T830 Series II Base Station Equipment Service Manual

Preliminary Issue

August 1997

(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

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С	T836 Transmitter Preliminary PCB Information
D	T837 Exciter Preliminary PCB Information
E	T838 Power Amplifier Preliminary PCB Information
F	T839 Power Amplifier Preliminary PCB Information
G	T830 VCO Preliminary PCB Information
Н	T800-22-0000 Rack Frame

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	



Changing the Operating Frequency of the T800 SeriesII

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:

Topic	See page	
How to change the operating frequency	2	
How to re-tune the T835	4	
How to re-tune the T836/837	7	
Configuring the Audio Processor	11	
How to determine if the T835/836/837 is still operating	16	



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 retune 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.



Changing the Operating Frequency of the T800 Series II

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:

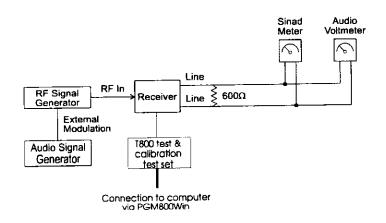
Computer with PGM800Win installed T800 programming kit T800 test & calibration unit Digital multimeter Audio signal generator RF signal generator Audio voltmeter Sinad meter

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 tl	he VCO	
1	Connect a high impedance voltmeter to the long lead of L1 in th 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.	



Changing the Operating Frequency of the T800 Series II

3

Settings are	front end first given for wide band sets, followed in brackets by settings for d []. For multichannel operation the receiver should be aligned on a unency.		
Fre- quency 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 no	oise 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 lin	ne 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.		

Set the line level to the required output level.



How to re-tune the T836/837

Equipment required

You will need:

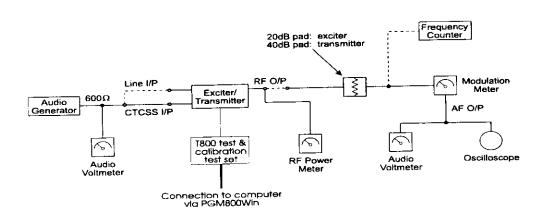
Computer with PGM800Win installed T800 programming kit
T800 test & calibration unit
Digital multimeter
Oscilloscope (digital preferred)
Audio signal generator
Audio voltmeter x 2
RF power meter
Modulation meter
20dB pad

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 "Configuring 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 th 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.		



Changing the Operating Frequency of the T800 SeriesII

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.		



Changing the Operating Frequency of the T800 Series II

Set the	e 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]. Readjust "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.

<u>General</u>

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	bypass high pass filter
	2 - 3 or 3 - 4	300Hz high pass filter in circuit
	4 - 5	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
PL270	2 - 3 1 - 2 2 - 3	not connected relay link



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

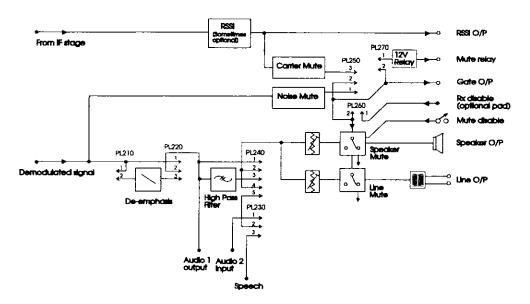
- decoding performed through the receiver (but externally) by T310-05 or similar
- speech injected back into receiver via "audio 2" and sent down 600 ohm line



Changing the Operating Frequency of the T800 Series II

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

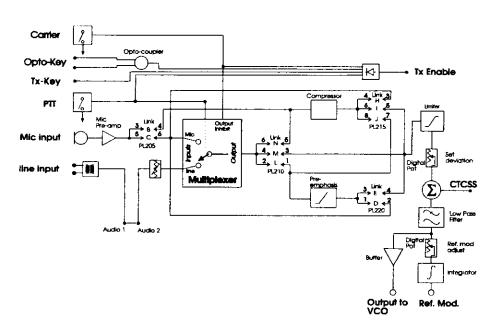
Typical options

	PL205	PL210	PL215	PL220
microphone pre-amp. compressed and pre-emphasised; line input pre-emphasised (stand- ard 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
	(C)	(NI)	(1)	(E)
line and microphone compressed and pre-emphasised	(C) 5 - 6	(N) 5 - 6	(J) 7 - 8	(E) 3 - 4
microphone pre-amp compressed;	(B) 3 - 4	(M) 3 - 4	(H) 3 - 4	(F) 5 - 6
line and microphone flat response;	_			



Configuring the Audio Processor cont..

T836/T837 audio processor links cont..



T836/837 Audio processor block diagram showing link options

Changing the Operating Frequency of the T800 Series II

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.

M830-00

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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 Lock-Detect gate

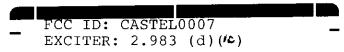
Q320, Q325, Q330, Q335 delay and PIN switch drive.

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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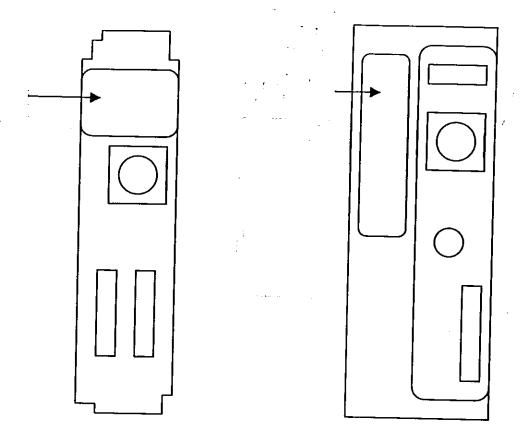
T830 Series II Base Station Equipment 136-174MHz

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Issue 200

April 1998

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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.

Section	Title
1	General Information
2	Circuit Operation
3	Initial Tuning & Adjustment
4	Functional Testing
5	Fault Finding
6	PCB Information

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 Width	183mm 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	2000 1
(see also Section 1.4 and Section 1.5)	±2.5ppm, -30°C to +60°C
- •	±2.5ppm, -30°C to +60°C
(see also Section 1.4 and Section 1.5)	±2.5ppm, -30°C to +60°C 75dBc
(see also Section 1.4 and Section 1.5) Adjacent Channel Power (full deviation): Wide Bandwidth (WB)	

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

 $(\pm 12.5 \text{kHz}/7.5 \text{kHz B/W})$

 $\begin{array}{cccc} At \pm 25kHz & & ... & -95dBc \\ At \pm 1MHz & & ... & -105dBc \end{array}$

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 Narrow Bandwidth

.. -53dB (CEPT).. -50dB (CEPT)

Compressor (optional):

Attack Time

Decay Time

.. 10ms

.. 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

V_{ds} max.

.. capable of sinking 2.25mA via $2k2\Omega$

. 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-<u>X</u>X-XXXX

'1' for 136-156MHz

'2' for 148-174MHz

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

T83X-XX-XXXX

'0' for wide bandwidth (25kHz)

'3' for mid bandwidth (20kHz)
'5' for narrow bandwidth (12.5kHz)

Options

T83X-XX-<u>XXXX</u>

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.

S	ection	Title	Page
2.1		Introduction	2.3
2.2		Microcontroller	2.4
2.3		Synthesised Local Oscillator	2.5
	2.3.1	Two Point Modulation	2.6
2.4		VCO	2.7
	2.4.1	VCO Supply	2.7
2.5		Audio Processor	2.8
	2.5.1	General	2.8
	2.5.2	Audio Inputs	2.8
	2.5.3	Keying Inputs	2.9
	2.5.4	Compressor (Automatic Level Control (ALC))	2.9
	2.5.5	Outputs To Modulators	2.9
2.6		Power Supply & Regulator Circuits	2.10
2.7		Transmit Timers	2.11
2.8		T836 Drive Amplifier & PA	2.12
2.9		T837 Exciter Drive Amplifier	2.13

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.

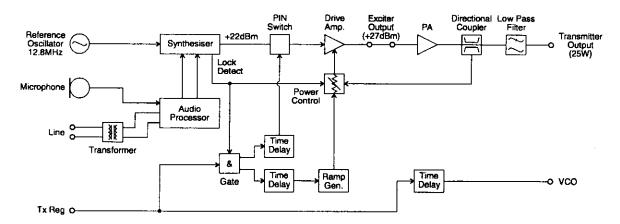


Figure 2.1 T836 High Level Block Diagram

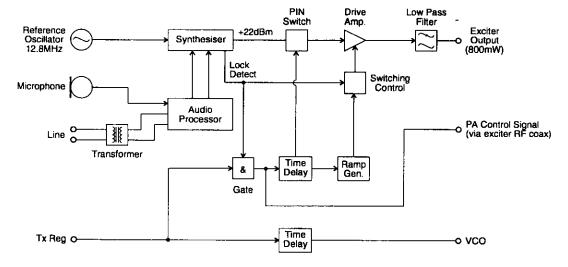


Figure 2.2 T837 High Level Block Diagram

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.)

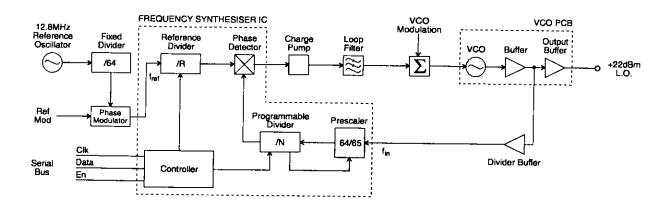


Figure 2.4 T836/837 Synthesiser Block Diagram

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.	
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

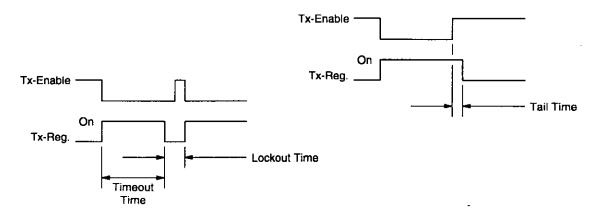


Figure 2.8 T836/837 Transmit Timers

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 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.

Section		Title			
3.1		Introduction	3.3		
3.2	-	Channel Programming	3.3		
3.3		Test Equipment Required	3.4		
3.4		Short Tuning Procedure	3.5		
	3.4.1	Introduction .	3.5		
	3.4.2	Synthesiser Alignment	3.5		
	3.4.3	Output Power Adjustment (T836 Only)	3.5		
	3.4.4	Two Point Modulation Adjustment	3.6		
	3.4.5	FM Deviation (Limiter) Adjustment	3.6		
	3.4.6	Line-in Level Adjustment	3.7		
3.5		Audio Processor Links	3.8		
	3.5.1	Link Details	3.8		
	3.5.2	Typical Options	3.8		
3.6		Synthesiser Alignment	3.9		

Convright T

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.

operate AT

^{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.

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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 $\pm 4.7 \text{kHz} \ (\pm 3.8 \text{kHz}) \ [\pm 2.3 \text{kHz}]$ (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 ($\pm 3.8\text{kHz}$) [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.

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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.



This trimmer is susceptible to physical damage. Do not exert a downward force of more than 500g (11b) 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

 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.
- 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.

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 ± 1 dB relative to 150Hz from 65 to 260Hz.

Check that $\pm 3kHz$ ($\pm 2.4kHz$) [$\pm 1.5kHz$] deviation is still available.

Slowly increase the audio input level until the demodulated waveform shows significant signs of clipping (approximately ± 4.5 kHz (± 3.6 kHz) [± 2.3 kHz] 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 $\pm 4.5 \text{kHz}$ ($\pm 3.6 \text{kHz}$) [$\pm 2.3 \text{kHz}$] 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 $\pm 4kHz$ ($\pm 3.2kHz$) [$\pm 2kHz$] 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.

Section	Title	Page
4.1	Current Consumption	4.3
4.2	Output Power	4.3
4.3	Output Frequency	4.3
4.4	Timers	4.3
4.5	Frequency Response	4.4
4.6	Audio Level Input Sensitivity	4.7
4.7	CTCSS Encoder	4.7

Figure	Title	Page
4.1	T836/837 Transmit Timers	4.4
4.2	T836/837 Pre-emphasis Response	4.5
4.3	T836/837 Limiting Response	4.6
4.4	T836 Main Tuning & Adjustment Controls	4.9
4.5	T837 Main Tuning & Adjustment Controls	4.11

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

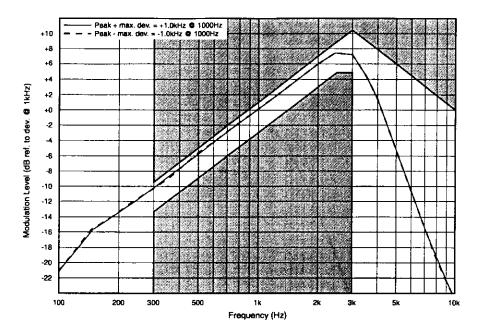
20dB pad.

Measure the output frequency and, if necessary, adjust the TCXO (IC700) to trim to the nominal frequency $(\pm 100 \text{Hz})$.

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

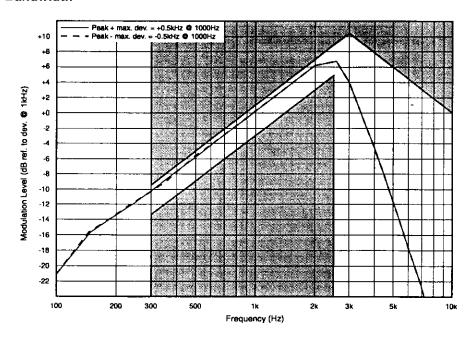


Figure 4.2 T836/837 Pre-emphasis Response

wright TEI

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

Section		Title			
5.1		Visual Checks	5.3		
5.2		Component Checks	5.3		
5.3		Front Panel LED Indicator	5.3		
5.4		DC Checks	5.4		
	5.4.1	Power Rails	5.4		
	5.4.2	VCO Locking	5.4		
5.5		RF Checks	5.5		
	5.5.1	T836 Drive Power	5.5		
	5.5.2	T836 PA Output Power	5.5		
	5.5.3	T837 Output Power	5.5		
	5.5.4	Audio And Modulation	5.6		
5.6		PGM800Win Generated Errors	5.7		

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:

	Fla	ish Rate	Condition	
	fast	(1/3 sec. on/1/3 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..

