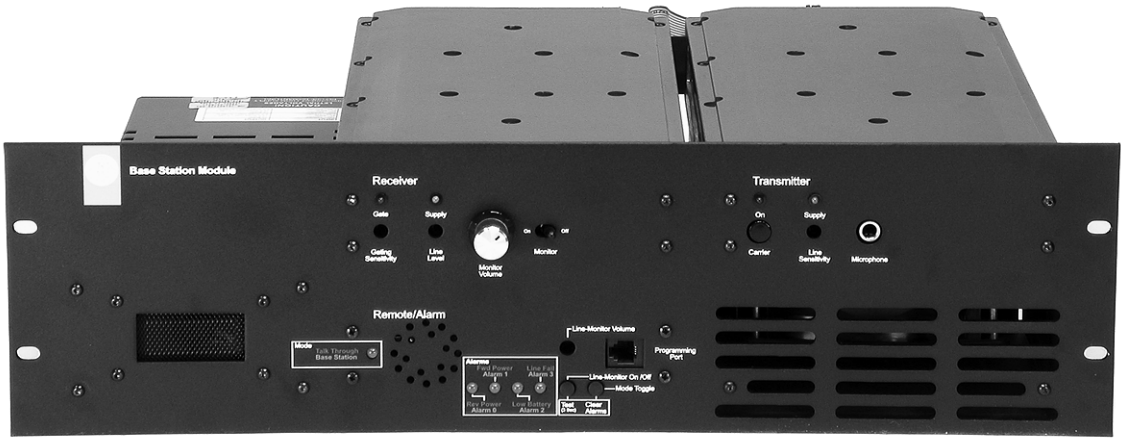
T800 SL2

Base Station Equipment

400 to 520MHz 25 Watt Continuous

Service Manual



August 2004

M8SL2-00-002-812

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About This Manual

Scope

This manual contains general, technical and servicing information on T800 SL2 25W continuous base station which comprise the following equipment:

T800 SL2 25W base station	T855 receiver T854 25W continuous transmitter T803-02 tone remote (optional) T800-23-0011 Power supply

Format

We have published this manual in a ring binder so that "revision packages" containing additional information pertaining to new issues of PCBs can be added as required.

PCB Information

PCB information is provided for all current issue PCBs, and is grouped according to PCB. Thus, you will find the parts list, grid reference index (if necessary), PCB layouts and circuit diagram(s) for each individual PCB grouped together.

Errors

If you find an error in this manual, or have a suggestion on how it might be improved, please do not hesitate to contact Technical Support, Tait Electronics Ltd, Christchurch, New Zealand (full contact details are on page 2).

Updating Equipment and Manuals

In the interests of improving performance, reliability or servicing, Tait Electronics Ltd reserve the right to update their equipment and/or manuals without prior notice.

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Publication Information

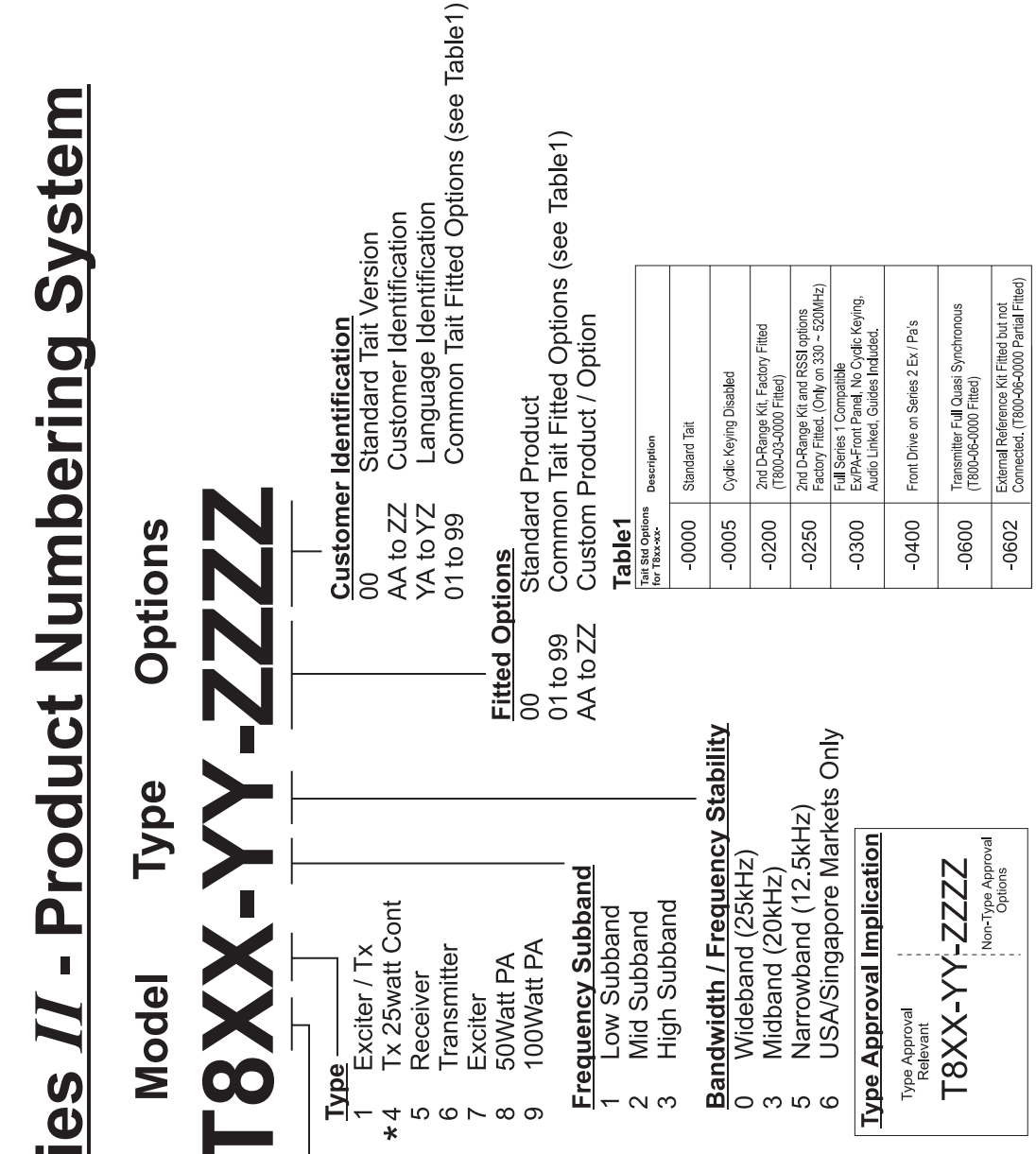
T800 SL2 Service Manual	
Publication Date	Product Code
June 2002	M8SL2-00-001-812
August 2004	M8SL2-00-002-812

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1 T800 Product Codes

The T800 product code provides information about the model, type and options fitted, according to the conventions described below

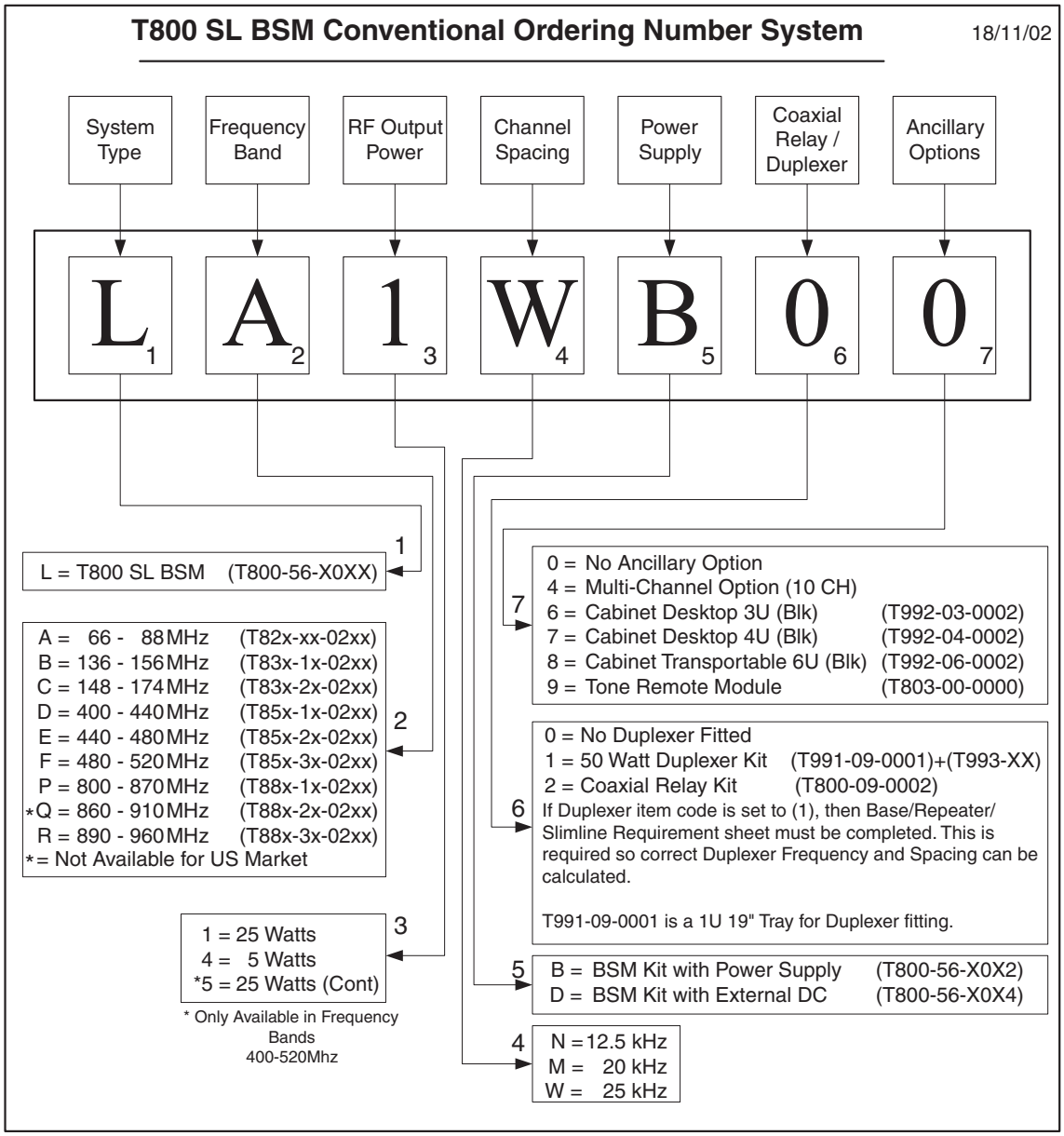
You can identify the unit's type by checking the product code printed on a label on the rear of the chassis (Figure 1.1 in Part A shows typical labels). You can further verify the type by checking the placement of an SMD resistor in the table that is screen printed onto the PCB..



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2 T800 SL2 Product Range

The following table lists the range of standard T800 types (i.e. no options fitted) available at the time this manual was published. Consult your nearest Tait Dealer or Customer Service Organisation for more information



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Table of Contents

This manual is divided into nine parts as listed below, with each part being further sub-divided into sections. There is a detailed table of contents at the start of each part and/or section.

Part	Title
A	Introduction To Servicing
B	T855 Receiver
C	T854 Transmitter
D	T803-02-9000 Tone Remote
E	T850 VCO PCB Information
F	T800-23-0011 Power Supply
G	Installation and Configuration
H	T800 Ancillary Equipment

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Part A Introduction To Servicing

This part of the manual is divided into the sections listed below. These sections provide some general and advisory information on servicing procedures.

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1.2	Caution: CMOS Devices	1.1
1.3	Caution: Aerial Load	1.2
1.4	Caution: Beryllium Oxide and Power Transistors	1.2
2	**Mechanical**	**2.1**
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Figure	Title	Page
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2.2	Pozidriv and Philips Screw and Screwdriver Identification	2.2

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1 General

1.1 Additional Technical Information

If you have any questions about this manual or the equipment it describes, please contact your nearest Tait Dealer or Customer Service Organisation. If necessary, you can get additional technical help from Technical Support, Tait Electronics Ltd, Christchurch, New Zealand (full contact details are on page 2).

When requesting information, please quote either the manual product code (e.g. M8SL2-00-002-812), or the equipment product code, build revision number and serial number which are printed on a label on the back of the product (as shown in Figure 1.1).

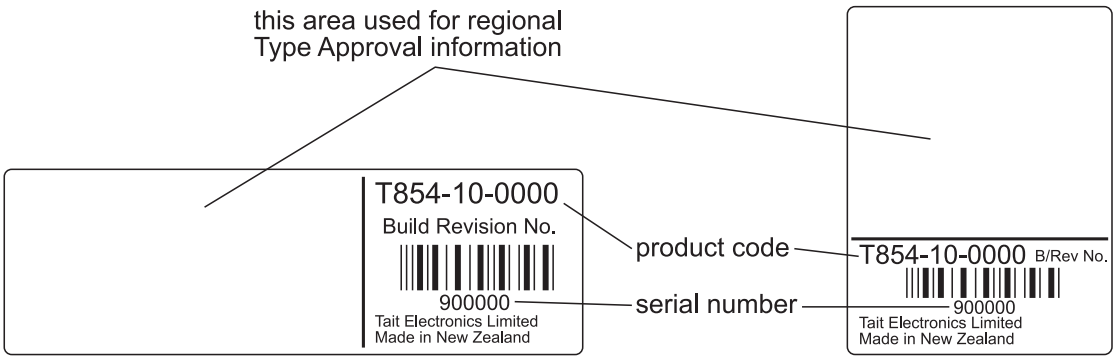


Figure 1.1 Typical Product Code and Serial Number Labels

If you require information about a particular PCB, please quote the full PCB internal part number (IPN) which is screen printed onto the top side of the board (refer to the appropriate PCB Information section in this manual for more details).

1.2 Caution: CMOS Devices

This equipment contains devices which are susceptible to damage from static charges. You must handle these devices carefully and according to the procedures described in the manufacturers' data books.

We recommend you purchase an antistatic bench kit from a reputable manufacturer and install and test it according to the manufacturer's instructions. Figure 1.2 shows a typical antistatic bench set-up.

You can obtain further information on antistatic precautions and the dangers of electrostatic discharge (ESD) from standards such as ANSI/ESD S20.20-1999 or BS EN 100015-4 1994.

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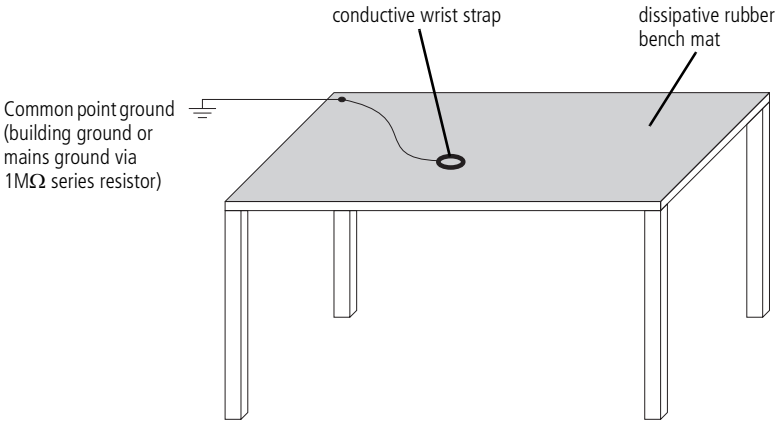


Figure 1.2 Typical Anti-static Bench Set-up

1.3 Caution: Aerial Load

The equipment has been designed to operate safely under a wide range of aerial loading conditions. However, we strongly recommend that the transmitter should always be operated with a suitable load to prevent damage to the transmitter output power stage.

1.4 Caution: Beryllium Oxide and Power Transistors

The RF power transistors in current use all contain some beryllium oxide. This substance, while perfectly harmless in its normal solid form, can become a severe health hazard when it has been reduced to dust. For this reason the RF power transistors should not be broken open, mutilated, filed, machined, or physically damaged in any way that can produce dust particles.

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2 Mechanical

2.1 Torx Recess Head Screws

Torx recess head screws are becoming the standard screw head type in all T800 SL2 equipment, with Pozidriv and Philips recess head screws being used in fewer applications.

The Torx recess head has the advantage of improved screwdriver tip location, reducing the chances of screw head damage caused by the driver tip rotating within the recess. In addition, using a ball-tip Torx screwdriver allows you to drive a Torx head screw with the driver on a slight angle, which can be useful in situations where access is restricted.

It is important that you use the correct Torx screwdriver tip:

M3 screws	T10
M4 screws	T20

Figure 2.1 below shows a typical Torx recess head screw (actual hardware may differ slightly from this illustration due to variations in manufacturing techniques).

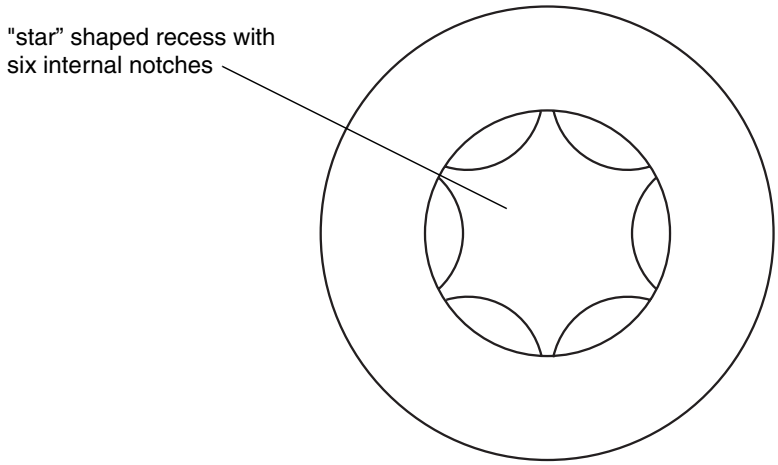


Figure 2.1 Torx Screw Identification

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2.2 Pozidriv and Philips Recess Head Screws

Pozidriv and Philips recess head screws will continue to be used in T800 SL2 equipment in a few special applications. It is important that you use the correct type and size screwdriver for each screw type to avoid damaging the screw head.

It is particularly important that you do not use Philips screwdrivers on Pozidriv screw heads as the tapered driving flutes of the Philips screwdriver do not engage correctly with the parallel-sided slots in the Pozidriv screw head. This can result in considerable damage to the screw head if the screwdriver tip turns inside the recess.

Note: If you find you need excessive downwards pressure to keep the screwdriver tip in the Pozidriv screw head, you are probably using the wrong type and/or size screwdriver.

Figure 2.2 below shows the main differences between typical Pozidriv and Philips screw heads and screwdriver tips (actual hardware may differ slightly from these illustrations due to variations in manufacturing techniques).

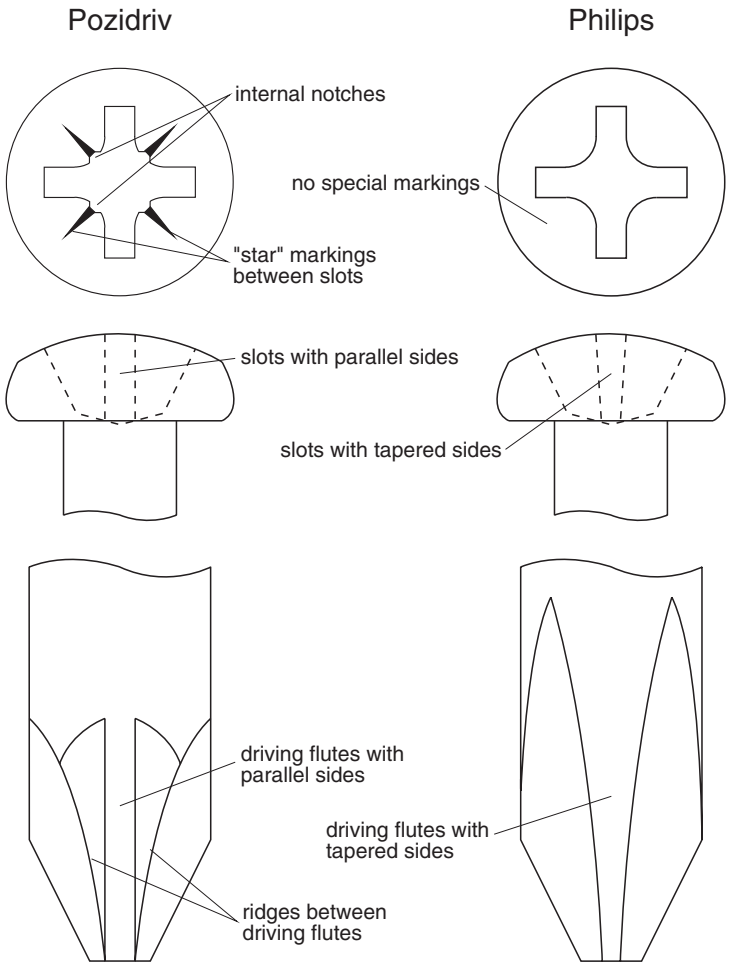


Figure 2.2 Pozidriv and Philips Screw and Screwdriver Identification

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2.3 Disassembly/Reassembly

2.3.1 Receivers/Transmitters

To carry out alignment or change option links, you need to remove only the top cover, i.e. the one on the opposite side to the main D-range connector (D-range 1/PL100).

You need to remove the bottom cover to:

- access transmitter RF power transistors and many SMD components
- change solder blob links
- fit test leads to circuit block access points.

2.4 Cover Screw Torques

Receivers/Transmitters … 1.36Nm/12in.lbf.

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3 Component Replacement

3.1 Leaded Components

Whenever you are doing any work on the PCB that involves removing or fitting components, you must take care not to damage the copper tracks. The two satisfactory methods of removing components from plated-through hole (PTH) PCBs are detailed below.

Note: The first method requires the use of a desoldering station, e.g. Philips SBC 314 or Pace MBT-100E.

3.1.1 Desoldering Iron Method

Place the tip over the lead and, as the solder starts to melt, move the tip in a circular motion.

Start the suction and continue the movement until 3 or 4 circles have been completed.

Remove the tip while continuing suction to ensure that all solder is removed from the joint, then stop the suction.

Before pulling the lead out, ensure it is not stuck to the plating.

If the lead is still not free, resolder the joint and try again.

Note: The desoldering iron does not usually have enough heat to desolder leads from the ground plane. Additional heat may be applied by holding a soldering iron on the tip of the desoldering iron (this may require some additional help).

3.1.2 Component Cutting Method

Cut the leads on the component side of the PCB.

Heat the solder joint ***sufficiently*** to allow ***easy*** removal of the lead by drawing it out from the component side: do ***not*** use undue force.

Fill the hole with solder and then clear with solderwick.

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3.2 Surface Mount Devices

Caution: **Surface mount devices (SMDs) require special storage, handling, removal and replacement techniques. This equipment should be serviced only by an approved Tait Dealer or Customer Service Organisation equipped with the necessary facilities. Repairs attempted with incorrect equipment or by untrained personnel may result in permanent damage. If in doubt, contact your nearest Tait Dealer or Customer Service Organisation.**

3.3 Cased Mica Capacitors

Cased mica capacitors can be removed by heating the top with a heavy-duty soldering iron and gently lifting the capacitor off the PCB with a solder-resistant spike or equivalent.

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Part B T855 Receiver

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 and Adjustment
4	Functional Testing
5	Fault Finding
6	PCB Information

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1 T855 General Information

This section provides a brief description of the T855 receiver, along with detailed specifications.

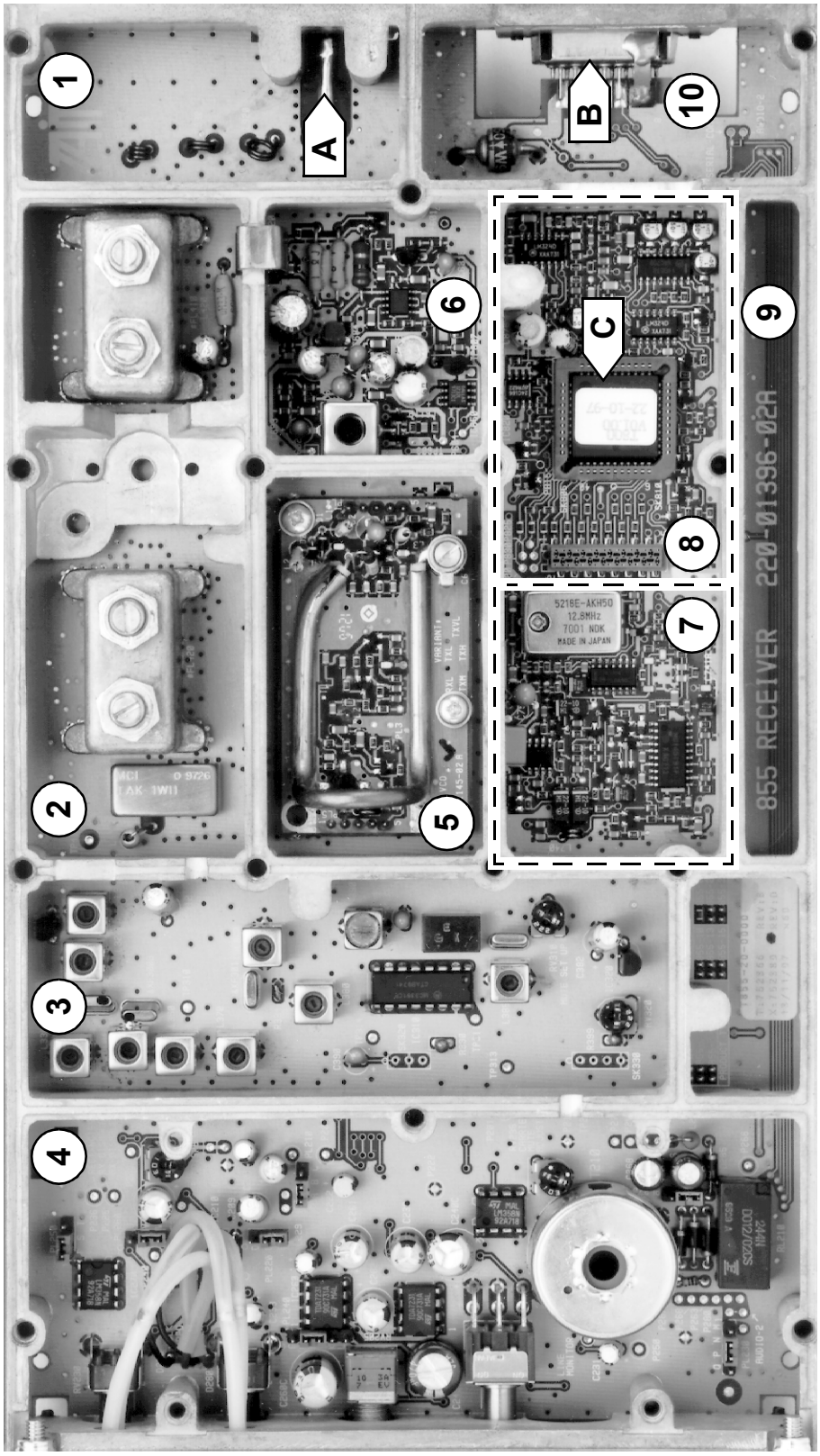
The following topics are covered in this section.

Section	Title	Page
1.1	**Introduction**	**1.5**
1.2	**Specifications**	**1.6**
1.2.1	Introduction	1.6
1.2.2	General	1.7
1.2.3	RF Section	1.7
1.2.4	Audio Section	1.9
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Figure	Title	Page
1.1	T855 Main Circuit Block Identification	1.3
1.2	T855 Front Panel Controls	1.4

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Key:

1 low pass filter
2 receiver front end
3 receiver IF
4 audio processor
5 VCO
6 regulators
7 synthesiser
8 microcontroller and CTCSS
9 duct for cabling to extra D-range (if fitted)
10 D-range
A RF input
B D-range connector ("D-range 1") incl. audio out and DC in (refer to Section 1.5 in Part G)
C microcontroller

Figure 1.1 T855 Main Circuit Block Identification

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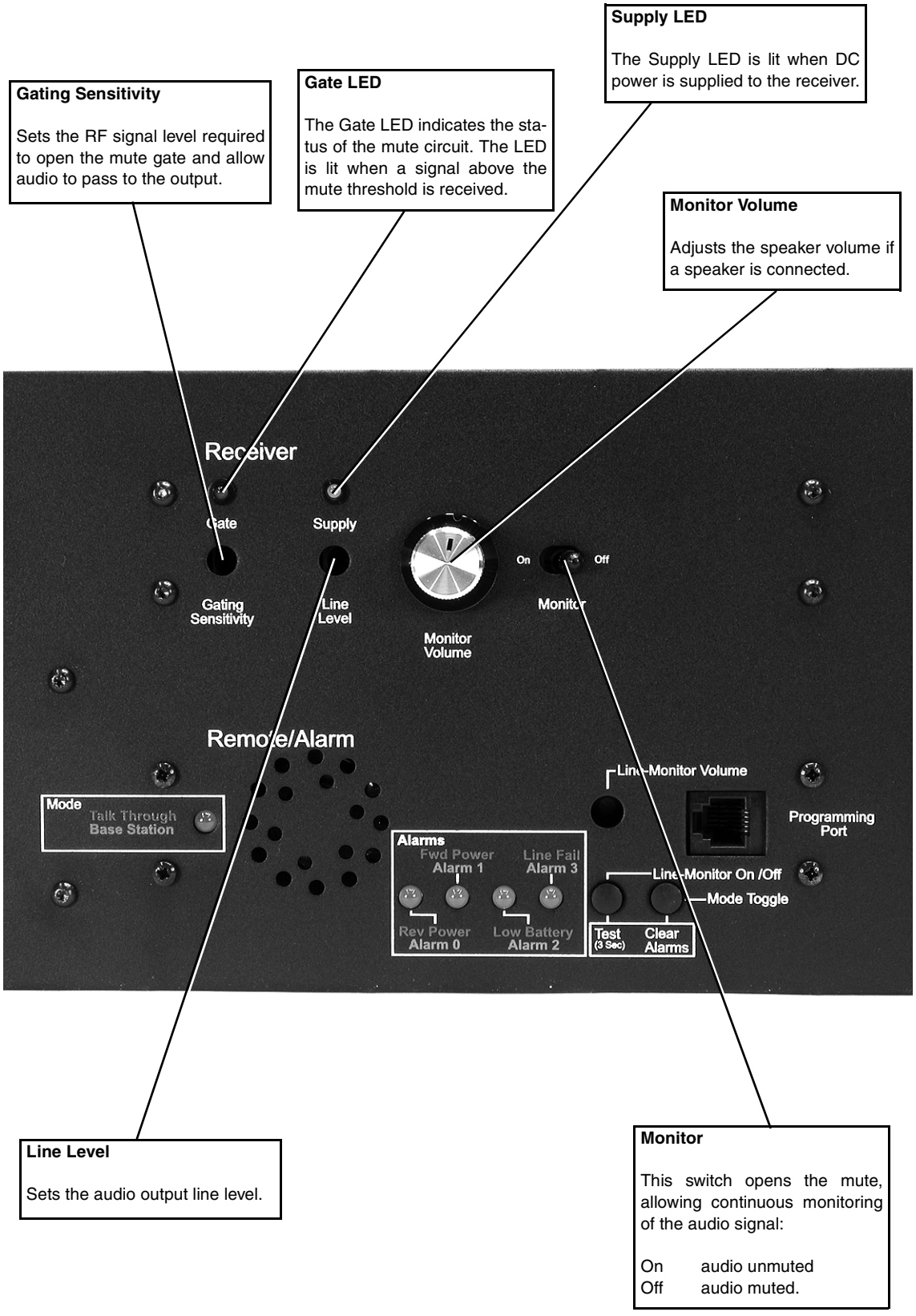


Figure 1.2 T855 Front Panel Controls

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1.1 Introduction

The T855 is a high performance microprocessor controlled FM base station receiver designed for single or multichannel operation in the 400 to 530MHz frequency range[1].

