R289		036-16100-00	RES M/F 0805 100K 5%
R290		036-13680-00	RES M/F 0805 680E 5%
R291		036-10000-00	RES M/F 0805 ZERO OHM
R292		036-14470-00	RES M/F 0805 4K7 5%
R293		036-15470-00	RES M/F 0805 47K 5%
R294		036-14470-00	RES M/F 0805 4K7 5%
R295		036-14270-00	RES M/F 0805 2K7 5%
R296		036-14100-00	RES M/F 0805 1K 5%
R297		036-14560-00	RES M/F 0805 5K6 5%
%R298		036-16100-00	RES M/F 0805 100K 5%
R299		036-14270-00	RES M/F 0805 2K7 5%
R302		036-15220-00	RES M/F 0805 22K 5%
R304		036-14270-00	RES M/F 0805 2K7 5%
R306		036-15100-00	RES M/F 0805 10K 5%
R308		036-16100-00	RES M/F 0805 100K 5%
R310		036-15220-00	RES M/F 0805 22K 5%
R312		036-14150-00	RES M/F 0805 1K5 5%
R314		036-13150-00	RES M/F 0805 150E 5%
R316		036-15100-00	RES M/F 0805 10K 5%
R318		036-14220-00	RES M/F 0805 2K2 5%
R320		036-14100-00	RES M/F 0805 1K 5%
R322		036-12220-00	RES M/F 0805 22E 5%
R324		036-13470-00	RES M/F 0805 470E 5%
R326		036-13470-00	RES M/F 0805 470E 5%
R328		036-13470-00	RES M/F 0805 470E 5%
R330		036-12220-00	RES M/F 0805 22E 5%
R332		036-15470-00	RES M/F 0805 47K 5%
R334		036-15100-00	RES M/F 0805 10K 5%
R336		036-14100-00	RES M/F 0805 1K 5%
R338		036-14100-00	RES M/F 0805 1K 5%
R340		036-16100-00	RES M/F 0805 100K 5%
R342		036-15150-00	RES M/F 0805 15K 5%
R344		036-15470-00	RES M/F 0805 47K 5%
R346		036-16120-00	RES M/F 0805 120K 5%
R348		036-14470-00	RES M/F 0805 4K7 5%
R350		036-14100-00	RES M/F 0805 1K 5%
R352		036-15150-00	RES M/F 0805 15K 5%
R354		036-15150-00	RES M/F 0805 15K 5%
R356		036-14100-00	RES M/F 0805 1K 5%
R359		030-53150-20	RES FILM AI 150E 5% 0.4W 4X1.6
R360		030-52390-20	RES FILM AI 39E 5% 0.4W 4X1.6
R362		030-53150-20	RES FILM AI 150E 5% 0.4W 4X1.6
R364		036-14150-00	RES M/F 0805 1K5 5%
R366		036-12470-00	RES M/F 0805 47E 5%
R368		036-15100-00	RES M/F 0805 10K 5%
R370		036-13560-00	RES M/F 0805 560E 5%
R372		036-14150-00	RES M/F 0805 1K5 5%
R374		036-13330-00	RES M/F 0805 330E 5%
R376		036-14100-00	RES M/F 0805 1K 5%
R378		030-53560-20	RES FILM AI 560E 5% 0.4W 4X1.6
R380		030-53180-20	RES FILM AI 180E 5% 0.4W 4X1.6
R382		030-53180-20	RES FILM AI 180E 5% 0.4W 4X1.6
R384		036-11330-00	RES M/F 0805 3E3 5%
R386		036-12470-00	RES M/F 0805 47E 5%
R388		030-53560-20	RES FILM AI 560E 5% 0.4W 4X1.6
R390		030-52120-20	RES M/F 12E 5% 4X1.6 0.2"
R392		030-53820-20	RES FILM AI 820E 5% 0.4W 4X1.6
R394		030-52120-20	RES M/F 12E 5% 4X1.6 0.2"
R396		030-53820-20	RES FILM AI 820E 5% 0.4W 4X1.6
R502		036-13330-00	RES M/F 0805 330E 5%
R505		036-15150-00	RES M/F 0805 15K 5%
R510		036-13680-00	RES M/F 0805 680E 5%
R515		036-12560-00	RES M/F 0805 56E 5%
R520		036-16120-00	RES M/F 0805 120K 5%
R525		036-15470-00	RES M/F 0805 47K 5%
R530		036-15220-00	RES M/F 0805 22K 5%
R535		036-15100-00	RES M/F 0805 10K 5%
R540		036-14220-00	RES M/F 0805 2K2 5%
R545		036-14470-00	RES M/F 0805 4K7 5%
R550		036-14470-00	RES M/F 0805 4K7 5%
R555		036-14470-00	RES M/F 0805 4K7 5%
R560		036-14270-00	RES M/F 0805 2K7 5%
R609		036-14100-00	RES M/F 0805 1K 5%
R613		036-13560-00	RES M/F 0805 560E 5%
R615		036-13100-00	RES M/F 0805 100E 5%
R617		036-10000-00	RES M/F 0805 ZERO OHM
R619		032-31100-00	RES M/F PWR 1E0 5% 1W 12X4.5MM
R621		032-31100-00	RES M/F PWR 1E0 5% 1W 12X4.5MM
R625		036-14100-00	RES M/F 0805 1K 5%
R629		032-33270-00	RES M/F PWR 270E 5% 1W 12X4.5
R633		036-14680-00	RES M/F 0805 6K8 5%
R637		036-12220-00	RES M/F 0805 22E 5%
R641		036-14150-00	RES M/F 0805 1K5 5%
R645		036-13470-00	RES M/F 0805 470E 5%
R649		036-14470-00	RES M/F 0805 4K7 5%
R653		036-15100-00	RES M/F 0805 10K 5%
R657		036-15100-00	RES M/F 0805 10K 5%
R661		036-15100-00	RES M/F 0805 10K 5%
R665		036-16100-00	RES M/F 0805 100K 5%
R669		036-15470-00	RES M/F 0805 47K 5%
R673		036-16100-00	RES M/F 0805 100K 5%
R677		036-15470-00	RES M/F 0805 47K 5%
R681		036-13100-00	RES M/F 0805 100E 5%
R685		036-15150-00	RES M/F 0805 15K 5%
R689		036-12100-00	RES M/F 0805 10E 5%
R693		036-16100-00	RES M/F 0805 100K 5%
R696		036-15560-00	RES M/F 0805 56K 5%
R701		036-12220-00	RES M/F 0805 22E 5%
R702		036-17100-00	RES M/F 0805 1M 5%
R703		036-17100-00	RES M/F 0805 1M 5%
R706		036-15150-00	RES M/F 0805 15K 5%
R708		036-16100-00	RES M/F 0805 100K 5%
R710		036-13100-00	RES M/F 0805 100E 5%
R711		036-13100-00	RES M/F 0805 100E 5%
R712		036-12100-00	RES M/F 0805 10E 5%
R713		036-12220-00	RES M/F 0805 22E 5%
%R715		036-14100-00	RES M/F 0805 1K 5%
R717		036-14270-00	RES M/F 0805 2K7 5%
R718		036-15560-00	RES M/F 0805 56K 5%
R719		036-15560-00	RES M/F 0805 56K 5%
R720		036-15390-00	RES M/F 0805 39K 5%
R721		036-15100-00	RES M/F 0805 10K 5%
R722		036-15100-00	RES M/F 0805 10K 5%
R723		036-14270-00	RES M/F 0805 2K7 5%
R725		036-15390-00	RES M/F 0805 39K 5%
%R726		036-13100-00	RES M/F 0805 100E 5%
R727		036-15100-00	RES M/F 0805 10K 5%
R728		036-15100-00	RES M/F 0805 10K 5%
R742		036-13150-00	RES M/F 0805 150E 5%
R743		036-13150-00	RES M/F 0805 150E 5%
R744		036-12220-00	RES M/F 0805 22E 5%
R746		036-12220-00	RES M/F 0805 22E 5%
R747		036-12220-00	RES M/F 0805 22E 5%
R748		036-15470-00	RES M/F 0805 47K 5%
R749		036-15470-00	RES M/F 0805 47K 5%
R750		036-12220-00	RES M/F 0805 22E 5%
R752		036-12220-00	RES M/F 0805 22E 5%
R753		036-17100-00	RES M/F 0805 1M 5%
R754		036-14100-00	RES M/F 0805 1K 5%
R756		036-16470-00	RES M/F 0805 470K 5%
R757		036-16470-00	RES M/F 0805 470K 5%
R758		036-14120-00	RES M/F 0805 1K2 5%
R759		036-13330-00	RES M/F 0805 330E 5%
R760		036-13180-00	RES M/F 0805 180E 5%
R762		036-13100-00	RES M/F 0805 100E 5%
R763		036-13100-00	RES M/F 0805 100E 5%
R765		036-13680-00	RES M/F 0805 680E 5%
R766		036-14100-00	RES M/F 0805 1K 5%
R767		036-13680-00	RES M/F 0805 680E 5%
R769		036-13180-00	RES M/F 0805 180E 5%
R771		036-14820-00	RES M/F 0805 8K2 5%
R772		036-15220-00	RES M/F 0805 22K 5%
R774		036-14820-00	RES M/F 0805 8K2 5%
R775		036-14560-00	RES M/F 0805 5K6 5%
R777		036-14220-00	RES M/F 0805 2K2 5%
R784		036-12680-00	RES M/F 0805 68E 5%
R785		036-14330-00	RES M/F 0805 3K3 5%
R786		036-12100-00	RES M/F 0805 10E 5%
R787		036-12100-00	RES M/F 0805 10E 5%
R790		036-13220-00	RES M/F 0805 220E 5%
R791		036-13100-00	RES M/F 0805 100E 5%
R792		036-14100-00	RES M/F 0805 1K 5%
R801		036-16150-00	RES M/F 0805 150K 5%
R802		036-15470-00	RES M/F 0805 47K 5%
R808		036-12100-00	RES M/F 0805 10E 5%
R809		036-14470-00	RES M/F 0805 4K7 5%
R810		036-14470-00	RES M/F 0805 4K7 5%
R811		036-14470-00	RES M/F 0805 4K7 5%
R812		036-14470-00	RES M/F 0805 4K7 5%
R813		036-14470-00	RES M/F 0805 4K7 5%
R815		036-15470-00	RES M/F 0805 47K 5%
R816		036-16150-00	RES M/F 0805 150K 5%
R818		036-14470-00	RES M/F 0805 4K7 5%
R819		036-14470-00	RES M/F 0805 4K7 5%
R821		036-15470-00	RES M/F 0805 47K 5%
R822		036-15470-00	RES M/F 0805 47K 5%
R824		036-14220-00	RES M/F 0805 2K2 5%
R825		036-14220-00	RES M/F 0805 2K2 5%
R826		036-14220-00	RES M/F 0805 2K2 5%
R827		036-14220-00	RES M/F 0805 2K2 5%
R828		036-14220-00	RES M/F 0805 2K2 5%
R829		036-14220-00	RES M/F 0805 2K2 5%
R830		036-14220-00	RES M/F 0805 2K2 5%
R831		036-14220-00	RES M/F 0805 2K2 5%
R832		036-14220-00	RES M/F 0805 2K2 5%
R833		036-14220-00	RES M/F 0805 2K2 5%
R835		036-14220-00	RES M/F 0805 2K2 5%
R836		036-14220-00	RES M/F 0805 2K2 5%
R837		036-14220-00	RES M/F 0805 2K2 5%
R840		036-14220-00	RES M/F 0805 2K2 5%
R841		036-14220-00	RES M/F 0805 2K2 5%

Note: %D205 and %D210 are optional level limiting diodes for special applications.