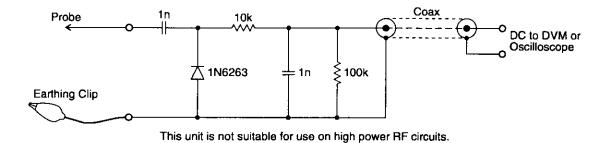


Figure 5.1 RF Diode Probe Circuit

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.

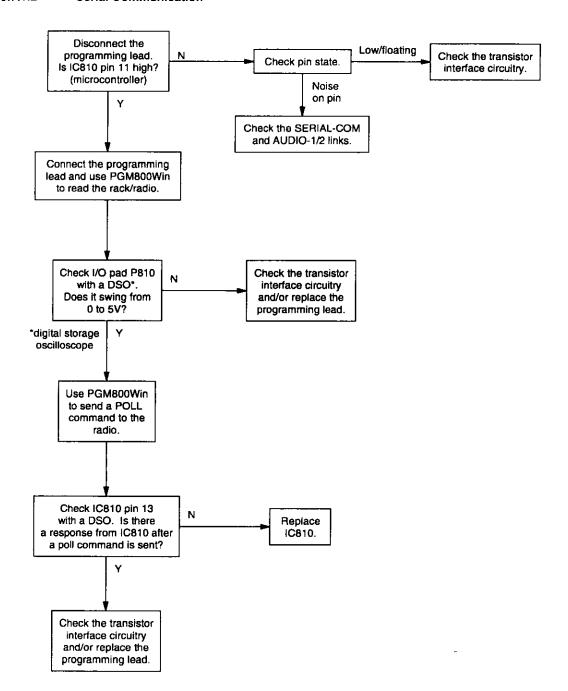
Internal Error

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.

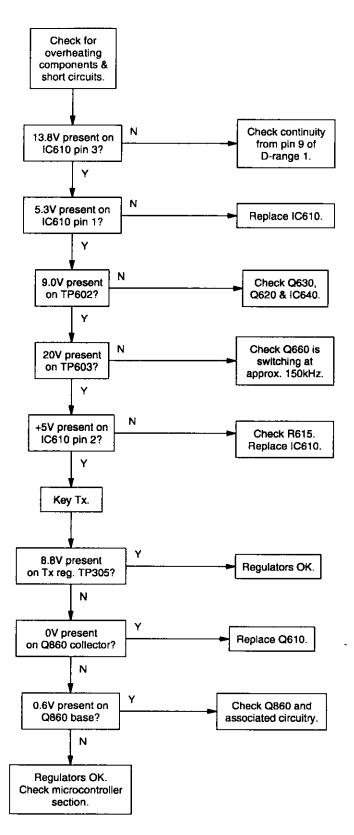
Write/Read To An Unlinked Module

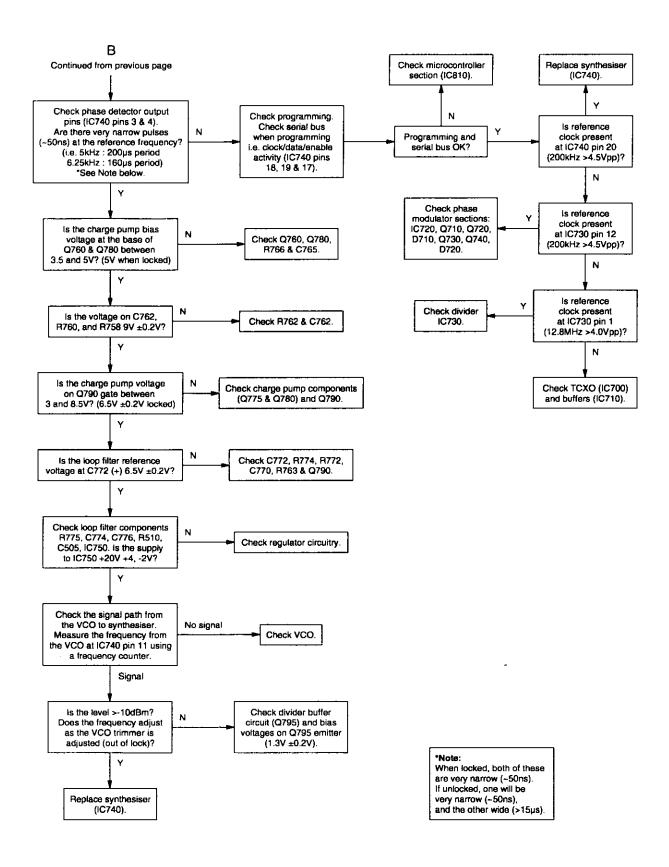
The link to the module does not exist. Undefined error.

5.7.1.2 Serial Communication

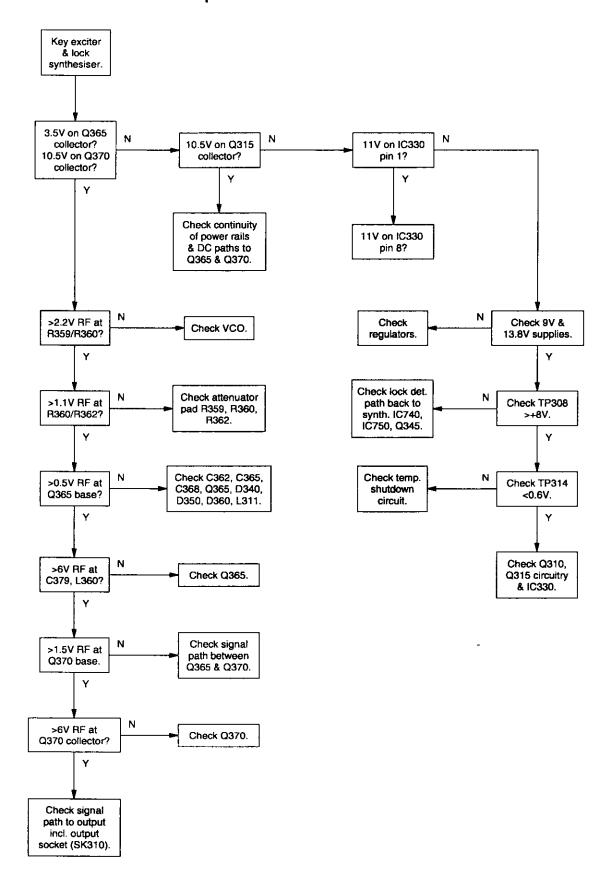


5.7.2 Regulator

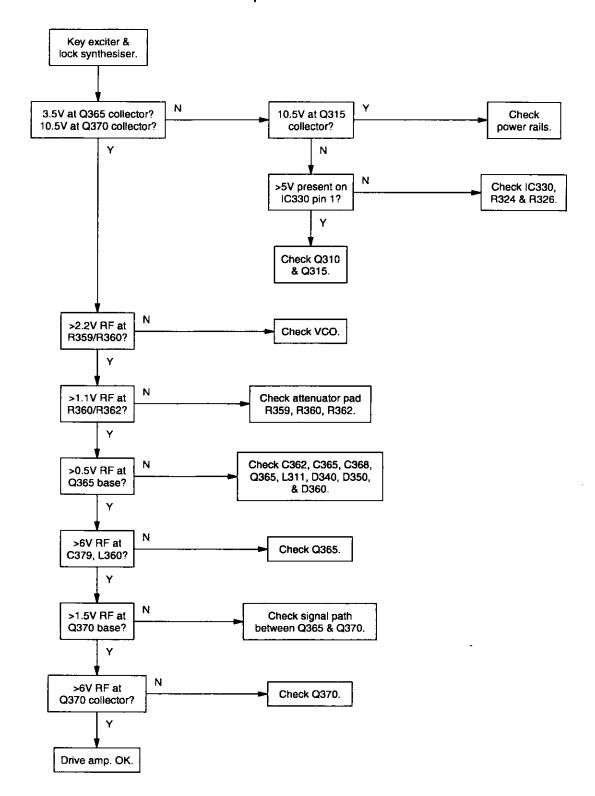




5.7.4 T836 Drive Amplifier



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.

Section	Title	IPN	Page
6.1	Introduction		6.1.3
6.2	T836 Transmitter PCB	220-01395-02	6.2.1
6.3	T837 Exciter PCB	220-01390-02	6.3.1

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

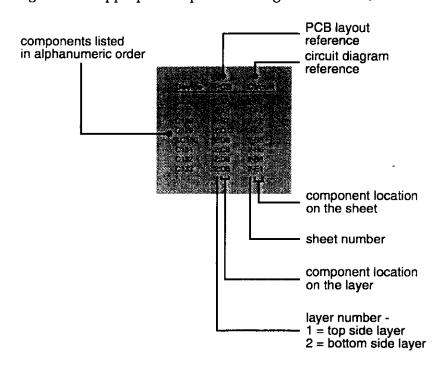
A variant component is one that has the same circuit reference but different value or specification in different product types. Where two products share the same PCB, the term "variant" is also used to describe components unplaced in one product. Variant components have a character prefix, such as "&",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

IPN	Section	Page
220-011390-02	Parts List	6.3.3
	Mechanical & Miscellaneous Parts	6.3.8
	Mechanical Assembly	6.3.9
	Grid Reference Index	6.3.11
	PCB Layout - Top Side	6.3.15
	PCB Layout - Bottom Side	6.3.16
	Test Points & Options Connections - Top & Bottom Side	6.3.17
	Exciter Overview Diagram	6.3.18
	Audio Processor Circuit Diagram	6.3.19
	Exciter Circuit Diagram	6.3.20
	VCO Section Circuit Diagram	6.3.22
	Regulators Circuit Diagram	6.3.23
	Synthesiser Circuit Diagram	6.3.24
	Microcontroller Circuit Diagram	6.3.25
	Harmonic Filter Circuit Diagram	6.3.26

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 Ame	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) $\Big $ To improve power at 174MHz					
R235, R545	Changed from 2k2 (036-14220-00) to 4k7 (036-14470-00)					
R290	Changed from 560 Ω (036-13560-00) to 680 Ω (036-13680-00) to reduce the level of side bands generated (710028).					
R304	Changed from 15k (036-15150-00) to 2k7 (036-14270-00)					
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)					
İ						