The receiver is a dual conversion superhet with a synthesised local oscillator. The first IF is 45.0MHz, allowing exceptionally high spurious signal rejection to be achieved in the receiver front end. The second IF section (455kHz) combines amplitude limiting, detection and audio preamplification within a single integrated circuit. It also drives carrier and noise level detectors for signal strength indication and gating the audio output. RSSI can be used to drive a carrier mute for audio output gating (link selectable) when the optional T800-04-0000 RSSI PCB is fitted.

The audio section output can be adjusted to deliver >+10dBm to a 600Ω balanced output, and 1W to a local monitor speaker. A flat or de-emphasised audio response is link selectable.

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

All components except those on the VCO board 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 PCB is obtained by removing each of the two chassis covers. There is provision within the chassis to mount small option PCBs.

The front panel controls include gating sensitivity, line level, monitor volume and a monitor mute switch.

1. Although capable of operating over the 400 to 530MHz frequency range, the T855 has a 5MHz switching range (see Section 1.2.3 and Section 3.1).

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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

Sensitivity and distortion figures are stated for standard operating conditions which includes audio de-emphasis. Note that the sensitivity and distortion figures will be degraded when flat audio is selected.

	Link PL210[a]	Link PL220[a]
De-emphasised Audio	1-2 (A-B)	2-3 (E-F)
Flat Audio	2-3 (B-C)	1-2 (D-E)

a. The letters in this column refer to the identification letters screen printed onto the PCB beside each set of links.

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1.2.2 General

Number Of Channels	… 128 (standard)[1]
Supply Voltage:	
Operating Voltage	… 10.8 to 16V_{DC}
Standard Test Voltage	… 13.8V_{DC}
Polarity	… negative earth only
Polarity Protection	… crowbar diode
Supply Current:	
Standby	… 350mA
Full Audio	… 800mA
Operating Temperature Range	… –20°C to +60°C

1.2.3 RF Section

Frequency Range	… 400 to 530MHz
Type	… dual conversion superheterodyne
Frequency Increment	… 5 or 6.25kHz
Switching Range	… 5MHz (i.e. ±2.5MHz from the centre frequency)
Input Impedance	… 50Ω
Frequency Stability	… ±1ppm, –20°C to +60°C
Signal Strength Indicator (RSSI optional)	… –115dBm to –70dBm, 0 to 5V at approx. 10dB/V

1. Additional channels may be factory programmed. Contact your nearest Tait Dealer or Customer Service Organisation.

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IF Amplifiers:

Frequencies	… 45MHz and 455kHz
Bandwidths	
Narrow Bandwidth (NB)	… 7.5kHz
Mid Bandwidth (MB)	… 12kHz
Wide Bandwidth (WB)	… 15kHz

Sensitivity (De-emphasised Response):

Single Channel	… –117dBm
Bandspread (12dB Sinad)	… –115dBm (across switching range)

Sensitivity (Flat Response):

Single Channel	… –111dBm
Bandspread (12dB Sinad)	… –109dBm (across switching range)

Signal+Noise To Noise Ratio (Typical):

		De-emphasised	**Flat**
RF Level –107dBm	…	30dB (WB)	20dB (WB)
		25dB (NB)	15dB (NB)
RF Level –83dBm (CEPT)	…	54dB (MB)	49dB (MB)
		50dB (NB)	45dB (NB)
RF Level –57dBm (EIA)	…	55dB (WB)	55dB (WB)

Selectivity:

Narrow Bandwidth (±12.5kHz)	… 83dB minimum, 85dB typical (CEPT)
Mid Bandwidth (±20kHz)	… 87dB minimum, 90dB typical (CEPT)
Wide Bandwidth (±25kHz)	… 87dB minimum, 90dB typical (CEPT)

Offset Selectivity (Canada only) … 20dB

Spurious Response Attenuation … 100dB (typical)

Intermodulation Response Attenuation:

Narrow Bandwidth	… 80dB CEPT (typical)
Mid Bandwidth	… 75dB CEPT (typical)
Wide Bandwidth	… 85dB EIA (typical)

Blocking … 100dB

Co-channel Rejection … 6dB

Amplitude Characteristic … 3dB

Spurious Emissions:

Conducted	… –90dBm to 4GHz
Radiated	… –57dBm to 1GHz
	–47dBm to 4GHz

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1.2.4 Audio Section

1.2.4.1 General

Outputs Available … line and monitor

Frequency Response … flat or de-emphasised (750µs) (link selectable)

Flat Response:

Bandwidth … 67 to 3400Hz
Response … within +1, –2dB of output level at 1kHz

De-emphasised Response:

Bandwidth … 300 to 3400Hz
Response … within +1, –3dB of a –6dB/octave de-emphasis characteristic (ref. 1kHz)

Line Output:

Power … adjustable to >+10dBm
Load Impedance … 600Ω
Distortion (at –70dBm signal level):

		De-emphasised	Flat
Wide Bandwidth	…	≤2%	≤2%
Mid and Narrow Bandwidth	…	≤2%	≤4%

Monitor Output:

Power … 1W
Speaker Impedance … 4Ω
Distortion … ≤3%
(at –70dBm signal level, links set to de-emphasis)

1.2.4.2 CTCSS

Linkable High Pass Filter:

Bandwidth … 350 to 3400Hz
Response … within +1, –3dB of level at 1kHz
Hum And Noise … 30dB min. at 250.3Hz
(1kHz at 60% system deviation 35dB typical (67 to 240Hz)
CTCSS at 10% system deviation)

Tone Detect:

Tone Squelch Opening … better than 6dB sinad
3dB sinad at 250.3Hz (typical)
4dB sinad at 100Hz (typical)

Tone Detect Bandwidth … ±2.1Hz accept (typical)
±3.0Hz reject (typical)

Response Time … 150ms open and close (typical)

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1.2.4.3 Mute Operation

Systems Available … noise mute and carrier mute

Noise Mute:

Operating Range	… 6 to 20dB sinad
Hysteresis	… 1.5 to 6dB
Threshold	… adjustable to –105dBm
Opening Time	… 20ms
Closing Time	… 50ms

Carrier Mute (Optional):

Operating Range	… –115 to –80dBm
Hysteresis	… 2 to 10dB
Opening Time	… 5ms
Closing Time	… 50ms

Note: The opening and closing times given above are for the standard setup (SL210 linked and SL220 not linked. Refer to Section 3.8).

1.2.5 Microprocessor Controller

Auxiliary Ports:

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

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.

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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.

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2 T855 Circuit Operation

This section provides a basic description of the circuit operation of the T855 receiver.

Note: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 4.02 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	Page
2.1	**Introduction**	**2.3**
2.2	**Receiver Front End**	**2.4**
2.3	**Mixer**	**2.5**
2.4	**IF Circuitry**	**2.5**
2.5	**Noise Mute (Squelch)**	**2.6**
2.6	**Carrier Mute**	**2.6**
2.7	**Audio Processor**	**2.7**
2.8	**Power Supply And Regulators**	**2.8**
2.9	**Microcontroller**	**2.9**
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2.11	**VCO**	**2.11**
2.12	**Received Signal Strength Indicator (RSSI)**	**2.12**

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2.2	T855 Front End, IF and Mute Block Diagram	2.4
2.3	T855 Audio Processor Block Diagram	2.7
2.4	T855 Power Supply And Regulators Block Diagram	2.8
2.5	T855 Microcontroller Block Diagram	2.9
2.6	T855 Synthesiser Block Diagram	2.10
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2.1 Introduction

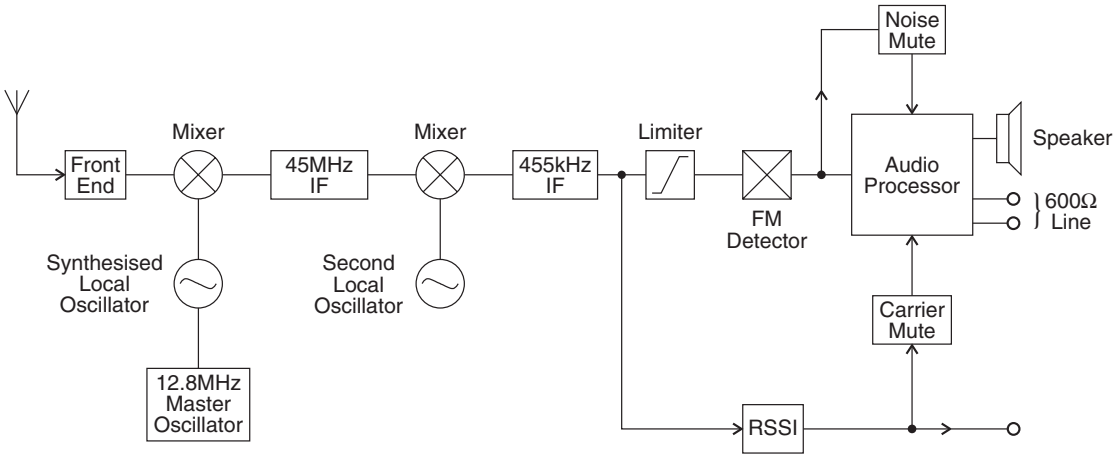


Figure 2.1 T855 High Level Block Diagram

The T855 receiver consists of a number of distinct stages:

- front end
- mixer
- synthesised local oscillator
- IF
- audio processor
- mute (squelch)
- regulator circuits
- received signal strength indicator (RSSI).

These stages are clearly identifiable in Figure 2.1. Refer to the circuit diagrams in Section 6 for further detail.

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2.2 Receiver Front End

(Refer to the front end, IF section and audio processor circuit diagrams (sheets 4, 3 and 2 respectively) in Section 6.3.)

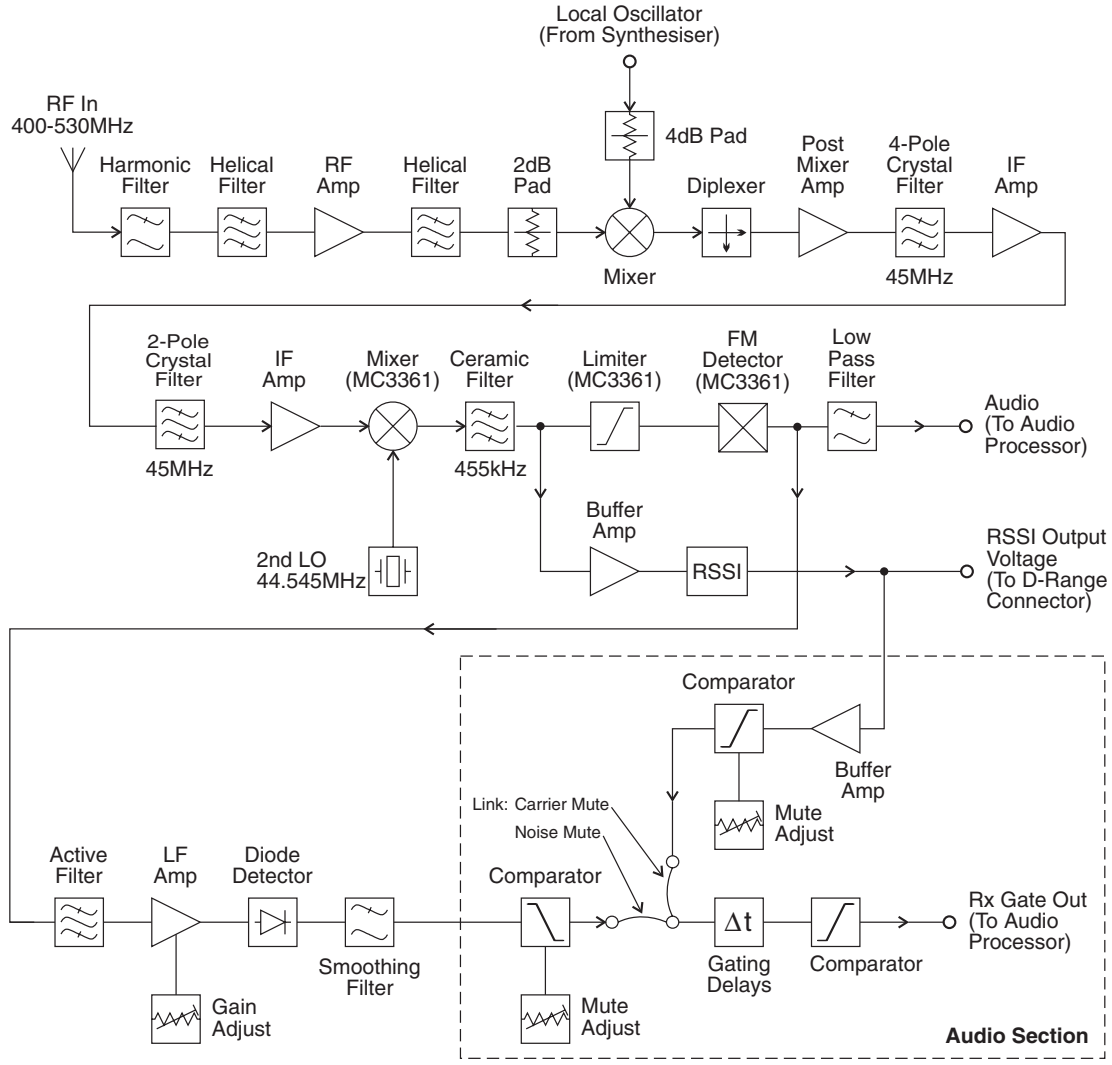


Figure 2.2 T855 Front End, IF and Mute Block Diagram

The incoming signal from the N-type antenna socket is fed through a 9-pole, low pass filter with a cut frequency of approximately 600MHz. This low loss filter (typically less than 0.5dB over 400 to 530MHz) provides excellent immunity to interference from high frequency signals.

The signal is then further filtered, using a high performance helical resonator doublet (FL410) which provides exceptional image rejection, before being amplified by approximately 8dB (Q410). The signal is then passed through a further helical filter doublet (FL420) before being presented to the mixer via a 2dB attenuator pad.

Each sub-block within the front end has been designed with 50Ω terminations for ease of testing and fault finding. The overall gain from the antenna socket to the mixer input is approximately 2dB.

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2.3 Mixer

(Refer to the front end circuit diagram (sheet 4) in Section 6.3 and Figure 2.2.)

IC410 is a high level mixer requiring a local oscillator (LO) drive level of +17dBm (nominal). The voltage controlled oscillator (VCO) generates a level of +21dBm (typical) and this is fed to the mixer via a 5dB attenuator pad. A diplexer terminates the IF port of the mixer in a good 50Ω, thus preventing unnecessary intermodulation distortion.

2.4 IF Circuitry

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

Losses in the mixer are made up for in a tuned, common gate, post mixer amplifier (Q310). Several stages of amplification and filtering are employed in the IF circuitry. The first crystal filter is a 4-pole device (&XF300) which is matched into 50Ω on both its input and output ports. This stage is followed by a common base amplifier (Q320) whose output is matched into a 2-pole crystal filter (&XF301). The signal is then amplified using a high gain MOSFET amplifier (Q350), after which the signal is mixed down to 455kHz with the second crystal local oscillator (44.5455MHz).

The 455kHz signal is filtered using a 6-pole ceramic filter (&XF302) before being limited and detected. Q340 provides a buffered 455kHz output for use with the optional RF level detector (RSSI)

The second IF mixer, limiter and detector is in a 16-pin IC (IC310). Quadrature detection is employed, using L390, and the recovered audio on pin 9 of IC310 is typically $1V_{pp}$ for 60% system deviation.

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2.5 Noise Mute (Squelch)

(Refer to the audio processor and IF section circuit diagrams (sheets 2 and 3 respectively) in Section 6.3 and Figure 2.2.)

The noise mute operates on the detected noise outside the audio bandwidth. An operational amplifier in IC310 is used as an active band pass filter centred on 70kHz to filter out audio components. The noise spectrum is then further amplified in a variable gain, two-stage amplifier (Q350 and Q360) with additional filtering. The noise is then rectified (D310) and filtered to produce a DC voltage proportional to the noise amplitude. The lowest average DC voltage corresponds to a high RF signal strength and the highest DC voltage corresponds to no signal at the RF input.

The rectified noise voltage is compared with a threshold voltage set up on RV230, the front panel "Gating Sensitivity" potentiometer. Hysteresis is provided by the feedback resistor (R267) to prevent the received message from being chopped when the average noise voltage is close to the threshold. R281 and R280 determine the mute opening and closing times and, in combination with solder links SL210 and SL220, provide three time delay options (SL210 is linked as standard. Refer to Section 3.8). The mute control signal at pin 7 of IC270 is used to disable the speaker and line audio outputs. The speaker output can be separately enabled for test purposes by operating the front panel mute disable switch, SW201.

2.6 Carrier Mute

(Refer to the audio processor and IF section circuit diagrams (sheets 2 and 3 respectively) in Section 6.3 and Figure 2.2.)

A high level carrier mute facility is also available. The RSSI (refer to Section 2.12) provides a DC voltage proportional to the signal strength. This voltage is compared with a preset level, set up on RV235, and may be linked into the mute timing circuit using PL250. PL250 selects either the noise mute or the carrier mute. From this point both the noise and carrier mute circuits operate in the same manner, using common circuitry.

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2.7 Audio Processor

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

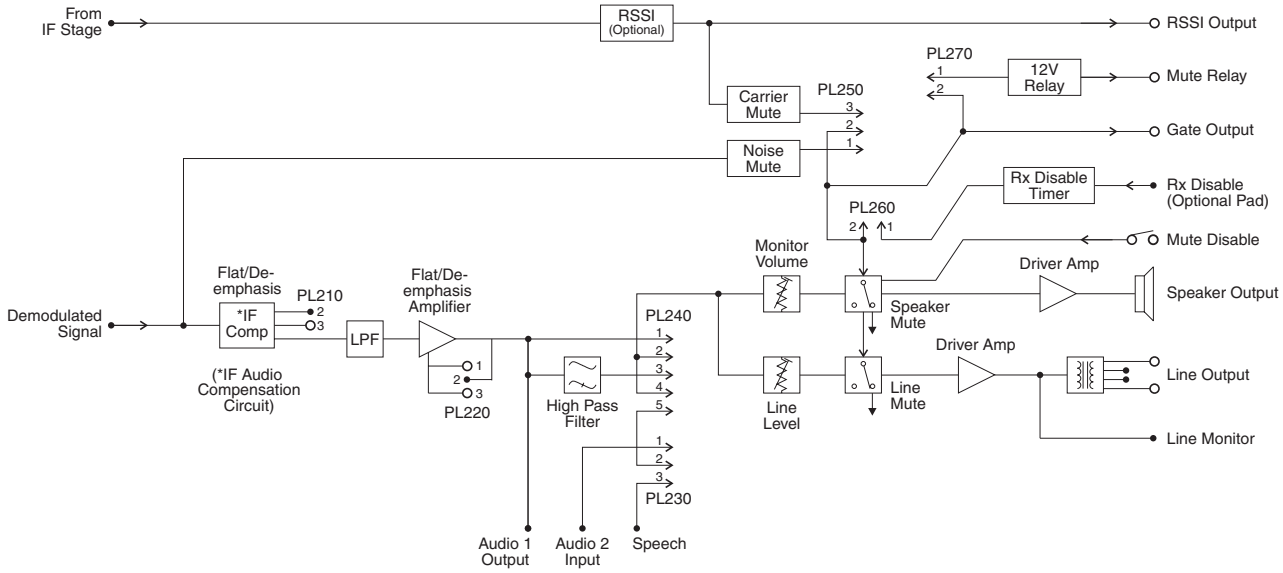


Figure 2.3 T855 Audio Processor Block Diagram

The recovered audio on pin 9 of IC310 is passed through a compensation network and processed in a third order elliptic active filter to give the required response. Linking (PL220 and PL210) is available to give either a flat or de-emphasised audio response, with de-emphasis giving a –6dB/octave roll off. The output of IC210 is split to provide separate paths for the speaker and line outputs. The "Audio 1", Audio 2" and "Speech" lines allow access to the receiver's audio path for external signalling purposes (refer to Section 3.5).

The signals are passed to audio drive amplifiers IC240 and IC260. Under muted conditions the inputs of these amplifiers are shunted to ground via transistors Q230 and Q290 respectively. The audio output of IC240 has a DC component which is removed by C249, and this then drives a speaker directly. The output of IC260 is fed into a line transformer to provide a balanced 2-wire or 4-wire, 600Ω output.

The speaker volume is set using the front panel "Monitor Volume" knob (RV205) and the line level is set using the recessed "Line Level" potentiometer (RV210).

The red front panel "Gate" LED (D250) indicates the status of the mute circuit. When a signal above the mute threshold is received, the LED is illuminated. The "Monitor" switch (SW201) on the front panel opens the mute, allowing continuous monitoring of the audio signal (on = audio unmuted; off = audio muted).

The mute control line is available on pad 234 ("RX GATE OUT") for control of external circuitry. A high (9V) on pad 234 indicates that the audio is disabled and a low (0V) indicates that a signal above the mute threshold level is being received.

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The audio can also be disabled using the "RX-DISABLE" inputs, pads 225 or 228, having connected the "RX-DISABLE" link between pins 1 and 2 of PL260. An adjustable time delay (RV220) is provided on these lines. In order to disable the audio, either pad must be pulled to 0V.

An undedicated relay is provided (RL210) for transmitter keying or other functions and this can be operated from the mute line by linking PL270.

2.8 Power Supply And Regulators

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

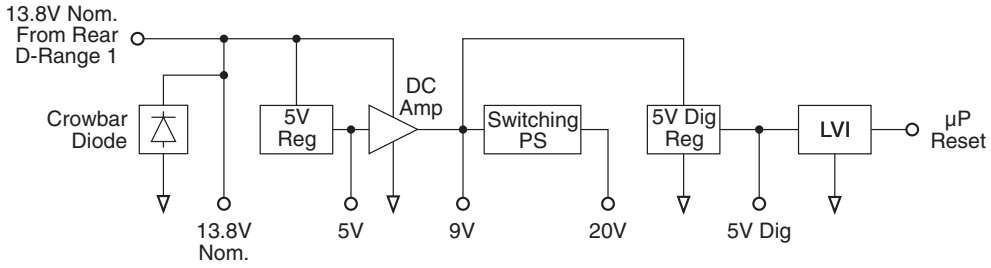


Figure 2.4 T855 Power Supply And Regulators Block Diagram

The T855 is designed to operate off a 10.8 to 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 and Q620) which provides a medium current capability 9V supply.

A switching power supply, based on Q670 and Q660, runs off the 9V supply and provides a low current capability +20V supply. This is used to drive the synthesiser loop filter (IC740), giving a VCO control voltage of up to 20V.

The 13.8V supply drives both output audio amplifiers without additional regulation. A separate 5V regulator (IC610) drives the microprocessor and associated digital circuitry. The output of this regulator is monitored by the Low Voltage Interrupt (LVI) circuit (IC650).

A crowbar diode is fitted for protection against connection to a power supply of incorrect polarity. It also provides transient overvoltage protection.

Note: A fuse must be fitted in the power supply line for the diode to provide effective protection.

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2.9 Microcontroller

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

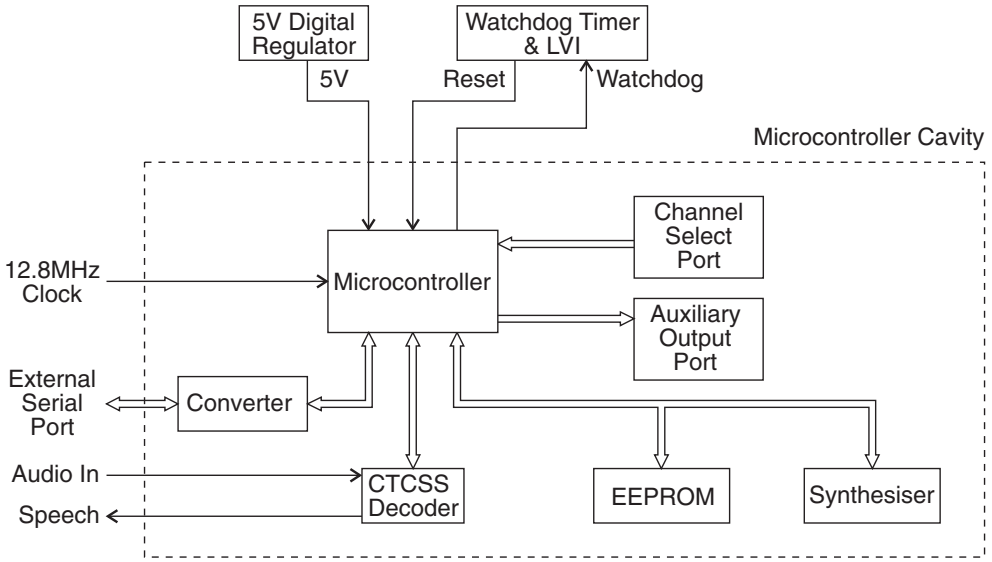


Figure 2.5 T855 Microcontroller Block Diagram

Overall system control of the T855 is accomplished by the use of a member of the 80C51 family of microcontrollers (IC810) which runs from internal ROM and RAM. Four ports are available 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).

The main tasks of the microcontroller are as follows:

- program the synthesiser;
- interface with the PGM800Win programming software at 9600 baud via the serial communication lines on D-range 1 (PL100) and D-range 2;
- monitor channel change inputs from D-range 2;
- generate timing waveforms for CTCSS detection;
- coordinate and implement timing control of the receiver;
- control the front panel “Supply” LED (refer to Section 5.3).

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2.10 Synthesised Local Oscillator

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

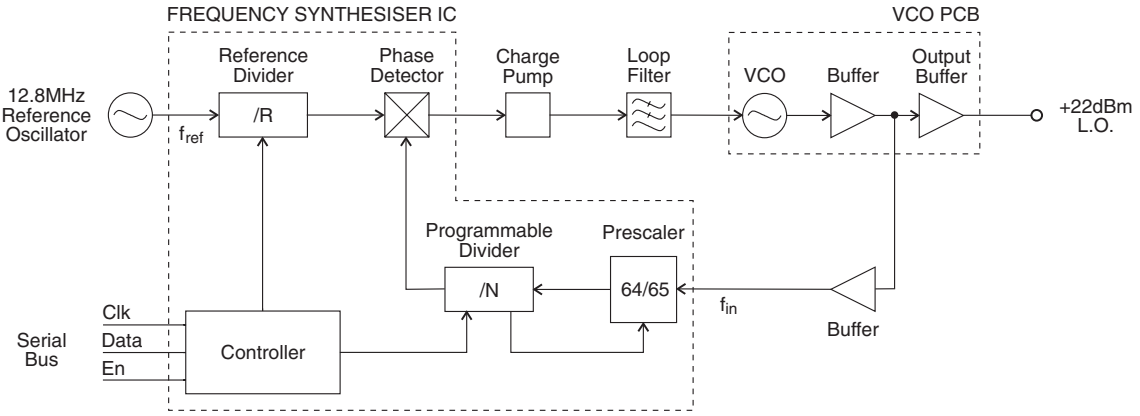


Figure 2.6 T855 Synthesiser Block Diagram

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 reference oscillator (f_{ref}).

A reference oscillator at 12.8MHz (IC700) is buffered (IC710) and divided down to 6.25kHz or 5kHz within the synthesiser IC (IC740).

A buffered output of the VCO is divided with a prescaler and programmable divider which is incorporated into the synthesiser chip (IC740). This signal is compared with the 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, Q790) 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.

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2.11 VCO

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

The VCO transistor (Q1) operates in a common emitter, and uses a transmission line resonator (TL1). The transmission line is used in a two port configuration with varicaps positioned at one end. The VCO control voltage from the loop filter (IC750) is applied to the varicaps (D1 and D2) to facilitate tuning. The VCO output is coupled into a cascode amplifier stage (Q2 and Q3) which supplies +10dBm (nominal) output. Further amplification in Q5 brings the output drive level to +20dBm to drive the mixer.

A low level "sniff" is taken from the input to Q5 to drive the divider buffer to the synthesiser (IC740).