=R705 (47 ohm) and =SK710 are fitted in place of =IC700 when an external frequency reference is used. These two components are supplied with the auxiliary D-range kits (T800-06-0000 & T800-06-0001).

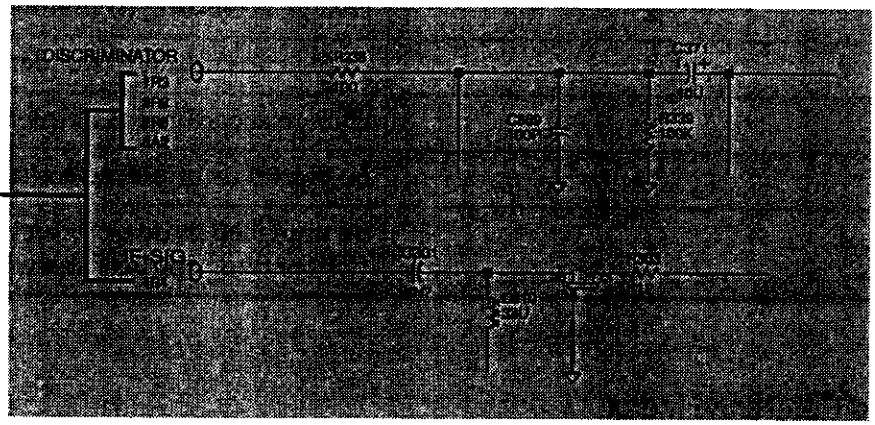
Ref	Var	IPN	Description
C201		020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS
C202		020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS
C204		020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS
C205		020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS
C207		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C209		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C210		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C211		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C213		025-08100-02	CAP TANT BEAD 10M 10% 16V
C215		014-08220-01	(L)CAP TANT 22UF10V276MSER
C217		015-24220-08	CAP CER 0805 2N2 10% X7R 50V
C219		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C221		014-08220-01	(L)CAP TANT 22UF10V276MSER
C223		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C225		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C227		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C229		015-23150-01	CAP CER 0805 150P 5% NPO 50V
C230		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C232		015-23150-01	CAP CER 0805 150P 5% NPO 50V
C233		020-08470-02	CAP ELE RA 47M 16V 6X11MM
C235		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C237		020-07100-02	CAP ELE RA 1M 50V 5X11MM
C239		020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS
C241		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C242		025-08100-02	CAP TANT BEAD 10M 10% 16V
C243		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C245		015-23150-01	CAP CER 0805 150P 5% NPO 50V
C247		015-23150-01	CAP CER 0805 150P 5% NPO 50V
C249		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C251		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C253		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C255		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C257		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C259		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C260		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C261		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C263		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C265		020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS
C267		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C269	10	015-21150-01	CAP CER 0805 1P5+-1/4P NPO 50V
&C269	13	015-21150-01	CAP CER 0805 1P5+-1/4P NPO 50V
&C269	15	015-21470-01	CAP CER 0805 4P7+-1/4P NPO 50V
&C269	20	015-21150-01	CAP CER 0805 1P5+-1/4P NPO 50V
&C269	23	015-21150-01	CAP CER 0805 1P5+-1/4P NPO 50V
&C269	25	015-21470-01	CAP CER 0805 4P7+-1/4P NPO 50V
C271		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C273		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C275		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C277		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C279		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C281		015-25220-08	CAP CER 0805 22N 10% X7R 50V
C283		015-21470-01	CAP CER 0805 4P7+-1/4P NPO 50V
C285		015-21470-01	CAP CER 0805 4P7+-1/4P NPO 50V
C287		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C289		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C291		014-08220-01	(L)CAP TANT 22UF10V276MSER
C293		015-27100-10	CAP CER 0805 1M+80-20% Y5V 16V
%C294		015-22470-01	CAP CER 0805 47P 5% NPO 50V
%C295		022-06470-02	CAP MYLAR 470N 10% 50V
C304		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C308		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C312		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C316		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C317		015-23100-01	CAP CER 0805 100P 5% NPO 50V
C318		015-23100-01	CAP CER 0805 100P 5% NPO 50V
C320		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C324		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C330A		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C330B		020-08100-04	CAP ELE RA 10M 16V 4X7MM
C332		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C334		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C336		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C338		015-25220-08	CAP CER 0805 22N 10% X7R 50V
C340		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C342		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C344		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C346		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C349		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C350		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C353		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C356		015-23150-01	CAP CER 0805 150P 5% NPO 50V
C359		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C362		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C365		015-22330-01	CAP CER 0805 33P 5% NPO 50V
C368		015-22820-01	CAP CER 0805 82P 5% NPO 50V
C370		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C373		022-55470-10	CAP MYLAR AI 47N 5% 63V POTTED
C376		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C379		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C382		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C385		020-07470-04	CAP ELE RA 4M7 25V 20%8X13 SOL
C388		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C391		015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
C394		015-04100-04	CAP CER 1206 1N 10% X7R 50V
C396		015-04100-04	CAP CER 1206 1N 10% X7R 50V
C399		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C503		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C505		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C510		015-25220-08	CAP CER 0805 22N 10% X7R 50V
C513		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C535		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C550		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C605		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C610A		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C610B		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C611A		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C611B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C623		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C625		020-09470-07	CAPEL470M16V20%V 8*20 3.5LESR
C626		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C628		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C630		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C631A		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C634		025-08100-02	CAP TANT BEAD 10M 10% 16V
C636		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C638		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C640		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C655		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C660		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C665		020-58100-03	CAP ELE AI RDL 10M 50V 5X11MM
C670		025-07330-01	CAP TANT BEAD 3M3 35V
C673		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C677		020-07100-02	CAP ELE RA 1M 50V 5X11MM
C681		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C684		025-08100-02	CAP TANT BEAD 10M 10% 16V
C687		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C690		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C693		025-08100-02	CAP TANT BEAD 10M 10% 16V
C700		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C703		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C705		015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
C706		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C708		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C709		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C710		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C712		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C720		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C722		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C724		014-08220-01	(L)CAP TANT 22UF10V276MSER
C725		014-08220-01	(L)CAP TANT 22UF10V276MSER
C726		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C727		015-23220-01	CAP CER 0805 220P 5% NPO 50V
C729		015-23220-01	CAP CER 0805 220P 5% NPO 50V
%C733		015-23470-08	CAP CER 0805 470P 10% X7R 50V
C735		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C736		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C740A		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C740B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C741A		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C741B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C742A		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C742B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C743		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C745		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C750		025-08100-03	CAP 10M 35V 20% TANT 5MM L/S
C757		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C759		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C761		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C762		014-08220-01	(L)CAP TANT 22UF10V276MSER
C764		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C765		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C767		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C769		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C770		014-08220-01	(L)CAP TANT 22UF10V276MSER
C772		014-08220-01	(L)CAP TANT 22UF10V276MSER
C774		022-06330-05	CAP METAL PPS 330N 10% 63V 5MM
C776		015-25150-08	CAP CER 0805 15N 10% X7R 50V
C782		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C784		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C786		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C788		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C790		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C792		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C810		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C812		015-23100-01	CAP CER 0805 100P 5% NPO 50V
C813		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C822		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C823		015-25220-08	CAP CER 0805 22N 10% X7R 50V
C824		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C826		015-23220-01	CAP CER 0805 220P 5% NPO 50V
C827		015-22330-01	CAP CER 0805 33P 5% NPO 50V
C828		015-25100-08	CAP CER 0805 10N 10% X7R 50V

Using CAD Circuit Diagrams

Reading a CAD circuit diagram is similar to reading a road map, in that both have an alphanumeric border. The circuit diagrams in this manual use letters to represent the horizontal axis, and numbers for the vertical axis. These circuit diagram "grid references" are useful in following a circuit that is spread over two or more sheets.

When a line representing part of the circuitry is discontinued, a reference will be given at the end of the line to indicate where the rest of the circuitry is located, as shown below. The first digit refers to the sheet number and the last two characters refer to the location on that sheet of the continuation of the circuit (e.g. 1R3).

these grid references show where the circuit is continued

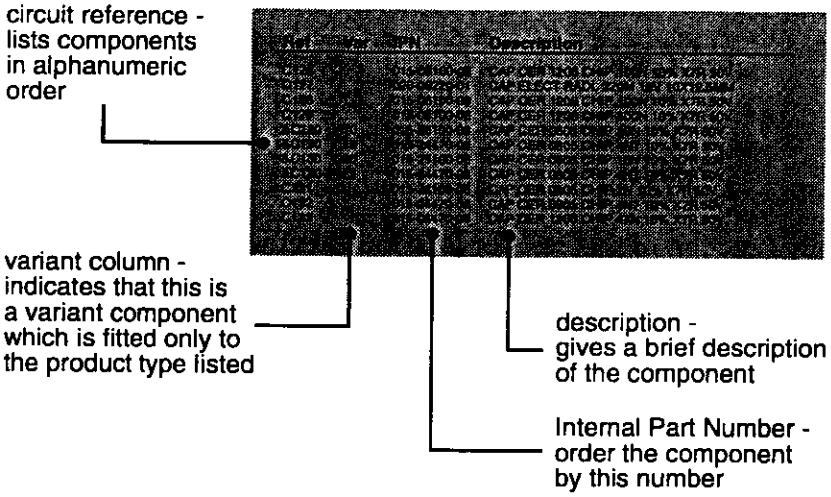


Parts Lists

The 10 digit numbers (000-00000-00) in this Parts List are "internal part numbers" (IPNs). We can process your spare parts orders more efficiently and accurately if you quote the IPN and provide a brief description of the part.