Ref	Var	IPN	Description	Ref	Var	· IPN	Description
C830		015-25470-08			· ·		
C838		020-09100-04		Q610 Q620		000-10008-0 000-00012-1	
C841		020-09100-04		Q630		000-50011-3	
C844		015-25100-08	CAP CER 0805 10N 10% X7R 50V	Q660		000-10008-1	
C910 C920		015-02120-06		Q670		000-10008-5	7 S) XSTR SMD BCW70 PNP SOT23 SS
C930		015-02270-06 015-02120-06		Q710 Q720		000-10008-4(000-10008-5)	
0000		013 02 123 00	ON DEN 1210 12F 14F03004GHM42	Q730		000-10008-4	
D111		001-00011-60		Q740		000-10008-5	
D220		001-10000-99	, 	Q750		000-10008-07	7 S) XSTR SMD BC807 PNP SOT23 AF
D230 D240		001-00010-40 001-10000-56		Q760		000-10008-46	,
D250		001-10000-56		Q770 Q775		000-10008-57 000-10008-57	
D260		001-10000-56	S) DIODE SMD BAW56 D-SW SOT23	Q780		000-10008-48	
D270		001-10000-99	,	Q785		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
D340 D350		001-10000-18 001-10000-18		Q790		000-10003-12	
D360		001-10000-18		Q795 Q810		000-10057-10 000-10008-48	
D610		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23	Q820		000-10008-17	
D620 D630		001-10000-70		Q830		000-10008-57	S) XSTR SMD 8CW70 PNP SOT23 SS
D635		001-10000-70 001-10065-00		Q840		000-10008-57	
D640		001-10000-70		Q850 Q860		000-10008-48 000-10008-48	
D710		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23			000 10000 40	0) 20 11 0 11 0 0 12 0 0 0
D720		001-10000-99		R160		036-12100-00	
D730 D740		001-10065-00 001-10065-00		R201		036-13560-00	
DB10		001-10065-00		R202 R204		036-14100-00 036-14220-00	
				R205		036-13220-00	
IC210		002-10003-24		R206		036-14100-00	
IC220 IC230		002-10126-70 002-10003-24		R207		036-14390-00	
IC240		002-10040-53	S) IC SMD 324 4X O-AMP SQ14 S)MC14053B SMD BREAK B4 MAKE	R208 R209		036-13560-00 036-15100-00	
IC250		002-00020-50	S) IC 4N25A OPTOCOUPLER	R210		036-14220-00	
IC260		002-10003-24		R212		036-16100-00	
IC330 IC610		002-00012-40		R213		036-15100-00	
IC630		002-00014-62	S) IC 78L05 5V 100MA REG TO92 S) IC 317L 100MA REG 3TER TO92	R214 R215		036-14820-00 036-16100-00	
IC640		002-10003-58	S) IC SMD LM358 DUAL O-AMP	FI216		036-16100-00	
IC650		002-10012-32	SMD DS1232LPS-2 LP RESET&W-DOG	R217		036-14100-00	
=IC700 IC710		539-00010-41	TCXO 12.8MHZ +-2.5PPM -30 +70C	R218		036-16150-00	
IC720		002-74910-04 002-74910-04	S) IC SMD 74HCU04 6X INV S) IC SMD 74HCU04 6X INV	R219 R221		036-14220-00	- · · · · ·
IC730		002-10045-20	S) IC SMD 74HC4520T 2XCTR 4BIT	R223		036-14150-00 036-17100-00	
IC740		002-14519-10	S) IC MC145191F SMD SYNTH	R224		036-14680-00	
IC750 IC810		002-10330-78 002-08951-20	S) IC MC33078D 2X AMP LO NOISE S) IC AT89C51 PLCC44 MIC 12MHZ	R225		036-17100-00	
IC820		002-12416-00	S)IC A189031 PLCC44 MIC 12MHZ S)IC SMD AT24C16N-10SC EEPROM	R226 R227		036-15100-00 036-14220-00	- · ·
IC830		002-10003-24	S) IC SMD 324 4X O-AMP SO14	R229		036-16470-00	
1001				R230		036-16100-00	RES M/F 0805 100K 5%
LED1 LED2		008-00013-32 008-00013-35	S) LED 3 RED LO CURRENT NO MTG S) LED 3 GRN LO CURRENT NO MTG	R231		036-15100-00	
LLDL		000-00013-30	3) LED 3 GRIN LO COMMENT NO MIG	R232 R233		036-16330-00 036-16100-00	
L335		056-00021-04	IND FXD 330NH AX	FI235		036-14470-00	
L340		056-00021-04	IND FXD 330NH AX	R237		036-15470-00	
L345 L350		052-08135-25 052-08125-15	COIL AW 2.5T/3.5MM HOR 0.8MM COIL AW 1.5T/2.5MM HOR 0.8MM	R238		036-15470-00	RES M/F 0805 47K 5%
L355		056-00021-01	IND FXD 1.5UH AX	R239 R241		036-14150-00 036-14470-00	RES M/F 0805 1K5 5% RES M/F 0805 4K7 5%
L360		052-08135-35	COIL AW 3.5T/3.5MM HOR 0.8MM	FI242		036-14220-00	RES M/F 0805 2K2 5%
L365 L370		052-08130-15 065-00010-08	COIL AW 1.5T/3.0MM HOR 0.8MM	R244		036-15100-00	RES M/F 0805 10K 5%
L375		065-00010-04	BEAD FERR 4S3 3X0.7X10MM RED BEAD FERR F8 4X2X5MM	R245 R247		036-16100-00	
L380		056-00021-01	IND FXD 1.5UH AX	R248		036-15100-00 036-16100-00	RES M/F 0805 10K 5% RES M/F 0805 100K 5%
L385		052-08140-35	COIL A/W 3.5T/4.0MM HOR 0.8MM	R249		036-16100-00	RES M/F 0805 100K 5%
1.390 1.750		056-00021-04 056-10068-00	IND FXD 330NH AX	R251		036-16100-00	RES M/F 0805 100K 5%
L910		052-08140-35	IND FXD SMD 68NH 3.2*2.5*1.6 COIL AW 3.5T/4.0MM HOR 0.8MM	R253 R254		036-16100-00 036-16100-00	RES M/F 0805 100K 5%
L920		052-08140-35	COIL AW 3.5T/4.0MM HOR 0.8MM	R255		036-15100-00	RES M/F 0805 100K 5% RES M/F 0805 10K 5%
DI 400		540 50540 65		R256		036-15470-00	RES M/F 0805 47K 5%
PL100 PL205		240-00010-55 240-00020-67	PLUG 15 W D RANGE W/W PNL MT HEADER 6W 2X3 PCB MTG STD	R257		036-16330-00	RES M/F 0805 330K 5%
PL210		240-00020-67	HEADER 6W 2X3 PCB MTG STD	R258 R259		036-16150-00 036-15220-00	RES WF 0805 150K 5% RES WF 0805 22K 5%
PL215		240-00020-44	HEADER 10W X2R PC8 MTG 5*2	H260		036-15470-00	RES M/F 0805 22K 5%
PL220		240-00020-67	HEADER 6W 2X3 PCB MTG STD	R262		036-15470-00	RES M/F 0805 47K 5%
Q210		000-10008-48	C) VCTD CHD BOWGO NON COTOO OC	R263		036-14470-00	RES M/F 0805 4K7 5%
Q220		000-10008-17	S) XSTR SMD BCW60 NPN SOT23 SS S) XSTR SMD BC817-25 NPN SOT23	&R264 &R264	10 13	036-15220-00 036-15220-00	RES WF 0805 22K 5%
Q230		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS	&R264	15	036-15270-00	RES M/F 0805 22K 5% RES M/F 0805 27K 5%
Q240		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS	&R264	20	036-15220-00	RES M/F 0805 22K 5%
Q250 Q260		000-10008-17 000-10008-57	S) XSTR SMD BC817-25 NPN SOT23	&R264	23	036-15220-00	RES M/F 0805 22K 5%
Q270		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS S) XSTR BD139 NPN AF PWR TO126	&R264 &R265	25 10	036-15270-00 036-15150-00	RES WF 0805 27K 5% RES WF 0805 15K 5%
Q305		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS	&R265	13	036-15150-00	RES M/F 0805 15K 5%
Q310		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS	≜ R265	15	036-15180-00	RES M/F 0805 16K 5%
Q315 Q320		000-00012-15 000-10008-07	S) XSTR BD234 PNP AF PWR TO126 S) XSTR SMD BC807 PNP SOT23 AF	&R265	20	036-15150-00	RES M/F 0805 15K 5%
Q325		000-10008-07	S) XSTR SMD BC807 PNP SC123 AF	&R265 &R265	23 25	036-15150-00 036-15180-00	RES M/F 0805 15K 5%
Q330		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS	&R266	10	036-15470-00	RES M/F 0805 18K 5% RES M/F 0805 47K 5%
Q335		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF	&R266	13	036-15470-00	RES M/F 0805 47K 5%
Q340 Q345		000-10008-48 000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS S) XSTR SMD BCW60 NPN SOT23 SS	&R266	15	036-15560-00	RES M/F 0805 56K 5%
Q365		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS S) XSTR 3866 NPN T092 SWITCH	&R266 &R266	20	036-15470-00	RES M/F 0805 47K 5%
Q370		000-00022-30	S) XSTR 2N4427 NPN T039 VHF DR	&R266	23 25	036-15470-00 036-15560-00	RES M/F 0805 47K 5% RES M/F 0805 56K 5%
Q510		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF	R267		036-14220-00	RES M/F 0805 2K2 5%
Q520 Q530		000-10008-07 000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF S) XSTR SMD BC807 PNP SOT23 AF	R268		036-13100-00	RES M/F 0805 100E 5%
Q540		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF	F1269 F1270		036-15100-00 036-13470-00	RES M/F 0805 10K 5% RES M/F 0805 470E 5%
Q550		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS	FI271		036-16390-00	RES M/F 0805 390K 5%
							·

Ref	Var	IPN	Description	Ref	Var	IPN	Description	
R842		036-14220-00	FIES 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%					
f1846		036-13470-00	RES M/F 0805 470E 5%					
R847		036-13470-00	RES M/F 0805 470E 5%					
FI848		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					

Device	РСВ	Circuit	Device	РСВ	Circuit	Device	РСВ	Circuit	Device	РСВ	Circuit
TRRG	Grid B	leference	C220	1:E5	2-D9	*L231	1:L4	2-J4	R141	1:E3	1-B5
1000	dila i	Cicicion	C221	1:E5	2- Q 9	L233	1:F6	2-R6	R142	1:E3	1-E7
Index	(C222	1:E5	2-E9	*L236	1:H6	2-N3	R143	1:E4	1- F 6
	•		C223	1:D5	2-H9	L239	1:E5	2-R3	R144	1:D3	1-F6
*C101	1:E4	1-B8	C224	1:D5	2-N9	L241	1:D6	2-R4	R145	1:E4	1- F 7
*C103	1:E4	1-89	C225	1:L6	2-J7	L243	1:C6	2-R4	R146	1:E4	1-G7
		1-D8	C226	1:D4	2-H9	L245	1:C7	2-R4	R148	1:C5	1-D5
*C105	1:B3		C227	1:K6	2-K7	L247	1:C6	2-R4	R149	1: C 5	1-C4
*C107	1:B3	1-D9	C229	1:H6	2-L6	L248	1:D7	2- R 4	R150	1:C4	1-F0
*C109	1:B3	1-D8	*C230	1:L4	2-J4	L249	1:B6	2-R4	R151	1:B5	1-D5
*C111	1:C4	1-D8	*C231		2-J3	L264	1:C6	2-M9	R152	1:85	1-C3
*C113	1:B5	1-F8		1:L4		LINK1	1:D3	1-L0	R153	1:C5	1-F4
*C115	1:B5	1-F8	*C232	1;K4	2-K3				R154	1:C5	1- F 3
*C117	1:B5	1-F9	*C233	1:K4	2-M3	LINK2	1:P6	1-D1			1-F2
*C119	1:B5	1-G8	*C234	1:J4	2-N3	LINK201	1:D5	2-F9	R155	1:D3	
*C121	1:D4	1-B6	*C240	1:H4	2-L2	P101	1:A5	1-R9	R156	1:D3	1-F3
*C123	1:D4	1-B6	C259	1:F7	2- R 5	P103	1: K3	1- R 0	R157	1:D4	1-G0
*C125	1:C4	1-D7	C261	1:F6	2- R 6	P105	1:K2	1-R0	R158	1:C4	1-H3
*C127	1:C4	1-D6	C268	1: E 6	2-R4	P201	1:B6	2-R4	R159	1:C4	1-H4
C129	1:B3	1-H5	C270	1:D6	2-R4	PL101	1:L3	1-C2	R160	1:C3	1-J5
C123	1:B3	1-J6	C271	1:C6	2-R4	*Q101	1:C3	1-C9	R161	1:B3	1- J 3
			C272	1:B6	2-R4	*Q103	1:B3	1-E8	R162	1:B3	1-K4
C132	1:A3	1-K7	C273	1:B6	2-R4	*Q105	1:C4	1-D7	R163	1:P7	1-K5
C133	1:B4	1-K8	C294	1:D6	2-R3	'Q 107	1:B5	1-F8	R164	1:B3	1-K4
C137	1:B2	1-K8	C295	1:D6	2-R3	*Q109	1:A5	1-G9	R165	1:B4	1-K4
C138	1:B2	1-L8	C295 C297	1:C5	2-M9	Q111	1:A3	1-J7	R166	1:P6	1-L5
C139	1:B4	1-M6			2-M9 2-M9	Q113	1:A3	1-57 1-K6	R168	1:E4	1-A1
C141	1:B3	1-M8	C298	1:C6				1-K0 1-L7	R169	1:E4	1-A0
C143	1:E3	1-E7	D101	1:B3	1-H5	Q115	1:A3		R170	1:D4	1-B0
C145	1:E3	1-F7	D101	1:B3	1-G5	Q117	1:B4	1-K8			
C147	1:D3	1-F6	D103	1:P7	1- K 9	Q119	1:B4	1-L6	R171	1:E4	1-B0
C149	1:D3	1-F7	D105	1:C2	1-J2	Q121	1:B3	1-L8	R172	1:E4	1-B0
C151	1:C5	1-D5	D105	1.C2	1-J2	Q123	1:E3	1-E7	R173	1:P6	1-C1
C153	1:B5	1-D3	D107	1:P7	1-K5	Q125	1:E3	1-F7	R174	1:P6	1-C1
C155	1:D3	1-G3	D109	1:P6	1-L5	Q127	1:D3	1-G7	R175	1:D4	1-C0
C159	1:B3	1-H2	D111	1:C2	1-M1	Q129	1:B4	1-L4	R176	1:D4	1-D0
C161	1:B3	1-K4	D111	1:C2	1-M1	Q131	1:B3	1-M5	R177	1:D4	1-D0
		1-L4	D113	1:F7	1-Q2	Q133	1:D4	1-D0	R178	1:D3	1-E1
C162	1:B3		D201	1:F6	2- R 5	Q135	1:E2	1-H0	R179	1:D4	1-E0
C164	1:B3	1-L4	D202	1:D4	2-J9	Q136	1:E3	1-H0	R180	1:D4	1-E0
C165	1:B3	1-M4	D202	1:D4	2-J9	Q137	1:D2	1-30	R181	1:E3	1-F2
C167	1:K3	1-P3	D203	1:E6	2-R4	Q201	1:D5	2-L9	R182	1:D4	1-E0
C169	1:K3	1-P3	IC101	1:D4	1-C6	R101	1:E4	1-A8	R183	1:D4	1-F1
C171	1:K3	1-Q3			1-G0	*R102	1:E4	1-A9	R184	1:E3	1-G1
C173	1:D4	1-B0	IC101	1:D4		R103	1:E4	1-A8	R185	1:E2	1-J0
C174	1:E4	1-B0	IC101	1:D4	1-B8				R186	1:D2	1-H1
C176	1:D4	1-E0	IC101	1:D4	1-C0	R104	1:E4	1-B9		1:E2	1- H 0
C178	1:C4	1-F0	IC101	1:D4	1-N0	*R105	1:D4	1-C8	R187		
C179	1:D3	1-G2	IC103	1:C4	1-D4	*R10 6	1:B3	1-C8	R188	1:D2	1-L1
C180	1:E2	1-H0	IC103	1:C4	1-J8	*R107	1:C4	1-D7	R189	1:D2	1-L1
C181	1:D3	1-G0	IC103	1:C4	1-F0	*R108	1:B3	1-E9	R190	1:C3	1-M1
C182	1:D3	1-H1	IC103	1:C4	1-J5	*R109	1:C3	1-E9	R191	1:B2	1-P1
C184	1:D4	1-G0	IC103	1:C4	1-E3	*R111	1:B5	1-E8	R192	1:B2	1-P1
			IC105	1:D3	1-M0	*R112	1:B5	1-E9	R193	1:C2	1-Q1
C185	1:D2	1-J1	IC105	1:D3	1-P0	*R113	1:B5	1- F 9	R194	1:D2	1-H0
C186	1.E2	1-J0	IC105	1:D3	1-G2	'R114	1:C4	1-A6	R195	1:D3	1-J0
C187	1:D3	1-K1	IC107	1:D3	1-K1	*R115	1:C5	1-A6	R196	1:D3	1-J0
C188	1:C2	1-L1	IC109	1:B2	1-N1	*R116	1:D4	1-A7	R197	1:D3	1-L1
C189	1: C 3	1-M1			2-J7	R117	1:C4	1-A6	*R201	1:N6	2-D2
C190	1:C3	1-N1	*IC201	1:K6		R118	1:D4	1-B6	*R202	1:N6	2-D2
C192	1:B2	1-N1	*#IC202	1:K4	2-J2			1-C7	R203	1:L7	2-J8
C193	1:82	1-P1	*IC203	1:N5	2-F4	R119	1:D4		*R204		2-E2
C195	1:C2	1-Q1	IC204	1:D5	2-H9	*R121	1:C4	1-C7		1:N6	
C201	1:J7	2-N7	IC204	1:D5	2- P 9	*R122	1:C4	1-D6	R205	1:K7	2-M7
C202	1:H3	2-B9	IC204	1:D5	2-H9	R123	1:B4	1-H7	*R206	1:C5	2-E9
*C203	1:P7	2-D3	*1C205	1:G5	2-R4	R124	1: B 4	1-H8	R 207	1:C5	2-G9
*C204	1:M6	2-E2	L101	1:K3	1- P 3	R125	1:B4	1-H8	*R208	1:C5	2-G9
			L103	1:K2	1-Q3	R126	1:B3	1-H6	R209	1:D5	2- G 9
C205	1:L7	2-J8	L105	1:E2	1-K0	R127	1:A3	1-H7	R210	1:D5	2-G9
°C206	1:P6	2-D2	*L201	1:P7	2-C3	R128	1:A3	1-J7	*R211	1:D4	2-H9
C207	1:K7	2-M7	*L202	1:H3	2-C9	R129	1: B 4	1-J9	R212	1:D4	2-J9
*C208	1:H2	2-C9				R130	1:B4	1-J8	R213	1:D5	2-F9
*C209	1:C5	2-D9	L203	1:L7	2-J9		1:A3	1-J7	R214	1:E4	2-K9
*C210	1:C5	2-E9	*L204	1:C5	2-D9	R131			*R215	1:H3	2-R9
*C212	1:D5	2-H9	L206	1:H5	2-C9	R132	1:B5	1-J8			
*C213	1:D4	2-H9	L208	1:E5	2-D9	R133	1:A3	1-K7	*R216	1:P6	2-E4
C215	1:D5	2-K9	*L211	1:P2	2-D5	R134	1:B3	1- K 6	*R217	1:P6	2-E4
C216	1:H5	2-R9	L215	1:L7	2-J8	R135	1:P7	1-K9	R218	1:E5	2-E9
	1:P3	2-69 2-E4	L217	1:J7	2-L8	R136	1:A3	1-K7	R219	1:H6	2- B 9
*C217			L223	1:J4	2-L3	R137	1:B3	1-K6	R220	1: E 5	2-G9
C218	1:H5	2-C9	"L230	1:L4	2-J5	R138	1:B4	1-L6	R222	1:D5	2-G9
*C219	1:P2	2-E5	2250	,,∟⊸	_ 55						