The VCO operates at the actual frequency required by the first mixer, i.e. there are no multiplier stages.

The VCO frequency spans from 355 to 395MHz, 395 to 435MHz or 435 to 485MHz according to product type. The VCO is tuned to 45MHz below the desired receive frequency (low side injection) to produce a 45MHz IF signal at the output of the mixer.

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2.12 Received Signal Strength Indicator (RSSI)

(Refer to the T800-04-0000 RSSI PCB circuit diagram in Section 6.2 and the IF section circuit diagram (sheet 3) in Section 6.3.)

The RSSI option PCB plugs directly into the main PCB (support circuitry being fitted as standard). It is fitted to the T855 whenever receiver signal strength monitoring is required, e.g. trunking or voting. Its function is to provide a DC voltage proportional to the signal level at the receiver input. The DC voltage is available at D-range 1 (PL100 pin 5).

The RSSI also provides the capability for high level signal strength muting, which may be selected on PL250 (refer to Section 3.5). The mute threshold may be set between –115dBm and –70dBm by RV235.

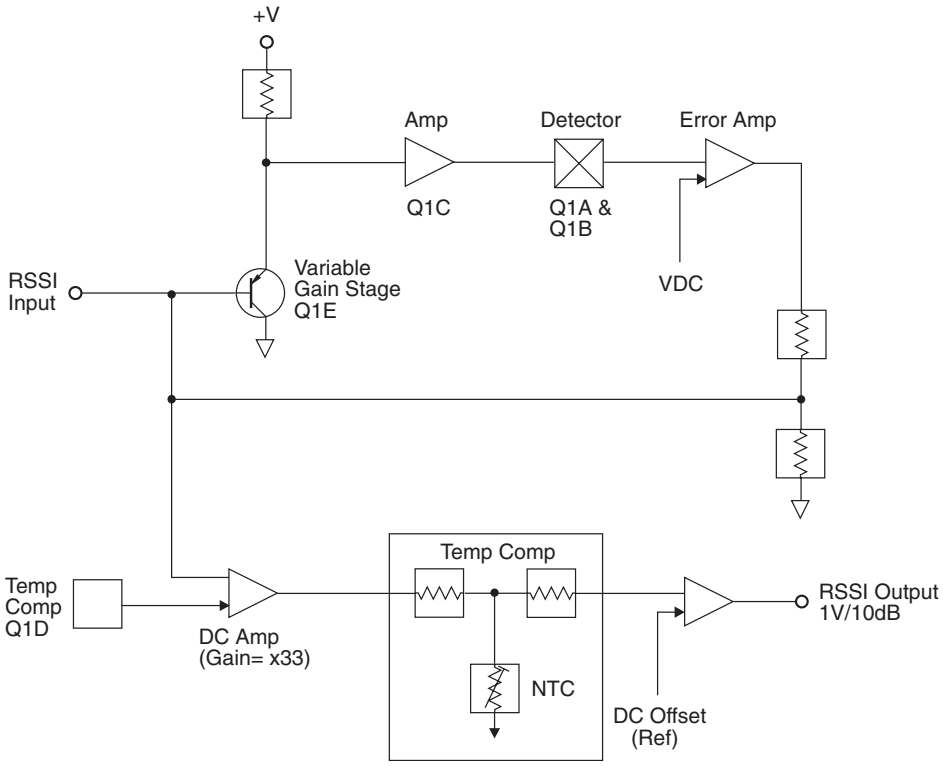


Figure 2.7 T855 RSSI Block Diagram (T800-04-0000 RSSI PCB)

The variable gain stage (Q1A) is a common emitter amplifier with its emitter grounded and the AGC control loop voltage applied to its base. Since the AGC loop will maintain a constant signal level at the collector, the gain of Q1 must be proportional to the incoming 455kHz signal level. The gain of Q1 is linearly proportional to its collector current which itself is exponentially related to the base-emitter voltage. Thus there is a logarithmic relationship between the base-emitter voltage and the gain. The circuit therefore produces a feedback voltage, and an output voltage, logarithmically related to the RF input signal.

The AGC loop is followed by a DC amplifier which provides level shifting, temperature compensation and gain to give a nominal 1V/10dB at the RSSI output. RV320 on the main PCB is used to set the RSSI voltage to a fixed value at a given RF input signal strength.

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3 T855 Initial Tuning and Adjustment

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

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

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

Note: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 4.02 and later of the software.

Refer to Figure 4.3 which shows 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	Page
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**
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3.4.2	Synthesiser Alignment	3.5
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3.4.6.1	Decoder Operation	3.7
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Section	Title	Page
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3.5.2	Audio Processor Linking Details For CTCSS	3.9
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3.12.3	High Pass Filter	3.14
3.13	**RSSI**	**3.14**

Figure	Title	Page
3.1	T855 Test Equipment Set-up For Short Tuning Procedure	3.4
3.2	T855 Test Equipment Set-up For Full Tuning and Adjustment Procedure	3.4

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3.1 Introduction

When you receive your T855 receiver it will be run up and working on a particular frequency (the "default channel")[1]. If you want to switch to a frequency that is within the 5MHz switching range (i.e. ±2.5MHz from the factory programmed frequency), you should only need to reprogram the receiver with the PGM800Win software (refer to the PGM800Win programming kit and Section 3.2 below).

However, if you want to switch to a frequency outside the 5MHz switching range, you will have to reprogram and re-tune the receiver to ensure correct operation. In this case you should carry out the short tuning procedure described in Section 3.4.

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

3.2 Channel Programming

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

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

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

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

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

Note: When an auxiliary D-range kit (D-range 2 – T800-03-0000) is fitted, you can also select a channel with an external switch, such as the DIP switch on a backplane PCB. Consult your nearest Tait Dealer or Customer Service Organisation for further details.

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

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3.3 Test Equipment Required

You will need the following test equipment:

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

  } or RF test set (optional)

- oscilloscope
- distortion meter

  } not needed for short tuning procedure

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

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

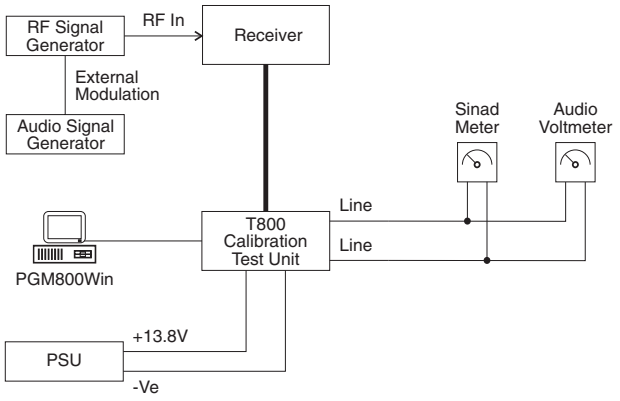


Figure 3.1 T855 Test Equipment Set-up For Short Tuning Procedure

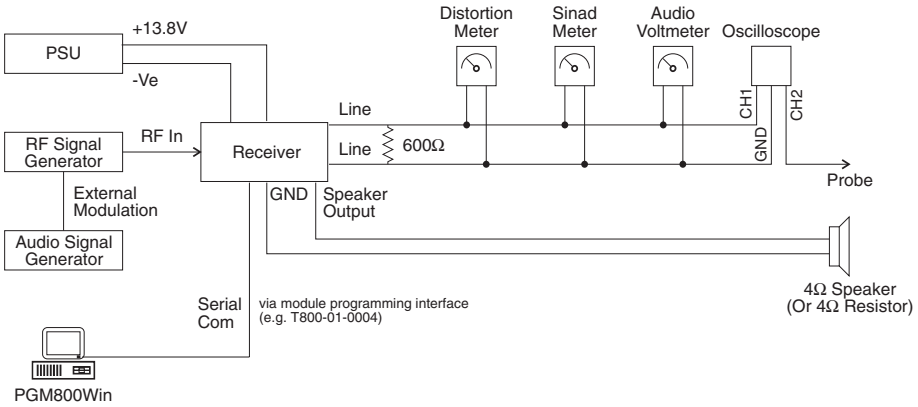


Figure 3.2 T855 Test Equipment Set-up For Full Tuning and Adjustment Procedure

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3.4 Short Tuning Procedure

Use this procedure only if you want to reprogram the receiver to a frequency outside the 5MHz 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.

Set up the test equipment as described in Section 3.3.

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

3.4.2 Synthesiser Alignment

- Connect a high impedance voltmeter to the long lead of L1 in the VCO (this measures the synthesiser loop voltage).

- **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 program channels with a greater frequency separation than the specified switching range of 5MHz.

3.4.3 Front End Alignment

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

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

Set RV230 (front panel gating sensitivity) fully clockwise.

Inject a strong on-channel RF signal with ±3kHz deviation (±2.4kHz) [±1.5kHz] at

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1kHz into the antenna socket and adjust the helical resonators #FL410 and #FL420 to give best sinad.

Continually decrease the RF level to maintain 12dB sinad.

Readjust FL410 and FL420 to give best sinad.

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

3.4.4 Mute Adjustment

3.4.4.1 Noise Mute

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

Set the RF level to –105dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Set RV230 (front panel gating sensitivity) fully anticlockwise.

Adjust RV310 (noise mute gain) fully clockwise to close the mute (if necessary turn off the RF signal and then turn it on again).

Rotate RV310 anticlockwise until the mute just opens.

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

3.4.4.2 Carrier Level Mute

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

Apply an on-channel signal from the RF generator at the required mute opening level with ±3kHz deviation (±2.4kHz) [±1.5kHz] at ±1kHz.

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

3.4.5 Line Amplifier Output

Apply an on-channel signal from the RF generator at a level of –70dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

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

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3.4.6 CTCSS

3.4.6.1 Decoder Operation

Program a CTCSS tone on the default channel using PGM800Win.

Set the RF signal generator output to –70dBm.

Modulate the generator with both:

- a 1kHz tone at ±3kHz deviation (±2.4kHz) [±1.5kHz]
- and a CTCSS tone at the programmed frequency at ±500Hz deviation (±400Hz) [±300Hz].

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

3.4.6.2 Opening Sinad

Adjust RV230 (front panel gating sensitivity) fully clockwise.

Reduce the RF signal level to –110dBm.

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

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

With PL240 pins 1 and 2 linked (G–H; high pass filter bypassed), check that the sinad is less than 6dB.

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

3.4.6.3 High Pass Filter

Set the audio processor links as follows:

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

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

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

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

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3.4.7 RSSI (If Fitted)

The T800-04-0000 RSSI is an optional PCB which adds signal strength monitoring and high level mute facilities to the basic receiver.

Ensure the T800-04-0000 PCB is fitted in SK320 and SK330 in the IF compartment.

Apply an on-channel signal from the RF generator at a level of –110dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Adjust RV320 (RSSI level) to give 2.0V RSSI output on pin 5 of D-range 1 (PL100) when measured with a high impedance DMM.

3.5 Audio Processor Links

3.5.1 General

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

Plug	Link[a]		Function
PL210	[1 – 2] 2 – 3	[A – B] B – C	de-emphasised response flat response
PL220	1 – 2 [2 – 3]	D – E [E – F]	flat response de-emphasised response
PL230[b]	1 – 2 [2 – 3] 3 – 4	M – N [N – P] P – Q	audio input via AUDIO-2 pad audio from internal CTCSS speech filter audio input via I/O pad P250
PL240[b]	1 – 2 [2 – 3] or 3 – 4 4 – 5	G – H [H – J] or J – K K – L	bypass high pass filter 300Hz high pass filter in circuit audio input via PL230 or I/O pad
PL250	[1 – 2] 2 – 3	[R – S] S – T	noise mute carrier mute
PL260	1 – 2 [2 – 3]	U – V [V – W]	RX-DISABLE link not connected
PL270	[1 – 2] 2 – 3	[X – Y] Y – Z	relay link 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 set of pins.

b. Refer to Section 3.5.2 for further details.

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3.5.2 Audio Processor Linking Details For CTCSS

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

CTCSS Option	PL230		PL240	
standard, no CTCSS	2 – 3	N – P	2 – 3	H – J
received CTCSS + speech passed to line output	3 – 4	P – Q	1 – 2	G – H
high pass filtered speech, internal CTCSS detection	2 – 3	N – P	4 – 5	K – L
external CTCSS detection	1 – 2	M – N	4 – 5	K – L

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 and noise –55dB
- received CTCSS tone + speech to line output
  - tone and speech transmitted down 600Ω line
  - audio bandwidth 10Hz to 3kHz
  - hum and noise –45dB
- high pass filtered speech + internal CTCSS detection
  - 400Hz to 3kHz
  - hum and noise –30dB with 250.3Hz tone present
- external CTCSS detection
  - decoding performed through the receiver (but externally)
  - speech injected back into receiver via "AUDIO-2" and sent down 600Ω line

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

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

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3.6 Synthesiser Alignment

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

- Connect a high impedance voltmeter to the long lead of L1 in the VCO (this measures the synthesiser loop voltage).

- **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 of 5MHz.

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

3.7 Alignment Of Receiver Front End And IF

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

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

Set RV230 (front panel gating sensitivity) fully clockwise.

Inject a strong on-channel RF signal with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz into the antenna socket and adjust the helicals (#FL410 and #FL420) to give the best sinad.

Continually decrease the RF level to maintain 12dB sinad.

Roughly tune IF coils L310, L320, L330, L340, L350, L360, L370, L380, L385 and L390 for best sinad.

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

Trim the synthesiser TCXO (=IC710) for zero beat.

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While maintaining the low level RF input to the receiver, loosely couple into the second IF an additional high level signal at 455kHz, you will hear a beat note.

Tune L385 for zero beat.

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

Readjust the front end helicals (#FL410 and #FL420) to give the best sinad.

Change the RF signal level to –75dBm and modulate with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Connect an oscilloscope probe to SK320 pin 3 (RSSI 455kHz input) and connect plugs PL210 and PL220 to give a flat audio response (refer to Section 3.5).

Readjust L310, L320, L330, L340, L350, L360, L370 and L380 to give a maximum amplitude response on the oscilloscope with minimal amplitude modulation.

Note: If you would like a more accurate method of tuning the IF, refer to the sweep tuning method described in Section 5.5.5.

Further adjust these coils, along with L390, for minimum audio distortion, ensuring that the 455kHz level (on the oscilloscope) does not fall significantly.

Check that the distortion reading is:

wide bandwidth	≤2%
mid and narrow bandwidth	≤4%.

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

Reduce the RF level until 12dB sinad is reached. The receiver sensitivity should be better than –117dBm (de-emphasised) or –111dBm (flat), assuming that the audio levels are not being overdriven (refer to Section 3.11).

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3.8 Gating Delay

Two solder links (SL210 and SL220) are provided on the bottom of the PCB to allow three gate delay time options, as shown in the table below.

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

*Factory setting.

3.9 Noise Mute Adjustment

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

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

Set the RF level to –105dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Set RV230 (front panel gating sensitivity) fully anticlockwise.

Adjust RV310 (noise mute gain) fully clockwise to close the mute (if necessary turn off the RF signal and then turn it on again).

Rotate RV310 anticlockwise until the mute just opens.

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

3.10 Carrier Level Mute

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

Apply an on-channel signal from the RF generator at the required mute opening level with ±3kHz deviation (±2.4kHz) [±1.5kHz] at ±1kHz.

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

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3.11 Audio Processor

3.11.1 Line Amplifier Output

Apply an on-channel signal from the RF generator at a level of –70dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

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

Check for any clipping or distortion on the oscilloscope.

Set the line level to the required output level.

3.11.2 Monitor Amplifier Output (Speaker Output)

Adjust RV205 (front panel monitor volume) to give an output of $2V_{rms}$ into a 4Ω resistive load.

Check for any clipping or distortion on the oscilloscope.

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

3.12 CTCSS

3.12.1 Decoder Operation

Program a CTCSS tone on the default channel using PGM800Win.

Set the RF signal generator output to –70dBm.

Modulate the generator with both:

- a 1kHz tone at ±3kHz deviation (±2.4kHz) [±1.5kHz]
- and a CTCSS tone at the programmed frequency at ±500Hz deviation (±400Hz) [±300Hz].

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

3.12.2 Opening Sinad

Adjust RV230 (front panel gating sensitivity) fully clockwise.

Reduce the RF signal level to –110dBm.

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

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

With PL240 pins 1 and 2 linked (G – H; high pass filter bypassed), check that the sinad is less than 6dB.

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

3.12.3 High Pass Filter

Set the audio processor links as follows:

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

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

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

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

3.13 RSSI

The T800-04-0000 RSSI is an optional PCB which adds signal strength monitoring and high level mute facilities to the basic receiver.

Ensure the T800-04-0000 PCB is fitted in SK320 and SK330 in the IF compartment.

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

Apply an on-channel signal from the RF generator at a level of –110dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Adjust RV320 (RSSI level) to give 2.0V RSSI output on pin 5 of D-range 1 (PL100) when measured with a high impedance DMM.

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4 T855 Functional Testing

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

The following test procedures will confirm that the T855 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 4.02 and later of the software.

Refer to Figure 4.3 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	**Sensitivity**	**4.3**
4.3	**Switching Range**	**4.3**
4.4	**Audio Distortion**	**4.4**
4.5	**Ultimate Signal-To-Noise Ratio**	**4.4**
4.6	**De-emphasised Audio Frequency Response**	**4.5**
4.7	**Noise Mute (If Linked In)**	**4.6**
4.8	**RSSI (If Fitted)**	**4.6**
4.9	**Carrier Level Mute (RSSI Fitted and Carrier Mute Linked In)**	**4.7**

Figure	Title	Page
4.1	T855 De-emphasised Audio Frequency Response	4.5
4.2	T855 RSSI Voltage vs Signal Strength	4.6
4.3	T855 Main Tuning and Adjustment Controls	4.9

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4.1 Current Consumption

Connect the T855 to a 13.8V power supply.

Rotate RV230 (front panel gating sensitivity) anticlockwise until the "Gate" LED is extinguished.

Set switch SW201 (front panel monitor mute) to the ***on*** position.

Check that the current in the 13.8V power cable is less than 350mA.

Rotate the RV230 clockwise until the "Gate" LED is lit.

Rotate RV210 (front panel line level) and RV205 (front panel monitor volume) to give maximum outputs.

Check that the current is less than 800mA.

Reset the front panel controls to the required settings.

4.2 Sensitivity

If CTCSS is enabled, disable the CTCSS tone by either programming the T855 for "No Tone" on the set channel, or by pulling pin 10 of D-range 2 (CTCSS ENABLE) low.

Apply an on-channel signal from the RF generator with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Adjust the RF level to give 12dB audio sinad.

Check that the sensitivity is –117dBm or better.

4.3 Switching Range

Apply an on-channel signal from the RF generator at various frequencies within the 5MHz switching range (front end bandwidth), corresponding to pre-programmed channels.

Measure the sensitivity at each frequency as described in Section 4.2.

Ensure that the sensitivity is –115dBm or better across the whole switching range.

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4.4 Audio Distortion

The level of distortion measured at the line output (refer to Figure 1.3 in Part G) gives an indication of the accuracy of the IF alignment.

Apply an accurate on-channel signal from the RF generator at a level of –70dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Adjust RV210 (front panel line level) to give +10dBm into 600Ω.

Check that the distortion is approximately 1% THD.

Note: For a flat response, the distortion should always be better than 2% for wide bandwidth sets or 4% for mid and narrow bandwidth sets.

Adjust RV205 (front panel monitor volume) to give $2V_{rms}$ into a 4Ω resistive load.

Check that the distortion at the monitor output is better than 2% THD.

Reset the controls before proceeding to the next set of tests.

4.5 Ultimate Signal-To-Noise Ratio

Apply a signal from the RF generator at a level of –57dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Select de-emphasis on the links provided in the audio processor (refer to Section 3.5), and link pins 2 and 3 of PL240 to include the 300Hz filter.

Adjust RV210 (front panel line level) to provide +10dBm output.

Switch off the modulation, checking that the residual noise is lower than –45dBm (–43dBm) [–39dBm] at the line output (this corresponds to S/N of 55dB (53dB) [49dB] and is in accordance with EIA measurement conditions).

Note: You can make the measurement without the 300Hz high pass filter, but the result will be 10dB worse.

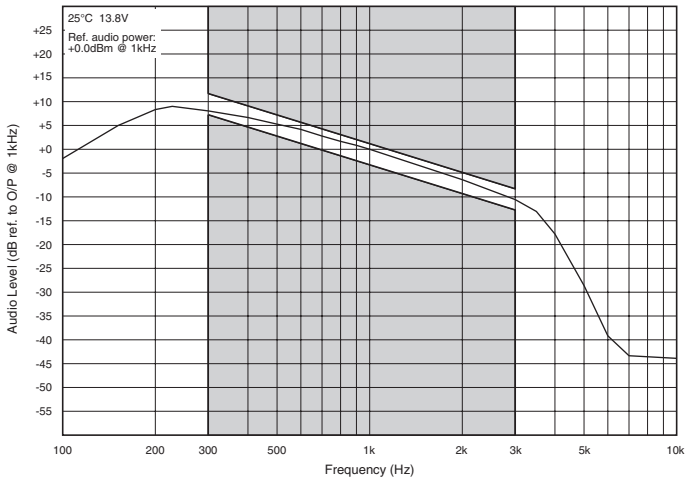
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4.6 De-emphasised Audio Frequency Response

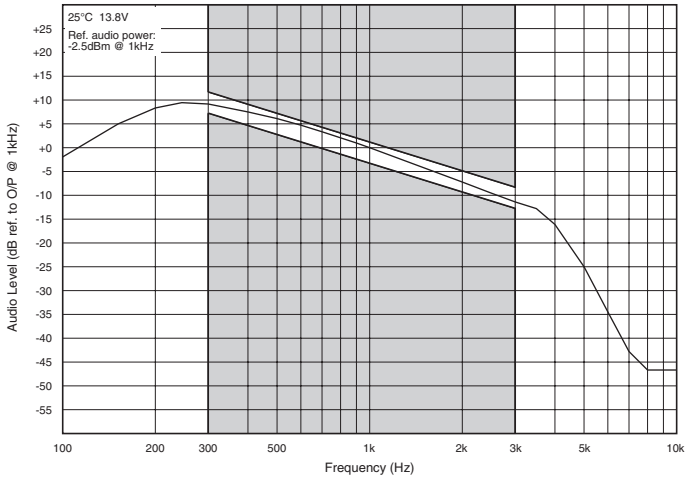
Set RV210 (front panel line level) to provide 0dBm output at 1kHz modulating frequency.

Sweep the modulating frequency, checking that the line audio response closely follows that shown in Figure 4.1 – the limits should not be exceeded.

Wide Bandwidth



Mid Bandwidth



Narrow Bandwidth

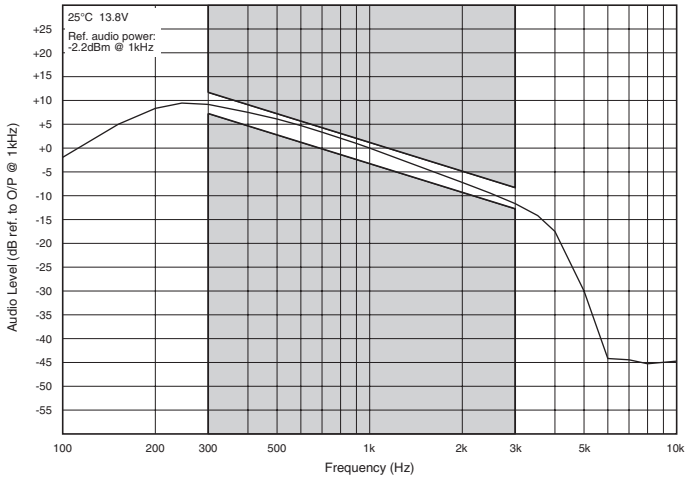


Figure 4.1 T855 De-emphasised Audio Frequency Response

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4.7 Noise Mute (If Linked In)

Rotate RV230 (front panel gating sensitivity) fully anticlockwise.

Apply an on-channel signal from the RF generator at a level of –110dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Increase the RF level in 1dB steps, checking that the mute opens for an RF input level of approximately –105dBm.

Turn the RF off and check that the mute closes.

Rotate RV230 clockwise and check that the mute opens.

Reset RV230 to give the required opening sinad.

Caution: **Some RF generators can cause a false opening of the mute because the generator produces a burst of noise when the attenuation range changes. To correct the problem you will have to change generators.**

4.8 RSSI (If Fitted)

Apply an on-channel signal from the RF generator at a level of –110dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Using a high impedance DMM, check that the RSSI output voltage on pin 5 of D-range 1 (PL100) is 2V (nominal).

Vary the RF level in 5dB steps and check that the RSSI output voltage changes at a rate of approximately 10dB/V over the range of –115dBm to –70dBm (refer to Figure 4.2 for RSSI voltage vs signal strength).

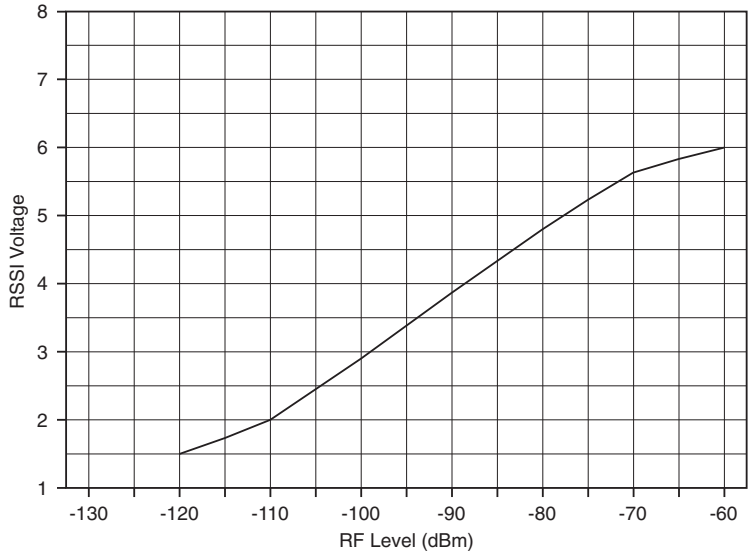


Figure 4.2 T855 RSSI Voltage vs Signal Strength

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4.9 Carrier Level Mute (RSSI Fitted and Carrier Mute Linked In)

Apply an on-channel signal from the RF generator at a level of –120dBm with ±3kHz deviation (±2.4kHz) [±1.5kHz] at 1kHz.

Increase the RF level in 2dB steps and check that the mute opens at an RF level which corresponds with the preset level on RV235 (carrier mute), i.e. between –115dBm and –70dBm.

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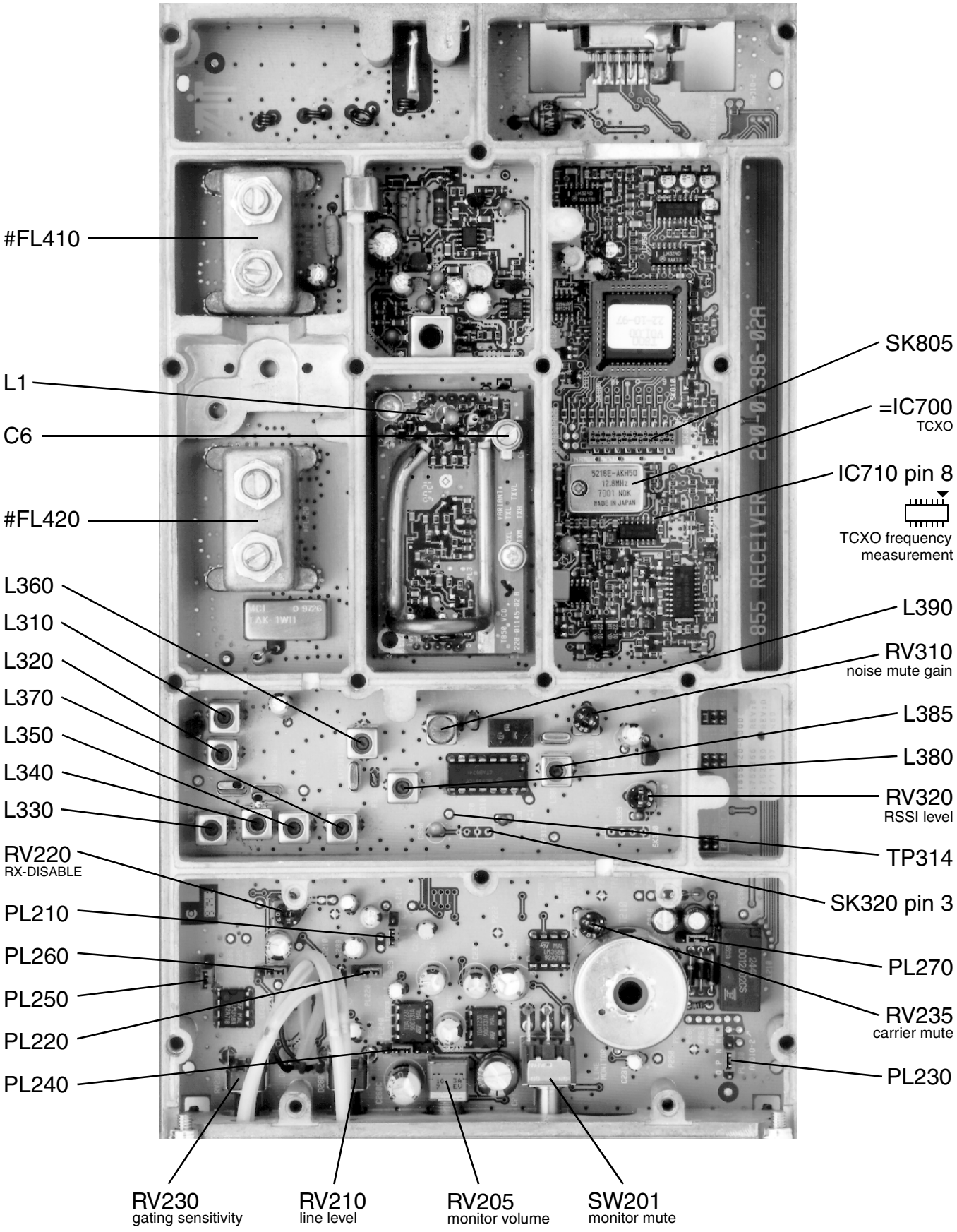


Figure 4.3 T854 Main Tuning and Adjustment Controls

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5 T855 Fault Finding

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

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 Customer Service Organisation. If necessary, you can get additional technical help from Technical Support, 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 4.02 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	Page
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
5.4.3	Mute Operation	5.4
5.5	**RF Checks**	**5.5**
5.5.1	VCO Frequency	5.5
5.5.2	RF Sensitivity	5.5
5.5.3	Oscillator Stability	5.6
5.5.3.1	TCXO	5.6
5.5.3.2	Second IF	5.6
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Section	Title	Page
5.6	**PGM800Win Generated Errors**	**5.8**
5.7	**Fault Finding Charts**	**5.9**
5.7.1	Microcontroller (IC810)	5.9
5.7.1.1	Basic Checks	5.9
5.7.1.2	Serial Communication	5.10
5.7.1.3	CTCSS Decode	5.11
5.7.2	Regulator	5.12
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5.7.5	Carrier Mute	5.17
5.7.6	Receiver	5.18
5.7.7	Audio	5.19

Figure	Title	Page
5.1	RF Test Cable	5.5
5.2	IF Swept Response	5.7
5.3	Ceramic Filter Swept Response	5.7

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5.1 Visual Checks

Remove the covers from the T855 and inspect the PCB for damaged or broken components, paying particular attention to the surface mounted devices (SMDs).