The components listed in this parts list are divided into two main types: those with a circuit reference (e.g. C2, D1, R121, etc.) and those without (miscellaneous and mechanical).

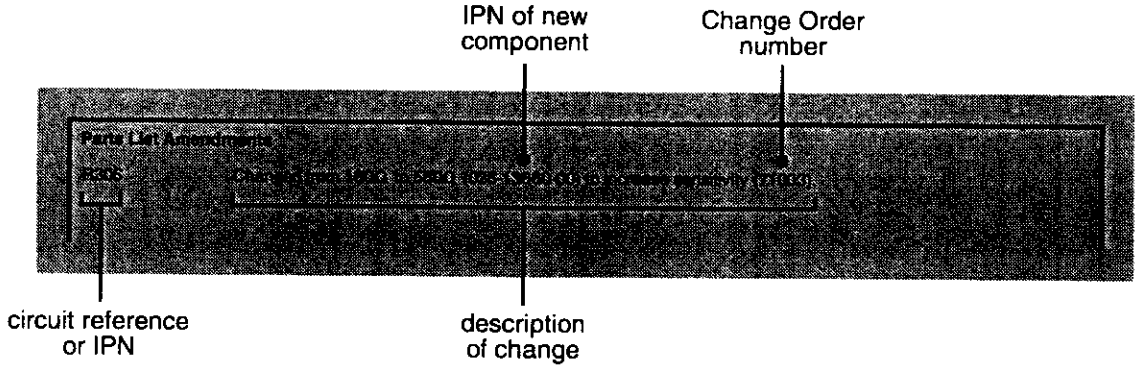
Those with a circuit reference are grouped in alphabetical order and then in numerical order within each group. Each component entry comprises three or four columns, as shown below:



The mechanical and miscellaneous section lists the variant and common parts in IPN order.

Parts List Amendments

At the front of the parts list is the Parts List Amendments box (an example of which is shown below). This box contains a list of component changes which took place after the parts list and diagrams in this section were compiled. These changes (e.g. value changes, added/deleted components, etc.) are listed by circuit reference in alphanumeric order and supersede the information given in the parts list or diagrams. Components without circuit references are listed in IPN order. The number in brackets at the end of each entry refers to the Tait internal Change Order document.



Replace each resistor and/or capacitor in exactly the same position as noted previously.

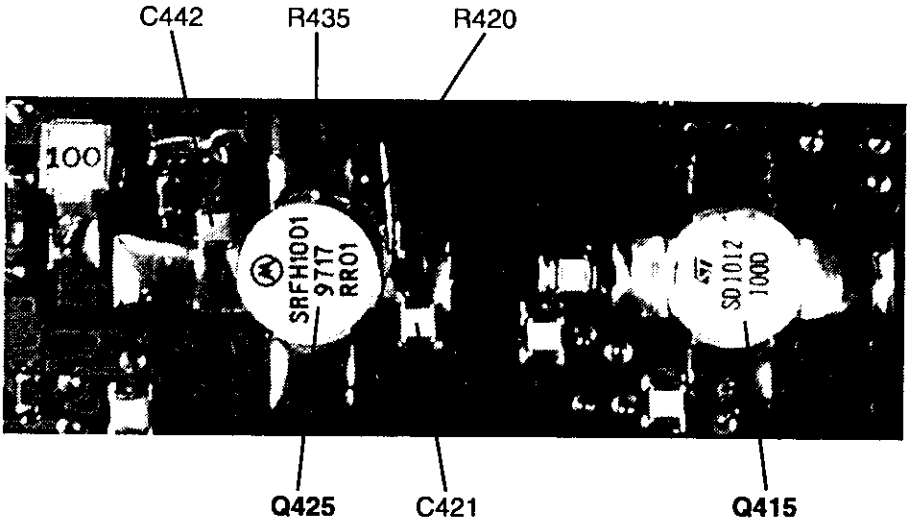
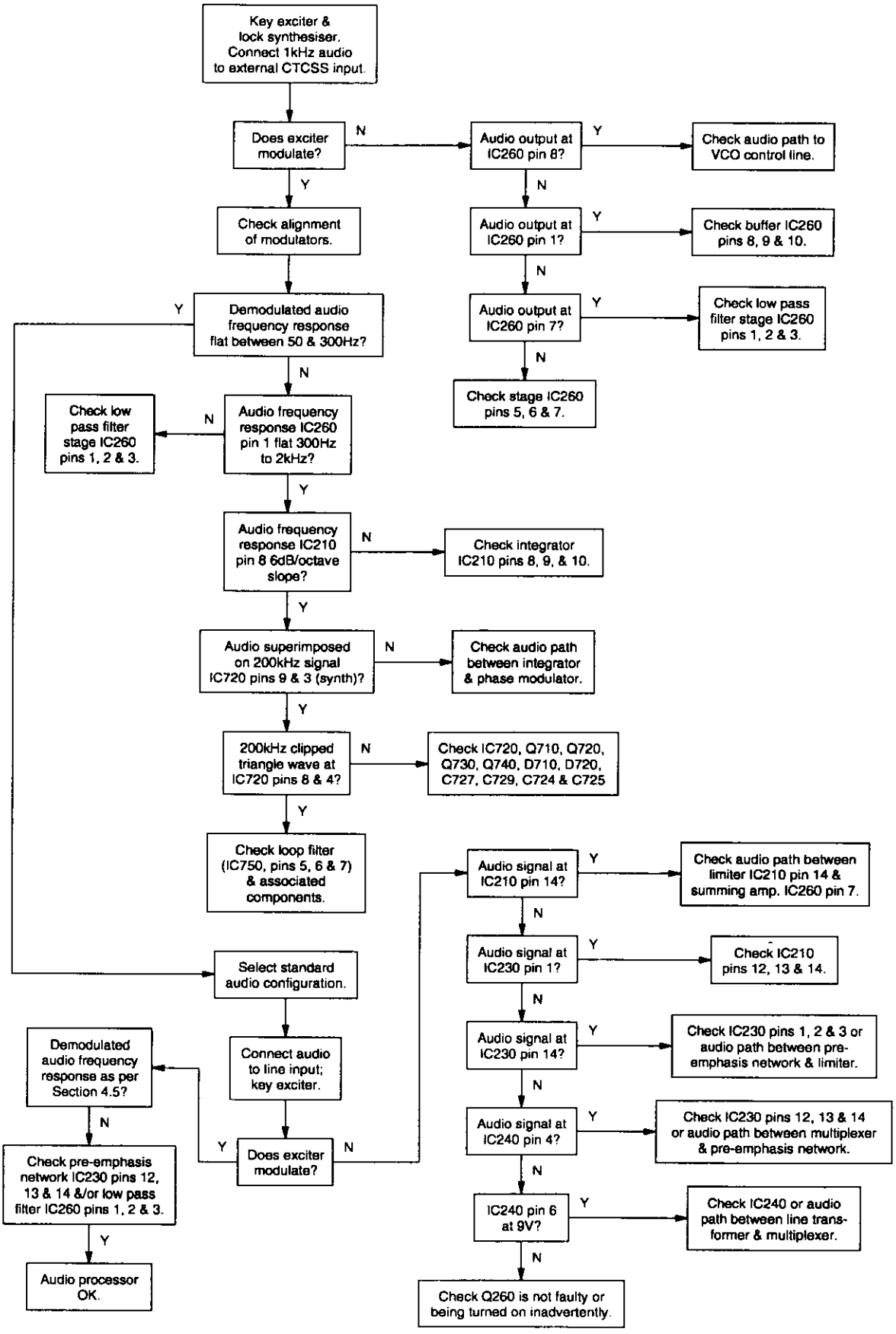
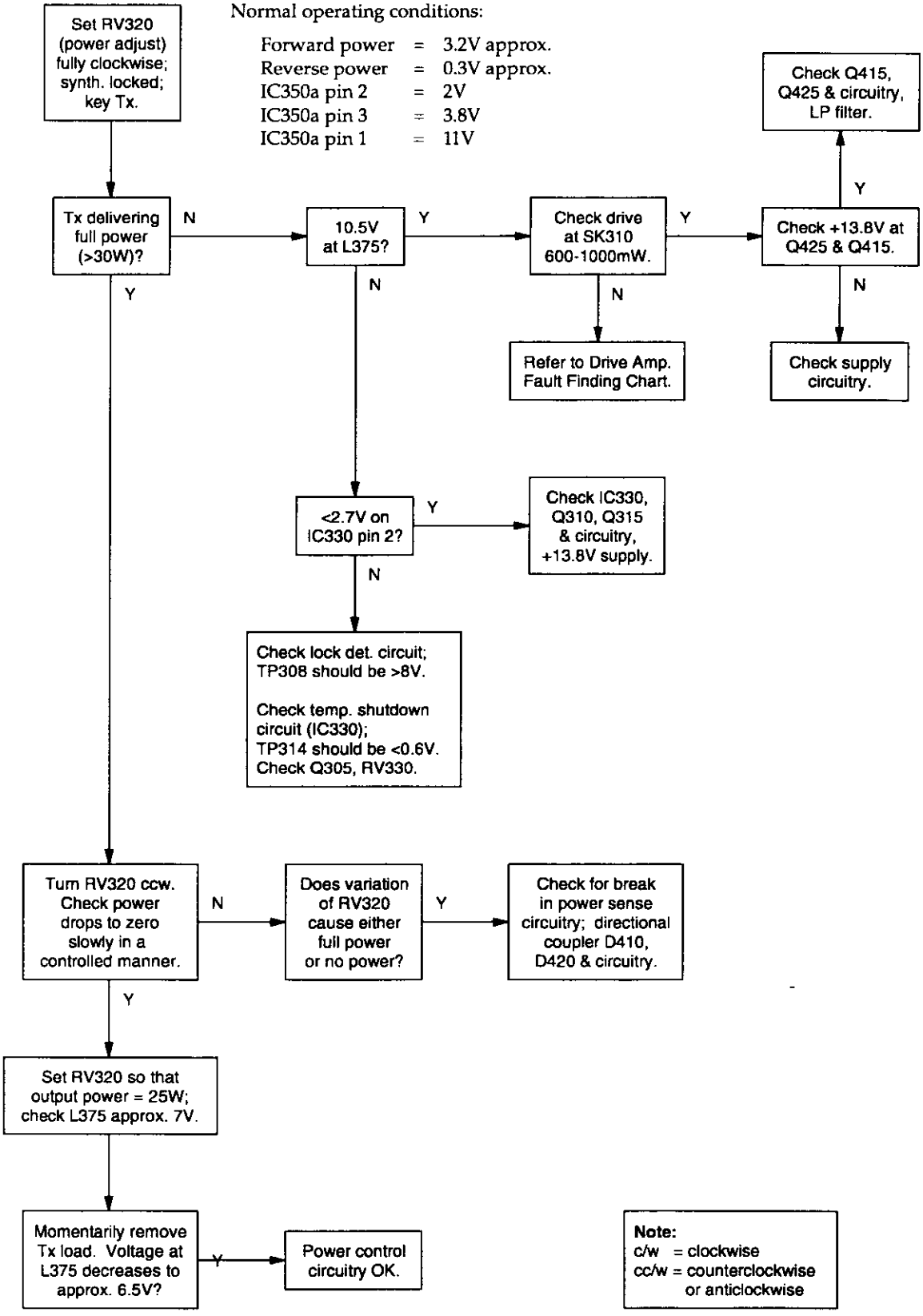