Device	PCB	Circuit	Dev	ice PC	В	Circuit	Device	РСВ	Circuit	Device	РСВ	Circuit
*R223	1:F2	2- R 4							<u> </u>	DEVICE	-CB	Circuit
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	1:05	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										

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HER MIL 0802 8KS 2%
                                                                                                                                 00-02871-960
                                                                                                                                                    BITTE
                                                                                                     HER WILL 0802 1K8 2%
                                                                                                                                 00-08141-960
                                                                                                     HER M/E 0802 41K 8%
                                                                                                                                 00-07791-960
                                                                                                                                                    9716
                                                                                                     HER MILL 0802 83K 2%
                                                                                                                                  00-02891-980
                                                                                                                                                    771H
                                                                                                     BES M/E 0809 10K 2%
                                                                                                                                  00-00151-960
                                                                                                                                                    2143
                                                                                                     BES W/F 0805 10K 5%
                                                                                                                                 00-00151-980
                                                                                                                                                    3145
                                                                                                     BER WILL 0802 10K 2%
                                                                                                                                 00-00191-960
                                                                                                                                                    LELH
                                                                                                     HES WIL 0802 10K 9%
                                                                                                                                 036-15100-00,
                                                                                                                                                    8C1F
                                                                                                     HER MIL 0802 SKS 2%
                                                                                                                                  039-14550-00
                                                                                                                                                    4137
                                                                                                     HER MIL 0802 JOK 2%
                                                                                                                                 000-00191-960
                                                                                                                                                    9818
                                                                                                    HER WIL 0802 680E 2%
                                                                                                                                 036-13680-00,
                                                                                                                                                    9818
                                                                                                    BES W/E 0809 430E 9%
                                                                                                                                  00-02461-960
                                                                                                                                                    F134
                                                                                                     HER MIL 0802 JOK 9%
                                                                                                                                 00-00191-960
                                                                                                                                                    SELH
                                                                                                      BES W/F 0805 1K 5%
                                                                                                                                 ,00-00141-850
                                                                                                    HER WILL 0802 180K 9%
                                                                                                                                 00-08191-980
                                                                                                                                                    121H
                                                                                                     3ES W/F 0805 2K2 5%
                                                                                                                                 039-14550-00
                                                                                                                                                    B130
                                                                                                      MES MI 9080 J/M S3%
                                                                                                                                 036-17100-00.
                                                                                                                                                    6Z1B
                                                                                                     BE2 W/E 0802 55K 2%
                                                                                                                                 039-12550-00
                                                                                                                                                    8Z1H
                                                                                                     HER MIL 0802 10K 2%
                                                                                                                                 00-00191-980
                                                                                                                                                    721H
                                                                                                      BES MIL 0802 1K 2%
                                                                                                                                 00-00141-920
                                                                                                     BES WIE 0802 10K 2%
                                                                                                                                 00-00151-980
                                                                                                                                                    9Z1H
                                                                                                                                 00-00191-980
                                                                                                                                                    H154
                                                                                                   MES W/F 0802 100K 2%
                                                                                                      HES WILL 0802 1K 2%
                                                                                                                                 00-00141-980
                                                                                                    HES M/F 0805 470K 5%
                                                                                                                                 00-04491-980
                                                                                                                                                    6118
                                                                                                     HER WILL 0802 SAK 2%
                                                                                                                                  039-12570-00
                                                                                                                                                    811B
                                                                                                    BES W/F 0805 220K 5%
                                                                                                                                  036-16220-00,
    CONN SMD SKL 8M SE M-MATCH
                                            'S40-100001-052'
                                                             2K103
                                                                                                    BES W/F 0805 470K 5%
                                                                                                                                 00-07491-960
                                                                                                                                                    #01H
                                                                                                                                  00-06681-960
                                                                                                                                                    E01H
                                            '90-0000 L-0#Z
                                                                                                     HER W/F 0802 33K P/F
    CONN SWD SKT 8W 2R M-MATCH
                                                              LOUNS
  HES PRESET SMD 2K CER 4MM SQ
                                                                                                      HES W/F 0805 1K 5%
                                            042-04220-05
                                                              BUTTE
                                                                                                                                  036-14100-00,
                                                                                                                                                    LOLE
BES PRESET SMD 500K CER 4MM SQ
                                            045-06200-05
                                                              EL LAH
                                                                                      SS ESTOR NAN GAWGB DMS FIZX (S
                                                                                                                                 85-80001-000
                                                                                                                                                    1020
                                                                                                                                  $6-06000-000
                                                                                                                                                    7610
                                            044-04S00-03
                                                                                           AA 0SSOT 9N9 TO18NS RTSX (8
      HER SHE SK 10 LOHA BALLMICE
                                                              601AH
 HES PRESET SMD 50K CER 4MM SQ
                                            042-05200-05
                                                              701VA
                                                                                       S) XSTR SMD BC817-25 NPN SOT23
                                                                                                                                 T1-80001-000
                                                                                                                                                    9810
 BES PRESET SMD 5K CER 4MM SQ RES PRESET SMD 50K CER 4MM SQ
                                            '90-009+0-2+0'
                                                              COLAH
                                                                                       S X X 2 LB 2 RC 8 LB 2 R R 2 C LS 3
                                                                                                                                 TT-8000T-000
                                                                                                                                                    9810