Check for defective solder joints. If repair or replacement of components 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 20kΩ/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 front panel will flash according to the conditions described in the following table:

Flash Rate		Condition
fast	(1s on/1s off approx.)	receiver is linked with PGM800Win
slow	(1s on/1s off approx.)	VCO is out of lock – refer to Section 5.4.2
unequal	(1s on/1s 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. receiver linked has the highest priority, followed by VCO error, then internal error).

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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 9V (TP602) and 13.8V (TP601) power supply test points in the regulator compartment with a DMM.

Check the 20V regulator output at the test point (TP603) in the regulator compartment.

Check the 5V regulator output at the test point (TP604) in the regulator compartment and on IC310 pin 4.

Check the 5V digital regulator output at the junction of C611A (+) and IC610 pin 2 in the regulator compartment.

5.4.2 VCO Locking

Using a DMM, monitor the VCO control voltage on the long lead of L1 on the VCO PCB.

If the synthesiser is locked and the VCO aligned, the voltage at this point should be between 3 and 16V.

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

5.4.3 Mute Operation

The front panel "Gate" LED will show the status of the mute circuitry and will turn on when a signal is received above the threshold level.

Check that PL250 is linked correctly:

noise mute	1–2
carrier mute	2–3.

Check that the mute gate opens as follows:

noise mute	rotate RV230 (front panel gating sensitivity) fully clockwise and check that the front panel "Gate" LED turns on;
carrier mute	rotate RV235 (carrier mute) fully clockwise and check that the front panel "Gate" LED turns on.

If the mute fails to operate correctly, refer to the noise mute fault finding chart (Section 5.7.4) or the carrier mute fault finding chart (Section 5.7.5).

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5.5 RF Checks

5.5.1 VCO Frequency

Check that the VCO is phase locked (refer to Section 5.4.2).

Connect a frequency counter (level +20dBm) to the VCO input to the mixer (IC410).

Monitor the local oscillator frequency and check that it is 45MHz ***below*** the required receive frequency.

Refer to the synthesiser fault finding charts (Section 5.7.3) for further information.

5.5.2 RF Sensitivity

Ensure that the VCO is on the correct frequency and the receiver correctly aligned.

Check that the 12dB sinad sensitivity into the front end is as follows:

–117dBm (de-emphasised response)
–111dBm (flat response).

If the sensitivity is poor, you can trace the fault by measuring the sensitivity into successive circuit blocks. Prepare a test cable by connecting a 1nF capacitor to the end of a length of coax cable as shown in Figure 5.1.

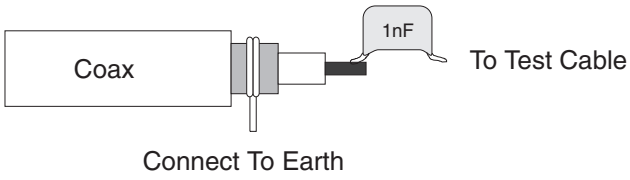


Figure 5.1 RF Test Cable

Note: Before using the test cable, ensure the coax braid is connected to an earth point on the PCB.

Using the RF test cable, apply a modulated 45MHz signal to the test breaks in the IF section, or an on-channel RF signal to the front end test breaks.

Check that the sensitivity at each test break is within 2dB of the levels shown on the circuit diagram.

Poor sensitivity indicates a fault in one of the circuit blocks following the test break.

Note: Poor sensitivity into the mixer can be caused by lack of drive level from the VCO (the drive level should be >+17dBm).

Refer to the receiver fault finding charts (Section 5.7.6) for further information.

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5.5.3 Oscillator Stability

5.5.3.1 TCXO

While maintaining a low level unmodulated RF input to the receiver, loosely couple into the first IF an additional high level signal at 45MHz. You should now hear a constant low frequency beat note.

Tap the TCXO with a finger and replace it if the beat note permanently changes.

5.5.3.2 Second IF

While maintaining a low level unmodulated RF input to the receiver, loosely couple into the second IF an additional high level signal at 455kHz. You should now hear a constant low frequency beat note.

Adjust L385 for “zero beat".

5.5.4 Demodulator Output

Apply an on-channel RF signal modulated by 1kHz with ±3kHz (±2.4kHz) [±1.5kHz] deviation at an amplitude of –65dBm.

Connect an oscilloscope probe (DC coupled) to TP314 (audio output).

Check that an audio signal of approximately 800mV peak to peak is present.

Optimum tuning of the quad coil (L390) for minimum audio distortion (with a “flat” audio response) should coincide with maximum audio amplitude and a DC level of approximately 1.7V.

5.5.5 IF Distortion

If the audio distortion is still high after careful IF alignment (Section 3.7), sweep the IF to investigate the bandpass response.

Apply an on-channel RF signal modulated at 10Hz (sine wave) with ±12kHz (±9kHz) [±6kHz] deviation at an amplitude of –80dBm.

Connect the modulating 10Hz audio signal to the “X” input of an oscilloscope and observe the 455kHz IF input to SK320 pin 3 via a suitable RF probe on the “Y” input. Alternatively, if you have an RSSI PCB fitted, use an oscilloscope probe for the “Y” input to monitor the RSSI output voltage at pad P238 (RSSI test point) or pin 5 of D-range 1 (PL100). This will give a demodulated log response and only the top half of the wave forms shown in Figure 5.2 and Figure 5.3 will be displayed on the oscilloscope screen.

Note: The “X” input should be DC coupled.

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Check that the swept response has a rounded top and no sharp non-linearities (refer to Figure 5.2).

Increase the RF level to –50dBm; the trace will now show the shape of the 455kHz ceramic filter (&XF302).

Check that the response has no sharp non-linearities.

If sharp non-linearities do occur, replace the filter and sweep again to confirm a satisfactory solution (refer to Figure 5.3).

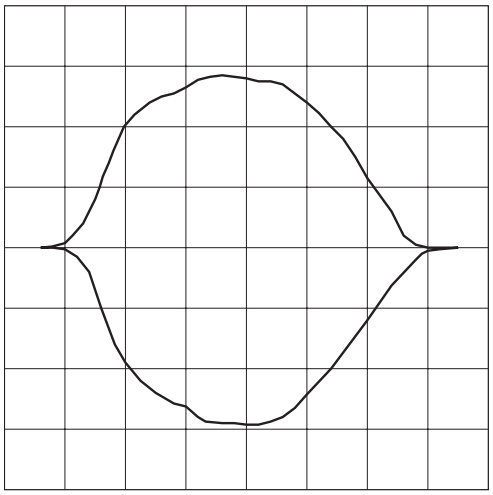


Figure 5.2 IF Swept Response

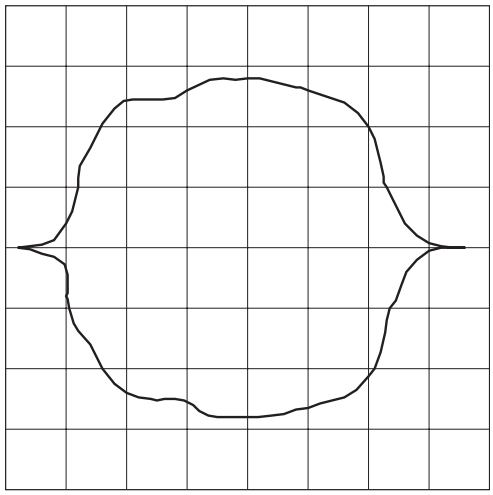


Figure 5.3 Ceramic Filter Swept Response

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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.

Write/Read To An Unlinked Module

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

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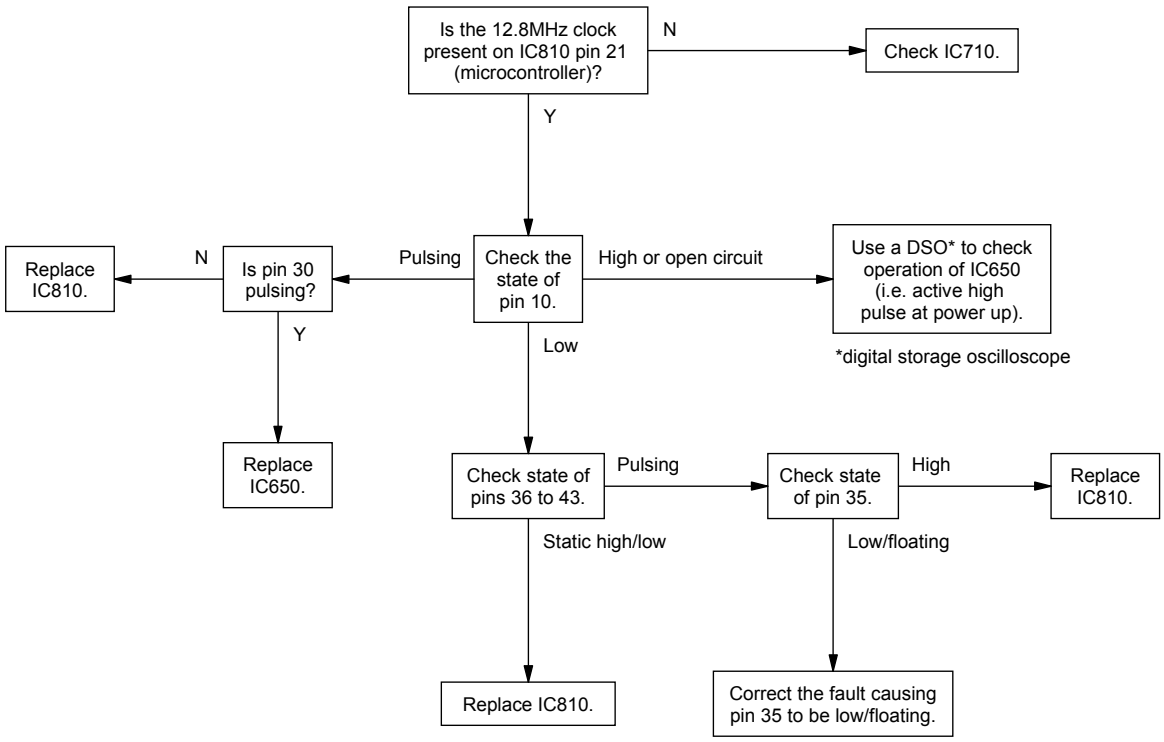
5.7 Fault Finding Charts

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

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

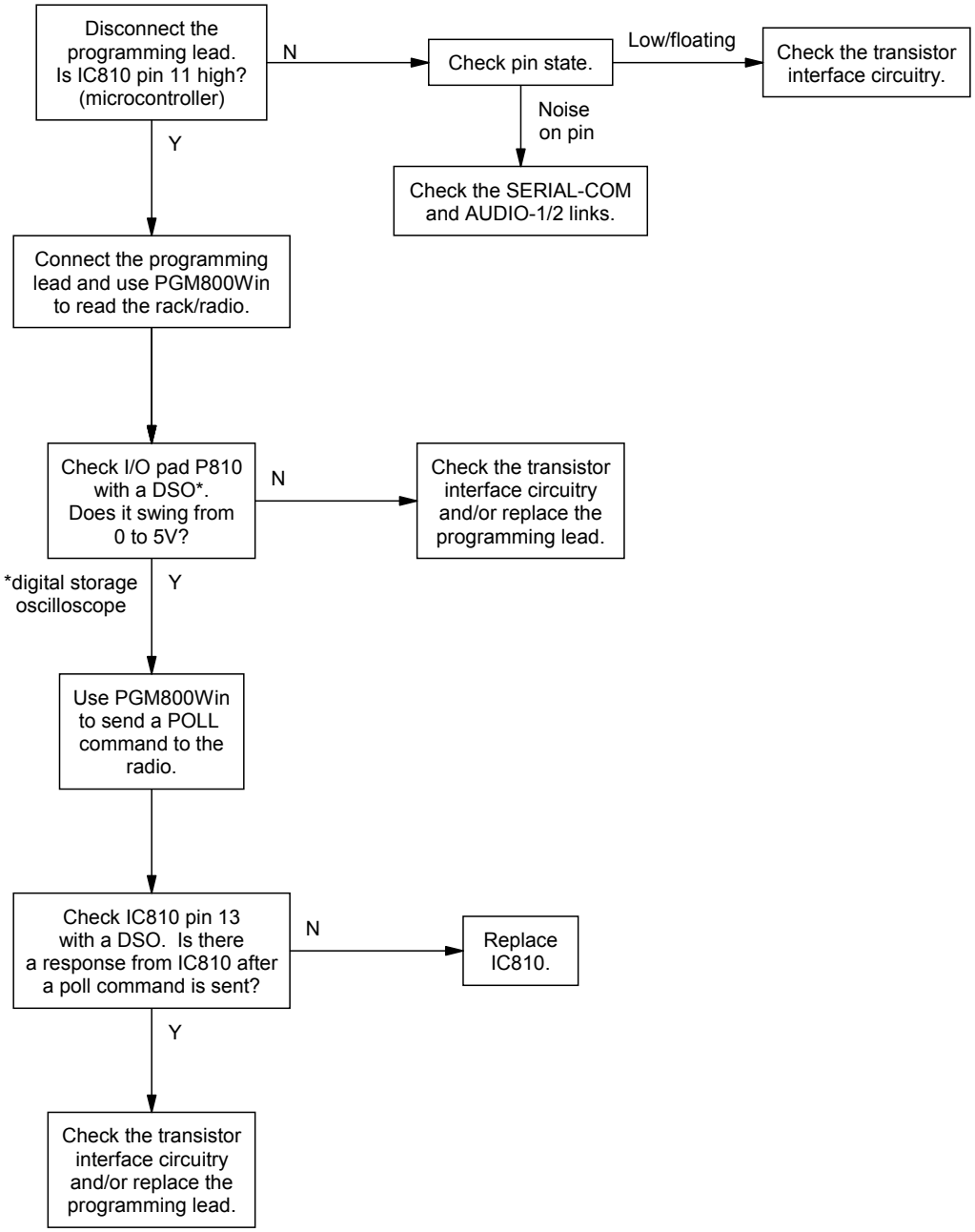
5.7.1 Microcontroller (IC810)

5.7.1.1 Basic Checks



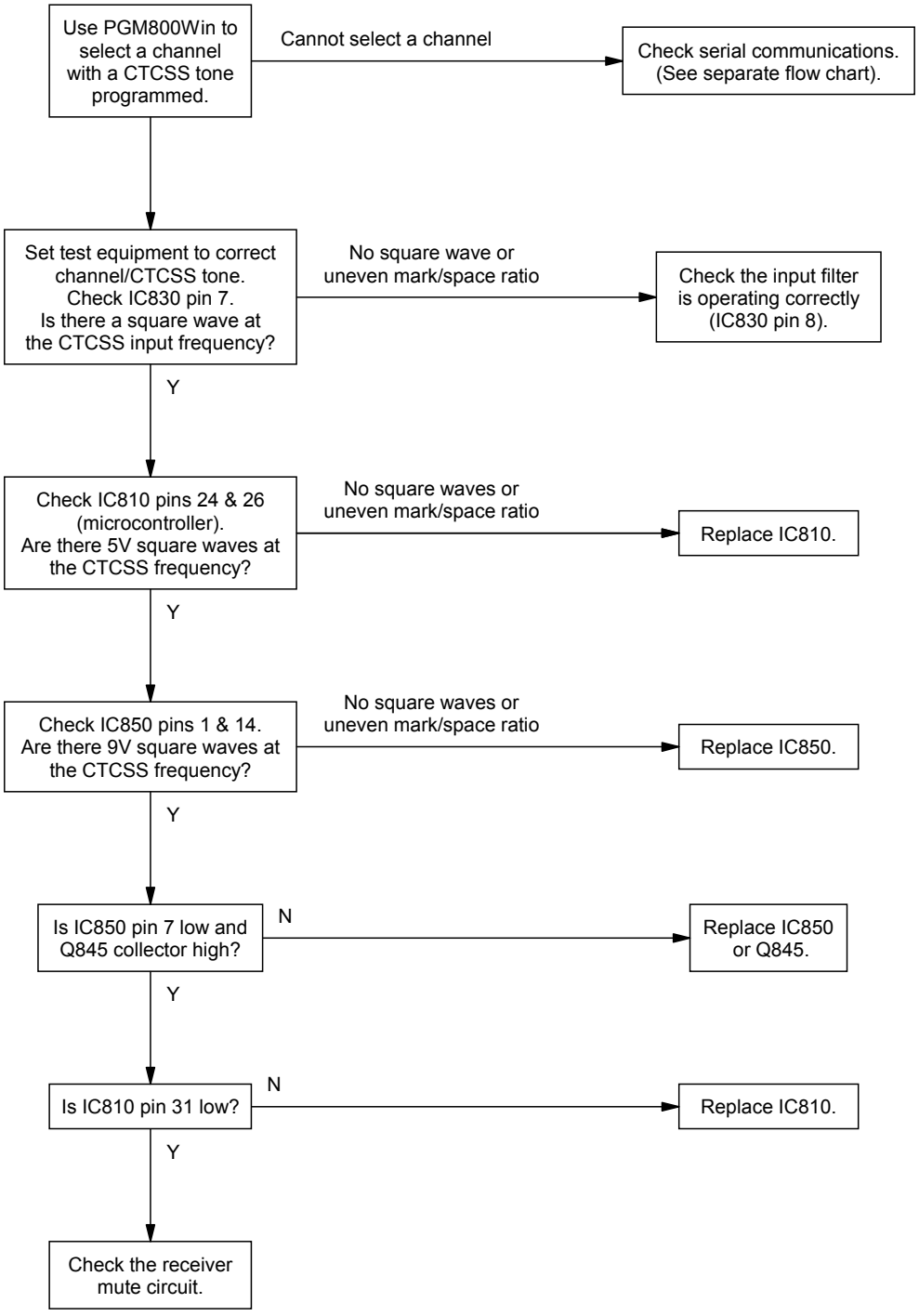
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5.7.1.2 Serial Communication



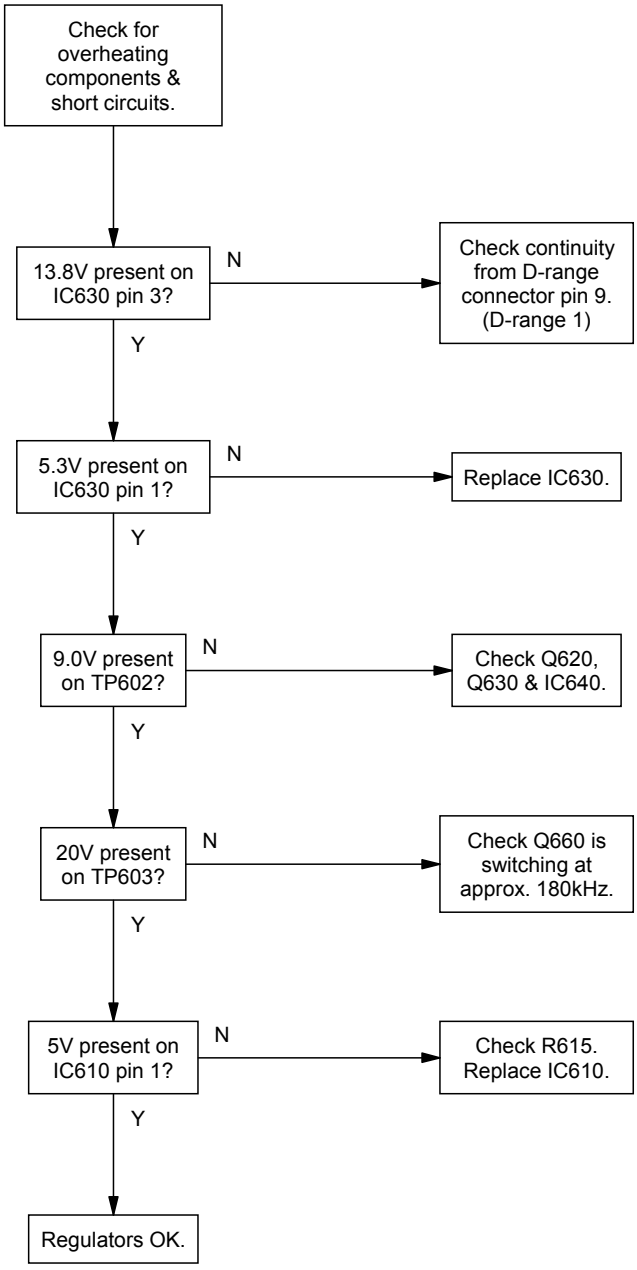
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5.7.1.3 CTCSS Decode



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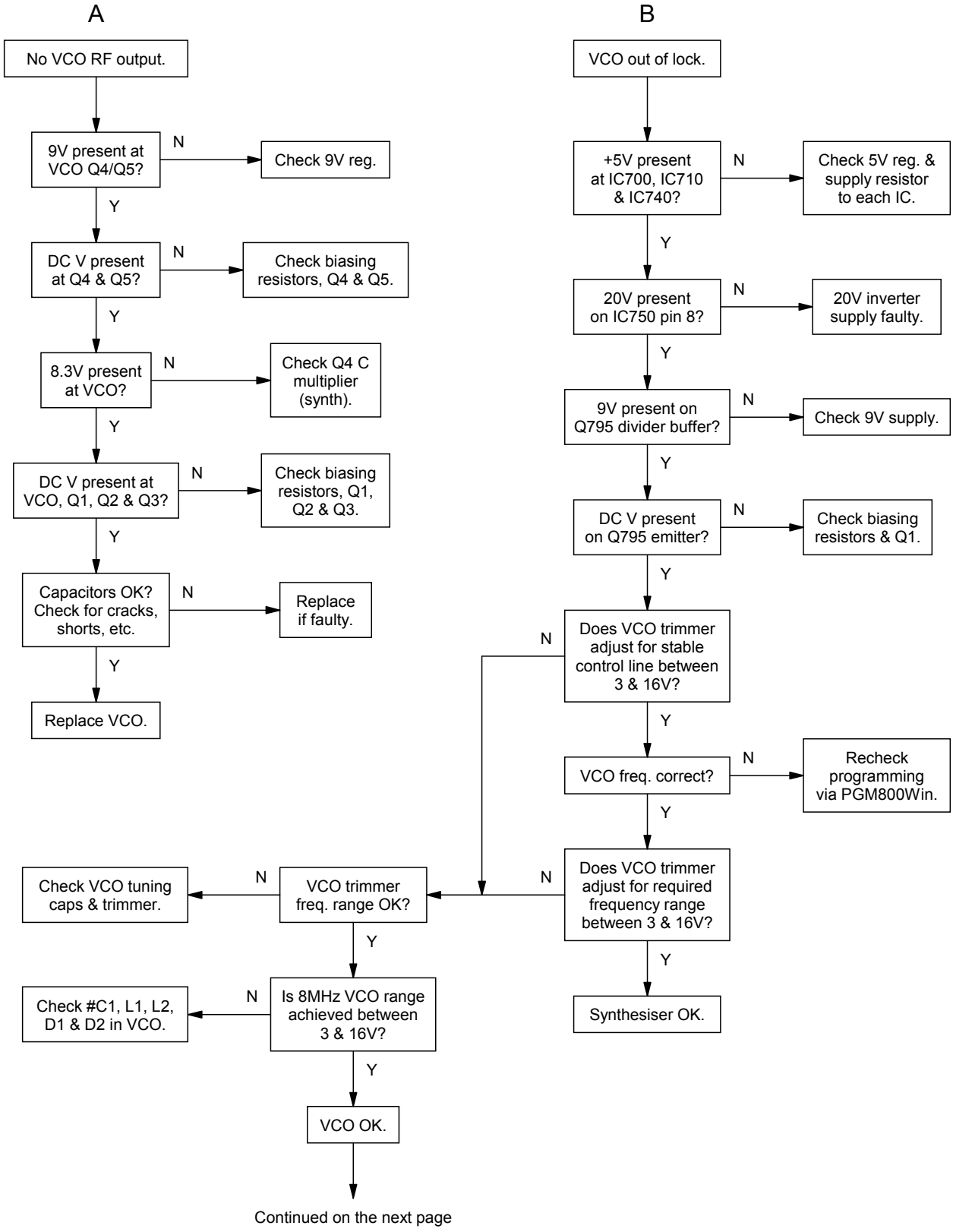
5.7.2 Regulator



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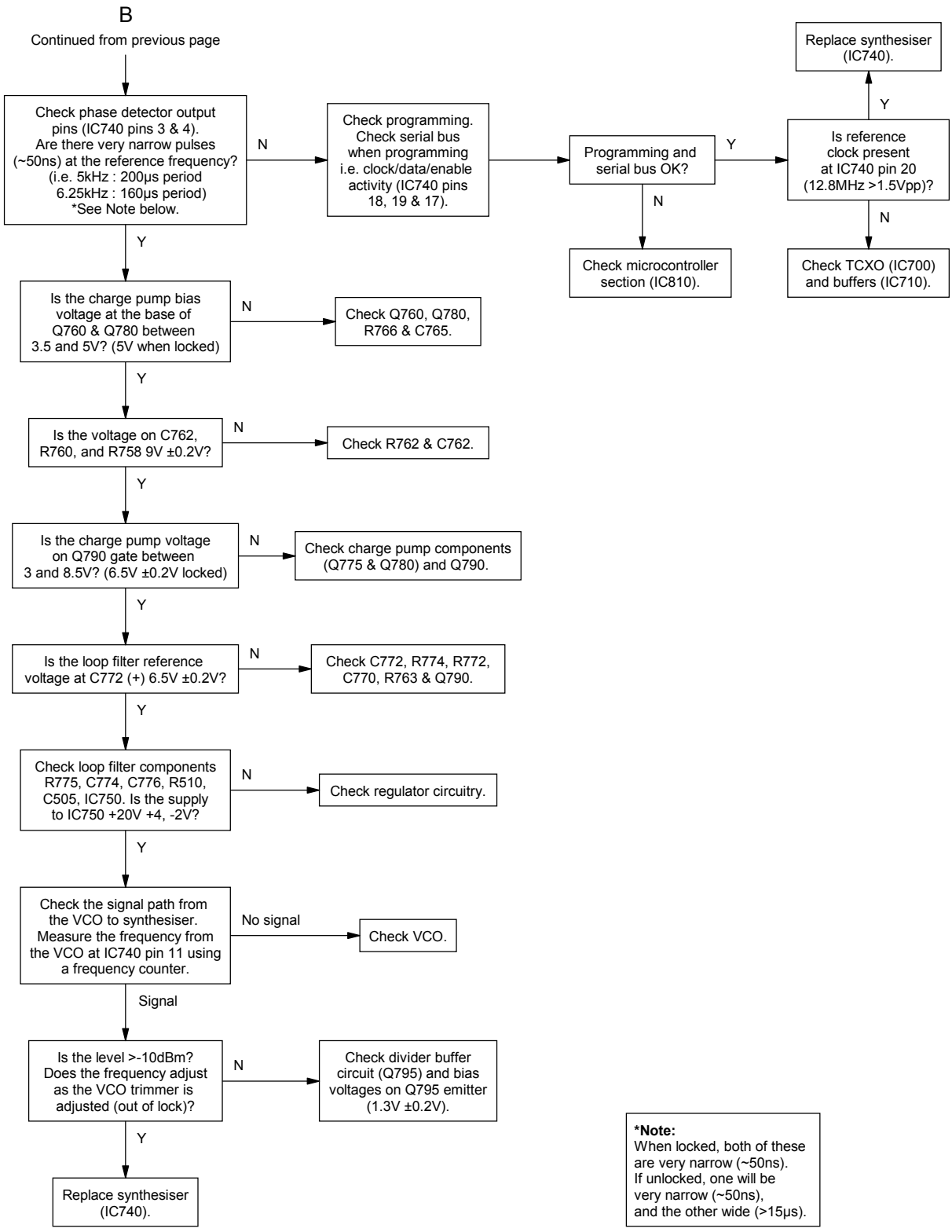
5.7.3 Synthesiser