Figure 5.2 Positioning Of Components Around Q425 & Q415

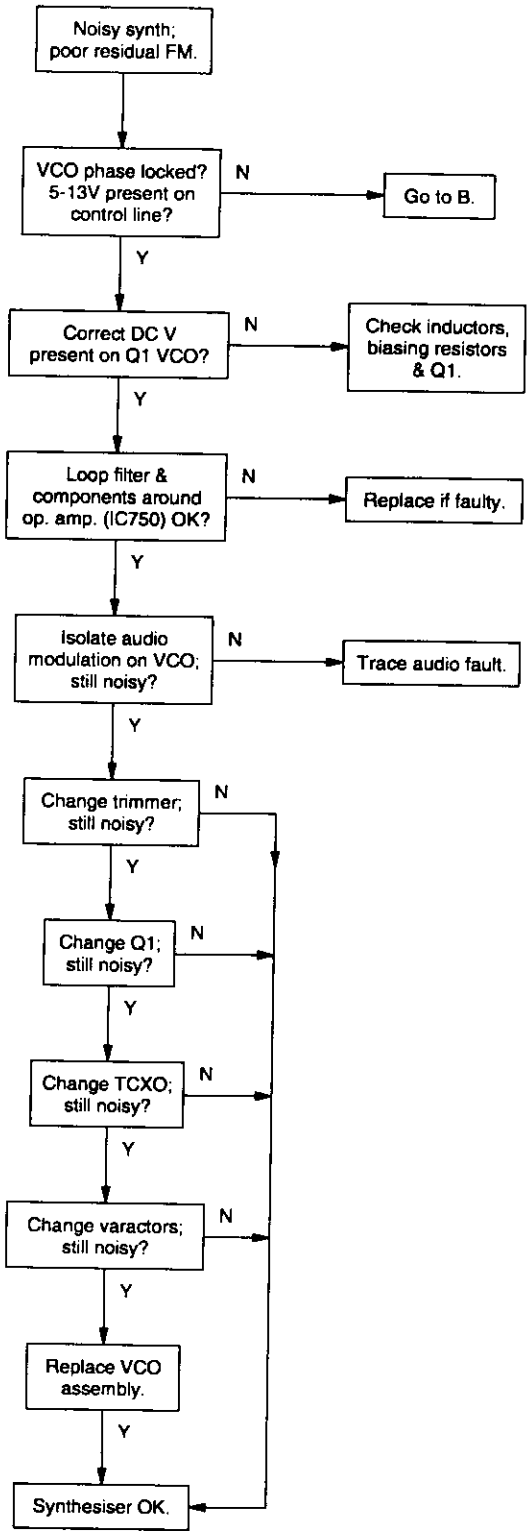
5.7.7 Audio Processor



5.7.5 T836 PA & Power Control

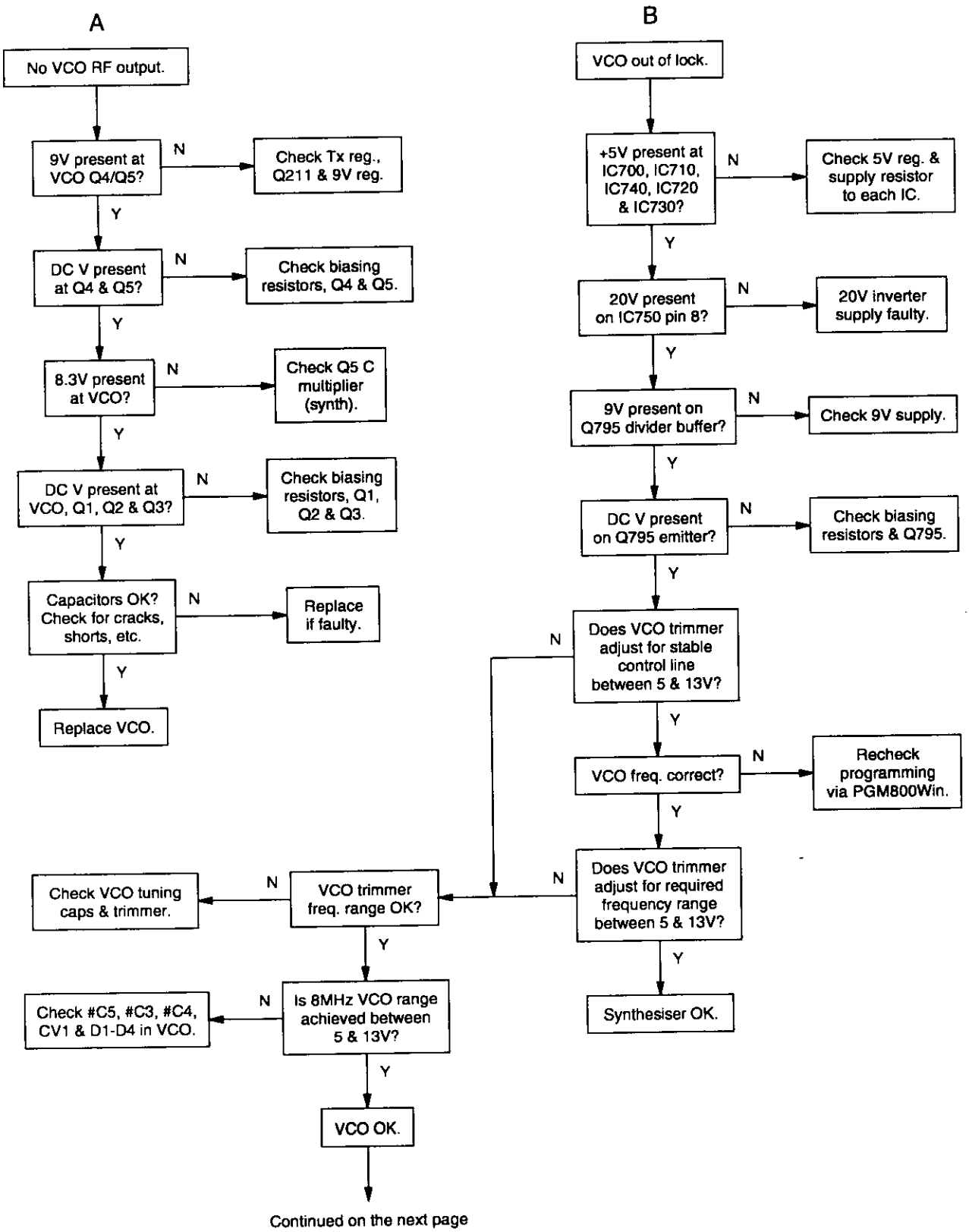


C


Noisy synth; poor residual FM.
VCO phase locked? 5-13V present on control line?
N
Go to B.
Y
Correct DC V present on Q1 VCO?
N
Check inductors, biasing resistors & Q1.
Y
Loop filter & components around op. amp. (IC750) OK?
N
Replace if faulty.
Y
Isolate audio modulation on VCO; still noisy?
N
Trace audio fault.
Y
Change trimmer; still noisy?
N
Y
Change Q1; still noisy?
N
Y
Change TCXO; still noisy?
N
Y
Change varactors; still noisy?
N
Y
Replace VCO assembly.
Y
Synthesiser OK.

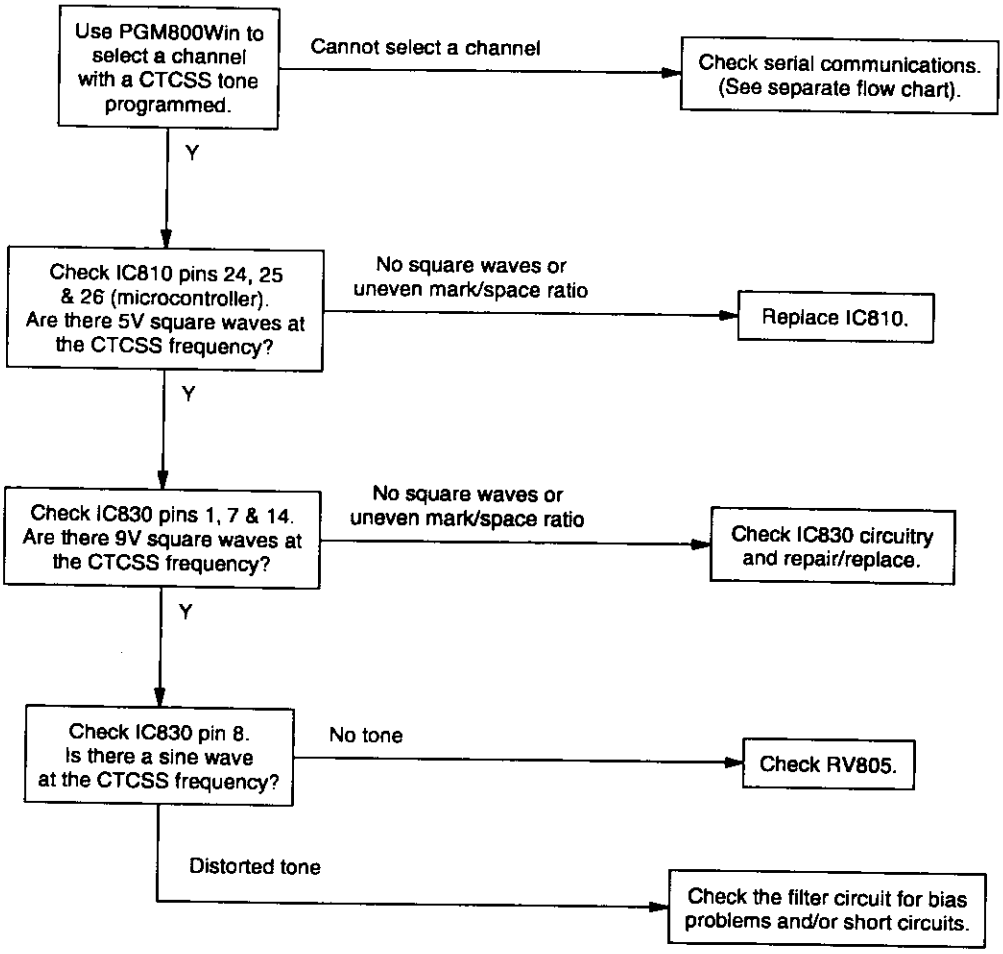
5.7.3 Synthesiser

Refer to the synthesiser circuit diagram (sheet 7) in Section 6 and the VCO circuit diagram in Part E.