                                            .0-00550-S#0.
                                                                                      S) XSTR SMD BCW60 NPN SOT23 SS
                                                                                                                                  84-80001-000
                                                                                                                                                    0133
                                                              FOTVR
  BES PRESET SMD 5K CER 4MM SQ
                                            042-04200-02
                                                                                           LS) XSTR SMD BF170LT1 SOT23
                                                                                                                                 00-71001-000
                                                              TOTAR
                                                                                                                                                    1610
      BES NIC SWD 4K1 2% SOWM
BES EIFW 150E 2% 0'SSM 1XS'S
                                                                                      S) XSTH SMD BCW70 PNP SOT23 SS (S) XSTH SMD BCW7-25 NPN SOT23 SS
                                             00-04440-940
                                                               453F
                                                                                                                                 71-80001-000
                                                                                                                                                    6210
                                             030-03150-00
                                                               H231
                                                                                                                                  78-80001-000
                                                                                                                                                    7210
           BES WE 0802 CHIB 20K 1%
                                             036-15560-10,
                                                               H229
                                                                                      SS ESTOR 9NY 07WO 9 MR HT2X (S
                                                                                                                                 72-80001-000
                                                                                                                                                    0152
      BES M/E 0802 CHIB 4K1 1%
BES EIFM 150E 2% 0.55M 1X5.5
                                                                                      SS $210S BCM30 BNB SOL$3 22
                                                                                                                                 79-80001-000
                                                                                                                                                    0153
                                             01-07661-960
                                                               822H
                                                                                           S) XSTR SMD BF170LT1 SOT23
                                             030-03120-00
                                                               H225
                                                                                                                                  00-71001-000
                                            01-05141-960
           BES WE 0802 CHIB 1K2 1%
                                                               HSS4
                                                                                      S) XSTR SMD BCW60 NPN SOT23 SS
                                                                                                                                  84-80001-000
                                                                                                                                                    6110
                                                                                       S) XSTR SMD BC817-25 NPN SOT23
                                                               R222
                                                                                                                                  71-80001-000
                                                                                                                                                    4110
                MES M/F 0805 47K 1%
                HES M/F 0805 47K 1%
                                                                                       SS ESTOS ANY OTWO DMS ATEX (S
                                             01-0491-960
                                                               H220
                                                                                                                                  49-80001-000
                                                                                                                                                    9110
          JES WE 0802 CHIB 330E 1%
                                            01-06661-960
                                                               8LZH
                                                                                      S) XZLB SWD BCM60 NPN SOT23 SS
                                                                                                                                 .84-80001-000
                                                                                                                                                    CHO
                                                                                                                                 78-80001-000
                RES M/F 0805 4K7 5%
                                             036-14470-00,
                                                               P214
                                                                                      S) XSTR SMD BCW70 PNP SOT23 SS
                                                                                                                                                    1110
                BES M/F 0805 3K9 5%
                                             00-06641-960
                                                               H213
                                                                                        PLUG 15 W D RANGE WW PNL MT
                                                                                                                                 240-00010-55
                                                                                                                                                  No Ref
PL101
                MES W/E 0802 JOK 2%
                                             00-00151-960
                                                               HS15
                                                                                          20HM 1/1 4-40X3/8 C2K FOZI BZ
                                                                                                                                 349-02000-646
           BES M/F 0805 CHIP 4K7 1%
                                             01-07441-860
                                                                                          SCRW 4-40 X 5/16 P/POZ T/T BLK
                                                                                                                                 249-00050-07
                                                                                                                                                   ын ои
                                                               8510
           BES ME 0809 CHIB 1K2 1%
                                            01-05141-960
                                                               H209
                                                                                         SCHW 1/T 4-40X3/8 IN P/POZ BLK
                                                                                                                                 349-00050-09
                                                                                                                                                  taR oN
     BES M/F 0805 47K 1%
BES 10E 1506 500V 250MW BC01
                                                                                       TAGE SOLDER 4MM LONG M61444/4.2
                                                                                                                                 02-00100-596
                                                                                                                                                  teH on
                                             01-07#91-960
                                                               70ZH
                                                               H205
                                                                                                                                 90-01000-996
                                                                                                                                                  ю Вег
                                             20-00120-950
     JES 10E 1506 500V 250MW RC01
                                             036-02100-02,
                                                               F203
                                                                                        TAH GOT MM1.1 DNITALUZUI HZUB
                                                                                                                                 EL-01000-Z98
                                                                                                                                                  19H ON
                                                                                            SCRW T/T M4X12MM P/POZ BZ
                                                                                                                                 349-000050-43
                                                                                                                                                   teR oN
            HES M/F 0805 ZERO OHM
                                             039-10000-000
                                                               261 H
                                             ,00-00151-860,
                                                                                            SCRW T/T M4X35MM P/POZ BZ
                                                                                                                                 349-000050-49
                                                                                                                                                   ISH ON
               HES W/F 0805 100E 5%
                                                                                                                                                   IoH oN
                                                                                                                                 326-00010-03,
                HER WIL 0802 SKS 2%
                                             009-14550-000
                                                               961H
                                                                                        TAG SOLDER BMM LONG M614/3.2
                                                                                             CLAMP CABLE 4.8MM P CLIP
                                                                                                                                 ,24-01000-73E
                                             036-03220-09,
                                                               ₽61H
                                                                                                                                                   teR ov
   BE2 1518 bMB CHIB 550E 50% 1M
                                            ,036-13220-10,
                                                                                        WSHR M3 FLAT 7MM*0.6MM ST 8Z
NUT M2.5 MACH HEX ST 8Z
                4E2 W/E 0809 10E 2%
                                                               E61H
                                                                                                                                 325-00010-04
                                                                                                                                                  19FI ON
                                                                                                                                 323-00010-10
                                                                                                                                                  ieA oN
                   %L F0ZZ 9080 SEH
                                                               H192
            BES M/F 0805 CHIP 1K 1%
                                             01-00141-950
                                                               161A
                                                                                      TAG SOLDER 3MM SHORT M6132/3.2
                                                                                                                                 10-01000-938
                                                                                                                                                  19H ON
                                                                                                                                                  teR oN
                WES M/F 0805 22E 5%
                                             039-15550-00
                                                               H190