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



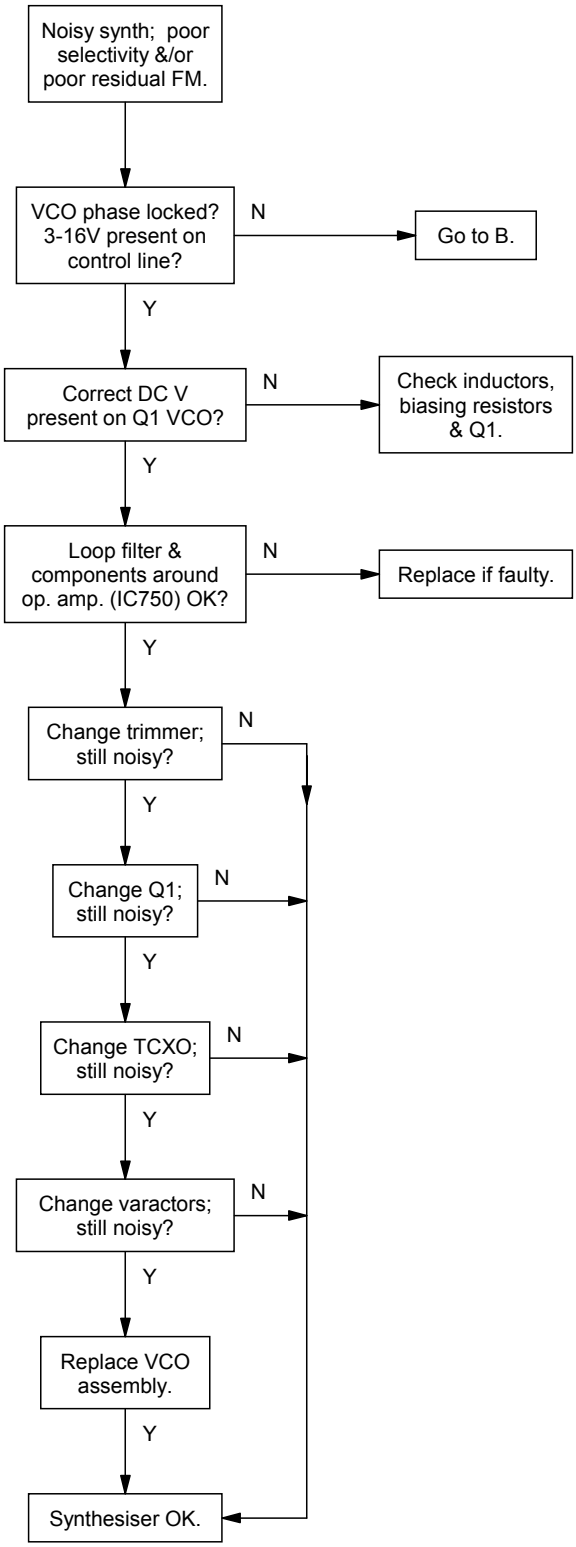
Continued on the next page

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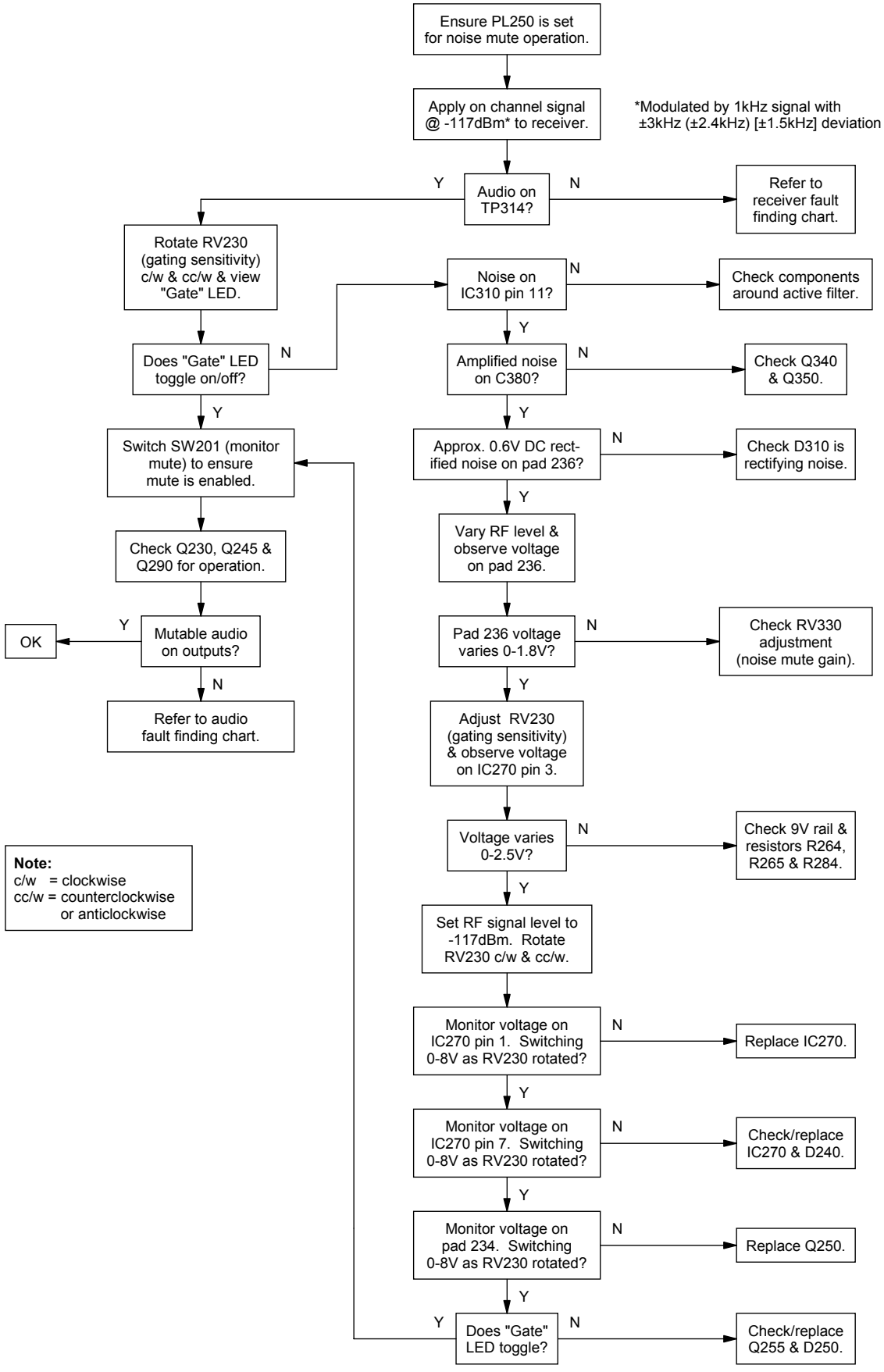
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C



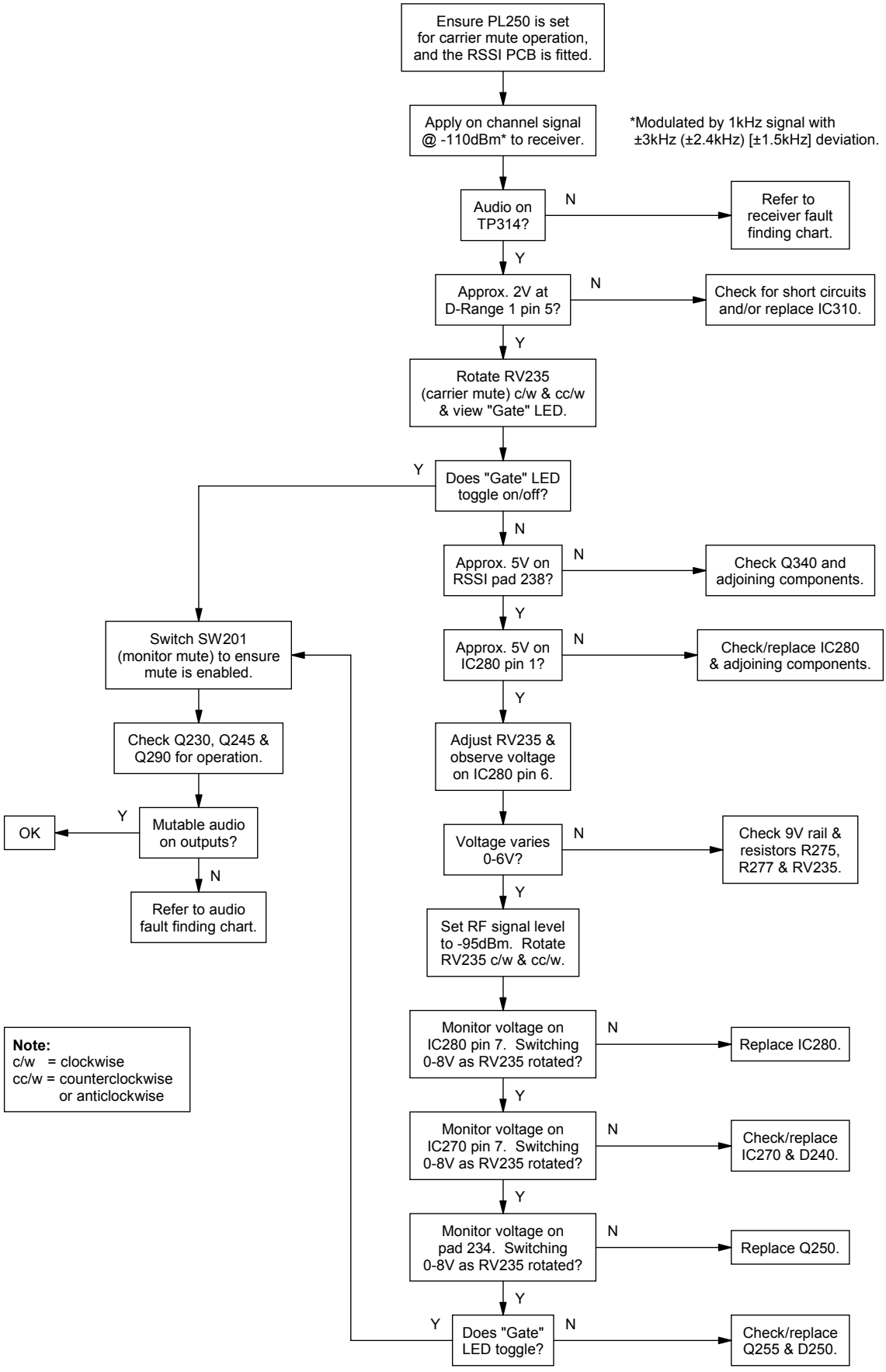
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5.7.4 Noise Mute



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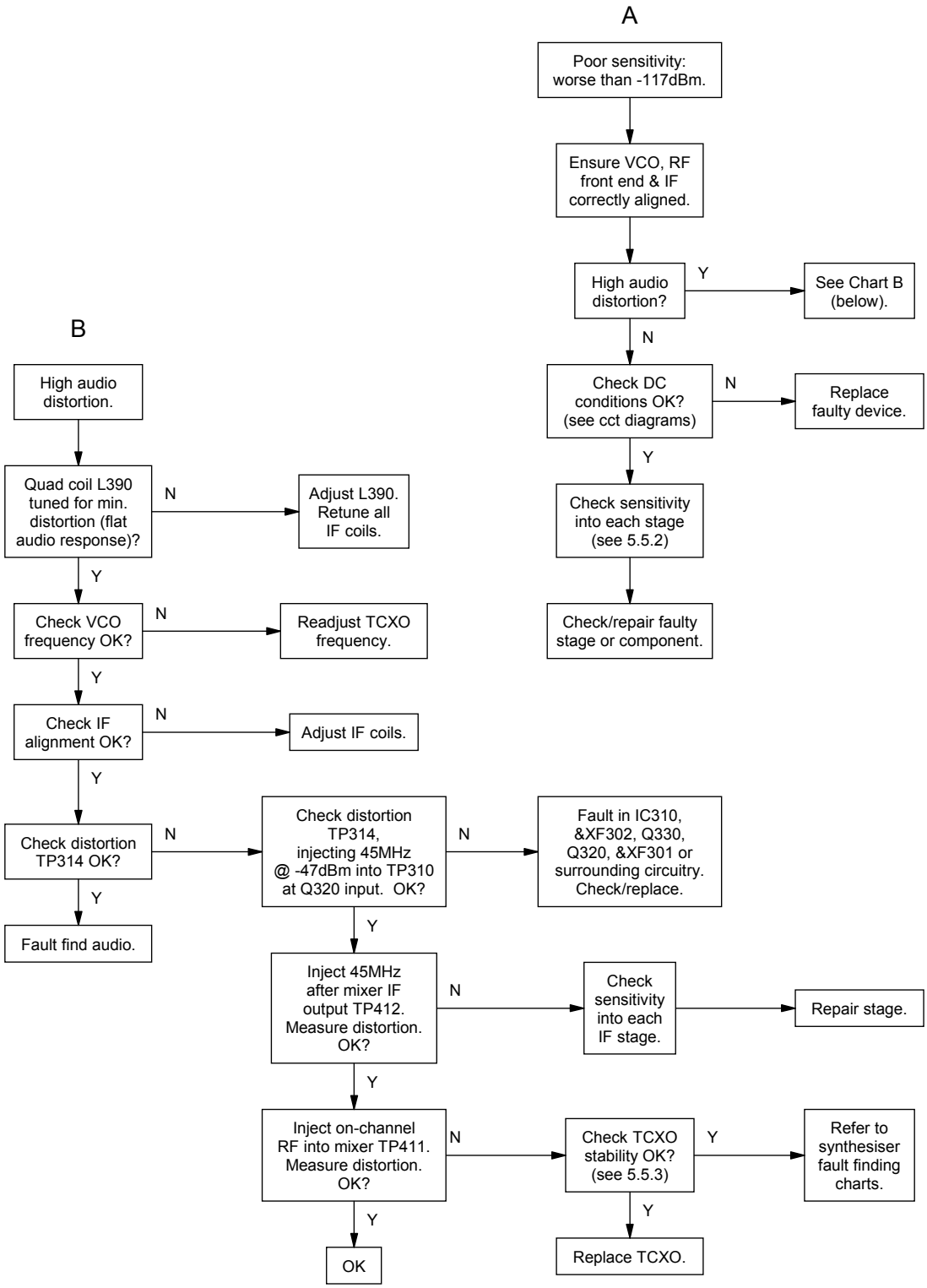
5.7.5 Carrier Mute



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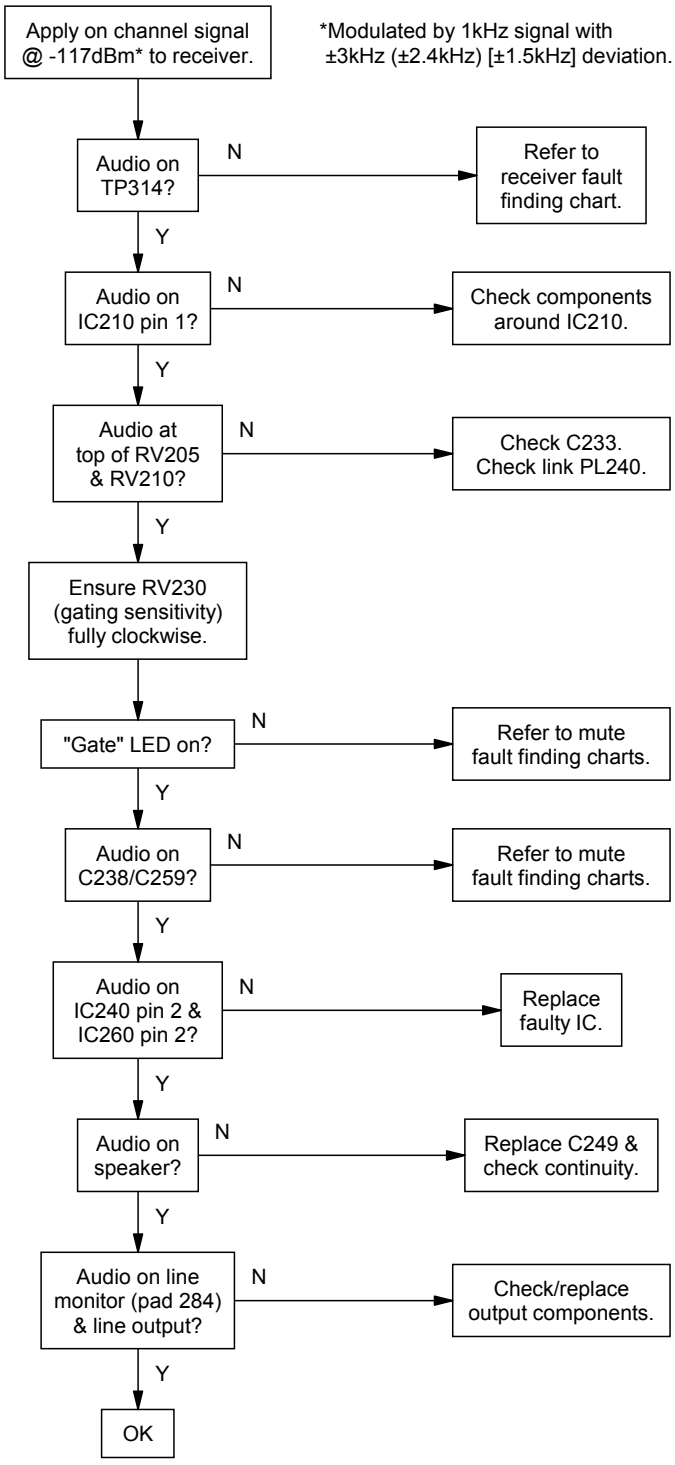
5.7.6 Receiver

Refer to the receiver IF and front end circuit diagrams (sheets 3 and 4) in Section 6.



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5.7.7 Audio



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6 T855 PCB Information

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

This section provides the following information on the T855 receiver:

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

Section	Title	IPN	Page
6.1	**Introduction**		**6.1.3**
6.2	**T800-04-0000 RSSI PCB**	**220-01138-03**	**6.2.1**
6.3	**T855 Receiver PCB**	**220-01396-02** **220-01396-03**	**6.3.1** **6.3.31**

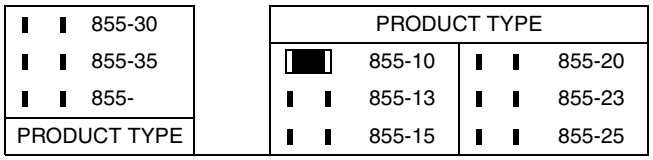
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6.1 Introduction

Product Type Identification

You can identify the receiver type by checking the product code printed on a label on the rear of the chassis (product codes are explained in Section 1 in the front matter of this 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. In this example, the resistor indicates that the product was built as a T855-10-XXXX.



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

PCB Identification

All PCBs are identified by a unique 10 digit "internal part number" (IPN), e.g. 220-01390-02, 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.

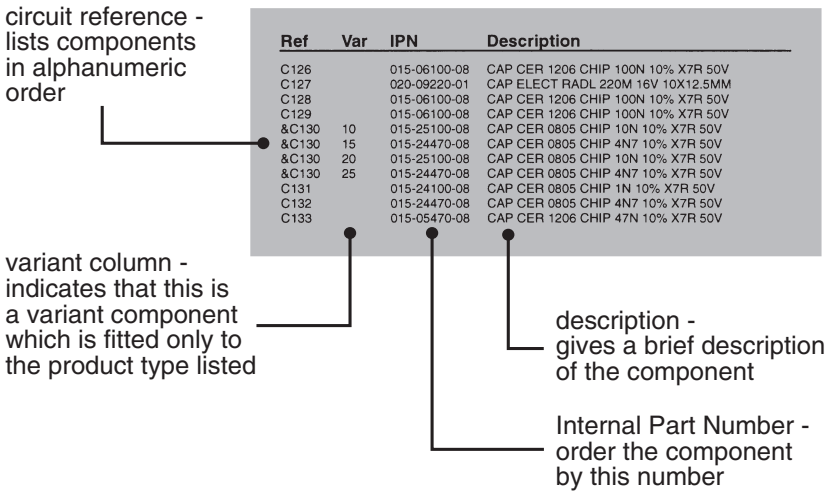
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Parts Lists

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

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

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



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

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).

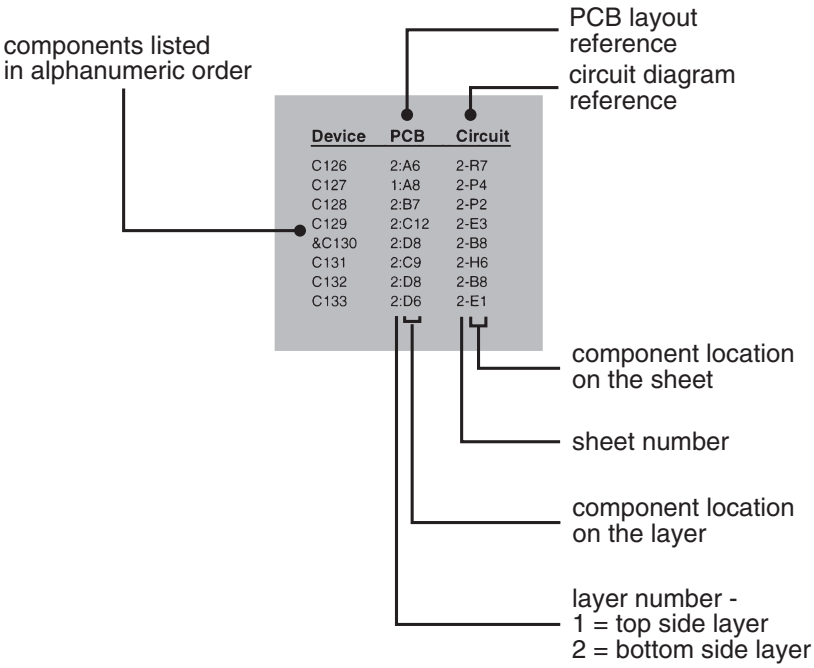
The table below explains the variant prefixes used in T800 SL2 products:

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

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Grid Reference Index

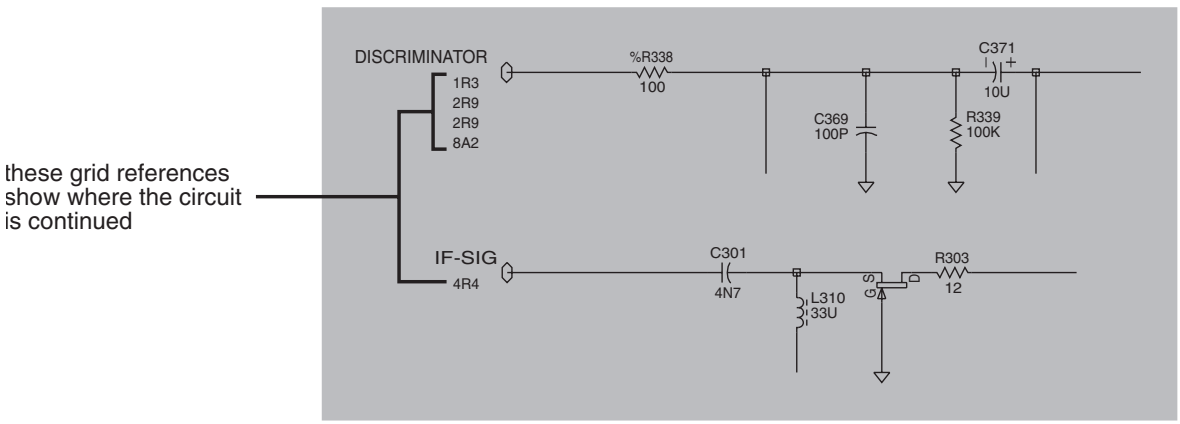
This section contains a component grid reference index to help you find components and labelled pads on the PCB layouts and circuit diagrams. This index lists the components and pads in alphanumeric order, along with the appropriate alphanumeric grid references, as shown below:



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).



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6.2 T800-04-0000 RSSI PCB

This section contains the following information.

IPN	Section	Page
220-01138-03	Parts List	6.2.3
	PCB Layout – Top Side	6.2.5
	PCB Layout – Bottom Side	6.2.6
	Circuit Diagram	6.2.7

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T800-04-0000 Parts List (IPN 220-01138-03)

How To Use This Parts List

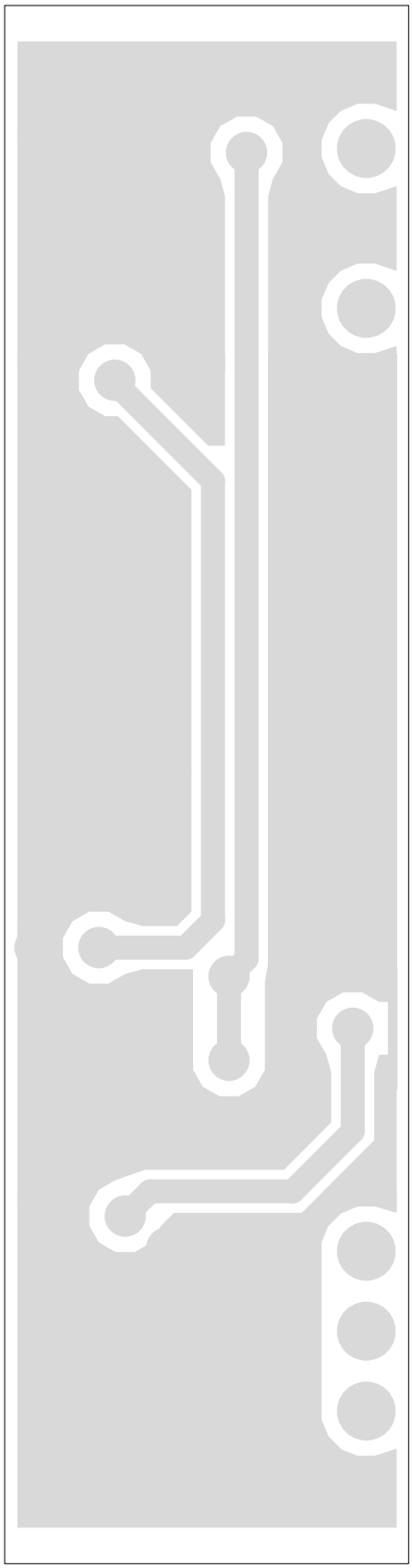
The components listed in this parts list are grouped in alphabetical order and then in numerical order within each group. Each component entry comprises three or four columns: the circuit reference, variant (if applicable), IPN and description. A number in the variant column indicates that this is a variant component which is fitted only to the product type listed.

This parts list is correct at the time of publishing, but is subject to change without notification. An up to date parts list can be obtained from your local Customer Service Organisation

Ref	Var	IPN	Description
C1		015-24100-08	Cap Cer 0805 1n 10% X7r 50v
C2		015-24100-08	Cap Cer 0805 1n 10% X7r 50v
C3		015-23330-08	Cap Cer 0805 330p 10% X7r 50v
C4		015-25100-08	Cap Cer 0805 10n 10% X7r 50v
C5		015-24100-08	Cap Cer 0805 1n 10% X7r 50v
C6		015-25100-08	Cap Cer 0805 10n 10% X7r 50v
C7		015-24470-08	Cap Cer 0805 4n7 10% X7r 50v
C8		015-25100-08	Cap Cer 0805 10n 10% X7r 50v
C9		015-24100-08	Cap Cer 0805 1n 10% X7r 50v
D1		001-10000-99	Diode SMD BAV99 D-Sw SOT23
IC1		002-10003-24	IC SMD 324 4x 0-Amp S014
Q1		002-10033-46	IC SMD MC3346D Xst Aray S014
R3		036-14100-10	Res M/F SMD 0805 1k 1%
R4		036-14220-00	Res M/F SMD 0805 2k2 5%
R5		036-15560-10	Res M/F SMD 0805 56k 1%
R6		036-15390-10	Res M/F SMD 0805 39k 1%
R7		036-15100-10	Res M/F SMD 0805 10k 1%
R8		036-13680-10	Res M/F SMD 0805 680e 1%
R9		036-14820-10	Res M/F SMD 0805 8k2 1%
R10		036-16220-00	Res M/F SMD 0805 220k 5%
R11		036-13470-00	Res M/F SMD 0805 470e 5%
R12		036-16330-00	Res M/F SMD 0805 330k 5%
R13		036-16100-10	Res M/F SMD 0805 100k 1%
R14		036-16180-00	Res M/F SMD 0805 180k 5%
R15		036-15220-00	Res M/F SMD 0805 22k 5%
R16		036-17100-10	Res M/F SMD 0805 1M 1%
R17		036-15330-10	Res M/F SMD 0805 33k 1%
R18		036-14100-10	Res M/F SMD 0805 1k 1%
R19		036-15100-10	Res M/F SMD 0805 10k 1%
R20		036-15100-10	Res M/F SMD 0805 10k 1%
R21		036-16330-00	Res M/F SMD 0805 330k 5%
R22		036-14470-10	Res M/F SMD 0805 4k7 1%
R23		036-15100-10	Res M/F SMD 0805 10k 1%
R24		036-16150-00	Res M/F SMD 0805 150k 5%
R25		036-16180-00	Res M/F SMD 0805 180k 5%
R26		036-15820-00	Res M/F SMD 0805 82k 5%
R29		036-14470-10	Res M/F SMD 0805 4k7 1%
R30		036-15100-10	Res M/F SMD 0805 10k 1%
R31		036-15220-00	Res M/F SMD 0805 22k 5%
R32		036-14470-10	Res M/F SMD 0805 4k7 1%
		369-00020-36	Tape Vinyl Foam 2Side 25.4*3mm
		220-01138-03	PCB T700 RSSI Brd
		356-00010-52	Pin Edge Mtg 0.8mm PCB Wako

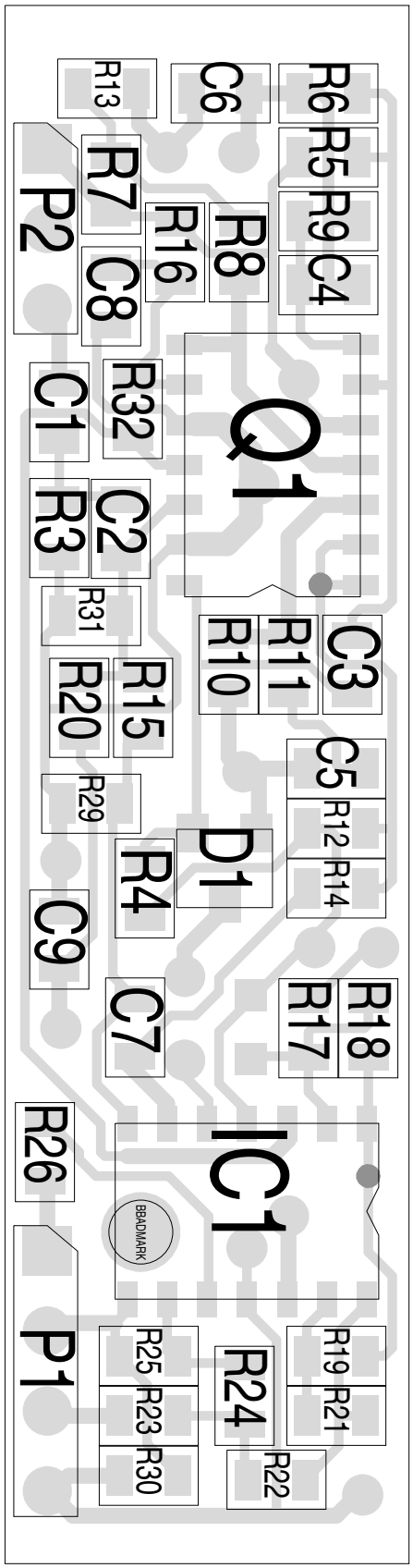
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T800-04-0000 PCB (IPN 220-01138-03) - Top Side

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T800-04-0000 PCB (IPN 220-01138-03) - Bottom Side

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P2
3 EDGE CONN PINS

P1
4 EDGE CONN PINS

+9V-SW
GND
INPUT
REF
O/P
NTC
D1 BAV99
IC1 LM324D
Q1 3346
R1 1K0
R2 1K0
R3 1K0
R4 2K2
R5 56K
R6 39K
R7 10K
R8 680
R9 8K2
R10 220K
R11 470
R12 330K
R13 100K
R14 180K
R15 22K
R16 1M0
R17 33K
R18 1K0
R19 10K
R20 10K
R21 330K
R22 4K7
R23 10K
R24 150K
R25 180K
R26 82K
R29 4K7
R30 10K
R31 22K
R32 4K7
C1 1N0
C2 1N0
C3 330P
C4 10N
C5 1N0
C6 10N
C7 4N7
C8 10N
C9 1N0
V+
V-

BBADMARK
BADMARK

REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE
3A	ECO 770177	M.HALL				
2A	ECO 740091	MJ/TB	M.HALL	M.HALL	JACKSON	24/06/99
1A	ECO 770163 - MIGRATED TO UNICAD.	M.HALL	M.HALL	M.HALL	JACKSON	12/05/99

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T800-04-0000
RSSI BOARD

IPN:	ISSUE:	ID:.
220-01138-03	A	2.SC. 1

PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:	NO.SHEETS:
T700	M.HALL	113803a	24-Aug-99	1

T800-04-0000 RSSI
220-01138-00

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6.3 T855 Receiver PCB

This section contains the following information.