Continued on the next page

5.7.1.3 CTCSS Encode



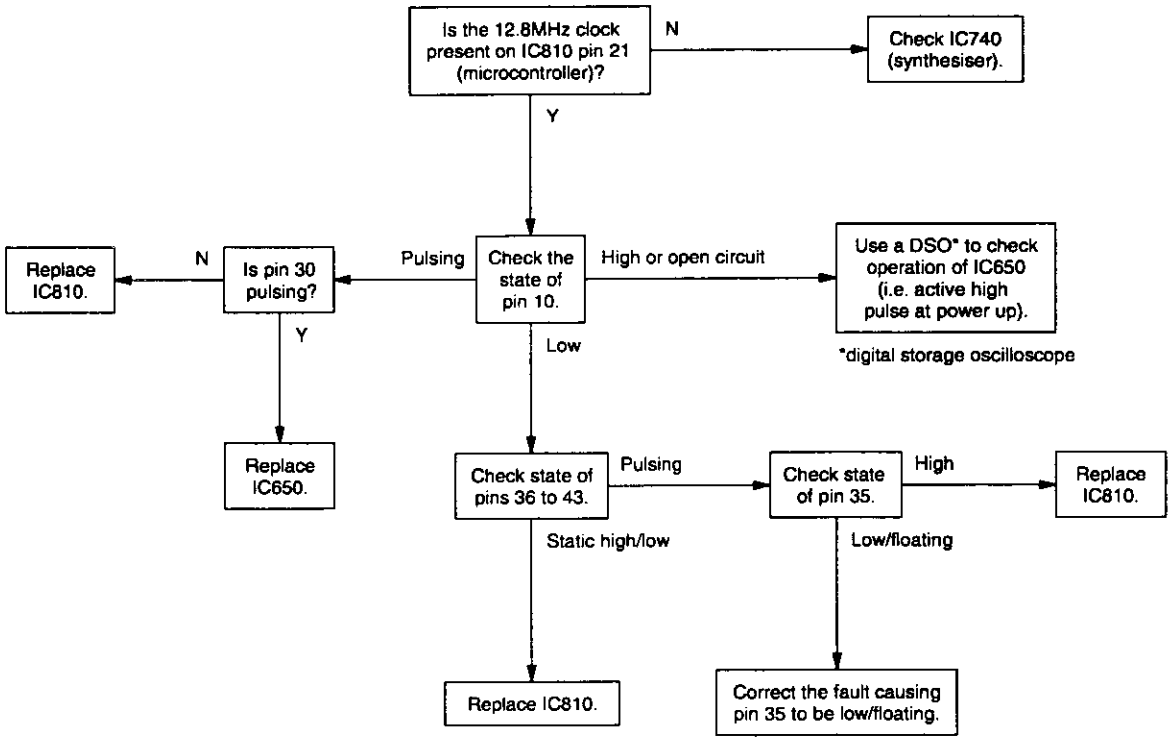
5.7 Fault Finding Charts

Note: The standard test point designations used in this section are as follows:

TP601	13.8V
TP602	9V
TP603	20V
TP604	5V

5.7.1 Microcontroller (IC810)

5.7.1.1 Basic Checks



Connect the exciter output to a power meter and key the exciter.

Check that the output power is between 600 and 1000mW.

Note: If the synthesiser is out of lock, the lock detector (synthesiser IC740 and comparator IC750) will prevent the RF signal from reaching the PA by switching the supply to the exciter amplifier (Q340, Q345).

5.5.4 Audio And Modulation

Refer to the audio processor fault finding chart (Section 5.7.7).

Set up the audio processor as described in Section 3.9.

Check that the demodulated RF output has the frequency response referred to in Section 4.5 with at least ±5kHz (±4kHz) [±2.5kHz] deviation available at 1kHz modulating frequency.

If the above result is not achieved, either the two modulators are incorrectly adjusted or a fault condition exists.

5.4 DC Checks

5.4.1 Power Rails

Refer to the test points and options diagrams in Section 6 for test point locations, and to the regulator fault finding chart (Section 5.7.2) for fault diagnosis.

Check the 13.8V (TP601) and 9V (TP602) supplies at their test points in the regulator compartment with a DMM.

Check the 5V (TP604) and 20V (TP603) rails at their respective test points in the regulator compartment.

Check that Tx-Reg. (TP305 in the exciter compartment) comes up to 8.8V when the exciter is keyed.

Check the +5V digital regulator output (TP607 in the regulator compartment).

Check for short circuits.

5.4.2 VCO Locking

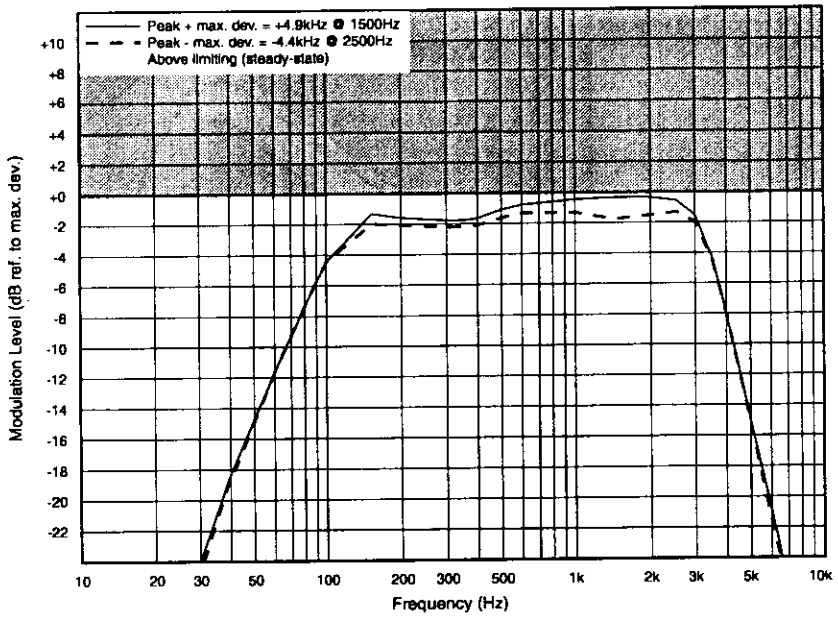
Key the exciter.

Using a DMM, monitor the VCO control voltage at PL4-1 or the junction of L1 and R1 on the VCO PCB.

If the synthesiser is locked and the VCO aligned, the voltage at this point should be between 5 and 13V.

If the VCO is not locked, refer to the synthesiser fault finding chart (Section 5.7.3).

Wide Bandwidth



Mid Bandwidth

The mid bandwidth graph is the same shape as the wide bandwidth graph. The deviation figures are as follows:

peak + max. deviation = +4kHz
peak - max. deviation = -4kHz.

Narrow Bandwidth

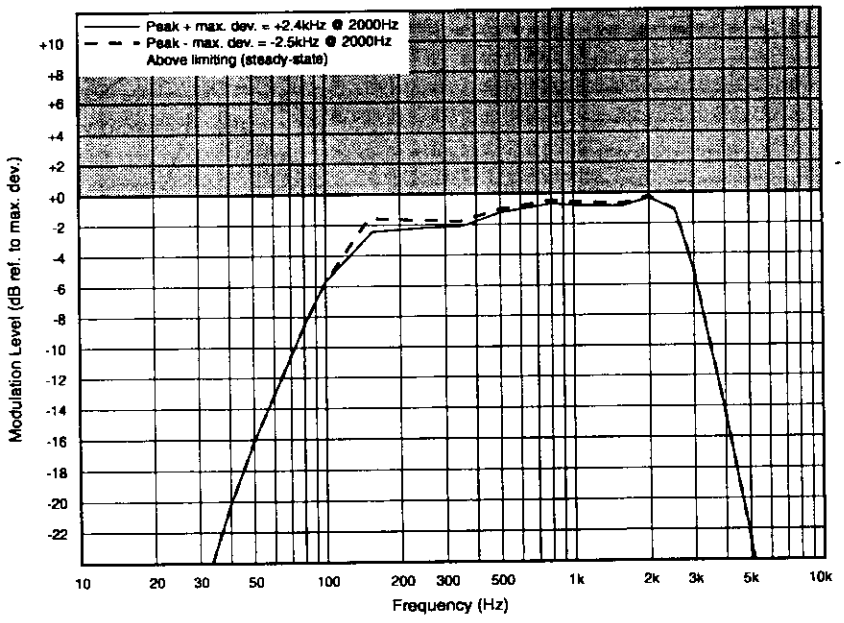


Figure 4.3 T836/837 Limiting Response

Timer	Function	Adjustment
Transmit Tail	Sets the tail time during which the transmitter stays keyed after the external key source has been removed.	0-5 seconds in 100ms steps
Transmit Timeout	Sets the maximum continuous transmission time. Once the timer has timed out, the transmitter must be keyed again, unless prevented by the transmit lockout timer.	0-300 seconds in 10 second steps
Transmit Lockout	Sets the period of time that must elapse after a timeout before the transmitter can re-transmit. Once the timer has timed out, the transmitter can be keyed again.	0-60 seconds in 10 second steps

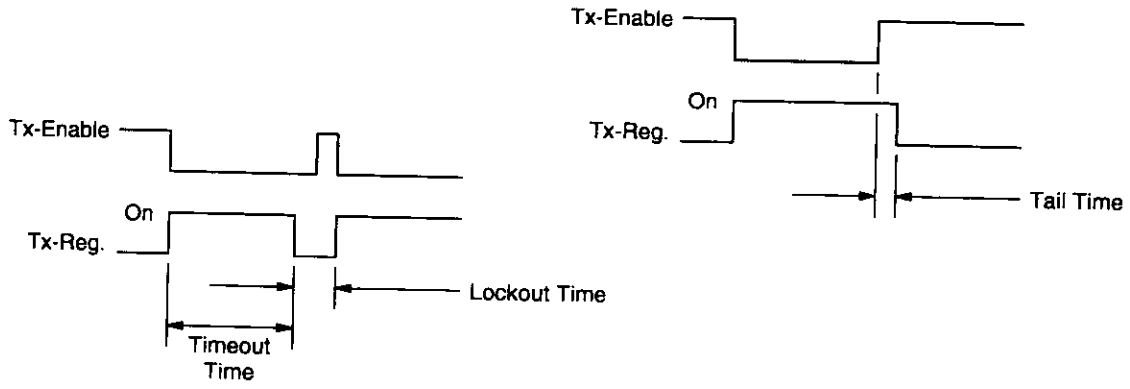


Figure 4.1 T836/837 Transmit Timers

4.5 Frequency Response

If the T836/837 has been correctly adjusted, the pre-emphasis and limiting responses should closely match those shown in Figure 4.2 and Figure 4.3 respectively.