                                                                                          CASKET SIL INSULATING TO-220
                                                                                                                                 362-00010-07,
                                                                                                AUTO 154 RED 41/0.3 PVC
                MES M/F 0805 10E 5%
                                             00-00121-980
                                                               681A
                                                                                                                                 SO1-00020-25
                                                                                                                                                   teR ov
               HES M/F 0805 220E 5%
                                             036-13220-00
                                                               881H
                                                                                        SHIELD T869PA CONTROL CIRCUIT
                                                                                                                                 319-01202-00
                                                                                                                                                   ISH ON
                                                                                                                                                   teR oN
                                                                                                                                  10-06110-616
   HER 1518 BMB CHIB 120E 50% 1M
                                             20-03150-950
                                                               ZBLH
                                                                                        A9686 HETJIH JAHAH JIAW GJEIHS
                                                                                          SKT 2 W RECEP SHORTING LINK
                                                                                                                                 'S40-04050-65'
                                                                                                                                                   IeA ov
               MES W/F 0805 100E 5%
                                             00-00161-960
                                                               9818
    3ES 100E 1506 200V 250MW RC01
                                             '20-00150-950'
                                                               981H
                                                                                            ASSY 100K NTC FOR MODULE
                                                                                                                                 '90-00190-910
                                                                                                                                                   to Ref
                                                                                              STEENING SWW SIT HUBBER
                                                                                                                                 400-00050-07
                                                                                                                                                   teR oN
                 BES W/E 0802 1K 9%
                                             039-14100-00
                                                               #818
                                                                                        TAG SOLDER 3MM LONG M614/3.2
                                                                                                                                                   іэЯ ои
                BES W/E 0802 4KV 2%
                                             00-02441-980
                                                               E8183
                                                                                                                                 50-01000-996
               HES W/F 0805 100K 5%
                                             00-00191-980
                                                               ZBIH
                                                                                       SHIELD A3M2250 F/THRU MTG T857
                                                                                                                                 319-01125-00
                                                                                                                                                  IOH ON
                                                                                                                                                  9H oN
                                                                                         BHK1 Y3W5314 F\LHH0 WTG 1826
                                                                                                                                 305-02504-00
                HER MILL 0802 2KB 2%
                                             039-14290-00
                                                               LRIH
               HES M/F 0805 150K 5%
                                             ,00-02191-950
                                                                                              HOOD CONNICHE & N-TYPE
                                                                                                                                 540-06010-44
                                                                                                                                                   No Het
                                                               081A
                                             00-00151-960
                                                                                      SKT COAX NITYPE PNL MTG OP-TER
                                                                                                                                 240-02100-06
                                                                                                                                                   No Ret
                HES M/F 0805 10K 5%
                                                               671A
                                                                                                                                                  teR oN
               HER W/E 0802 100K 2%
                                             00-00191-980
                                                               871H
                                                                                        FING COPX BMF 1PCK $42WC20-5
                                                                                                                                 240-00100-46
                HER M/F 0805 4K7 5%
                                             036-14470-00,
                                                               7718
                                                                                          PLG COAX MINI PIN CRIMP 1.5D
                                                                                                                                 540-00100-43
                                                                                                                                                   teR ov
               BE2 W/E 0802 10K 2%
BE2 W/E 0802 550K 2%
                                             00-00151-980
                                                               971H
                                                                                     COVER BLACK 41/0.3 PVC
                                                                                                                                 303-23148-00
                                                                                                                                                   No Ret
                                             036-16220-00,
                                                                                                                                 201-00050-26
                                                                                                                                                   teR oN
                                                               9418
               SES W/F 0805 220E 5%
                                             036-13220-00,
                                                                                            SCRW M3X20MM P/POZ ST BZ
                                                                                                                                 91-00000-578
                                                                                                                                                   ieR oN
                                                               7218
               %S ROAT 9080 H/W SRE
                                             00-07461-960
                                                               E/TH
                                                                                                MIBE T/C 7/0.2 PVC BLACK
                                                                                                                                 01-060000-102
                                                                                                                                                   IOH ON
                                                                                            WIRE T/C WIRE 7/0.2 PVC RED
                HES W/F 0805 10K 1%
                                             01-00151-950
                                                               B172
                                                                                                                                 201-000030-02,
                                                                                                                                                   No Ref
                                                                                            BEAD FER 7D 1.9"0.9"8
PCB 1839 PA MODULE DESIGN
                 HES M/F 0805 1K 5%
                                             036-14100-00
                                                                                                                                 121-01000-590
                                                                                                                                                   No Ref
                                                               1718
                                                                                                                                 SS0-01404-05'
                                                                                                                                                   No Ref
                 MES W/F 0805 1K 5%
                                             00-001#1-960
                                                               0718
                                                                                       PCB 1839 TEFLON DIRINL COUPLER
                                                                                                                                 SS0-0140S-05'
                                                                                                                                                   19H ON
                 BES WIE 0802 1K 8%
                                             036-14100-00,
                                                               691 H
                BES W/E 0802 10K 18
                                             01-00151-960
                                                               891H
                                                                                         AREST HOT YAW B NOBBIR MOOJ
                                                                                                                                 00-16920-612
                                                                                                                                                  19H ON
                                                                                                                                                   No Ref
               MES M/F 0805 680E 5%
                                             000-08961-960
                                                               991H
                                                                                          BLOCK LATCHING 15W D RANGE
                                                                                                                                 240-06010-15,
                                             00-00141-960
                                                                                              2CBM 6-32 . 3/8 P/PH T/T ZP
                                                                                                                                 69-01000-646
                                                                                                                                                   No Ref
                                                               991H
                 HER WILL 0809 1K 98
                                                                                         XA BBUT MM2SXettXett VST NAP
                                                                                                                                 528-00010-03
                                                                                                                                                   ISH ON
                HER WILL 0802 SKS 88