IPN	Section	Page
220-01396-03	Parts List	6.3.3
	Mechanical and 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 and Options Connections – Top Side	6.3.17
	Test Points and Options Connections – Bottom Side	6.3.18
	Receiver Overview Diagram	6.3.19
	Audio Processor Circuit Diagram	6.3.20
	IF Section Circuit Diagram	6.3.21
	Front End Circuit Diagram	6.3.22
	VCO Section Circuit Diagram	6.3.23
	Regulators Circuit Diagram	6.3.24
	Synthesiser Circuit Diagram	6.3.25
	Microcontroller Circuit Diagram	6.3.26
	Harmonic Filter Circuit Diagram	6.3.27

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T855 Parts List (IPN 220-01396-03)

How To Use This Parts List

The components listed in this parts list 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.

This parts list is correct at the time of publishing, but is subject to change without notification. An up to date parts list can be obtained from your local Customer Service Organisation

Ref	Var	IPN	Description
C201		020-08100-04	CAP ELE RA 10M 16V 4X7MM
&C203	10	015-25100-08	CAP CER 0805 10N 10% X7R 50V
&C203	13	015-25100-08	CAP CER 0805 10N 10% X7R 50V
&C203	15	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C203	20	015-25100-08	CAP CER 0805 10N 10% X7R 50V
&C203	23	015-25100-08	CAP CER 0805 10N 10% X7R 50V
&C203	25	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C203	30	015-25100-08	CAP CER 0805 10N 10% X7R 50V
&C203	35	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C205	10	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C205	13	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C205	15	015-25100-08	CAP CER 0805 10N 10% X7R 50V
&C205	20	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C205	23	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C205	25	015-25100-08	CAP CER 0805 10N 10% X7R 50V
&C205	30	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C205	35	015-25100-08	CAP CER 0805 10N 10% X7R 50V
C207		020-07100-02	CAP ELE RA 1M 50V 5X11MM
C209		020-08470-02	CAP ELE RA 47M 16V 6X11MM
C210		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C211		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C213		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C215		015-21220-01	CAP CER 0805 2P2+-1/4P NPO 50V
C217		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C219		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C221		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C222		020-08100-04	CAP ELE RA 10M 16V 4X7MM
C223		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C225		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C227		015-23100-01	CAP CER 0805 100P 5% NPO 50V
C229		020-08100-04	CAP ELE RA 10M 16V 4X7MM
C231		020-08100-04	CAP ELE RA 10M 16V 4X7MM
C233		020-08100-04	CAP ELE RA 10M 16V 4X7MM
C235		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C237		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C238		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C239		020-09100-03	CAP ELE RA 100M 16V 8X11MM
C240A		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C240B		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C240C		020-09220-01	CAP ELE RA 220M 16V 10X12.5MM
C249		020-09470-05	CAP ELE RAD 470M 16V 10X12.5MM
C251		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C253		020-09100-03	CAP ELE RA 100M 16V 8X11MM
C255		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C257		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C259		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C260A		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C260B		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C260C		020-09220-01	CAP ELE RA 220M 16V 10X12.5MM
C261		020-09100-03	CAP ELE RA 100M 16V 8X11MM
C262		020-09100-03	CAP ELE RA 100M 16V 8X11MM
C264		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C266		020-07470-91	CAP ELE RA 4M7 63V 6X11MM BI-P
C268		020-07470-91	CAP ELE RA 4M7 63V 6X11MM BI-P
C270		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C272		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C274		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C276		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C278		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C280		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C286		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C302		015-23100-01	CAP CER 0805 100P 5% NPO 50V
C306		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C308		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C310		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C312		020-58100-03	CAP ELE AI RDL 10M 50V 5X11MM
C314		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C316		015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C318	10	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C318	13	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C318	15	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C318	20	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C318	23	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C318	25	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C318	30	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C318	35	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C320	10	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C320	13	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C320	15	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C320	20	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C320	23	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C320	25	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C320	30	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C320	35	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C322	10	015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C322	13	015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C322	15	015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C322	20	015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C322	23	015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C322	25	015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C322	30	015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C322	35	015-22150-01	CAP CER 0805 15P 5% NPO 50V
&C324	10	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C324	13	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C324	15	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C324	20	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C324	23	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C324	25	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C324	30	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C324	35	015-21390-01	CAP CER 0805 3P9+-1/4P NPO 50V
&C326	10	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C326	13	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C326	15	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C326	20	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C326	23	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C326	25	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C326	30	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
&C326	35	015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
C328		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C330		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C331		015-21220-01	CAP CER 0805 2P2+-1/4P NPO 50V
C332		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C334	10	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C334	13	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C334	15	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C334	20	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C334	23	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C334	25	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C334	30	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C334	35	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C336	10	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C336	13	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C336	15	015-22100-01	CAP CER 0805 10P+-1/2P NPO 50V
&C336	20	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C336	23	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C336	25	015-22100-01	CAP CER 0805 10P+-1/2P NPO 50V
&C336	30	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C336	35	015-22100-01	CAP CER 0805 10P+-1/2P NPO 50V
&C338	10	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C338	13	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C338	15	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C338	20	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C338	23	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C338	25	015-22100-01	CAP CER 0805 10P+-1/2P NPO 50V
&C338	30	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C338	35	015-22120-01	CAP CER 0805 12P 5% NPO 50V
&C340	10	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C340	13	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C340	15	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C340	20	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C340	23	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C340	25	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
&C340	30	015-22470-01	CAP CER 0805 47P 5% NPO 50V
&C340	35	015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C342		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C344		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C346		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C347		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C348		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C349		015-21270-01	CAP CER 0805 2P7+-1/4P NPO 50V
C350		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C352		015-22270-01	CAP CER 0805 27P 5% NPO 50V
C354		025-08100-04	(L) CAP10M 35V 10%TANT2.5L/S
C355		025-08100-04	(L) CAP10M 35V 10%TANT2.5L/S
C356		015-22120-01	CAP CER 0805 12P 5% NPO 50V
C357		015-25100-08	CAP CER 0805 10N 10% X7R 50V

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Ref	Var	IPN	Description
C358		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C359		025-08100-04	(L) CAP10M 35V 10%TANT2.5L/S
C360		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C361		015-26100-08	CAP CER 0805 100N 10% X7R 50V
C362		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C364		015-22390-01	CAP CER 0805 39P 5% NPO 50V
C366		015-22390-01	CAP CER 0805 39P 5% NPO 50V
C367		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C368		015-05470-08	CAP CER 1206 47N 10% X7R 50V
C370		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C372		015-05470-08	CAP CER 1206 47N 10% X7R 50V
C374		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C376		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C378		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C380		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C382		020-58100-03	CAP ELE AI RDL 10M 50V 5X11MM
C384		015-05470-08	CAP CER 1206 47N 10% X7R 50V
C386		015-05470-08	CAP CER 1206 47N 10% X7R 50V
C388		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C390		025-08100-02	CAP TANT BEAD 10M 10% 16V
C392		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C394		015-05470-08	CAP CER 1206 47N 10% X7R 50V
C410		015-21180-01	CAP CER 0805 1P8+-1/4P NPO 50V
C420		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C430		015-23100-01	CAP CER 0805 100P 5% NPO 50V
C440		020-58100-03	CAP ELE AI RDL 10M 50V 5X11MM
C450		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C470		015-22100-01	CAP CER 0805 10P+-1/2P NPO 50V
C480		015-22560-01	CAP CER 0805 56P 5% NPO 50V
C505		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C515		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C530		014-08220-01	(L)CAP TANT 22UF10V276MSER
C535		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C610A		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C610B		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C611A		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C611B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C623		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C625		020-09470-07	CAPEL470M16V20%V 8*20 3.5L.ESR
C626		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C628		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C630		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C631A		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C631B		025-08100-02	CAP TANT BEAD 10M 10% 16V
C637		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C640		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C651		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C658		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C660		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C665		020-58100-03	CAP ELE AI RDL 10M 50V 5X11MM
C670		025-07330-01	CAP TANT BEAD 3M3 35V
C673		015-24470-08	CAP CER 0805 4N7 10% X7R 50V
C677		020-07100-02	CAP ELE RA 1M 50V 5X11MM
C681		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C684		025-08100-02	CAP TANT BEAD 10M 10% 16V
C687		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C690		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C693		025-08100-02	CAP TANT BEAD 10M 10% 16V
C700		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C702		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C703		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C705		015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
C707		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C708		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C709		015-22100-01	CAP CER 0805 10P+-1/2P NPO 50V
C710A		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C710B		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C710C		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C711		015-22220-01	CAP CER 0805 22P 5% NPO 50V
C712		015-22220-01	CAP CER 0805 22P 5% NPO 50V
C713		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C735		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C736		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C740A		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C740B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C741A		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C741B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C742A		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C742B		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C743		015-22470-01	CAP CER 0805 47P 5% NPO 50V
C745		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C750		025-08100-03	CAP 10M 35V 20% TANT 5MM L/S
C757		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C759		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C761		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C762		014-08220-01	(L)CAP TANT 22UF10V276MSER
C764		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C765		014-07470-00	CAP TANT CHIP 4U7 3.5 X 2.8MM
C767		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C769		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C770		014-08220-01	(L)CAP TANT 22UF10V276MSER
C772		014-08220-01	(L)CAP TANT 22UF10V276MSER
C774		022-06100-16	CAP METAL POLY 100N +-10% 100V
C776		015-24680-08	CAP CER 0805 6N8 10% X7R 50V
C782		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C784		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C786		015-06100-08	CAP CER 1206 100N 10% X7R 50V
C788		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C791		015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
C792		015-23120-01	CAP CER 0805 120P 5% NPO 50V
C810		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C812		015-23100-01	CAP CER 0805 100P 5% NPO 50V
C813		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C814		015-24100-08	CAP CER 0805 1N 10% X7R 50V
C815		015-05100-07	CAP 1206 CHIP NPO 10nF 25V
C816		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C818		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C819		015-22330-01	CAP CER 0805 33P 5% NPO 50V
C820		015-23220-01	CAP CER 0805 220P 5% NPO 50V
C822		015-25220-08	CAP CER 0805 22N 10% X7R 50V
C824		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C826		015-05100-07	CAP 1206 CHIP NPO 10nF 25V
C828		015-05100-07	CAP 1206 CHIP NPO 10nF 25V
C830		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C832		016-07100-01	CAP EL 6X4 1M 20% 50V
C833		015-25220-08	CAP CER 0805 22N 10% X7R 50V
C834		015-25100-08	CAP CER 0805 10N 10% X7R 50V
C836		015-05100-07	CAP 1206 CHIP NPO 10nF 25V
C837		015-05100-07	CAP 1206 CHIP NPO 10nF 25V
C838		015-05100-07	CAP 1206 CHIP NPO 10nF 25V
C840		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C842		016-07100-01	CAP EL 6X4 1M 20% 50V
C844		016-07100-01	CAP EL 6X4 1M 20% 50V
C846		016-07100-01	CAP EL 6X4 1M 20% 50V
C848		016-07100-01	CAP EL 6X4 1M 20% 50V
C850		015-25470-08	CAP CER 0805 47N 10% X7R 50V
C873		015-25220-08	CAP CER 0805 22N 10% X7R 50V
C876		020-09100-04	CAP ELE RA 100M 10V 6.3X9MM
C879		020-08100-04	CAP ELE RA 10M 16V 4X7MM
C910		015-21330-01	CAP CER 0805 3P3+-1/4P NPO 50V
C920		015-21680-01	CAP CER 0805 6P8+-1/4P NPO 50V
C930		015-21820-01	CAP CER 0805 8P2+-1/4P NPO 50V
C940		015-21680-01	CAP CER 0805 6P8+-1/4P NPO 50V
C950		015-21330-01	CAP CER 0805 3P3+-1/4P NPO 50V
D111		001-00011-60	S) DIODE MR750 OR SR2607
D220		001-10000-56	S) DIODE SMD BAW56 D-SW SOT23
D230		001-10000-70	S) DIODE SMD BAV70 D-SW SOT23
D240		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23
D250		008-00014-79	S)LED 3MM RED WITH WIRE
D260		001-10084-33	S)DIODE ZENSMD BZX84C3V3 SOT23
D270		001-10000-70	S) DIODE SMD BAV70 D-SW SOT23
D280		008-00014-80	S)LED 3MM GREEN WITH WIRE
D285		001-00011-70	S) DIODE 1N4001 1A/50V
D289		001-00011-70	S) DIODE 1N4001 1A/50V
D290		001-00011-70	S) DIODE 1N4001 1A/50V
D295		001-00011-70	S) DIODE 1N4001 1A/50V
D310		001-10000-56	S) DIODE SMD BAW56 D-SW SOT23
D350		001-10000-17	S) DIODE SMD DUAL BAT-17 SOT23
D610		001-10000-99	S) DIODE SMD BAV99 D-SW SOT23
D640		001-10000-70	S) DIODE SMD BAV70 D-SW SOT23
D730		001-10065-00	DIODE SHTKY SOD123 BAT65 BAT54
D740		001-10065-00	DIODE SHTKY SOD123 BAT65 BAT54
D820		001-10065-00	DIODE SHTKY SOD123 BAT65 BAT54
D860		001-10000-70	S) DIODE SMD BAV70 D-SW SOT23
D880		001-10000-70	S) DIODE SMD BAV70 D-SW SOT23
#FL410	10	051-00576-00	COIL HELIC 400-440MHz T855SII
#FL410	13	051-00576-00	COIL HELIC 400-440MHz T855SII
#FL410	15	051-00576-00	COIL HELIC 400-440MHz T855SII
#FL410	20	051-00577-00	COIL HELIC 440-480MHz T855SII
#FL410	23	051-00577-00	COIL HELIC 440-480MHz T855SII
#FL410	25	051-00577-00	COIL HELIC 440-480MHz T855SII
#FL410	30	051-00578-00	COIL HELIC 480-530MHz T855SII
#FL410	35	051-00578-00	COIL HELIC 480-530MHz T855SII
#FL420	10	051-00576-00	COIL HELIC 400-440MHz T855SII
#FL420	13	051-00576-00	COIL HELIC 400-440MHz T855SII
#FL420	15	051-00576-00	COIL HELIC 400-440MHz T855SII
#FL420	20	051-00577-00	COIL HELIC 440-480MHz T855SII
#FL420	23	051-00577-00	COIL HELIC 440-480MHz T855SII
#FL420	25	051-00577-00	COIL HELIC 440-480MHz T855SII
#FL420	30	051-00578-00	COIL HELIC 480-530MHz T855SII
#FL420	35	051-00578-00	COIL HELIC 480-530MHz T855SII
IC210		002-00012-40	S) IC 358 DUAL O-AMP
IC240		002-00014-05	S) IC TDA7231 1.6W AF PWR
IC260		002-00014-05	S) IC TDA7231 1.6W AF PWR
IC270		002-00012-40	S) IC 358 DUAL O-AMP
IC280		002-00012-40	S) IC 358 DUAL O-AMP
IC310		002-00014-73	S) IC MC3361CP IF AMP
IC320		002-00014-58	S) IC 78L05 5V 100MA REG TO92
IC410		002-00022-01	S)MIXER DBLE TAK BLNCD2-750MHZ
IC610		002-00014-58	S) IC 78L05 5V 100MA REG TO92
IC630		002-00014-62	S) IC 317L 100MA REG 3TER TO92
IC640		002-10003-58	S) IC SMD LM358 DUAL O-AMP
IC650		002-10012-32	SMD DS1232LPS-2 LP RESET&W-DOG
=IC700		539-00010-50	TCXO 12.8MHZ +-1PPM -20 +70C
IC710		002-74900-04	S) IC SMD 74HC04D 6X INV BUFFD
IC740		002-14519-10	S) IC MC145191F SMD SYNTH
IC750		002-10330-78	S) IC MC33078D 2X AMP LO NOISE
IC810		002-08951-20	S) IC AT89C51 PLCC44 MIC 12MHZ
IC820		002-12416-00	S)IC SMD AT24C16N-10SC EEPROM
IC830		002-10003-24	S) IC SMD 324 4X O-AMP SO14
IC840		002-10040-53	S)MC14053B SMD BREAK B4 MAKE
IC850		002-10003-24	S) IC SMD 324 4X O-AMP SO14

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Ref	Var	IPN	Description
L230		056-00021-02	IND FXD 100UH AX
L310		050-00016-22	COIL TAIT NO 622 20-120M
L320		050-00016-22	COIL TAIT NO 622 20-120M
L330		050-00016-22	COIL TAIT NO 622 20-120M
L340		050-00016-22	COIL TAIT NO 622 20-120M
L350		050-00016-22	COIL TAIT NO 622 20-120M
L360		050-00016-22	COIL TAIT NO 622 20-120M
L370		050-00016-22	COIL TAIT NO 622 20-120M
L380		050-00016-22	COIL TAIT NO 622 20-120M
L385		050-00016-22	COIL TAIT NO 622 20-120M
L390		050-00016-31	COIL TAIT NO 631 455KHZ
L420		056-00021-04	IND FXD 330NH AX
L440		056-00021-04	IND FXD 330NH AX
L740		052-08125-15	COIL A/W 1.5T/2.5MM HOR 0.8MM
L910		052-08125-25	COIL A/W 2.5T/2.5MM HOR 0.8MM
L920		052-08140-15	COIL A/W 1.5T/4.0MM HOR 0.8MM
L930		052-08140-15	COIL A/W 1.5T/4.0MM HOR 0.8MM
L940		052-08125-25	COIL A/W 2.5T/2.5MM HOR 0.8MM
PL200		240-00020-72	HEADER 2W PCB MG ULTREX
PL210		240-00020-59	HEADER 3 W 1 R PCB MTG
PL220		240-00020-59	HEADER 3 W 1 R PCB MTG
PL230		240-00020-63	HEADER 4 W X1R PCB MTG
PL240		240-00020-58	HEADER 5 WX1 R PCB MTG
PL250		240-00020-59	HEADER 3 W 1 R PCB MTG
PL260		240-00020-59	HEADER 3 W 1 R PCB MTG
PL270		240-00020-59	HEADER 3 W 1 R PCB MTG
Q210		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q220		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q230		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q240		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q245		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q250		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q255		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q260		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q270		000-10008-17	S) XSTR SMD BC817-25 NPN SOT23
Q280		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q290		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q310		000-50020-18	S) XSTR AI BF247A JFETTO92 VHF
Q320		000-10008-92	S) XSTR SMD BFS17 NPN SOT23
Q350		000-10009-91	S) XSTR SMD BF991 DG MFET
Q340		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q350		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q360		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q410		000-10057-10	S) XSTR SMD BR571 NPN SOT23
Q540		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q620		000-00012-15	S) XSTR BD234 PNP AF PWR TO126
Q630		000-50011-30	S) XSTR AI BC557B PNP TO92 AF
Q660		000-10008-17	S) XSTR SMD BC817-25 NPN SOT23
Q670		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q750		000-10008-07	S) XSTR SMD BC807 PNP SOT23 AF
Q760		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q770		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q775		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q780		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q785		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q790		000-10003-12	S) XSTR SMD BFR31 N JFET SOT23
Q795		000-10057-10	S) XSTR SMD BR571 NPN SOT23
Q810		000-10008-17	S) XSTR SMD BC817-25 NPN SOT23
Q820		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q840		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q850		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q860		000-10008-57	S) XSTR SMD BCW70 PNP SOT23 SS
Q870		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q880		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q890		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
Q895		000-10008-48	S) XSTR SMD BCW60 NPN SOT23 SS
R160		036-12100-00	RES M/F 0805 10E 5%
R201		036-14470-00	RES M/F 0805 4K7 5%
&R202	10	036-14470-00	RES M/F 0805 4K7 5%
&R202	13	036-14470-00	RES M/F 0805 4K7 5%
&R202	15	036-14330-00	RES M/F 0805 3K3 5%
&R202	20	036-14470-00	RES M/F 0805 4K7 5%
&R202	23	036-14470-00	RES M/F 0805 4K7 5%
&R202	25	036-14330-00	RES M/F 0805 3K3 5%
&R202	30	036-14470-00	RES M/F 0805 4K7 5%
&R202	35	036-14330-00	RES M/F 0805 3K3 5%
R204		036-15100-00	RES M/F 0805 10K 5%
R205		036-16220-00	RES M/F 0805 220K 5%
R207		036-14820-00	RES M/F 0805 8K2 5%
&R209	10	036-15220-00	RES M/F 0805 22K 5%
&R209	13	036-15220-00	RES M/F 0805 22K 5%
&R209	15	036-15180-00	RES M/F 0805 18K 5%
&R209	20	036-15220-00	RES M/F 0805 22K 5%
&R209	23	036-15220-00	RES M/F 0805 22K 5%
&R209	25	036-15180-00	RES M/F 0805 18K 5%
&R209	30	036-15220-00	RES M/F 0805 22K 5%
&R209	35	036-15180-00	RES M/F 0805 18K 5%
R210		036-15150-00	RES M/F 0805 15K 5%
R211		036-15390-00	RES M/F 0805 39K 5%
R213		036-14270-00	RES M/F 0805 2K7 5%
R215		036-15150-00	RES M/F 0805 15K 5%
R218		036-14390-00	RES M/F 0805 3K9 5%
&R219	10	036-14820-00	RES M/F 0805 8K2 5%
&R219	13	036-14820-00	RES M/F 0805 8K2 5%
&R219	15	036-14470-00	RES M/F 0805 4K7 5%

Ref	Var	IPN	Description
&R219	20	036-14820-00	RES M/F 0805 8K2 5%
&R219	23	036-14820-00	RES M/F 0805 8K2 5%
&R219	25	036-14470-00	RES M/F 0805 4K7 5%
&R219	30	036-14820-00	RES M/F 0805 8K2 5%
&R219	35	036-14470-00	RES M/F 0805 4K7 5%
R221		036-15470-00	RES M/F 0805 47K 5%
R222		036-16100-00	RES M/F 0805 100K 5%
%R223		036-12100-00	RES M/F 0805 10E 5%
R224		036-14390-00	RES M/F 0805 3K9 5%
R225		036-13470-00	RES M/F 0805 470E 5%
R227		036-14100-00	RES M/F 0805 1K 5%
R229		036-14470-00	RES M/F 0805 4K7 5%
R230		036-14470-00	RES M/F 0805 4K7 5%
R232		036-15470-00	RES M/F 0805 47K 5%
R233		036-14820-00	RES M/F 0805 8K2 5%
R234		036-15470-00	RES M/F 0805 47K 5%
R236		036-15470-00	RES M/F 0805 47K 5%
R238		036-11470-00	RES M/F 0805 4E7 10%
R239		036-14100-00	RES M/F 0805 1K 5%
R241		036-14100-00	RES M/F 0805 1K 5%
R242		036-13100-00	RES M/F 0805 100E 5%
R244		036-14680-00	RES M/F 0805 6K8 5%
R245		036-14100-00	RES M/F 0805 1K 5%
R247		036-14220-00	RES M/F 0805 2K2 5%
R249		036-15100-00	RES M/F 0805 10K 5%
R251		036-15390-00	RES M/F 0805 39K 5%
R252		036-14470-00	RES M/F 0805 4K7 5%
R254		036-14820-00	RES M/F 0805 8K2 5%
R255		036-15470-00	RES M/F 0805 47K 5%
R256		036-14470-00	RES M/F 0805 4K7 5%
R258		036-15470-00	RES M/F 0805 47K 5%
R260		036-11470-00	RES M/F 0805 4E7 10%
R261		036-13150-00	RES M/F 0805 150E 5%
R262		036-14100-00	RES M/F 0805 1K 5%
R264		036-15270-00	RES M/F 0805 27K 5%
R265		036-13100-00	RES M/F 0805 100E 5%
R266		036-15220-00	RES M/F 0805 22K 5%
R267		036-16330-00	RES M/F 0805 330K 5%
R269		036-14220-00	RES M/F 0805 2K2 5%
R271		036-16100-00	RES M/F 0805 100K 5%
R272		036-15470-00	RES M/F 0805 47K 5%
R273		036-15150-00	RES M/F 0805 15K 5%
R275		036-13100-00	RES M/F 0805 100E 5%
R277		036-14560-00	RES M/F 0805 5K6 5%
R278		036-16220-00	RES M/F 0805 220K 5%
R280		036-16100-00	RES M/F 0805 100K 5%
R281		036-14470-00	RES M/F 0805 4K7 5%
R282		036-16100-00	RES M/F 0805 100K 5%
R284		036-13100-00	RES M/F 0805 100E 5%
R285		036-15470-00	RES M/F 0805 47K 5%
R287		036-15100-00	RES M/F 0805 10K 5%
R288		036-14470-00	RES M/F 0805 4K7 5%
R289		036-14680-00	RES M/F 0805 6K8 5%
R290		036-14100-00	RES M/F 0805 1K 5%
R292		036-14680-00	RES M/F 0805 6K8 5%
R293		036-13560-00	RES M/F 0805 560E 5%
R294		036-14100-00	RES M/F 0805 1K 5%
R295		036-14680-00	RES M/F 0805 6K8 5%
R296		036-14120-00	RES M/F 0805 1K2 5%
R297		030-52100-20	RES FILM AI 10E 5% 0.4W 4X1.6
R298		036-15470-00	RES M/F 0805 47K 5%
R299		036-15470-00	RES M/F 0805 47K 5%
R302		036-12390-00	RES M/F 0805 39E 5%
R304		036-14270-00	RES M/F 0805 2K7 5%
R306		036-12100-00	RES M/F 0805 10E 5%
R308		036-12100-00	RES M/F 0805 10E 5%
R310		036-10000-00	RES M/F 0805 ZERO OHM
R312		036-14330-00	RES M/F 0805 3K3 5%
R314		036-14470-00	RES M/F 0805 4K7 5%
R316		036-12470-00	RES M/F 0805 47E 5%
R318		036-15100-00	RES M/F 0805 10K 5%
R320		036-14390-00	RES M/F 0805 3K9 5%
R322		036-14820-00	RES M/F 0805 8K2 5%
R323		036-15100-00	RES M/F 0805 10K 5%
R324		036-15220-00	RES M/F 0805 22K 5%
R326		036-15100-00	RES M/F 0805 10K 5%
R328		036-14100-00	RES M/F 0805 1K 5%
R330		036-12470-00	RES M/F 0805 47E 5%
R332		036-13330-00	RES M/F 0805 330E 5%
R334		045-03150-01	RES NTC 150E 0.5W 5MM DISC
R336		036-13470-00	RES M/F 0805 470E 5%
R337		036-13220-00	RES M/F 0805 220E 5%
R338		036-14100-00	RES M/F 0805 1K 5%
R339		036-15100-00	RES M/F 0805 10K 5%
R340		036-10000-00	RES M/F 0805 ZERO OHM
R341		036-10000-00	RES M/F 0805 ZERO OHM
&R344	10	036-15560-00	RES M/F 0805 56K 5%
&R344	13	036-15560-00	RES M/F 0805 56K 5%
&R344	15	036-15820-00	RES M/F 0805 82K 5%
&R344	20	036-15560-00	RES M/F 0805 56K 5%
&R344	23	036-15560-00	RES M/F 0805 56K 5%
&R344	25	036-15820-00	RES M/F 0805 82K 5%
&R344	30	036-15560-00	RES M/F 0805 56K 5%
&R344	35	036-15820-00	RES M/F 0805 82K 5%
R346		036-12100-00	RES M/F 0805 10E 5%
R348		036-13220-00	RES M/F 0805 220E 5%
R350		036-15180-00	RES M/F 0805 18K 5%
R351		036-15100-00	RES M/F 0805 10K 5%