Note: The limits shown on these graphs should not be exceeded.

- Measure the pre-emphasis response as follows:

  Reduce the line level to give ±1kHz (±0.8kHz) [±0.5kHz] deviation at 1kHz.

  Sweep the modulation frequency.

  The response should closely match that shown in Figure 4.2.

- Measure the limiting response as follows:

  Set the line level to give ±3kHz (±2.4kHz) [±1.5kHz] deviation at 1kHz.

  Increase the line level 20dB and sweep the modulation frequency.

  The response should closely match that shown in Figure 4.3.

3.9.3 Limiter Adjustment

Note: If the T836/837 will be used over the whole 8MHz switching range, you must set the deviation for each channel. However, if the module will be used on frequencies that cover only a 1MHz (or less) switching range, you can set the deviation on the middle channel and use this value for all other channels with the "fill" option in PGM800Win.

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

Inject 1kHz at -10dBm into the line input (D-range 1 (PL100) pins 1 & 4; and pins 2 & 3 shorted; refer to Section 2.2 of Part F).

Adjust RV210 (line sensitivity) fully clockwise and key the transmitter by earthing the Tx-Key line. Adjust "deviation" via PGM800Win to set the peak deviation to ±4.7kHz (±3.8kHz) [±2.3kHz] (you can use either the mouse or up and down arrow keys).

Sweep the audio frequency from 100Hz to 4kHz and ensure that the maximum deviation does not exceed 4.7kHz (±3.8kHz) [2.3kHz]. Readjust "deviation" if necessary via PGM800Win.

3.9.4 Line Level Without Compressor

This section assumes that the compressor is not used. If the compressor is required, refer to Section 3.9.5.

Adjust the line sensitivity as follows:

- set the injected signal at the line input to the required line level (typically -10 to -20dBm);
- adjust RV210 (line sensitivity) to provide ±3kHz (±2.4kHz) [±1.5kHz] deviation.

3.9.5 Compressor

The compressor may be used on the line input only, the microphone input only, or on both the line and microphone inputs. If the compressor is used, refer to one of the following sections as appropriate.

3.9.5.1 Compressor On Line Input Only

Set RV210 (line sensitivity) fully clockwise and key the transmitter by earthing the Tx-Key line.

Reduce the line level to -50dBm at 1kHz and set RV220 (compression level) fully clockwise.

3.7 PA Alignment (T836 Only)

Check that the exciter is connected to the PA with the coaxial link.

Connect an RF power meter to the PA output.

Turn RV320 (power adjust) fully clockwise.

Measure and record the voltage (VL) at L490; perform this measurement at room temperature so that the NTC (R460) is close to 25°C.

Key the transmitter by earthing the Tx-Key line.

Tune CV451 until maximum power is obtained.

Reduce the current by approximately 1A by detuning CV451 or until the power drops below 30W.

Check that the total current drawn is less than 4.5A for 25W output power.

Adjust RV320 for an output power between 5 and 25W.

3.8 Thermal Shutdown (T836 Only)

Key the transmitter by earthing the Tx-Key line and set the output power to 25W as described in Section 3.7.

Short L490 to ground.

Set RV330 (high temperature power adjust) for an output power of 5W.

Set RV310 (temperature adjust) to 0.16VL volts (measured at IC330 pin 5), where VL is the voltage measured at L490 in Section 3.7. This sets the thermal shutdown at 85°C at NTC R460.

3.5 Audio Processor Links

3.5.1 Link Details

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 any of the tuning and adjustment procedures. The factory settings are shown in brackets [ ].

Plug	Link[a]		Function
PL205	1-2	A	not connected
	[3-4]	B	microphone pre-amp. output to compressor input
	5-6	C	microphone pre-amp. output to multiplexer input
PL210	[1-2]	L	multiplexer output to pre-emphasis input
	3-4	M	multiplexer output to limiter input
	5-6	N	multiplexer output to compressor input
PL215	1-2	G	not connected
	[3-4]	H	compressor output to multiplexer input
	5-6	I	compressor output to limiter input
	7-8	J	compressor output to pre-emphasis input
	9-10	K	not connected
PL220	1-2	D	pre-emphasis output to multiplexer input
	[3-4]	E	pre-emphasis output to limiter input
	5-6	F	not connected

a. The letters in this column and in the table in Section 3.5.2 below refer to the identification letters screen printed onto the PCB beside each pair of pins.

3.5.2 Typical Options

	PL205	PL210	PL215	PL220
microphone pre-amp. compressed and pre-emphasised; line input pre-emphasised (standard set-up)	[3-4] B	[1-2] L	[3-4] H	[3-4] E
microphone pre-amp. compressed and pre-emphasised; line input unprocessed	3-4 B	3-4 M	7-8 J	1-2 D
line and microphone compressed and pre-emphasised	5-6 C	5-6 N	7-8 J	3-4 E
microphone pre-amp. compressed; line and microphone flat response	3-4 B	3-4 M	3-4 H	5-6 F

3.4.4 Two Point Modulation Adjustment

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

Note 2: Reference modulation and limiter adjustment are controlled by PGM800Win. Electronic potentiometers (256 step) are used to allow channel-by-channel adjustment of deviation and two point modulation.

Note 3: To optimise the modulation response across the switching range, repeat steps 1-4 below for each channel that will be used (usually needed only for data applications). In applications where the modulation response is less critical (e.g. voice use only), carry out steps 1-4 below on the middle channel and cut and paste the value to all other channels.

1. Inject an audio signal of 600Hz 1.5V rms (+5dBm) into the CTCSS input (D-range 1 (PL100) pin 8).

   Key the transmitter by earthing the Tx-Key line.

2. Adjust the output from the audio generator to obtain ±3kHz (±2.4kHz) [±1.5kHz] deviation at 600Hz.

3. Change the input frequency to 120Hz and adjust "reference modulation" via PGM800Win to obtain ±3kHz (±2.4kHz) [±1.5kHz] deviation (you can use either the mouse or up and down arrow keys).

4. Change the input frequency back to 600Hz.

   Repeat steps 2 and 3 above until the deviations achieved at the two input frequencies are within 0.2dB of each other. You will need to do this at least four times.

5. Sweep the audio between 50 and 300Hz for peaks.

Note: A peak between 50 and 300Hz will indicate a fault condition, i.e:

- incorrect set-up

or - modulation circuitry fault.

The specification window is ±1dB relative to 150Hz from 65 to 260Hz.

3.4.5 FM Deviation (Limiter) Adjustment

Note: If the T836/837 will be used over the whole 8MHz switching range, you must set the deviation for each channel. However, if the module will be used on frequencies that cover only a 1MHz (or less) switching range, you can set the deviation on the middle channel and use this value for all other channels with the "fill" option in PGM800Win.

Inject 1kHz at -10dBm into the line input (D-range 1 (PL100) pins 1 & 4; pins 2 & 3 shorted; refer to Section 2.2 of Part F).

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 power meter
- audio voltmeter x 2
- modulation meter
- oscilloscope (digital preferred)
- 20dB pad

  } or RF test set (optional)

- T800-01-0010 calibration test unit (optional)

Figure 3.1 and Figure 3.2 show typical test equipment set-ups.

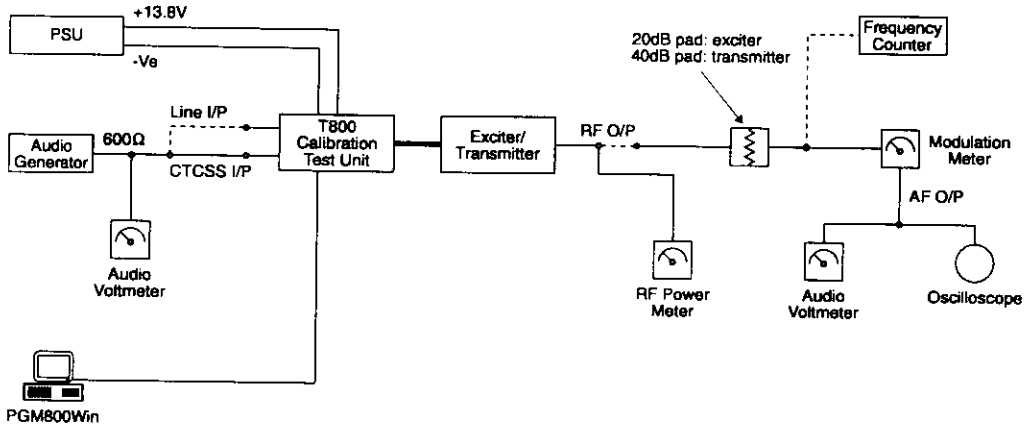


Figure 3.1 T836/837 Test Equipment Set-up With T800-01-0010

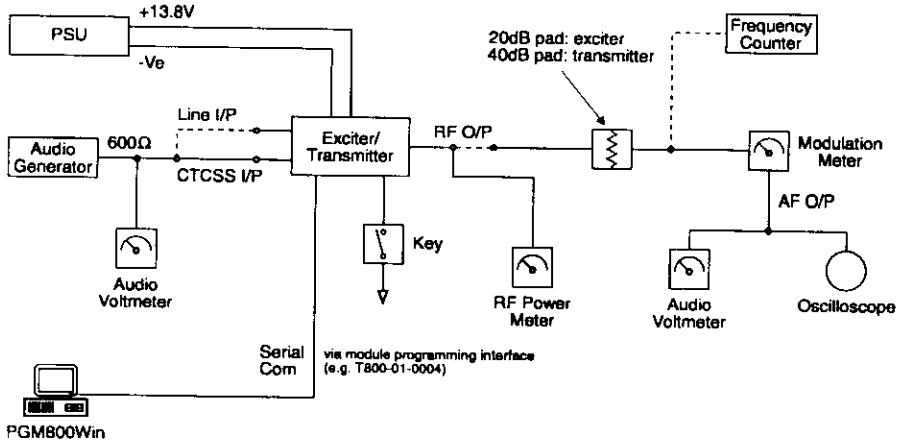


Figure 3.2 T836/837 Test Equipment Set-up Without T800-01-0010

2.8 T836 Drive Amplifier & PA

(Refer to Figure 2.1 and the exciter and PA circuit diagrams (sheets 3 & 4) in Section 6.2.)