                                             039-14220-00
                                                               t91H
                                                                                                                                  10-16610-598
                                                                                                                                                   19R oV
                                                                                              LABEL 30*10.8 T/MARK VOID
               %9 B089 9080 B/W SBH
                                             '00-089£1-9£0'
                                                               E91H
                                                                                            HEATSINK T839 PA COMPLETE
                                                                                                                                 308-13122-01,
                                                                                                                                                   teR oN
                                             00-00171-980
                 HER M/F 0805 TM 5%
                                                               R162
                                                                                                HEATSINK T839 COUPLER
                                                                                                                                 308-13152-00
                                                                                                                                                   No Her
                                             00-00171-980
                                                               1918
                 MES W/E 0802 1K 9%
                                                                                                                                                   iaR oN
                                                               091A
                                                                                                                                  11-01000-902
                                             036-14470-00
                                                                                             COAX 50 OHM RG316-U PTFE
                HER WILL 0802 4KV 5%
                                                                                                                                 400-000S0-30°
                                                                                                                                                   IaR oN
                MES W/E 0802 JOK 28
                                             00-00191-980
                                                               691H
                                                                                                       HEATSHRINK 3MM
                                                                                        SPACER HSINK RF MODULE 869PA
                                                                                                                                                   i9R oN
                                             00-00171-980
                                                               B158
                                                                                                                                 319-30064-00.
                 MES W/E 0802 #K 8%
                                                                                            ASSY 100K NTC FOR MODULE TIE CABLE NYLON 100'2.6MM
                3E2 M/E 0802 SSE 2%
                                             036-13100-00,
                                                               Z$18
                                                                                                                                 b1-01000-698
                                                                                                                                                   19H ON
                                                                                                                                  90-00190-970
                                                                                                                                                   No Ref
               BES W/E 0802 100E 260
                                                               9918
```

BES W/F 0805 220E 5%

MES W/F 0805 6K8 5%

BES W/E 0802 PK8 2%

BES W/E 0802 10K 2%

%S X01 9080 3/W SBB

4ES W\E 0802 SSE 2%

HES M/F 0805 470E 5%

0098-13220-000

00-089#1-980

00-08971-960

00-00191-980

00-00121-980

039-15550-00

00-07461-960

SSUE

#SIH

5515

Z912-

tera

91120

671E

C6.3.8

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

<u>IPN</u>	Legend	Description	<u>IPN</u>	Legend	Description
012-04150-01		CAP CER F/THRU 1N5 NO LEAD Fitted to D-range pins.	365-00100-09		LABEL WHITE VINYL 15X11MM S/A
051-00006-02		SOLDER SPRING 1.3MM A4M1877	365-00100-20		LABEL WHITE S/A 28X11MM
		Support for front panel LED solder joints.	365-01541-00		LABEL TX/RX/EX TYPE APR/SER NO
065-00010-13		BEAD FER 7D 1.9X0.9X3.8 Fitted to D-range pins.	400-00020-07		SLEEVING 2MM SIL RUBBER
200-00010-05		WIRE T/C 0.5	410-01081-01		CRT T800 SERIES II
		For ferrite beads.	410-01082-01		CRTN 10 T800 KIWI 423X410X360
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			
16-06619-00	12	PNL FRT EX NO EX OUT SER II			
119-01152-00	13	SHIELD A3M2250 F/THRU MTG			
45-00040-10	14	SCRW M3X6MM P/POZ ST BZ			
49-00020-36	15	LIM)SCREW TT M3X8m PANTORX BLK			·
49-00020-43	16	SCRW T/T M4X12MM P/POZ BZ			
49-00020-45	17	SCRW T/T M4X20MM P/POZ BZ			
50-00016-42	18	SPACER 5MM HI 8MM ST 2.5MM HO			
52-00010-08	19	NUT M3 COLD FORM HEX ST BZ			
52-00010-29	20	NUT M4 NYLOC HEX			
53-00010-10	21	WSHR M3 FLAT 7MMX0.6MM ST BZ			
53-00010-13	22	WSHR M3 S/PROOF INT BZ			
62-00010-08		GASKET SIL INSUL TO-5 TO-39 Under Q370.			
62-00010-23	23	GASKET SIL TO-220 CLIP MTG.			
62-00010-33	24	GROMMET LED MTG 3MM			
65-00011-53		LABEL 104X37MM			

Ref	Var IPN	Description	Ref	Var IPN	Description
R272	036-13560-00				Description
R273	036-15120-00		R645 R649	036-13470-00 036-14470-00	
R274	036-15150-00	RES M/F 0805 15K 5%	R653	036-15100-00	
R275 R277	036-14270-00 036-16100-00		R657	036-15100-00	RES M/F 0805 10K 5%
R278	036-16120-00		R661 R665	036-15100-00	
R279	036-17100-00	RES M/F 0805 1M 5%	R669	936-16100-00 936-15470-00	
R280 R282	036-15100-00 036-15560-00		R673	036-16100-00	RES M/F 0805 100K 5%
R283	036-15560-00		R677 R681	036-15470-00 036-13100-00	
R284	036-17100-00	RES M/F 0805 1M 5%	R685	036-15150-00	
R285 R286	036-10000-00 036-14220-00		R689	036-12100-00	RES M/F 0805 10E 5%
R287	036-15100-00		R693 R696	036-16100-00 036-15560-00	
R288	036-15150-00		R701	036-12220-00	
R289 R290	036-16100-00 036-13680-00		R702	036-17100-00	RES M/F 0805 1M 5%
R291	036-10000-00		9703 8706	036-17100-00 036-15150-00	
R292 R293	036-14470-00		R708	036-16100-00	
R294	036-15470-00 036-14470-00		F1710 F711	036-13100-00 036-13100-00	
R295	036-14270-00	RES M/F 0805 2K7 5%	R712	036-12100-00	
R296 R297	036-14100-00 036-14560-00		R713	036-12220-00	RES M/F 0805 22E 5%
%R298	036-16100-00	RES M/F 0805 5K6 5% RES M/F 0805 100K 5%	%R715 R717	036-14100-00 036-14270-00	
R299	036-14270-00	RES M/F 0805 2K7 5%	R718	036-15560-00	
R302 R304	036-15220-00 036-14270-00	RES M/F 0805 22K 5% RES M/F 0805 2K7 5%	R719	036-15560-00	RES M/F 0805 56K 5%
FI306	036-15100-00	RES M/F 0605 10K 5%	R720 R721	036-15390-00 036-15100-00	
R308	036-16100-00	RES M/F 0805 100K 5%	R722	036-15100-00	RES M/F 0805 10K 5%
R310 R312	036-15220-00 036-14150-00	RES M/F 0805 22K 5% RES M/F 0805 1K5 5%	R723	036-14270-00	RES M/F 0805 2K7 5%
R314	036-13150-00	RES M/F 0805 150E 5%	R725 %R726	036-15390-00 036-13100-00	RES M/F 0805 39K 5% RES M/F 0805 100E 5%
R316 R318	036-15100-00	RES M/F 0805 10K 5%	R727	036-15100-00	RES M/F 0805 10K 5%
R320	036-14220-00 036-14100-00	RES M/F 0805 2K2 5% RES M/F 0805 1K 5%	R728 R742	036-15100-00	RES M/F 0805 10K 5%
FI322	036-12220-00	RES M/F 0805 22E 5%	R743	036-13150-00 036-13150-00	RES M/F 0805 150E 5% RES M/F 0805 150E 5%
R324 R326	036-13470-00 036-13470-00	RES M/F 0805 470E 5%	R744	036-12220-00	RES M/F 0805 22E 5%
R328	036-13470-00	RES M/F 0805 470E 5% RES M/F 0805 470E 5%	R746 A747	036-12220-00 036-12220-00	RES M/F 0805 22E 5%
R330	036-12220-00	RES M/F 0805 22E 5%	R748	036-15470-00	RES M/F 0805 22E 5% RES M/F 0805 47K 5%
R332 R334	036-15470-00 036-15100-00	RES M/F 0805 47K 5% RES M/F 0805 10K 5%	R749	036-15470-00	RES M/F 0805 47K 5%
R336	036-14100-00	RES M/F 0805 1K 5%	R750 R752	036-12220-00 036-12220-00	RES M/F 0805 22E 5%
R338	036-14100-00	RES M/F 0805 1K 5%	R753	036-17100-00	RES M/F 0805 22E 5% RES M/F 0805 1M 5%
R340 R342	036-16100-00 036-15150-00	RES M/F 0805 100K 5% RES M/F 0805 15K 5%	R754	036-14100-00	RES M/F 0805 1K 5%
R344	036-15470-00	RES M/F 0805 47K 5%	R756 R757	036-16470-00 036-16470-00	RES M/F 0805 470K 5% RES M/F 0805 470K 5%
R346 R348	036-16120-00	RES M/F 0805 120K 5%	R758	036-14120-00	RES M/F 0805 1K2 5%
R350	036-14470-00 036-14100-00	RES M/F 0805 4K7 5% RES M/F 0805 1K 5%	R759	036-13330-00	RES M/F 0805 330E 5%
R352	036-15150-00	RES M/F 0805 15K 5%	R760 R762	036-13180-00 036-13100-00	RES M/F 0805 180E 5% RES M/F 0805 100E 5%
R354 R356	036-15150-00 036-14100-00	RES M/F 0805 15K 5% RES M/F 0805 1K 5%	R763	036-13100-00	RES M/F 0805 100E 5%
R359	030-53150-20	RES FILM AI 150E 5% 0.4W 4X1.6	R765 R766	036-13680-00 036-14100-00	RES M/F 0805 680E 5%
R360	030-52390-20	RES FILM AI 39E 5% 0.4W 4X1.6	R767	036-13680-00	RES M/F 0805 1K 5% RES M/F 0805 680E 5%
R362 R364	030-53150-20 036-14150- 0 0	RES FILM AI 150E 5% 0.4W 4X1.6 RES M/F 0805 1K5 5%	R769	036-13180-00	RES M/F 0805 180E 5%
R366	036-12470-00	RES M/F 0805 47E 5%	R771 R772	036-14820-00 036-15220-00	RES M/F 0805 8K2 5% RES M/F 0805 22K 5%
R368	036-15100-00	RES M/F 0805 10K 5%	R774	036-14820-00	RES M/F 0805 8K2 5%
R370 R372	036-13560-00 036-14150-00	RES M/F 0805 560E 5% RES M/F 0805 1K5 5%	R775 R777	036-14560-00	RES M/F 0805 5K6 5%
R374	036-13330-00	RES M/F 0805 330E 5%	R784	036-14220-00 036-12680-00	RES M/F 0805 2K2 5% RES M/F 0805 68E 5%
R376 R378	036-14100-00	RES WF 0805 1K 5%	R785	036-14330-00	RES M/F 0605 3K3 5%
R380	030-53560-20 030-53180-20	RES FILM AI 560E 5% 0.4W 4X1.6 RES FILM AI 180E 5% 0.4W 4X1.6	R786 R787	036-12100-00 036-12100-00	RES M/F 0805 10E 5%
R382	030-53180-20	RES FILM AI 180E 5% 0.4W 4X1.6	R790	036-13220-00	RES M/F 0805 10E 5% RES M/F 0805 220E 5%
F1384 F1386	036-11330-00 036-12470-00	RES M/F 0805 3E3 5% RES M/F 0805 47E 5%	R791	036-13100-00	RES M/F 0805 100E 5%
R388	030-53560-20	RES FILM AI 560E 5% 0.4W 4X1.6	R792 R801	036-14100-00 036-16150-00	RES M/F 0805 1K 5% RES M/F 0805 150K 5%
R390 R392	030-52120-20	RES M/F 12E 5% 4X1.6 0.2*	R802	036-15470-00	RES M/F 0805 47K 5%
R392 R394	030-5382 0-20 030-52120-20	RES FILM At 820E 5% 0.4W 4X1.6 RES M/F 12E 5% 4X1.6 0.2"	R808	036-12100-00	RES M/F 0805 10E 5%
R396	030-53820-20	RES FILM AI 820E 5% 0.4W 4X1.6	R809 R810	036-14470-00 036-14470-00	RES M/F 0805 4K7 5% RES M/F 0805 4K7 5%
R502 R505	036-13330-00 036-15150-00	RES M/F 0805 330E 5%	R811	036-14470-00	RES M/F 0805 4K7 5%
R510	036-13680-00	RES M/F 0805 15K 5% RES M/F 0805 680E 5%	R812 R813	036-14470-00	RES M/F 0805 4K7 5%
R515	036-12560-00	RES M/F 0805 56E 5%	R815	036-14470-00 036-15470-00	RES M/F 0805 4K7 5% RES M/F 0806 47K 5%
R520 R525	036-16120-00 036-15470-00	RES M/F 0805 120K 5%	R816	036-16150-00	RES M/F 0805 150K 5%
R530	036-15220-00	RES M/F 0805 47K 5% RES M/F 0805 22K 5%	A818 A819	036-14470-00 036-14470-00	RES M/F 0805 4K7 5%
R535	036-15100-00	RES M/F 0805 10K 5%	R821	036-15470-00	RES M/F 0805 4K7 5% RES M/F 0805 47K 5%
R540 R545	036-14220-00 036-14470-00	RES M/F 0805 2K2 5% RES M/F 0805 4K7 5%	R822	036-15470-00	RES M/F 0805 47K 5%
R550	036-14470-00	RES M/F 0805 4K7 5%	R824 R825	036-14220-00 036-14220-00	RES M/F 0805 2K2 5% RES M/F 0805 2K2 5%
F1555	036-14470-00	RES M/F 0805 4K7 5%	R826	036-14220-00	RES M/F 0805 2K2 5%
R560 R609		RES M/F 0805 2K7 5% RES M/F 0805 1K 5%	R827		RES M/F 0805 2K2 5%
R613	036-13560-00	RES M/F 0805 560E 5%	R828 R829		RES M/F 0805 2K2 5% RES M/F 0805 2K2 5%
R615		RES M/F 0805 100E 5%	R830		RES M/F 0805 2K2 5%
R617 R619	036-10000-00 032-31100-00	RES MF 0805 ZERO OHM RES MF PWR 1E0 5% 1W 12X4.5MM	R831	036-14220-00	RES M/F 0805 2K2 5%
R621	032-31100-00	RES MF PWR 1E0 5% 1W 12X4.5MM	R832 R833		RES M/F 0805 2K2 5% RES M/F 0805 2K2 5%
R625	036-14100-00	RES M/F 0805 1K 5%	R835		RES M/F 0805 2K2 5%
R629 R633	032-33270-00 036-14680-00	RES MF PWR 270E 5% 1W 12X4.5 RES MF 0805 6K8 5%	R836	036-14220-00	RES M/F 0805 2K2 5%
R637	036-12220-00	RES M/F 0805 22E 5%	R837 R840		RES M/F 0805 2K2 5% RES M/F 0805 2K2 5%
R641	036-14150-00	RES M/F 0805 1K5 5%	R841		RES M/F 0805 2K2 5%

Ref	Var	IPN	Description	Ref	Var	IPN	Description
				C368		015-22820-01	CAP CER 0805 82P 5% NPO 50V
Note	: %[0205 and %D	210 are optional level limiting diodes for	C370 C373		015-24100-08 022-55470-10	CAP CER 0805 1N 10% X7R 50V CAP MYLAR AI 47N 5% 63V POTTED
	spe	ecial application	ons.	C376		015-24100-08	CAP CER 0805 1N 10% X7R 50V
	_			C379 C382		015-24100-08 015-22470-01	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 47P 5% NPO 50V
			n) and =SK710 are fitted in place of	C385		020-07470-04	CAP ELE RA 4M7 25V 20%8X13 SOL
			n external frequency reference is used.	C388 C391		015-24100-08	CAP CER 0805 1N 10% X7R 50V
Į.			ponents are supplied with the auxiliary	C394		015-21820-01 015-04100-04	CAP CER 0805 BP2+-1/4P NPO 50V CAP CER 1206 1N 10% X7R 50V
1	D-r	ange kits (T8	00-06-0000 & T800-06-0001).	C396		015-04100-04	CAP CER 1206 1N 10% X7R 50V
				C399 C503		015-24100-08 015-24470-08	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 4N7 10% X7R 50V
C201		020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS	C505		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C202 C204		020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS	C510 C513		015-25220-08 015-25100-08	CAP CER 0805 22N 10% X7R 50V CAP CER 0805 10N 10% X7R 50V