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Ref	Var	IPN	Description
R352		036-16390-00	RES M/F 0805 390K 5%
R353		036-10000-00	RES M/F 0805 ZERO OHM
R354		036-17100-00	RES M/F 0805 1M 5%
R356		036-13180-00	RES M/F 0805 180E 5%
R358		036-12470-00	RES M/F 0805 47E 5%
R360		036-15150-00	RES M/F 0805 15K 5%
R362		036-14330-00	RES M/F 0805 3K3 5%
R364		036-14100-00	RES M/F 0805 1K 5%
R365		036-16150-00	RES M/F 0805 150K 5%
R366		036-14330-00	RES M/F 0805 3K3 5%
R367		036-16150-00	RES M/F 0805 150K 5%
R368		036-15220-00	RES M/F 0805 22K 5%
R370		036-16100-00	RES M/F 0805 100K 5%
R372		036-14270-00	RES M/F 0805 2K7 5%
R374		036-14100-00	RES M/F 0805 1K 5%
R376		036-10000-00	RES M/F 0805 ZERO OHM
R378		036-16100-00	RES M/F 0805 100K 5%
R380		036-15100-00	RES M/F 0805 10K 5%
R382		036-15470-00	RES M/F 0805 47K 5%
R384		036-15470-00	RES M/F 0805 47K 5%
R386		036-15120-00	RES M/F 0805 12K 5%
R388		036-15100-00	RES M/F 0805 10K 5%
R390		045-05100-01	RES NTC 10K 5% 5MM DISC
R392		036-10000-00	RES M/F 0805 ZERO OHM
R393		036-15100-00	RES M/F 0805 10K 5%
R394		036-12470-00	RES M/F 0805 47E 5%
R395		036-10000-00	RES M/F 0805 ZERO OHM
R396		036-13390-00	RES M/F 0805 390E 5%
R397		036-13820-00	RES M/F 0805 820E 5%
R398		036-14220-00	RES M/F 0805 2K2 5%
R399		045-05100-01	RES NTC 10K 5% 5MM DISC
R405		036-10000-00	RES M/F 0805 ZERO OHM
R410		036-10000-00	RES M/F 0805 ZERO OHM
R415		036-13330-00	RES M/F 0805 330E 5%
R420		036-12100-00	RES M/F 0805 10E 5%
R425		036-14100-00	RES M/F 0805 1K 5%
R430		036-13150-00	RES M/F 0805 150E 5%
R435		036-12100-00	RES M/F 0805 10E 5%
R440		036-10000-00	RES M/F 0805 ZERO OHM
R445		036-13470-00	RES M/F 0805 470E 5%
R450		036-12100-00	RES M/F 0805 10E 5%
R455		036-13470-00	RES M/F 0805 470E 5%
R460		036-13180-00	RES M/F 0805 180E 5%
R465		036-12330-00	RES M/F 0805 33E 5%
R470		036-13180-00	RES M/F 0805 180E 5%
R475		036-12470-00	RES M/F 0805 47E 5%
R510		036-14220-00	RES M/F 0805 2K2 5%
R515		036-12560-00	RES M/F 0805 56E 5%
R555		036-13470-00	RES M/F 0805 470E 5%
R615		036-13100-00	RES M/F 0805 100E 5%
R617		036-10000-00	RES M/F 0805 ZERO OHM
R619		032-31100-00	RES M/F PWR 1E0 5% 1W 12X4.5MM
R621		032-31100-00	RES M/F PWR 1E0 5% 1W 12X4.5MM
R625		036-14100-00	RES M/F 0805 1K 5%
R629		032-33270-00	RES M/F PWR 270E 5% 1W 12X4.5
R633		036-14680-00	RES M/F 0805 6K8 5%
R636		036-12330-00	RES M/F 0805 33E 5%
R637		036-12330-00	RES M/F 0805 33E 5%
R641		036-14150-00	RES M/F 0805 1K5 5%
R645		036-13470-00	RES M/F 0805 470E 5%
R649		036-14470-00	RES M/F 0805 4K7 5%
R653		036-15100-00	RES M/F 0805 10K 5%
R681		036-13100-00	RES M/F 0805 100E 5%
R685		036-15150-00	RES M/F 0805 15K 5%
R689		036-12100-00	RES M/F 0805 10E 5%
R693		036-16100-00	RES M/F 0805 100K 5%
R696		036-15560-00	RES M/F 0805 56K 5%
R701		036-12220-00	RES M/F 0805 22E 5%
R702		036-17100-00	RES M/F 0805 1M 5%
R703		036-17100-00	RES M/F 0805 1M 5%
R706		036-15150-00	RES M/F 0805 15K 5%
R707		036-15470-00	RES M/F 0805 47K 5%
R708		036-13100-00	RES M/F 0805 100E 5%
R709		036-13100-00	RES M/F 0805 100E 5%
R710		036-13100-00	RES M/F 0805 100E 5%
R711		036-13100-00	RES M/F 0805 100E 5%
R712		036-12100-00	RES M/F 0805 10E 5%
R742		036-13150-00	RES M/F 0805 150E 5%
R743		036-13150-00	RES M/F 0805 150E 5%
R744		036-12220-00	RES M/F 0805 22E 5%
R746		036-12220-00	RES M/F 0805 22E 5%
R747		036-12220-00	RES M/F 0805 22E 5%
R748		036-15470-00	RES M/F 0805 47K 5%
R749		036-15470-00	RES M/F 0805 47K 5%
R750		036-12220-00	RES M/F 0805 22E 5%
R752		036-12220-00	RES M/F 0805 22E 5%
R753		036-17100-00	RES M/F 0805 1M 5%
R754		036-14100-00	RES M/F 0805 1K 5%
R756		036-16470-00	RES M/F 0805 470K 5%
R757		036-16470-00	RES M/F 0805 470K 5%
R758		036-14120-00	RES M/F 0805 1K2 5%
R759		036-13330-00	RES M/F 0805 330E 5%
R760		036-13180-00	RES M/F 0805 180E 5%
R762		036-13100-00	RES M/F 0805 100E 5%
R763		036-13100-00	RES M/F 0805 100E 5%
R765		036-13680-00	RES M/F 0805 680E 5%
R766		036-14100-00	RES M/F 0805 1K 5%
R767		036-13680-00	RES M/F 0805 680E 5%
R769		036-13180-00	RES M/F 0805 180E 5%
R771		036-14820-00	RES M/F 0805 8K2 5%
R772		036-15220-00	RES M/F 0805 22K 5%
R774		036-14820-00	RES M/F 0805 8K2 5%
R775		036-15180-00	RES M/F 0805 18K 5%
R780		036-12680-00	RES M/F 0805 68E 5%
R782		036-12180-00	RES M/F 0805 18E 5%
R784		036-13120-00	RES M/F 0805 120E 5%
R785		036-14330-00	RES M/F 0805 3K3 5%
R786		036-12100-00	RES M/F 0805 10E 5%
R787		036-12100-00	RES M/F 0805 10E 5%
R790		036-13390-00	RES M/F 0805 390E 5%
R791		036-14100-00	RES M/F 0805 1K 5%
R804		036-15470-00	RES M/F 0805 47K 5%
R805		036-13470-00	RES M/F 0805 470E 5%
R808		036-12100-00	RES M/F 0805 10E 5%
R809		036-14470-00	RES M/F 0805 4K7 5%
R810		036-14470-00	RES M/F 0805 4K7 5%
R811		036-14470-00	RES M/F 0805 4K7 5%
R812		036-14470-00	RES M/F 0805 4K7 5%
R813		036-14470-00	RES M/F 0805 4K7 5%
R815		036-15470-00	RES M/F 0805 47K 5%
R816		036-16150-00	RES M/F 0805 150K 5%
R818		036-14470-00	RES M/F 0805 4K7 5%
R819		036-14470-00	RES M/F 0805 4K7 5%
R820		036-15470-00	RES M/F 0805 47K 5%
R821		036-15470-00	RES M/F 0805 47K 5%
R822		036-15470-00	RES M/F 0805 47K 5%
R823		036-15470-00	RES M/F 0805 47K 5%
R824		036-14220-00	RES M/F 0805 2K2 5%
R825		036-14220-00	RES M/F 0805 2K2 5%
R826		036-14220-00	RES M/F 0805 2K2 5%
R827		036-14220-00	RES M/F 0805 2K2 5%
R828		036-14220-00	RES M/F 0805 2K2 5%
R829		036-14220-00	RES M/F 0805 2K2 5%
R830		036-14220-00	RES M/F 0805 2K2 5%
R831		036-14220-00	RES M/F 0805 2K2 5%
R832		036-14220-00	RES M/F 0805 2K2 5%
R833		036-14220-00	RES M/F 0805 2K2 5%
R835		036-14220-00	RES M/F 0805 2K2 5%
R836		036-14220-00	RES M/F 0805 2K2 5%
R837		036-14220-00	RES M/F 0805 2K2 5%
R840		036-14220-00	RES M/F 0805 2K2 5%
R841		036-14220-00	RES M/F 0805 2K2 5%
R842		036-14220-00	RES M/F 0805 2K2 5%
R843		036-14220-00	RES M/F 0805 2K2 5%
R844		036-15470-00	RES M/F 0805 47K 5%
R845		036-16150-00	RES M/F 0805 150K 5%
R846		036-14470-00	RES M/F 0805 4K7 5%
R847		036-14470-00	RES M/F 0805 4K7 5%
R848		036-13470-00	RES M/F 0805 470E 5%
R849		036-13470-00	RES M/F 0805 470E 5%
R850		036-13470-00	RES M/F 0805 470E 5%
R851		036-13470-00	RES M/F 0805 470E 5%
R852		036-14470-00	RES M/F 0805 4K7 5%
R853		036-13470-00	RES M/F 0805 470E 5%
R854		036-16330-00	RES M/F 0805 330K 5%
R855		036-15470-00	RES M/F 0805 47K 5%
R856		036-16150-00	RES M/F 0805 150K 5%
R857		036-16150-00	RES M/F 0805 150K 5%
R858		036-15270-10	RES M/F 0805 27K 1%
R859		036-17120-10	RES MF 0805 CHIP 1M2 1%
R860		036-16820-10	RES MF 0805 CHIP 820K 1%
R861		036-14510-10	RES MF 0805 CHIP 5K1 1%
R863		036-14470-00	RES M/F 0805 4K7 5%
R865		036-14270-00	RES M/F 0805 2K7 5%
R866		036-16820-00	RES M/F 0805 820K 5%
R867		036-16820-00	RES M/F 0805 820K 5%
R868		036-14470-00	RES M/F 0805 4K7 5%
R869		036-15270-10	RES M/F 0805 27K 1%
R870		036-17120-10	RES MF 0805 CHIP 1M2 1%
R871		036-16820-10	RES MF 0805 CHIP 820K 1%
R872		036-14510-10	RES MF 0805 CHIP 5K1 1%
R873		036-14220-00	RES M/F 0805 2K2 5%
R875		036-14470-00	RES M/F 0805 4K7 5%
R876		036-16100-00	RES M/F 0805 100K 5%
R877		036-16100-00	RES M/F 0805 100K 5%
R878		036-16100-00	RES M/F 0805 100K 5%
R879		036-16100-00	RES M/F 0805 100K 5%
R881		036-15470-00	RES M/F 0805 47K 5%
R882		036-15470-00	RES M/F 0805 47K 5%
R884		036-16150-00	RES M/F 0805 150K 5%
R885		036-16150-00	RES M/F 0805 150K 5%
R886		036-15100-10	RES M/F 0805 10K 1%
R887		036-14100-10	RES M/F 0805 CHIP 1K 1%
R888		036-14820-10	RES M/F 0805 8K2 1%
R889		036-16100-00	RES M/F 0805 100K 5%
R890		036-16150-00	RES M/F 0805 150K 5%
R891		036-16100-00	RES M/F 0805 100K 5%
R892		036-16330-00	RES M/F 0805 330K 5%
R894		036-14470-00	RES M/F 0805 4K7 5%
R895		036-15100-00	RES M/F 0805 10K 5%
R897		036-15100-00	RES M/F 0805 10K 5%
R898		036-16470-00	RES M/F 0805 470K 5%
RL210		237-00010-22	RELAY 12V DPDT 8PIN DIL PCB MT
RV205		040-05100-22	POT 10K LOG DUAL PCB 6 OD SFT

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Ref	Var	IPN	Description
RV210		040-05100-23	POT 10K LOG PCB 15MM SLOT SFT
RV220		042-05100-06	RES PRE 10K CAR 6MM FLAT
RV230		040-05100-21	POT 10K LIN PCB 15MM SLOT SFT
RV235		042-05100-06	RES PRE 10K CAR 6MM FLAT
RV310		042-04220-06	RES PRE 2K2 CAR 6MM FLAT
RV320		042-04220-06	RES PRE 2K2 CAR 6MM FLAT
SHLD610		062-00010-13	CAN 10MM SQ X 11MM CAN A4M1017
SK320		240-04020-64	SKT JACK 0.98MM PCB MTG 64 WAY
SK330		240-04020-64	SKT JACK 0.98MM PCB MTG 64 WAY
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
SW201		230-00010-30	SWITCH TOG SPDT R-ANG PCB MTG
T210		053-00010-17	XFMR T4030 LINE MATCH POTCORE
T610		050-00016-50	COIL TAIT NO 650 455KHZ
&XF300A	10	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300A	13	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300A	15	276-00010-57	FLTR XTAL 45MHZ 7.5K 4POLE 1PR
&XF300A	20	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300A	23	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300A	25	276-00010-57	FLTR XTAL 45MHZ 7.5K 4POLE 1PR
&XF300A	30	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300A	35	276-00010-57	FLTR XTAL 45MHZ 7.5K 4POLE 1PR
&XF300B	10	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300B	13	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300B	15	276-00010-57	FLTR XTAL 45MHZ 7.5K 4POLE 1PR
&XF300B	20	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300B	23	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300B	25	276-00010-57	FLTR XTAL 45MHZ 7.5K 4POLE 1PR
&XF300B	30	276-00010-58	FLTR XTAL 45MHZ 15K 4POLE 1PR
&XF300B	35	276-00010-57	FLTR XTAL 45MHZ 7.5K 4POLE 1PR
&XF301	10	276-00010-56	FLTR XTAL 45MHZ 14KHZ BW 2 P
&XF301	13	276-00010-56	FLTR XTAL 45MHZ 14KHZ BW 2 P
&XF301	15	276-00010-54	FLTR XTAL 45MHZ 7.5KHZ 2POLE
&XF301	20	276-00010-56	FLTR XTAL 45MHZ 14KHZ BW 2 P
&XF301	23	276-00010-56	FLTR XTAL 45MHZ 14KHZ BW 2 P
&XF301	25	276-00010-54	FLTR XTAL 45MHZ 7.5KHZ 2POLE
&XF301	30	276-00010-56	FLTR XTAL 45MHZ 14KHZ BW 2 P
&XF301	35	276-00010-54	FLTR XTAL 45MHZ 7.5KHZ 2POLE
&XF302	10	276-00010-14	FLTR CER 455KHZ E 15KHZ B/W
&XF302	13	276-00010-76	FLTR CER 455KHZ F 12KHZ B/W
&XF302	15	276-00010-13	FLTR CER 455KHZ G 9KHZ B/W
&XF302	20	276-00010-14	FLTR CER 455KHZ E 15KHZ B/W
&XF302	23	276-00010-76	FLTR CER 455KHZ F 12KHZ B/W
&XF302	25	276-00010-13	FLTR CER 455KHZ G 9KHZ B/W
&XF302	30	276-00010-14	FLTR CER 455KHZ E 15KHZ B/W
&XF302	35	276-00010-13	FLTR CER 455KHZ G 9KHZ B/W
X310		274-00010-22	XTAL 44.545MHZ TE/22 HC45/U

T855 Mechanical and Miscellaneous Parts (220-01396-03)

IPN	Legend	Description
066-00010-20	1	SLUG BRASS A4M764 HELIC RESNTR
070-01001-00	15/28	D-RANGE 15 WAY COMPL T800
070-02001-00		LED RED COMPL T800 RX/TX/EX
070-02002-00		LED GREEN COMPL T800 RX/TX/EX
200-00010-04		WIRE T/C 0.7
220-01145-02	2	PCB T855/856/857 VCO
220-01396-02	3	PCB T855 SERIES II
230-00010-31	4	SWITCH COVER FOR 230-00010-30
240-02100-06	5	SKT COAX N TYPE PNL MTG OP-TER
240-04020-62		SKT 2 W RECEP SHORTING LINK PL210/220/230/240/250/260/270
303-11169-03	6	CHASSIS PAINTED T800 SERIES
303-23118-00	7	COVER A3M2247 D RANGE T855/7
303-50074-00	8	CLIP A3M2246 SPRING CLAMP T857
308-01007-01	9	HANDLE BASE STATION SERIES II
308-01048-00	10	HOUSING A3M2378 DOUBLET H/RES
311-01015-00	11	KNOB 15MM & SKIRT 6MM SFT
312-01052-01	12	LID TOP PNTD A1M2364 T800
312-01053-01	13	LID BOTTOM PNTD A1M2364 T800
316-06622-00	14	PNL FRT RX T800 SL2
345-00040-10	16	SCRW M3X6MM P/POZ ST BZ
349-00020-36	17	LIM)SCREW TT M3X8m PANTORX BLK
349-00020-43	18	SCRW T/T M4X12MM P/POZ BZ
349-00020-45	19	SCRW T/T M4X20MM P/POZ BZ
350-00016-42	20	SPACER 5MM HI 8MM ST 2.5MM HO
352-00010-08	21	NUT M3 COLD FORM HEX ST BZ
352-00010-29	22	NUT M4 NYLOC HEX
352-00010-54	23	NUT BRASS HEX 1/4" UNF 3MM
353-00010-10	24	WSHR M3 FLAT 7MMX0.6MM ST BZ
353-00010-13	25	WSHR M3 S/PROOF INT BZ
356-00010-03		TAG SOLDER 3MM LONG M614/3.2 Main PCB to chassis earth strap (via D-range shield).
362-00010-23	26	GASKET SIL TO-220 CLIP MTG.
362-00010-33	27	GROMMET LED MTG 3MM
365-00011-53		LABEL 104X37MM
365-00100-09		LABEL WHITE VINYL 15X11MM S/A
365-00100-20		LABEL WHITE S/A 28X11MM
365-01541-00		LABEL TX/RX/EX TYPE APR/SER NO
399-00010-51		BAG PLASTIC 75X100MM
410-01081-01		CRT T800 SL2
410-01082-01		CRTN 10 T800 KIWI 423X410X360

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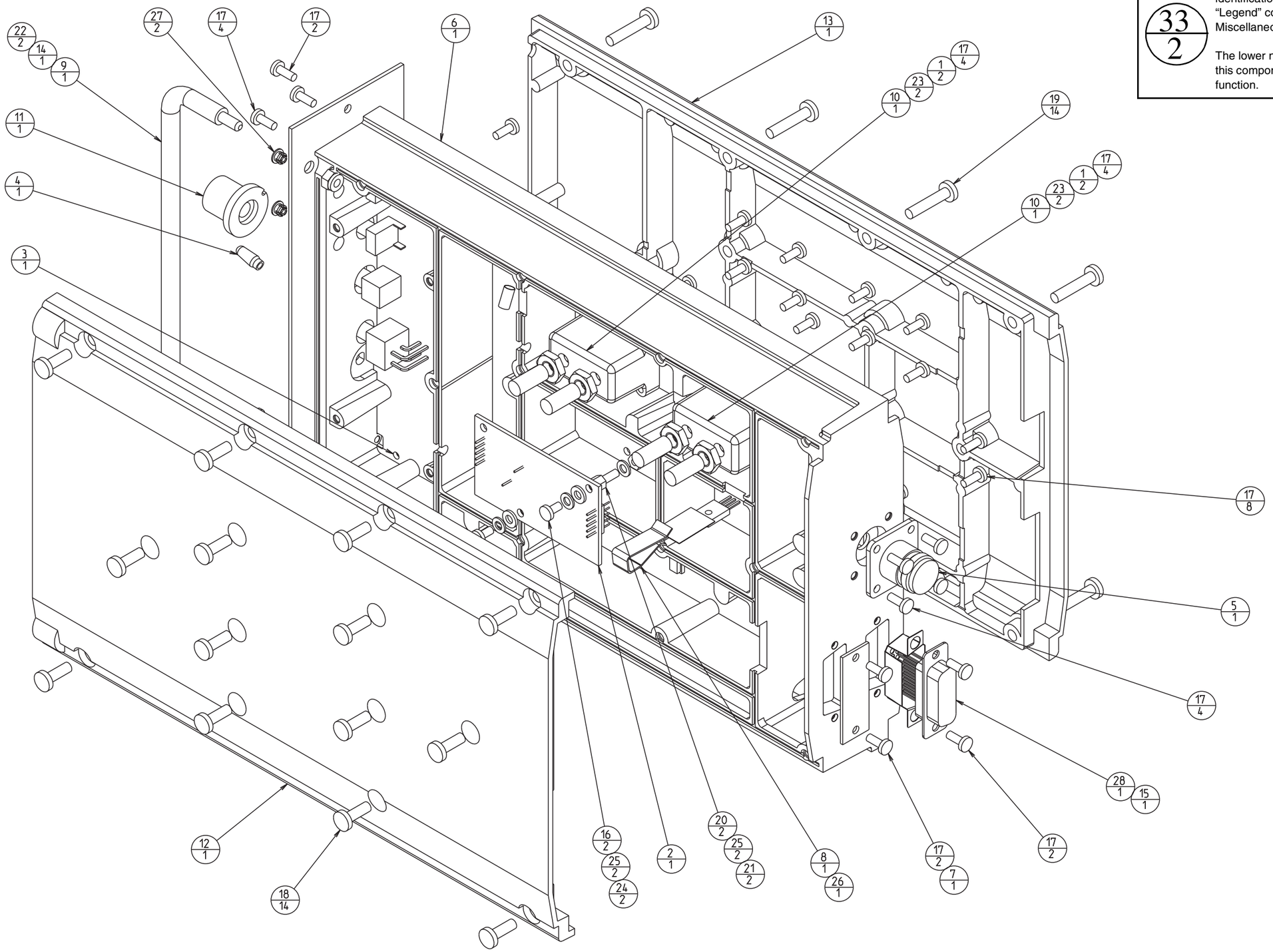
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Key

33/2

The upper number is the component identification number which appears in the "Legend" column of the Mechanical and Miscellaneous Parts on the facing page.

The lower number indicates how many of this component are used in this location or function.



T855 Mechanical Assembly
220-01396-03

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T855 Grid Reference Index (IPN 220-01396-03)

How To Use This Grid Reference Index

The first digit in the PCB layout reference is a “1” or “2”, indicating the top or bottom side layout respectively, and the last two characters give the location of the component on that diagram.

The first digit in the circuit diagram reference is the sheet number, and the last two characters give the location of the component on that sheet.

Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit
C201	1:D7	2-B9	&C326	2:E7	3-E5	C611B	1:M5	6-F8	C784	1:G2	7-Q1
&C203	2:C6	2-B8	C328	2:E7	3-F5	C623	1:M6	6-N8	C786	1:G2	7-R1
&C205	2:C6	2-B8	C330	2:F7	3-F6	C625	1:M6	6-Q8	C788	1:G3	7-P0
C207	1:D6	2-C8	C331	2:F7	3-H5	C626	1:M6	6-R8	C791	1:G4	7-Q0
C209	1:C7	2-E8	C332	2:E7	3-G4	C628	1:M6	6-R8	C792	1:G4	7-R0
C210	2:C7	2-C7	&C334	2:F7	3-H5	C630	1:M5	6-K4	C810	1:L4	8-K8
C211	2:C7	2-D7	&C336	2:E7	3-H5	C631A	1:M5	6-M6	C812	1:K2	8-E5
C213	2:C7	2-E7	&C338	2:E7	3-J5	C631B	1:N5	6-M6	C813	1:J3	8-H5
C215	2:C7	2-E7	&C340	2:E7	3-J5	C637	1:M6	6-P5	C814	1:L2	8-Q4
C217	2:C7	2-E7	C342	2:E6	3-K5	C640	1:M5	6-R5	C815	1:N3	8-B2
C219	2:C6	2-H6	C344	2:E6	3-K6	C651	1:M5	6-M4	C816	1:N3	8-B2
C221	2:C6	2-H6	C346	2:E6	3-L5	C658	1:M5	6-J1	C818	1:N3	8-C1
C222	1:C6	2-J9	C347	2:E4	3-M5	C660	1:L5	6-K1	C819	1:N3	8-D1
C223	2:C6	2-J8	C348	2:E6	3-M5	C665	1:L5	6-K1	C820	1:N4	8-E1
C225	2:C6	2-J8	C349	2:E6	3-L6	C670	1:L6	6-L1	C822	1:N3	8-D2
C227	2:C6	2-J8	C350	2:E6	3-M6	C673	1:L5	6-P2	C824	1:N3	8-D2
C229	1:C6	2-K8	C351	2:E4	3-M6	C677	1:M6	6-P1	C826	1:N3	8-D0
C231	1:B3	2-K8	C352	2:E4	3-N5	C681	1:M5	6-R3	C828	1:N3	8-D0
C233	1:B7	2-J7	C354	1:F5	3-N6	C684	1:M6	6-R3	C830	1:M4	8-F1
C235	2:C5	2-M6	C355	1:F4	3-P6	C687	1:L6	6-Q1	C832	1:M3	8-G2
C237	2:C6	2-M5	C356	2:E5	3-N6	C690	1:L6	6-R1	C833	1:M4	8-G1
C238	2:C5	2-N7	C357	2:E5	3-Q5	C693	1:L6	6-R1	C834	1:M3	8-H2
C239	1:C5	2-P6	C358	2:F5	3-Q6	C700	1:J4	7-A8	C836	1:M3	8-G0
C240A	2:B5	2-Q8	C359	1:F4	3-P6	C702	1:J4	7-B8	C837	1:M3	8-G0
C240B	2:B5	2-R8	C360	2:F4	3-R6	C703	1:J3	7-B7	C838	1:N4	8-H0
C240C	1:C5	2-R8	C361	2:F5	3-Q6	C705	1:J3	7-B7	C840	1:M2	8-K1
C249	1:B5	2-Q7	C362	2:E6	3-R4	C707	1:J3	7-B5	C842	1:N2	8-L0
C251	2:A5	2-R7	C364	2:E5	3-A2	C708	1:J3	7-B5	C844	1:N3	8-L0
C253	1:C8	2-G5	C366	2:E5	3-B2	C709	1:H3	7-C5	C846	1:M2	8-M0
C255	2:B7	2-L2	C367	2:E5	3-Q5	C710A	1:H3	7-D8	C848	1:N2	8-M0
C257	2:B6	2-M2	C368	2:F5	3-C2	C710B	1:H4	7-D8	C850	1:M2	8-N0
C259	2:B6	2-M3	C370	2:E4	3-C1	C710C	1:J3	7-F8	C873	1:M4	8-N2
C260A	2:B6	2-P4	C372	2:F3	3-E1	C711	1:J2	7-E7	C876	1:M4	8-P2
C260B	2:B6	2-P4	C374	2:F3	3-D3	C712	1:H2	7-E7	C879	1:M3	8-Q0
C260C	1:B6	2-P4	C376	2:E3	3-E2	C713	1:H2	7-F7	C910	2:P6	9-E6
C261	1:C6	2-N2	C378	2:F3	3-E2	C735	1:J2	7-A1	C920	2:P6	9-F6
C262	1:B5	2-P3	C380	2:E3	3-F2	C736	1:J2	7-B1	C930	2:P7	9-G6
C264	2:B5	2-P2	C382	1:F3	3-G3	C740A	1:H2	7-B4	C940	2:P7	9-H6
C266	1:D2	2-R3	C384	2:E4	3-H2	C740B	1:H2	7-B3	C950	2:N8	9-J6
C268	1:D3	2-R3	C386	2:E4	3-J2	C741A	1:H2	7-C4			
C270	2:B8	2-E3	C388	2:E5	3-M2	C741B	1:G2	7-C3	D111	1:P4	1-R1
C272	2:B8	2-D1	C390	1:E6	3-M2	C742A	1:H2	7-D4	D220	2:D8	2-E4
C274	2:B8	2-E1	C392	2:E4	3-N2	C742B	1:H3	7-D3	D220	2:D8	2-E4
C276	2:C4	2-B0	C394	2:F3	3-P2	C743	1:H2	7-B1	D230	2:C6	2-J4
C278	2:C4	2-C0	C410	2:L8	4-E4	C745	1:G3	7-D1	D230	2:C6	2-J5
C280	2:C4	2-F1	C420	2:L8	4-F5	C750	1:H4	7-H7	D240	2:C8	2-D2
C286	2:B8	2-F1	C430	2:L8	4-G6	C757	1:G4	7-G5	D240	2:C8	2-D3
C302	2:F8	3-C9	C440	1:M7	4-H6	C759	1:G4	7-G4	D250	1:B7	2-H1
C304	2:F8	3-C9	C450	2:K8	4-G5	C761	1:H3	7-J4	D260	2:A7	2-H1
C306	2:F8	3-D8	%C460	2:K8	4-H4	C762	1:G3	7-J4	D270	2:B7	2-H1
C308	2:F8	3-E8	C470	2:G7	4-P5	C764	1:H3	7-J2	D270	2:B7	2-J1
C310	2:F8	3-E8	C480	2:G8	4-Q5	C765	1:G3	7-J2	D280	1:B7	2-K1
C312	1:F7	3-F8	C505	1:K6	5-L8	C767	1:H3	7-K3	D285	1:D2	2-L1
C314	2:F8	3-F8	C515	1:H5	5-F3	C769	1:H4	7-M4	D289	1:C2	2-K0
C316	2:F9	3-F9	C530	1:K5	5-K1	C770	1:H3	7-N4	D290	1:C2	2-L0
&C318	2:E8	3-A5	C535	1:K5	5-L1	C772	1:G4	7-M2	D295	1:C2	2-L0
&C320	2:E8	3-B5	C610A	1:M5	6-C8	C774	1:H4	7-N2	D310	2:E4	3-G2
&C322	2:E8	3-C5	C610B	1:M5	6-D8	C776	1:H4	7-N1	D310	2:E4	3-G1
&C324	2:E7	3-E5	C611A	1:L5	6-E8	C782	1:G2	7-N0	D350	2:E4	3-M4