The output power of the PA is maintained at a constant level via a power control loop applied to the two-stage, wide band exciter amplifier (Q365, Q370). The forward and reverse RF power levels are sensed via a dual directional coupler and detector diodes (D410, D420 in the PA cavity). The detected DC signals are summed with the 'power adjust' level and fed to the control integrator (IC330 pins 1, 2 & 3). The output control voltage is buffered by Q310 and Q315, and applied to the collectors of the wide band exciter amplifier.

Note: Forward and reflected power signals are summed so that, under high VSWR, the power control will turn the output RF level down.

To reduce the spurious output level when the synthesiser is out-of-lock, the Tx-Reg. and Lock-Detect signals are gated to inhibit the PA control circuit and to switch off the RF signal at the input to the drive amplifier. This is achieved by a PIN switch attenuator (D340, D350, D360).

Cyclic keying control is provided by additional circuitry consisting of several time delay, ramp and gate stages:

- Q350, Q355, Q360, IC330 pins 1, 2 & 3 — power ramping
- Q340, Q345 — Tx-Reg. and $\overline{\text{Lock-Detect}}$ gate
- Q320, Q325, Q330, Q335 — delay and PIN switch drive.

This is to allow the RF power circuits (both exciter and PA) to ramp up and down in a controlled manner so that minimal adjacent channel interference is generated during the transition.

The output of the wide band amplifier is approximately 500mW (+27dBm) for an input of 170mW (+22dBm) when the power control is set to maximum.

The zener diode (D330) limits the upper range of the controlled voltage to the exciter transistors.

A temperature sensor (R460) is provided so that the RF output power can be reduced to a preset level when a set temperature is exceeded. This is a protection circuit (IC330 pins 5, 6 & 7, Q305) to prevent overheating, as the unit is ***not*** rated for continuous operation at high temperatures (refer to Section 1.2.3 for duty cycle specifications). RV330 sets the PA output power while under high temperature fold-back conditions.

R359, R360 and R362 form a 6dB attenuator to provide good VCO/exciter isolation.

The output attenuator (R392, R390, R394 and R396) aids in reducing exciter/PA interaction while also ensuring a reasonable match for Q350.

The RF output from the exciter is fed to the driver stage (Q415) and then to the final (Q425). DC is fed to the final via a low pass filter with special low frequency decoupling. CV451 tunes the output matching across the entire band.

2.6 Power Supply & Regulator Circuits

(Refer to the regulators circuit diagram (sheet 6) in Section 6.2 or 6.3.)

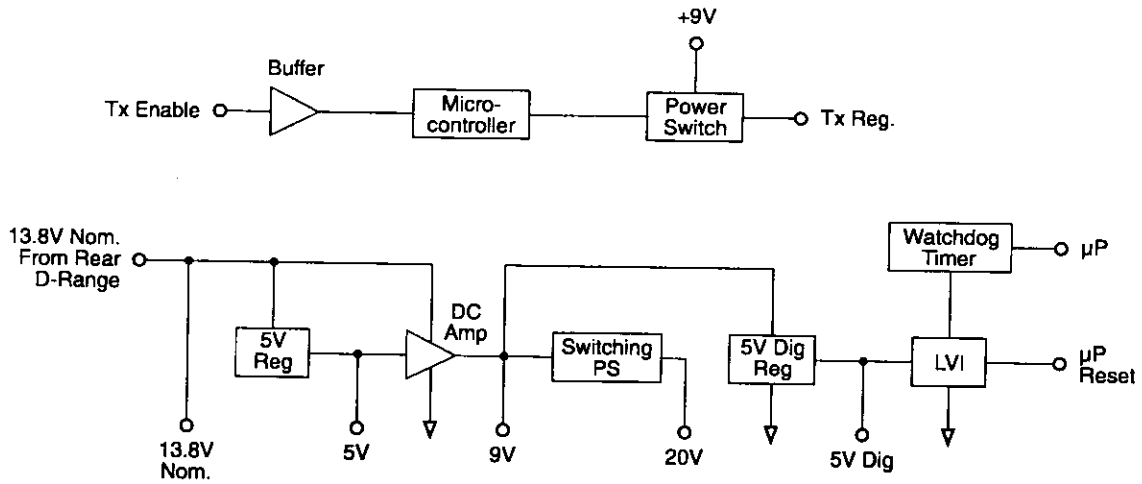


Figure 2.7 T836/837 Power Supply & Regulators Block Diagram

The T836 and T837 are designed to operate from a 10.8-16V DC supply (13.8V nominal). A 5.3V regulator (IC630) runs directly from the 13.8V rail, driving much of the synthesiser circuitry. It is also used as the reference for a DC amplifier (IC640, Q630, Q620) which provides a medium current capability 9V supply.

A switching power supply (Q660, Q670) runs from the 9V supply and provides a low current capability +20V supply. This is used to drive the synthesiser loop filter (IC750), giving a VCO control voltage range of up to 20V, and the Lock-Detect amplifiers.

Ultimate control of the transmitter is via the Tx-Reg. supply, switched from 9V by Q610. This is enabled via the Tx-Enable signal from the audio processor, and microprocessor.

2.5 Audio Processor

(Refer to the audio processor circuit diagram (sheet 2) in Section 6.2 or 6.3.)

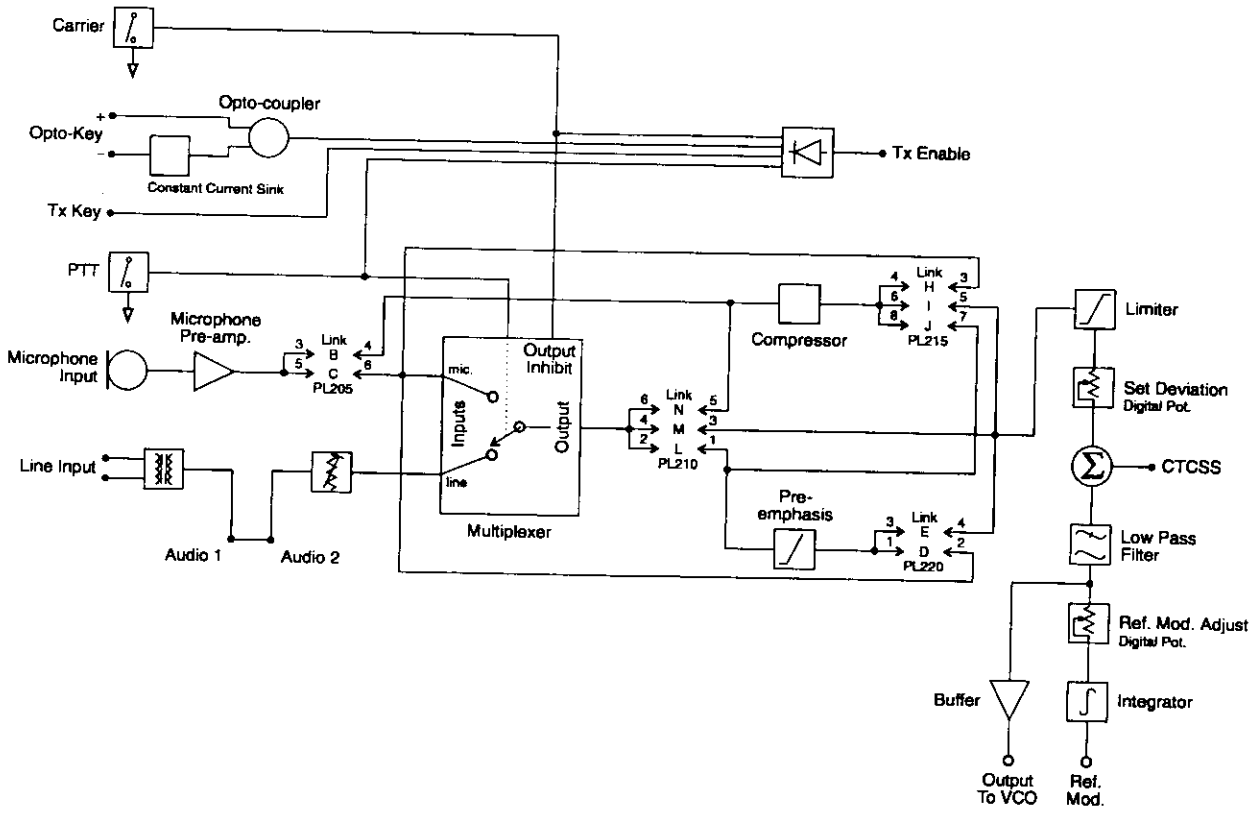


Figure 2.6 T836/837 Audio Processor Block Diagram

2.5.1 General

The audio processor comprises several link selectable circuit blocks which may be configured in a variety of combinations to suit individual requirements. The pre-emphasis network and compressor may be linked individually or cascaded between either or both audio inputs and the limiter.

Refer to Section 3.5.1 for linking details.

2.5.2 Audio Inputs

Two audio inputs are available: one from a 600 ohm balanced (or unbalanced) line, and the other from a local microphone. The microphone signal is passed first to a pre-amplifier (Q210) and ultimately to a multiplexer (IC240), but in between may pass through the compressor (depending on the linking details). The line transformer is also connected to the multiplexer and is disabled by the microphone PTT switch.

A third input for external CTCSS tones is also provided.

2.3.1 Two Point Modulation

Frequency modulation occurs by modulating both the VCO input and the synthesiser reference input. This process is called two point modulation and ensures a flat modulation response from 67Hz to 3kHz (2.55kHz for narrow bandwidth).

The PLL has a fast response time, allowing a Tx key-up time of <30ms. Because of this fast response time the PLL sees lower modulation frequencies superimposed on the VCO as an error and corrects for it, resulting in no modulation on the carrier. At modulation frequencies greater than 300Hz the loop cannot correct fast enough and modulation is seen on the carrier. The response of the loop to VCO modulation is shown by f_2 in Figure 2.5 below.

To achieve low frequency modulation, the reference oscillator is also modulated so that the phase detector of IC740 detects no frequency error under modulation. Thus, the synthesiser loop will not attempt to correct for modulation and the audio frequency response of the transmitter remains unaffected. The response of the loop to reference frequency modulation is shown by f_1 in Figure 2.5.