C205		020-07470-92 020-07470-92	CAP BI-P RA 4M7 50V 6X11 5 LS CAP BI-P RA 4M7 50V 6X11 5 LS	C535		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C207		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM	C550 C605		014-07470-00 015-24100-08	CAP TANT CHIP 4U7 3.5 X 2.8MM CAP CER 0805 1N 10% X7R 50V
C209 C210		015-25470-08 015-06100-08	CAP CER 0805 47N 10% X7R 50V CAP CER 1206 100N 10% X7R 50V	C610A		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C211		015-06100-08	CAP CER 1206 100N 10% X7R 50V	C610B C611A		020-09100-04 020-09100-04	CAP ELE RA 100M 10V 6.3X9MM CAP ELE RA 100M 10V 6.3X9MM
C213 C215		025-08100-02 014-08220-01	CAP TANT BEAD 10M 10% 16V (L)CAP TANT 22UF10V276MSER	C611B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C217		015-24220-08	CAP CER 0805 2N2 10% X7R 50V	C623 C625		015-24100-08 020-09470-07	CAP CER 0805 1N 10% X7R 50V CAPEL470M16V20%V 8*20 3.5LESR
C219 C221		015-24100-08 014-08220-01	CAP CER 0805 1N 10% X7R 50V (L)CAP TANT 22UF10V276MSER	C626		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C223		015-06100-08	CAP CER 1206 100N 10% X7R 50V	C628		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C225 C227		015-06100-08 015-06100-08	CAP CER 1206 100N 10% X7R 50V CAP CER 1206 100N 10% X7R 50V	C630 C631A		015-06100-08 015-06100-08	CAP CER 1206 100N 10% X7R 50V CAP CER 1206 100N 10% X7R 50V
C229		015-23150-01	CAP CER 0805 150P 5% NPO 50V	C634		025-08100-02	CAP TANT BEAD 10M 10% 16V
C230		015-06100-08	CAP CER 1206 100N 10% X7R 50V	C636 C638		015-06100-08 015-24100-08	CAP CER 1206 100N 10% X7R 50V CAP CER 0805 1N 10% X7R 50V
C232 C233		015-23150-01 020-08470-02	CAP CER 0805 150P 5% NPO 50V CAP ELE RA 47M 16V 6X11MM	C640		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C235		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C655 C660		015-24100-08 015-06100-08	CAP CER 0805 1N 10% X7R 50V CAP CER 1206 100N 10% X7R 50V
C237 C239		020-07100-02 020-07470- 9 2	CAP ELE RA 1M 50V 5X11MM CAP BI-P RA 4M7 50V 6X11 5 LS	C665		020-58100-03	CAP ELE AI RDL 10M 50V 5X11MM
C241		015-06100-08	CAP CER 1206 100N 10% X7R 50V	C670 C673		025-07330-01 015-24470-08	CAP CAP CAP CAP AND
C242 C243		025-08100-02 015-24100-08	CAP TANT BEAD 10M 10% 16V CAP CER 0805 1N 10% X7R 50V	C677		020-07100-02	CAP CER 0805 4N7 10% X7R 50V CAP ELE RA 1M 50V 5X11MM
C245		015-23150-01	CAP CER 0805 150P 5% NPO 50V	C681		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C247 C249		015-23150-01 015-24100-08	CAP CER 0805 150P 5% NPO 50V CAP CER 0805 1N 10% X7R 50V	C684 C687		025-08100-02 015-24100-08	CAP TANT BEAD 10M 10% 16V CAP CER 0805 1N 10% X7R 50V
C251		015-24100-08	CAP CER 0805 IN 10% X7R 50V	C690		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C253		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C693 C700		025-08100-02 015-06100-08	CAP TANT BEAD 10M 10% 16V CAP CER 1206 100N 10% X7R 50V
C255 C257		015-24100-08 015-22470-01	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 47P 5% NPO 50V	C703		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C259		015-25470-08	CAP CER 0805 47N 10% X7R 50V	C705 C706		015-21820-01 015-22470-01	CAP CER 0805 8P2+-1/4P NPO 50V CAP CER 0805 47P 5% NPO 50V
C260 C261		015-06100-08 014-07470-00	CAP CER 1206 100N 10% X7R 50V CAP TANT CHIP 4U7 3.5 X 2.8MM	C708		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C263		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM	C709 C710		015-06100-08 015-25100-08	CAP CER 1206 100N 10% X7R 50V CAP CER 0805 10N 10% X7R 50V
C265 C267		020-07470-92 015-24470-08	CAP BI-P RA 4M7 50V 6X11 5 LS CAP CER 0805 4N7 10% X7R 50V	C712		015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C269	10	015-21150-01	CAP CER 0805 1P5+-1/4P NPO 50V	C720 C722		015-06100-08	CAP CER 1206 100N 10% X7R 50V
&C269 &C269	13 15	015-21150-01 015-21470-01	CAP CER 0805 1P5+-1/4P NPO 50V CAP CER 0805 4P7+-1/4P NPO 50V	C724		015-06100-08 014-08220-01	CAP CER 1206 100N 10% X7R 50V (L)CAP TANT 22UF10V276MSER
&C269	20	015-21150-01	CAP CER 0805 1P5+-1/4P NPO 50V	C725		014-08220-01	(L)CAP TANT 22UF10V276MSER
&C269 &C269	23 25	015-21150-01 015-21470-01	CAP CER 0805 1P5+-1/4P NPO 50V CAP CER 0805 4P7+-1/4P NPO 50V	C726 C727		015-25100-08 015-23220-01	CAP CER 0805 10N 10% X7R 50V CAP CER 0805 220P 5% NPO 50V
C271	23	015-22470-01	CAP CER 0805 47P 5% NPO 50V	C729		015-23220-01	CAP CER 0805 220P 5% NPO 50V
C273		015-25470-08	CAP CER 0805 47N 10% X7R 50V	%C733 C735		015-23470-08 015-22470-01	CAP CER 0805 470P 10% X7R 50V CAP CER 0805 47P 5% NPO 50V
C275		015-23120-01	CAP CER 0805 120P 5% NPO 50V CAP CER 0805 10N 10% X7R 50V	C736		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C279		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C740A C740B		015-24100-08 015-25100-08	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 10N 10% X7R 50V
C281 C283		015-25220-08 015-21470-01	CAP CER 0805 22N 10% X7R 50V CAP CER 0805 4P7+-1/4P NPO 50V	C741A		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C285		015-21470-01	CAP CER 0805 4P7+-1/4P NPO 50V	C741B C742A		015-25100-08 015-06100-08	CAP CER 0805 10N 10% X7R 50V CAP CER 1206 100N 10% X7R 50V
C287 C289		020-09100-04 015-25470-08	CAP ELE RA 100M 10V 6.3X9MM CAP CER 0805 47N 10% X7R 50V	C742B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C291		014-08220-01	(L)CAP TANT 22UF10V276MSER	C743 C745		015-22470-01 015-24100-08	CAP CER 0805 47P 5% NPO 50V CAP CER 0805 1N 10% X7R 50V
C293 %C294		015-27100-10 015-22470-01	CAP CER 0805 1M+80-20% Y5V 16V CAP CER 0805 47P 5% NPO 50V	C750		025-08100-03	CAP 10M 35V 20% TANT 5MM L/S
%C295		022-06470-02	CAP MYLAR 470N 10% 50V	C757 C759		015-25100-08 015-25100-08	CAP CER 0805 10N 10% X7R 50V
C304 C308		015-24470-08 015-25100-08	CAP CER 0805 4N7 10% X7R 50V CAP CER 0805 10N 10% X7R 50V	C761		015-25100-08	CAP CER 0805 10N 10% X7R 50V CAP CER 0805 10N 10% X7R 50V
C312		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C762		014-08220-01	(L)CAP TANT 22UF10V276MSER
C316 C317		015-24100-08 015-23100-01	CAP CER 0805 1N 10% X7R 50V	C764 C765		015-25100-08 014-07470-00	CAP CER 0805 10N 10% X7R 50V CAP TANT CHIP 4U7 3.5 X 2.8MM
C318		015-23100-01	CAP CER 0805 100P 5% NPO 50V CAP CER 0805 100P 5% NPO 50V	C767		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C320		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C769 C770		015-24100-08 014-08220-01	CAP CER 0805 1N 10% X7R 50V (L)CAP TANT 22UF10V276MSER
C324 C330A		015-24100-08 015-25100-08	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 10N 10% X7R 50V	C772		014-08220-01	(L)CAP TANT 22UF10V276MSER
C330B		020-08100-04	CAP ELE RA 10M 16V 4X7MM	C774 C776		022-06330-05 015-25150-08	CAP METAL PPS 330N 10% 63V 5MM CAP CER 0805 15N 10% X7R 50V
C332 C334		015-24100-08 015-25100-08	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 10N 10% X7R 50V	C782		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C336		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C784 C786		015-24100-08 015-06100-08	CAP CER 0805 1N 10% X7R 50V CAP CER 1206 100N 10% X7R 50V
C338 C340		015-25220-08 015-24100-08	CAP CER 0805 22N 10% X7R 50V CAP CER 0805 1N 10% X7R 50V	C788		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C342		015-06100-08	CAP CER 1206 100N 10% X7R 50V	C790		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C344 C346		015-24100-08 015-24100-08	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 1N 10% X7R 50V	C792 C810		015-24100-08 015-25470-08	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 47N 10% X7R 50V
C349		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C812		015-23100-01	CAP CER 0805 100P 5% NPO 50V
C350 C353		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C813 C822		015-24100-08 014-07470-00	CAP CER 0805 1N 10% X7R 50V CAP TANT CHIP 4U7 3.5 X 2.8MM
C353		015-24100-08 015-23150-01	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 150P 5% NPO 50V	C823		015-25220-08	CAP CER 0805 22N 10% X7R 50V
C359		015-24100-08	CAP CER 0805 1N 10% X7R 50V	C824 C826		015-25470-08 015-23220-01	CAP CER 0805 47N 10% X7R 50V CAP CER 0805 220P 5% NPO 50V
C362 C365		015-24100-08 015-22330-01	CAP CER 0805 1N 10% X7R 50V CAP CER 0805 33P 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

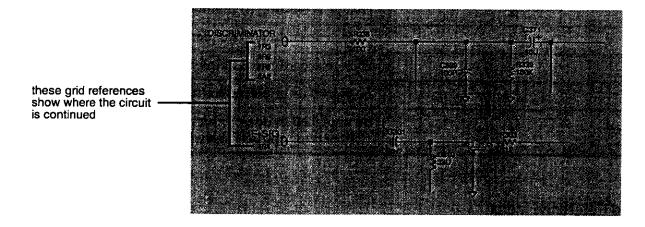
C6.3.2 T837 PCB Information

M830-00

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).



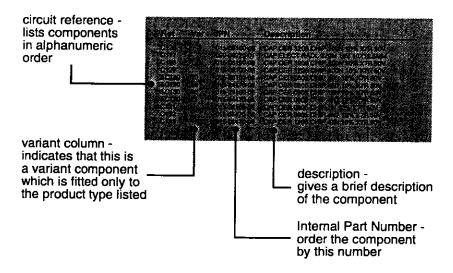
Parts Lists

C6.1.4

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).

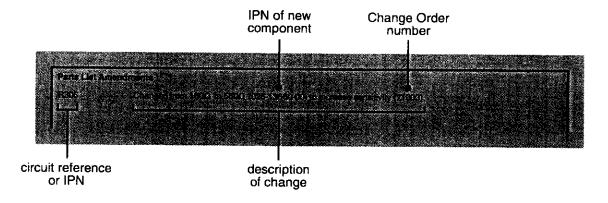
Those with a circuit reference are grouped in alphabetical order and then in numerical order within each group. Each component entry comprises three or four columns, as shown below:



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.

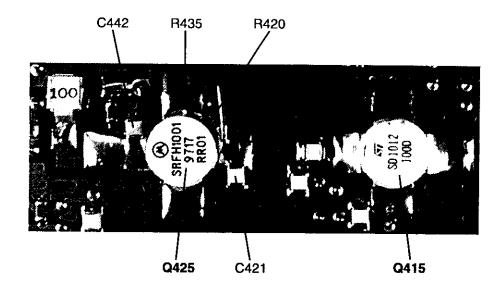
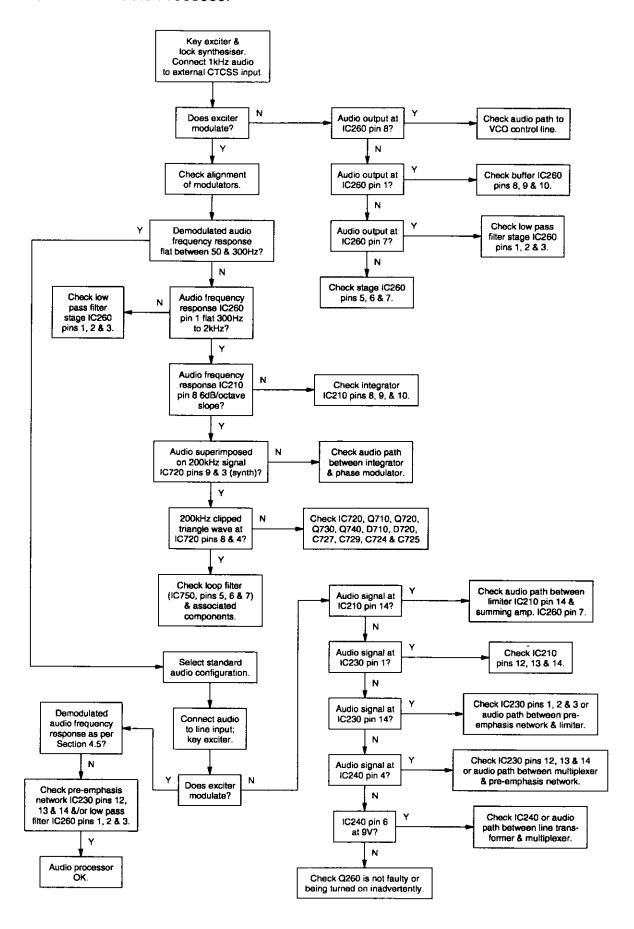
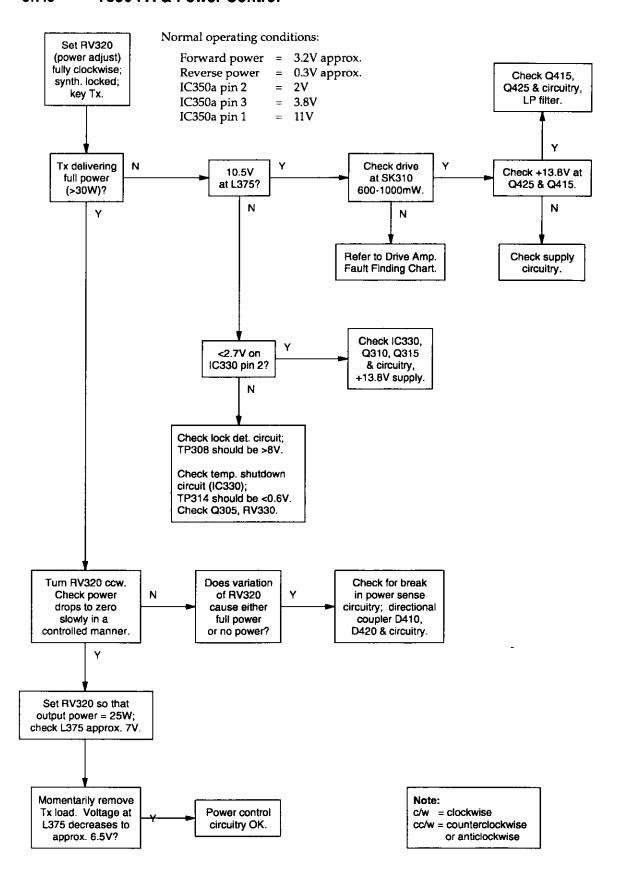


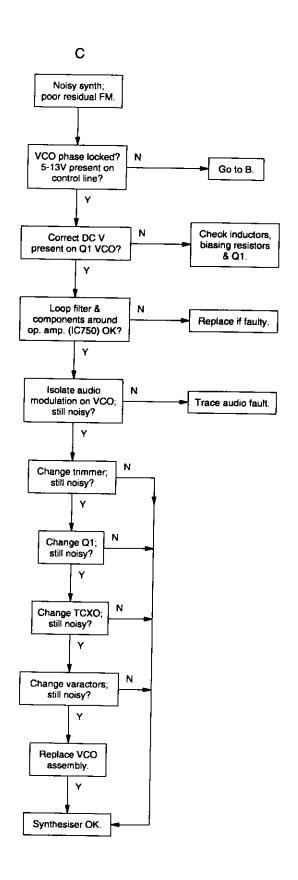
Figure 5.2 Positioning Of Components Around Q425 & Q415

5.7.7 Audio Processor



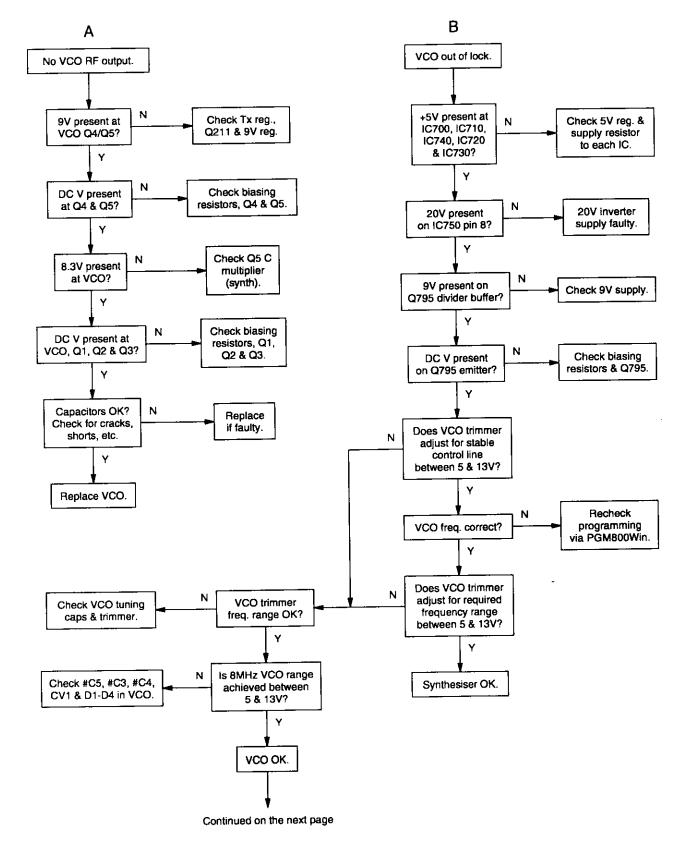
5.7.5 T836 PA & Power Control



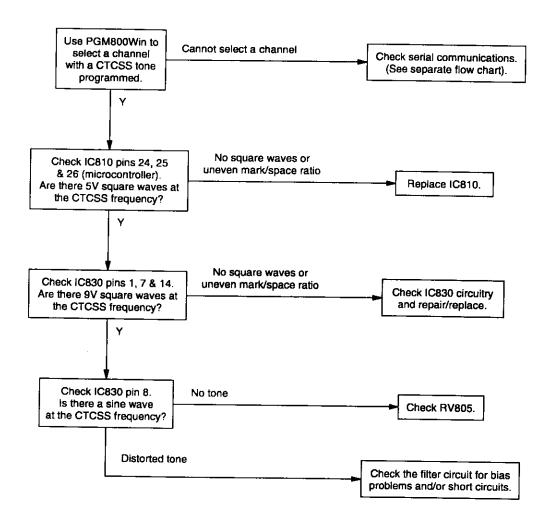


5.7.3 Synthesiser

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



5.7.1.3 CTCSS Encode



5.7 Fault Finding Charts

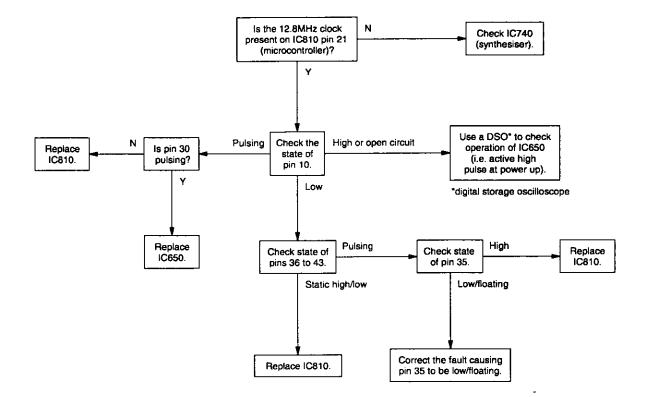
Note:

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.

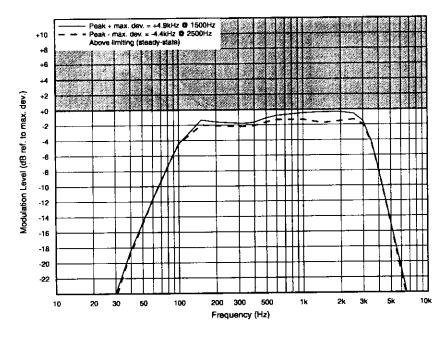
If the synthesiser is locked and the VCO aligned, the voltage at this point should be between 5 and 13V.

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

Se	Section Title		Page
5. <i>7</i>		Fault Finding Charts	5.8
	5.7.1 5.7.1.1 5.7.1.2 5.7.1.3	Microcontroller Basic Checks Serial Communications CTCSS Encode	5.8 5.8 5.9 5.10
	5.7.2	Regulator	5.11
	5.7.3	Synthesiser	5.12
	5.7.4	T836 Drive Amplifier	5.15
	5.7.5	T836 PA & Power Control	5.16
	5.7.6	T837 Exciter Drive Amplifier	5.17
	5.7.7	Audio Processor	5.18
5.8		To Replace The T836 PA Transistors (Q415 & Q425)	5.19

Figure	Title	Page
5.1	RF Diode Probe Circuit	5.5
5.2	Positioning Of Components Around Q425 & Q415	5.20

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

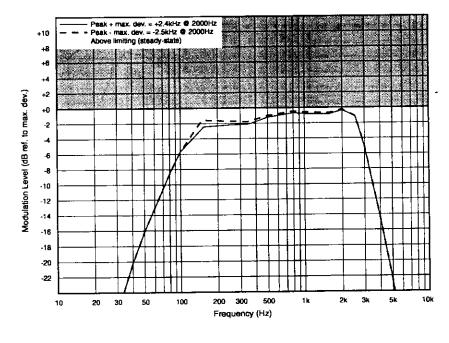


Figure 4.3 T836/837 Limiting Response

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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

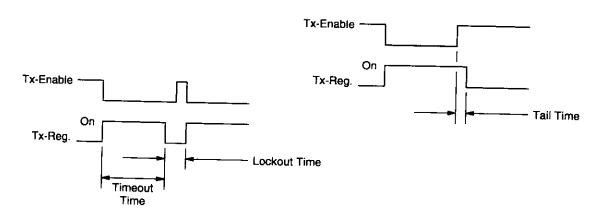


Figure 4.1 T836/837 Transmit Timers

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 $\pm 1 \text{kHz}$ ($\pm 0.8 \text{kHz}$) [$\pm 0.5 \text{kHz}$] deviation at 1 kHz.

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 $\pm 3kHz$ ($\pm 2.4kHz$) [$\pm 1.5kHz$] 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 $\pm 4.7 \text{kHz}$ ($\pm 3.8 \text{kHz}$) [$\pm 2.3 \text{kHz}$] (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	Lir	ık ^a	Function
	1-2	Α	not connected
PL205	[3-4]	В	microphone pre-amp. output to compressor input
	5-6	C	microphone pre-amp. output to multiplexer input
	[1-2]	L	multiplexer output to pre-emphasis input
PL210	3-4	M	multiplexer output to limiter input
	5-6	N	multiplexer output to compressor input
	1-2	G	not connected
	[3-4]	H	compressor output to multiplexer input
PL215	5-6	I	compressor output to limiter input
	7-8	J	compressor output to pre-emphasis input
	9-10	K	not connected
	1-2	D	pre-emphasis output to multiplexer input
PL220	[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;	[3-4]	[1-2]	[3-4]	[3-4]
line input pre-emphasised (standard set-up)	В	L	Н	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;	3-4	3-4	3-4	5-6
line and microphone flat response	В	М	Н	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 ± 3 kHz (± 2.4 kHz) [± 1.5 kHz] 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 ± 1 dB 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.

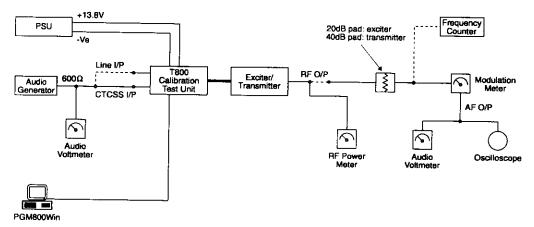
Inject 1kHz at -10dBm into the line input (D-range 1 (PL100) pins 1 & 4; pins 2 & 3 shorted; refer to Section 2.2 of Part F).

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 generatorRF power meter
- audio voltmeter x 2
- modulation meter
- oscilloscope (digital preferred)
- 20dB pad
- T800-01-0010 calibration test unit (optional)

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



or RF test set (optional)

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

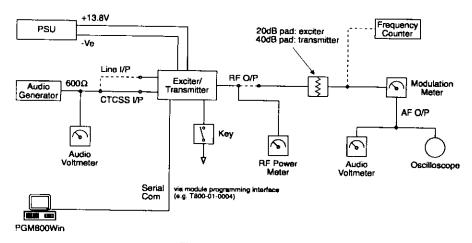


Figure 3.2 T836/837 Test Equipment Set-up Without T800-01-0010

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Se	ction	Title	Page
3.7			3.10
3.8			3.10
3.9		Audio Processor	3.11
	3.9.1	Two Point Modulation	3.11
	3.9.2	Modulator Adjustment	3.11
	3.9.3	Limiter Adjustment	3.12
	3.9.4	Line Level Without Compressor	3.12
	3.9.5 3.9.5.1 3.9.5.2 3.9.5.3	Compressor Compressor On Line Input Only Compressor On Microphone Input Only Compressor On Both Line & Microphone Inputs	3.12 3.12 3.13 3.13

Figure	Title	Page
3.1	T836/837 Test Equipment Set-up With T800-01-0010	3.4
3.2	T836/837 Test Equipment Set-up Without T800-01-0010	3.4

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 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.)

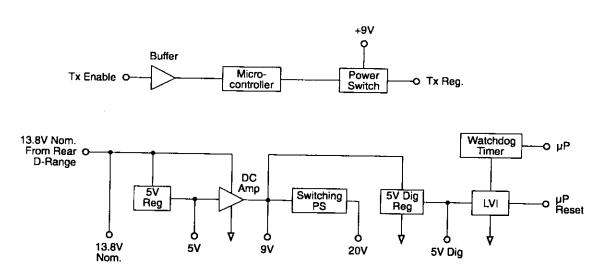


Figure 2.7 T836/837 Power Supply & Regulators Block Diagram

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.)

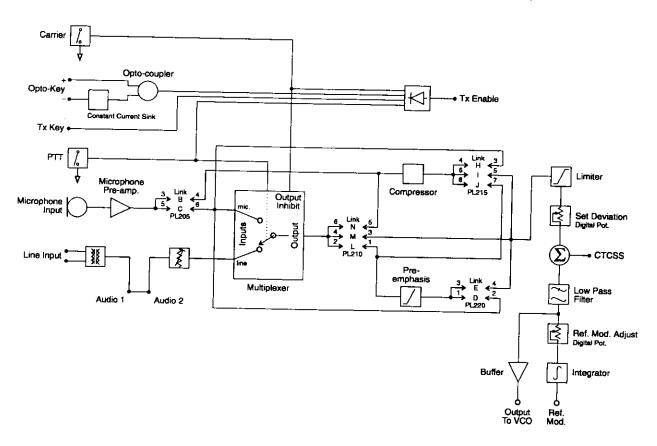


Figure 2.6 T836/837 Audio Processor Block Diagram

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.

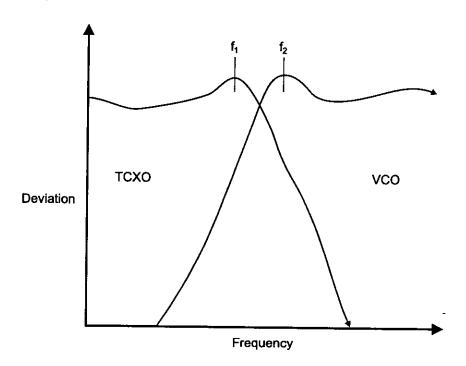


Figure 2.5 T836/837 Two Point Modulation

2.2 Microcontroller

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

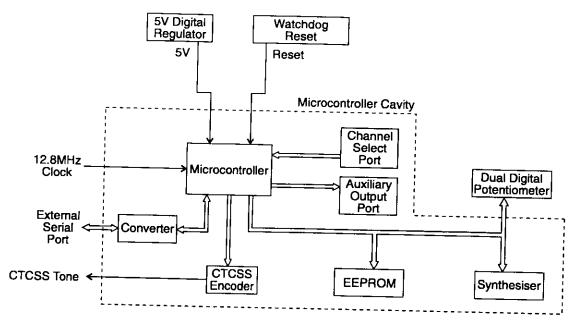


Figure 2.3 T836/837 Microcontroller Block Diagram

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.

Figure	Title	Page
2.1	T836 High Level Block Diagram	2.3
2.2	T837 High Level Block Diagram	2.3
2.3	T836/837 Microcontroller Block Diagram	2.4
2.4	T836/837 Synthesiser Block Diagram	2.5
2.5	T836/837 Two Point Modulation	2.6
2.6	T836/837 Audio Processor Block Diagram	2.8
2.7	T836/837 Power Supply & Regulators Block Diagram	2.10
2.8	T836/837 Transmit Timers	2.11

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.

Frequen	cy Range (MHz)		136-	156	
Deviatio	n (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					
Deviatio	n (kHz)	2.5	2.5	4	5
TCXOª	±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 Protection

.. negative earth only

Polarity Protection

.. diode

Line Keying Supply (if required)

. -50V DC

Supply Current:

Transmit

.. 4.5A (typical)

- T836 - 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.