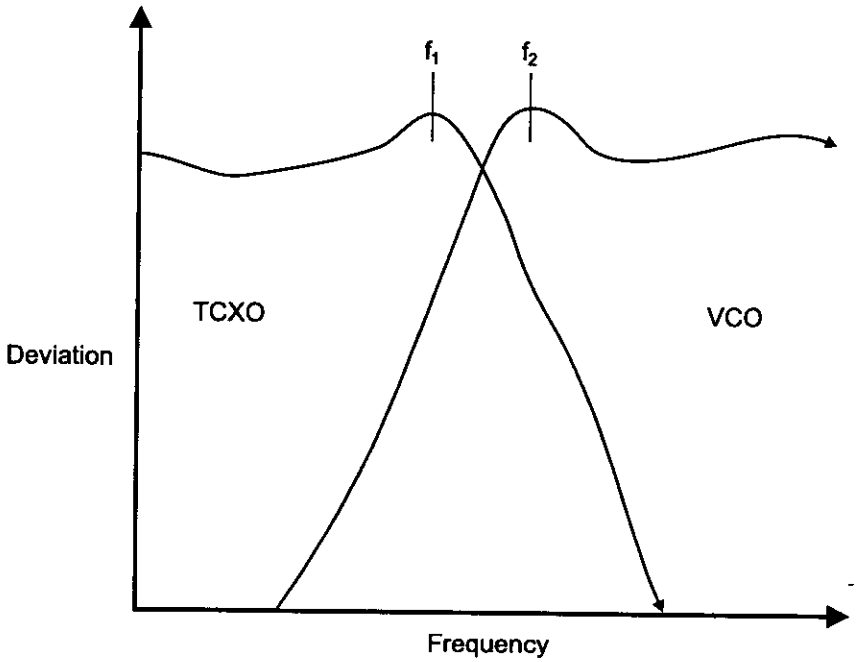


Figure 2.5 T836/837 Two Point Modulation

2.2 Microcontroller

(Refer to the microcontroller circuit diagram (sheet 8) in Section 6.2 or 6.3.)

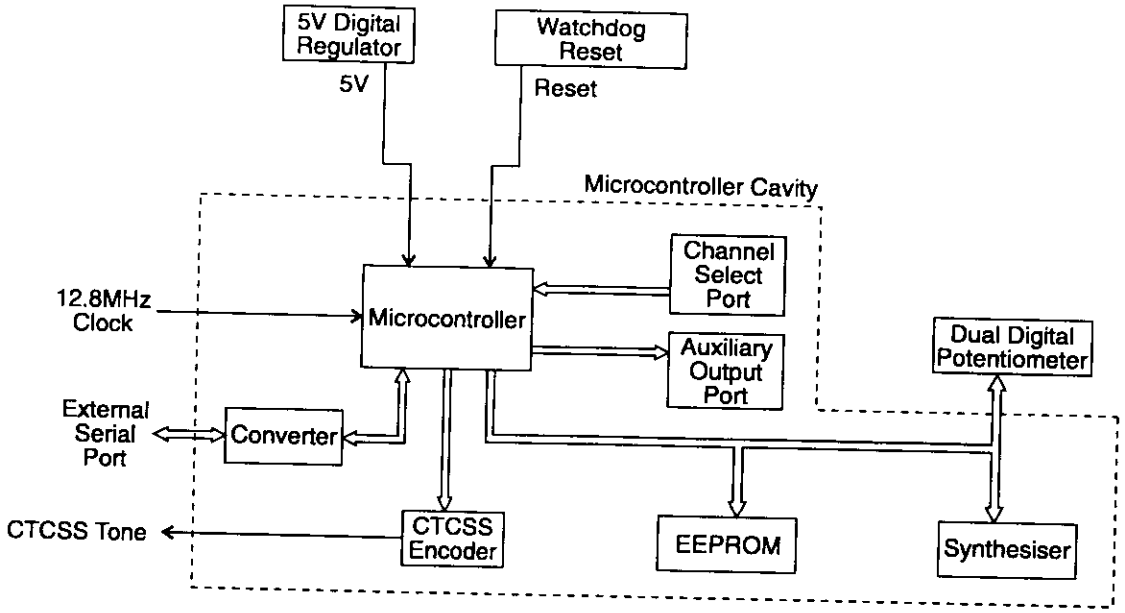


Figure 2.3 T836/837 Microcontroller Block Diagram

Overall system control of the T836/837 is accomplished by the use of a member of the 80C51 family of microcontrollers (IC810). It runs from internal ROM and RAM, thus leaving all four ports free for input/output functions.

Non-volatile data storage is achieved by serial communication with a 16kBit EEPROM (IC820). This serial bus is also used by the microcontroller to program the synthesiser (IC740) and deviation control EPOTS (IC220).

The main tasks of the microcontroller are as follows:

- program the synthesiser and EPOT;
- interface with the PGM800Win programming software at 9600 baud via the serial communication lines on D-range 1 (PL100) & D-range 2;
- monitor channel change inputs from D-range 2;
- generate timing waveforms for CTCSS encoding;
- coordinate and implement timing control of the exciter/transmitter.

1.4 T836 Standard Product Range

The following table lists the range of standard T836 types (i.e. no options fitted) available at the time this manual was published. Consult your nearest Tait Dealer or Subsidiary for more information.

Frequency Range (MHz)		136-156			
Deviation (kHz)		2.5	2.5	4	5
TCXO[a]	±2.5ppm -30°C to +60°C	•	•	•	•
Transmitter Type: T836-		16-0000[b]	15-0000	13-0000	10-0000

Frequency Range (MHz)		148-174			
Deviation (kHz)		2.5	2.5	4	5
TCXO[a]	±2.5ppm -30°C to +60°C	•	•	•	•
Transmitter Type: T836-		26-0000[b]	25-0000	23-0000	20-0000

a. A TCXO with a stability of ±1ppm (0°C to +60°C) is available to suit specific requirements. Contact your nearest authorised Tait Dealer or Subsidiary for further details.

b. United States market only.

You can identify the transmitter type by checking the product code printed on a label on the rear of the chassis (Figure 1.1 in Part A shows typical labels). You can further verify the transmitter type by checking the placement of an SMD resistor in the table that is screen printed onto the PCB (refer to Section 6.1 for more details).

1.2.6 Test Standards

Where applicable, this equipment is tested in accordance with the following standards.

1.2.6.1 European Telecommunication Standard

ETS 300 086 January 1991

Radio equipment and systems; land mobile service; technical characteristics and test conditions for radio equipment with an internal or external RF connector intended primarily for analogue speech.

ETS 300 113 March 1996

Radio equipment and systems; land mobile service; technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector.

ETS 300 219 October 1993

Radio equipment and systems; land mobile service; technical characteristics and test conditions for radio equipment transmitting signals to initiate a specific response in the receiver.

ETS 300 279 February 1996

Radio equipment and systems; electromagnetic compatibility (EMC) standard for private land mobile radio (PMR) and ancillary equipment (speech and/or non-speech).

1.2.6.2 DTI CEPT Recommendation T/R-24-01

Annex I: 1988

Technical characteristics and test conditions for radio equipment in the land mobile service intended primarily for analogue speech.

Annex II: 1988

Technical characteristics of radio equipment in the land mobile service with regard to quality and stability of transmission.

1.2.6.3 Telecommunications Industry Association

ANSI/TIA/EIA-603-1992

Land mobile FM or PM communications equipment measurement and performance standards.

Intermodulation	.. -40dBc with interfering signal of -30dBc .. -70dBc with 25dB isolation & interfering signal of -30dBc (PA with output isolator)
T836 Mismatch Capability:	
Ruggedness	.. refer to your nearest Tait Dealer or Subsidiary
Stability	.. 3:1 VSWR (all phase angles)
Radiated Spurious Emissions:	
Transmit	.. -36dBm to 1GHz -30dBm to 4GHz
Standby	.. -57dBm to 1GHz -47dBm to 4GHz
Conducted Spurious Emissions: (T836 Only)	
Transmit	.. -36dBm to 1GHz -30dBm to 4GHz
Standby	.. -57dBm to 1GHz -47dBm to 4GHz
Power Output:	
T836 - Rated Power	.. 25W
- Range Of Adjustment	.. 5-25W
T837	.. 800mW ±200mW
Duty Cycle (T836 Only)	.. 100% @ 25W at +25°C .. 30% @ 25W at +60°C .. 100% @ 10W at +60°C

1.2.4 Audio Processor

1.2.4.1 Inputs

Inputs Available	.. line, microphone and CTCSS
Line Input:	
Impedance	.. 600 ohms (balanced)
Sensitivity (60% modulation @ 1kHz)-	
With Compressor	.. -50dBm
Without Compressor	.. -30dBm
Microphone Input:	
Impedance	.. 600 ohms
Sensitivity (60% modulation @ 1kHz)-	
With Compressor	.. -70dBm
Without Compressor	.. -50dBm

1.2 Specifications

1.2.1 Introduction

The performance figures given are minimum figures, unless otherwise indicated, for equipment tuned with the maximum switching range and operating at standard room temperature (+22°C to +28°C) and standard test voltage (13.8V DC).

Where applicable, the test methods used to obtain the following performance figures are those described in the EIA and ETS specifications. However, there are several parameters for which performance according to the CEPT specification is given. Refer to Section 1.2.6 for details of test standards.

Details of test methods and the conditions which apply for Type Approval testing in all countries can be obtained from Tait Electronics Ltd.

The terms "wide bandwidth", "mid bandwidth" and "narrow bandwidth" used in this and following sections are defined in the following table.

	Channel Spacing	Modulation 100% Deviation	Receiver IF Bandwidth
Wide Bandwidth	25kHz	±5.0kHz	15.0kHz
Mid Bandwidth	20kHz	±4.0kHz	12.0kHz
Narrow Bandwidth	12.5kHz	±2.5kHz	7.5kHz

1.2.2 General

Number Of Channels .. 128 (standard)[1]

Supply Voltage:

Operating Voltage	.. 10.8 to 16V DC
Standard Test Voltage	.. 13.8V DC
Polarity	.. negative earth only
Polarity Protection	.. diode
Line Keying Supply (if required)	.. -50V DC

Supply Current:

Transmit - T836	.. 4.5A (typical)
- T837	.. 600mA
Standby	.. 150mA (typical)

Operating Temperature Range .. -30°C to +60°C

1. Additional channels may be factory programmed. Contact your nearest Tait Dealer or Subsidiary.