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Device	PCB	Circuit
D350	2:E4	3-M4
D610	1:N5	6-L6
D610	1:N5	6-M6
D640	1:L5	6-M1
D640	1:L5	6-M2
D730	1:H3	7-H1
D730A	1:H3	7-G0
D740	1:H3	7-J2
D740A	1:H3	7-H0
D820	1:J3	8-B7
D820A	1:J3	8-N0
D860	1:M2	8-N0
D860	1:M2	8-N0
D880	1:M2	8-R2
D880	1:M2	8-R2
#FL410	1:M8	4-C5
#FL420	1:J8	4-K5
IC210	1:C7	2-C7
IC210	1:C7	2-F7
IC210	1:C7	2-G7
IC240	1:B5	2-P7
IC260	1:B6	2-N2
IC270	1:B8	2-F3
IC270	1:B8	2-E2
IC270	1:B8	2-B2
IC280	1:C4	2-E1
IC280	1:C4	2-B0
IC280	1:C4	2-D0
IC310	1:E5	3-Q5
IC310	1:E5	3-N5
IC310	1:E5	3-B2
IC320	1:F3	3-N2
IC410	1:G7	4-P5
IC610	1:M5	6-D8
IC630	1:N5	6-K5
IC640	1:M5	6-N5
IC640	1:M5	6-J0
IC640	1:M5	6-Q5
IC650	1:L5	6-E5
=IC700	1:J3	7-A8
IC710	1:H3	7-D7
IC710	1:H3	7-J0
IC710	1:H3	7-C6
IC710	1:H3	7-D6
IC710	1:H3	7-D6
IC710	1:H3	7-C6
IC710	1:H3	7-E8
IC740	1:H2	7-D1
IC750	1:H4	7-M3
IC750	1:H4	7-H6
IC750	1:H4	7-H5
IC820	1:L4	8-N5
IC830	1:N4	8-J0
IC830	1:N4	8-F1
IC830	1:N4	8-F0
IC830	1:N4	8-H2
IC830	1:N4	8-E2
IC840	1:M2	8-L0
IC850	1:M3	8-N1
IC850	1:M3	8-M2
IC850	1:M3	8-Q2
IC850	1:M3	8-M0
IC850	1:M3	8-M2
L230	1:D2	2-K2
L310	1:F8	3-D9
L320	1:F8	3-E8
L330	1:E8	3-B5
L340	1:E8	3-C5
L350	1:E7	3-D5
L360	1:F6	3-G5
L370	1:E7	3-J5
L380	1:E6	3-L6
L385	1:E4	3-M6

Device	PCB	Circuit
L390	1:F5	3-R6
L410	2:L9	4-F5
L420	1:M7	4-F6
L430	2:K8	4-H5
L440	1:G8	4-Q5
L740	1:G3	7-Q0
L910	1:P6	9-E7
L920	1:P6	9-F7
L930	1:P7	9-G7
L940	1:P8	9-H7
P100	1:Q6	1-R8
P160	1:P2	1-Q4
P170	1:P2	1-R4
P201	1:D4	2-A9
P204	1:D7	2-A9
P207	1:D6	2-A8
P210	1:D6	2-C7
P213	1:D3	2-A7
P216	1:B2	2-A7
P219	1:D7	2-A7
P222	1:C5	2-A6
P225	1:C8	2-A4
P228	1:D8	2-A4
P231	1:C7	2-A4
P234	1:B7	2-A3
P236	1:C8	2-A1
P238	1:D3	2-A1
P240	1:C8	2-G2
P242	1:C7	2-G1
P244	1:C7	2-G8
P246	1:C6	2-H9
P248	1:C6	2-H9
P250	1:B3	2-K8
P252	1:B2	2-L9
P254	1:B2	2-L9
P256	1:B2	2-L8
P258	1:D3	2-P8
P260	1:D3	2-P7
P263	1:B2	2-R6
P266	1:D2	2-R5
P268	1:B2	2-R5
P270	1:B2	2-R5
P280	1:B2	2-R4
P282	1:B2	2-R4
P284	1:B3	2-R4
P287	1:B2	2-R0
P810	1:K2	8-A5
P815	1:L4	8-C4
P820	1:K4	8-M8
P825	1:K4	8-M8
P830	1:K4	8-M8
P835	1:K4	8-M7
P840	1:K4	8-M7
PL100	1:P3	1-F0
PL200	1:A3	2-R7
PL210	1:C6	2-B8
PL220	1:C6	2-H7
PL230	1:B2	2-L8
PL240	1:B6	2-K7
PL250	1:C8	2-C2
PL260	1:C8	2-H3
PL270	1:C2	2-L1
Q210	2:C6	2-J8
Q220	2:C5	2-M6
Q230	2:C5	2-N6
Q240	2:C8	2-H4
Q245	2:B6	2-J4
Q250	2:B8	2-G2
Q255	2:B7	2-H2
Q260	2:B7	2-K0
Q270	2:C2	2-K0
Q280	2:B7	2-L2
Q290	2:B6	2-M2

Device	PCB	Circuit
Q310	1:F9	3-D9
Q320	2:F7	3-F5
Q350	2:E6	3-L5
Q340	2:E5	3-P5
Q350	2:F4	3-D2
Q360	2:E3	3-F2
Q410	2:L8	4-G5
Q540	1:K5	5-K2
Q620	1:N6	6-P8
Q630	1:M6	6-P5
Q660	1:L5	6-N1
Q670	1:L6	6-Q2
Q750	1:G4	7-G3
Q760	1:G3	7-H3
Q770	1:H3	7-H1
Q775	1:H3	7-K3
Q780	1:H3	7-K3
Q785	1:H3	7-K2
Q790	1:H4	7-L3
Q795	1:G3	7-P0
Q810	1:K2	8-C5
Q820	1:K2	8-C6
Q840	1:K2	8-F5
Q850	1:L2	8-G5
Q860	1:K4	8-B4
Q870	1:L4	8-C4
Q880	1:L2	8-L5
Q890	1:L4	8-K3
Q895	1:M3	8-P2
R160	1:P2	1-Q4
R201	2:D6	2-B8
&R202	2:D6	2-B7
R204	2:C6	2-C9
R205	2:C7	2-C8
R207	2:C7	2-D8
&R209	2:C7	2-D8
R210	2:C7	2-D8
R211	2:C7	2-E8
R213	2:C7	2-G6
R215	2:C6	2-G9
R218	2:C7	2-G8
&R219	2:C7	2-G7
R221	2:C7	2-H7
R222	2:C7	2-H7
%R223	2:D6	2-J9
R224	2:C6	2-J8
R225	2:C6	2-J8
R227	2:B7	2-J7
R229	2:C5	2-L6
R230	2:C6	2-M5
R232	2:B5	2-M7
R233	2:C5	2-M7
R234	2:C5	2-N7
R236	2:B5	2-N7
R238	2:A5	2-R6
R239	2:B5	2-R7
R241	2:D8	2-F5
R242	2:C8	2-F4
R244	2:C8	2-G4
R245	2:C8	2-G5
R247	2:B7	2-J4
R249	2:B6	2-J3
R251	2:B7	2-L3
R252	2:B7	2-L3
R254	2:B7	2-L3
R255	2:B6	2-M3
R256	2:B6	2-M3
R258	2:B6	2-N3
R260	2:B5	2-P2
R261	2:B4	2-Q3
R262	2:B3	2-Q3
R264	2:B8	2-A3
R265	2:B8	2-A2
R266	2:B8	2-B2
R267	2:C8	2-C3

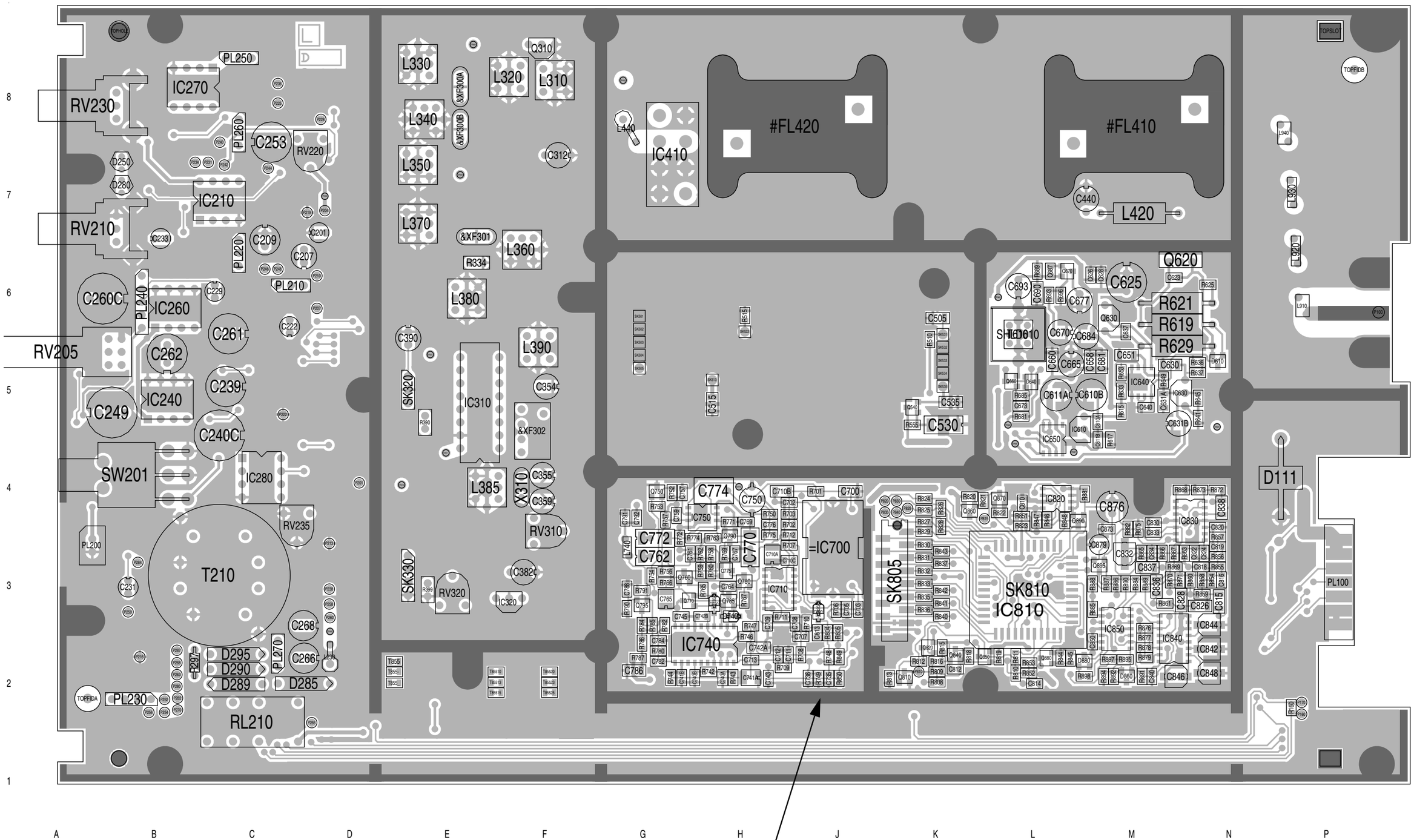
Device	PCB	Circuit
R269	2:C8	2-B1
R271	2:D3	2-A0
R272	2:C4	2-B1
R273	2:C4	2-C1
R275	2:C4	2-C1
R277	2:C4	2-C0
R278	2:C4	2-C1
R280	2:C8	2-D3
R281	2:C8	2-D2
R282	2:B8	2-E2
R284	2:C8	2-F3
R285	2:B8	2-F2
R287	2:B8	2-F2
R288	2:B8	2-F1
R289	2:B7	2-G3
R290	2:B7	2-G3
R292	2:C8	2-G2
R293	2:B7	2-H1
R294	2:C3	2-H0
R295	2:B7	2-J1
R296	2:A7	2-K1
R297	1:B2	2-M0
R298	2:D7	2-J0
R299	2:C7	2-J0
R302	2:F8	3-D8
R304	2:F8	3-E9
R306	2:F8	3-E8
R308	2:F7	3-F8
R310	2:E9	3-A5
R312	2:F7	3-F5
R314	2:E7	3-F4
R316	2:F7	3-G6
R318	2:F7	3-G5
R320	2:F7	3-G5
R322	2:E7	3-K5
R323	2:E6	3-K5
R324	2:E6	3-K5
R326	2:E6	3-K6
R328	2:E6	3-L6
R330	2:E6	3-M7
R332	2:E6	3-L5
R334	1:E6	3-L4
R336	2:E6	3-M4
R337	2:E4	3-M5
R338	2:F4	3-N6
R339	2:E5	3-N5
R340	2:F5	3-N5
R341	2:F5	3-Q5
&R344	2:F5	3-R6
R346	2:F5	3-R7
R348	2:E6	3-R5
%R349	2:E6	3-R4
R350	2:E5	3-A2
R351	2:E6	3-A2
R352	2:E5	3-B2
R353	2:F4	3-N6
R354	2:E5	3-B2
R356	2:F4	3-C2
R358	2:F3	3-D3
R360	2:F3	3-D2
R362	2:E4	3-D1
R364	2:F3	3-D1
R365	2:E5	3-Q4
R366	2:F3	3-D2
R367	2:E5	3-Q4
R368	2:E4	3-E1
R370	2:E3	3-E2
R372	2:E3	3-F3
R374	2:E4	3-F2
R376	2:E4	3-F1
R378	2:E3	3-G3
R380	2:E4	3-G2
R382	2:E4	3-H2
R384	2:E4	3-H2
R386	2:E5	3-L3
R388	2:E5	3-L3

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Device	PCB	Circuit
R390	1:E5	3-L2
R392	2:E5	3-L2
R393	2:E5	3-P3
R394	2:E5	3-M2
R395	2:F3	3-N2
R396	2:E3	3-P2
R397	2:E3	3-Q2
R398	2:E3	3-Q1
R399	1:E3	3-P1
R405	2:N8	4-B5
R410	2:L8	4-E5
R415	2:L8	4-F4
R420	2:L8	4-G4
R425	2:L8	4-G5
R430	2:L8	4-G6
R435	2:M7	4-G6
R440	2:K8	4-J5
R445	2:H8	4-N4
R450	2:H8	4-N5
R455	2:H8	4-N4
R460	2:G7	4-P6
R465	2:G7	4-P6
R470	2:G7	4-P6
R475	2:G7	4-P4
R510	1:K6	5-J9
R515	1:H6	5-J5
R555	1:K5	5-K1
R615	1:M5	6-C9
R617	1:M5	6-F8
R619	1:M6	6-L8
R621	1:M6	6-L8
R625	1:N6	6-L7
R629	1:M5	6-P6
R633	1:M5	6-Q8
R636	1:N5	6-K6
R637	1:N5	6-K5
R641	1:N5	6-L4
R645	1:N5	6-L5
R649	1:M5	6-M5
R653	1:M5	6-Q4
R681	1:L5	6-L2
R685	1:L5	6-N2
R689	1:L6	6-Q3
R693	1:L6	6-Q1
R696	1:L6	6-Q1
R701	1:J4	7-A9
R702	1:J4	7-C9
R703	1:J4	7-C8
R706	1:J3	7-B6
R707	1:J3	7-C7
R708	1:J2	7-D7
R709	1:H2	7-E7
R710	1:J3	7-B6
R711	1:H3	7-B6
R712	1:J4	7-E9
R742	1:H2	7-B4
R743	1:H2	7-C5
R744	1:G2	7-D4
R746	1:H3	7-E4
R747	1:H3	7-E5
R748	1:J2	7-A1
R749	1:J2	7-B1
R750	1:H4	7-H7
R752	1:G4	7-F5
R753	1:G4	7-F3
R754	1:G3	7-F3
R756	1:G3	7-G5
R757	1:G4	7-H4
R758	1:H3	7-H4
R759	1:H3	7-J4
R760	1:H3	7-K4
R762	1:H3	7-K4
R763	1:H4	7-L4
R765	1:H3	7-H2
R766	1:G3	7-J3
R767	1:H3	7-K2
R769	1:H3	7-K3
R771	1:H4	7-L3
R772	1:G4	7-L2
R774	1:H4	7-L2
R775	1:H4	7-N2
R780	1:G2	7-P1
R782	1:G3	7-P0
R784	1:G3	7-P1
R785	1:G3	7-Q1
R786	1:G2	7-R1
R787	1:G2	7-R1
R790	1:G3	7-P0
R791	1:G3	7-Q0
R804	1:J3	8-C7
R805	1:J3	8-C7
R808	1:K2	8-B6
R809	1:K2	8-C6
R810	1:L2	8-D6
R811	1:L2	8-D6
R812	1:K2	8-C6
R813	1:K2	8-C5
R815	1:K2	8-E4
R816	1:K2	8-F4
R818	1:K2	8-F5
R819	1:L2	8-F5
R820	1:K4	8-B4
R821	1:L4	8-C4
R822	1:L4	8-D3
R823	1:L4	8-D4
R824	1:K4	8-L8
R825	1:K4	8-L8
R826	1:K4	8-L8
R827	1:K4	8-L7
R828	1:K4	8-L7
R829	1:K4	8-P9
R830	1:K3	8-P9
R831	1:K3	8-P9
R832	1:K3	8-P8
R833	1:K3	8-P8
R835	1:K3	8-P8
R836	1:K3	8-P8
R837	1:K3	8-P7
R840	1:K3	8-P7
R841	1:K3	8-P7
R842	1:K3	8-P6
R843	1:K3	8-P6
R844	1:L2	8-M5
R845	1:L2	8-M5
R846	1:L4	8-L6
R847	1:L4	8-M6
R848	1:L4	8-Q5
R849	1:J2	8-Q5
R850	1:J2	8-Q4
R851	1:L4	8-Q4
R852	1:L2	8-N4
R853	1:L2	8-Q4
R854	1:N3	8-C1
R855	1:N3	8-C2
R856	1:N3	8-D2
R857	1:N4	8-D2
R858	1:N3	8-C0
R859	1:N3	8-D0
R860	1:N3	8-E0
R861	1:M3	8-F0
R863	1:N3	8-F2
R865	1:M3	8-G2
R866	1:M3	8-H2
R867	1:M3	8-G1
R868	1:N4	8-G0
R869	1:M3	8-G0
R870	1:M3	8-H0
R871	1:N3	8-H0
R872	1:N4	8-H0
R873	1:N4	8-K0
R875	1:M4	8-J1
R876	1:M3	8-K1
R877	1:M2	8-K1
R878	1:M2	8-K0
R879	1:M2	8-K0
R881	1:M4	8-K2
R882	1:M4	8-L3
R884	1:M3	8-N3
R885	1:M3	8-N2
R886	1:M3	8-P3
R887	1:M3	8-P3
R888	1:M3	8-P2
R889	1:M3	8-M1
R890	1:M3	8-N1
R891	1:M2	8-M1
R892	1:M2	8-N0
R894	1:M2	8-P0
R895	1:M2	8-Q1
R897	1:M2	8-Q1
R898	1:M2	8-Q2
RL210	1:C2	2-P4
RL210	1:C2	2-K1
RL210	1:C2	2-P5
RV205	1:B5	2-M7
RV210	1:B7	2-K3
RV220	1:D7	2-F5
RV230	1:B8	2-A2
RV235	1:C4	2-C0
RV310	1:F4	3-E1
RV320	1:E3	3-Q2
SHLD610	1:L6	6-J3
SK320	1:E5	3-L1
SK330	1:E3	3-Q1
SK501	1:G6	5-D6
SK502	1:G6	5-D5
SK503	1:G6	5-D4
SK504	1:G5	5-D3
SK505	1:G5	5-D2
SK513	1:H5	5-G3
SK522	1:H6	5-K5
SK531	1:K6	5-N6
SK532	1:K5	5-N5
SK533	1:K5	5-N4
SK534	1:K5	5-N3
SK535	1:K5	5-N2
SK805	1:K3	8-Q9
SK805	1:K3	8-Q9
SK805	1:K3	8-Q7
SK805	1:K3	8-Q8
SK805	1:K3	8-Q6
SK805	1:K3	8-Q8
SK805	1:K3	8-Q6
SK805	1:K3	8-Q8
SK805	1:K3	8-Q7
SK805	1:K3	8-Q8
SK805	1:K3	8-Q7
SK805	1:K3	8-Q5
SK805	1:K3	8-Q7
SK805	1:K3	8-Q6
SK805	1:K3	8-Q9
SK805	1:K3	8-Q6
SK810	1:L3	8-H5
SL210	2:B8	2-E2
SL220	2:B8	2-D2
SW201	1:B4	2-A6
T210	1:C3	2-Q2
T610	1:L6	6-N2
TP201	1:D3	2-P8
TP202	1:D7	2-D9
TP309	1:E9	3-A5
TP310	1:E7	3-E5
TP311	1:E4	3-M6
TP313	1:E4	3-J2
TP314	1:E5	3-R5
TP408	2:N8	4-B5
TP409	2:L7	4-D5
TP410	2:J8	4-J5
TP411	2:H8	4-M5
TP412	1:G8	4-Q5
TP601	1:N5	6-K9
TP602	1:L6	6-R9
TP603	1:L5	6-J2
TP604	1:L4	6-N6
TP607	1:L4	6-F9
TP710	1:H4	7-J5
X310	1:F4	3-M6
&XF300A	1:E8	3-C5
&XF300B	1:E8	3-D5
&XF301	1:E7	3-J5
&XF302	1:F5	3-P5

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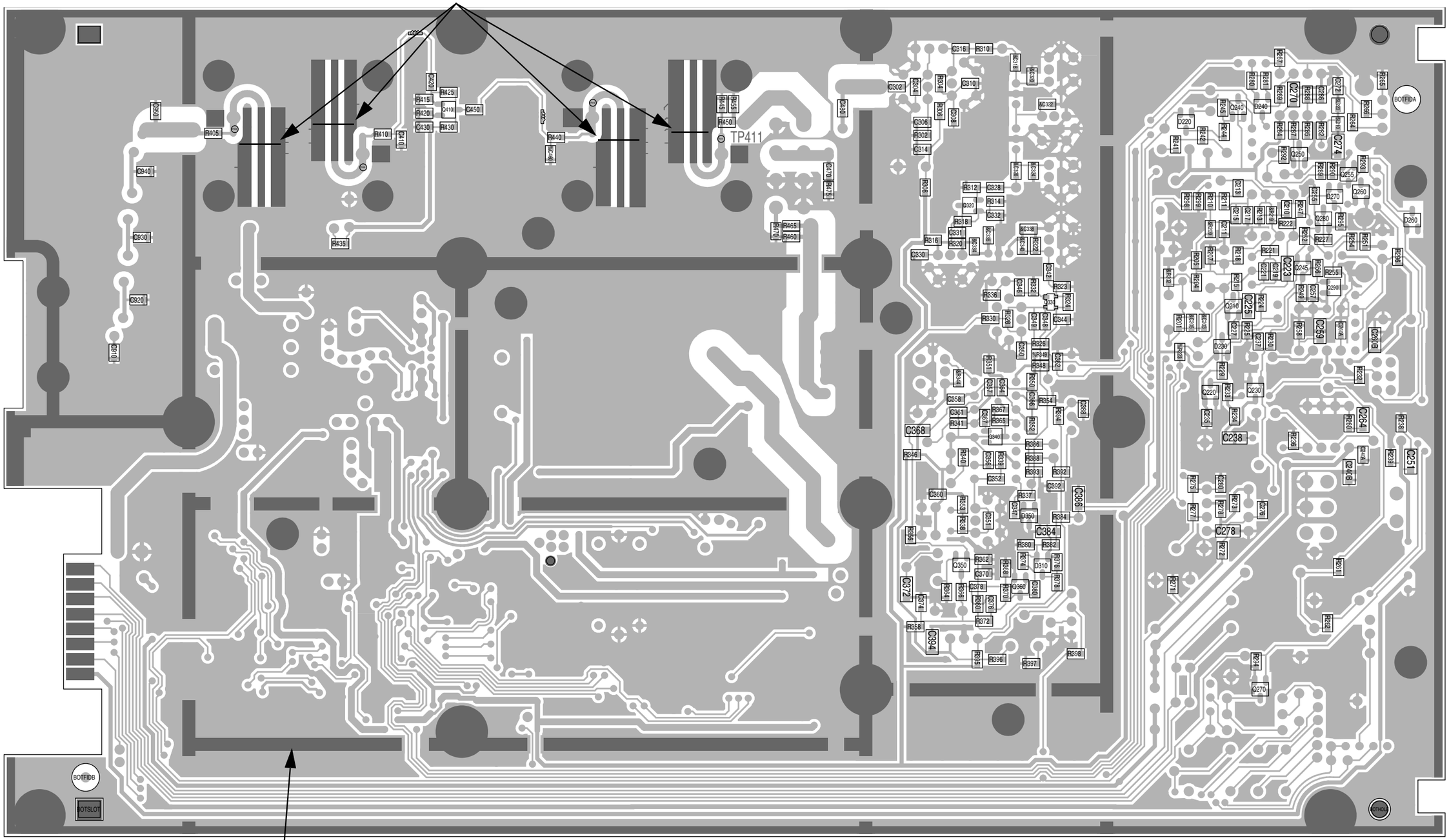


The darker shading shows the outline of the chassis.

T855 PCB Layout – Top Side
220-01396-03

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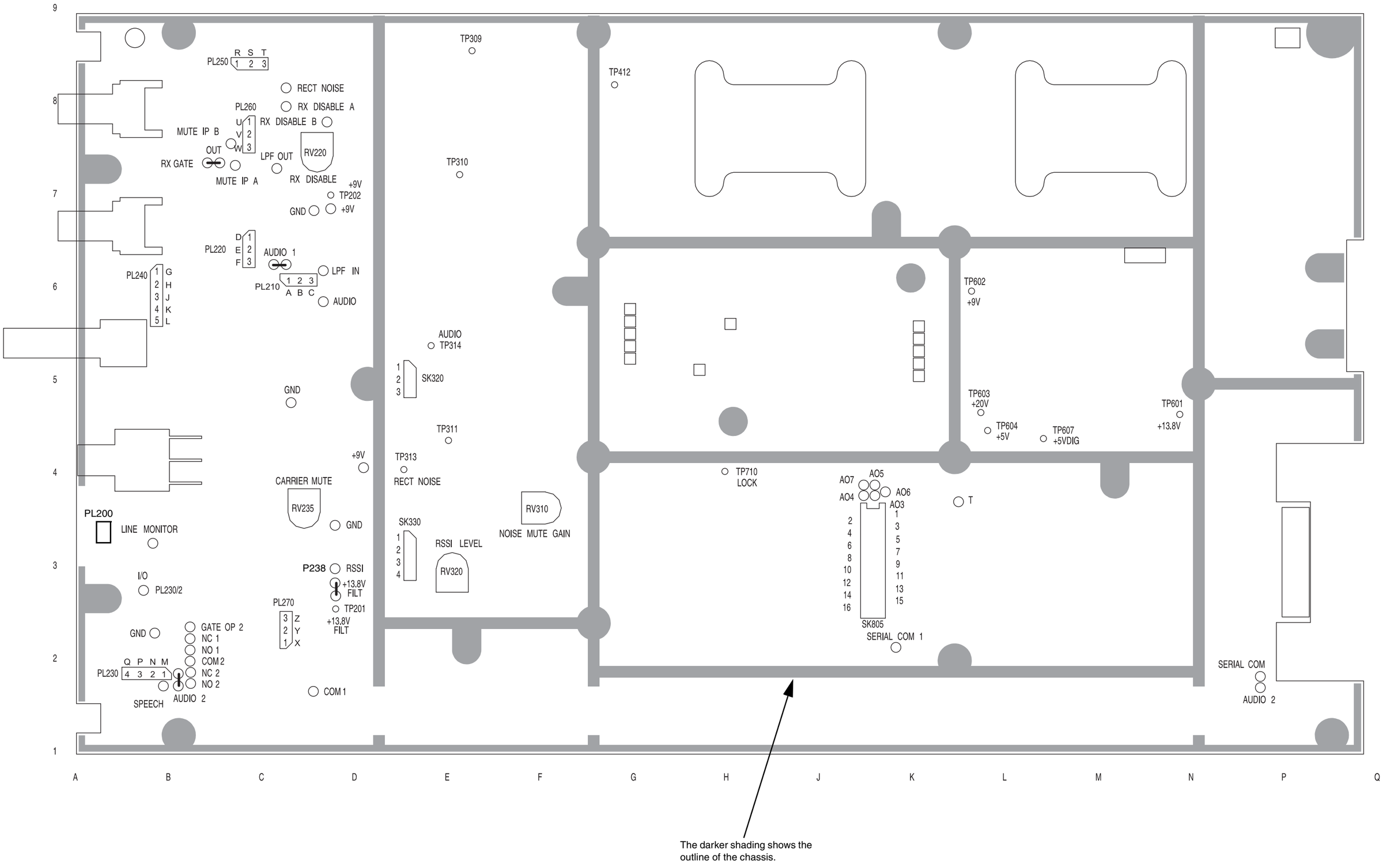
These link wires are positioned according to frequency range and should not be moved as their position is optimised in the factory.



The darker shading shows the footprint of the bottom cover.

T855 PCB Layout – Bottom Side
220-01396-03

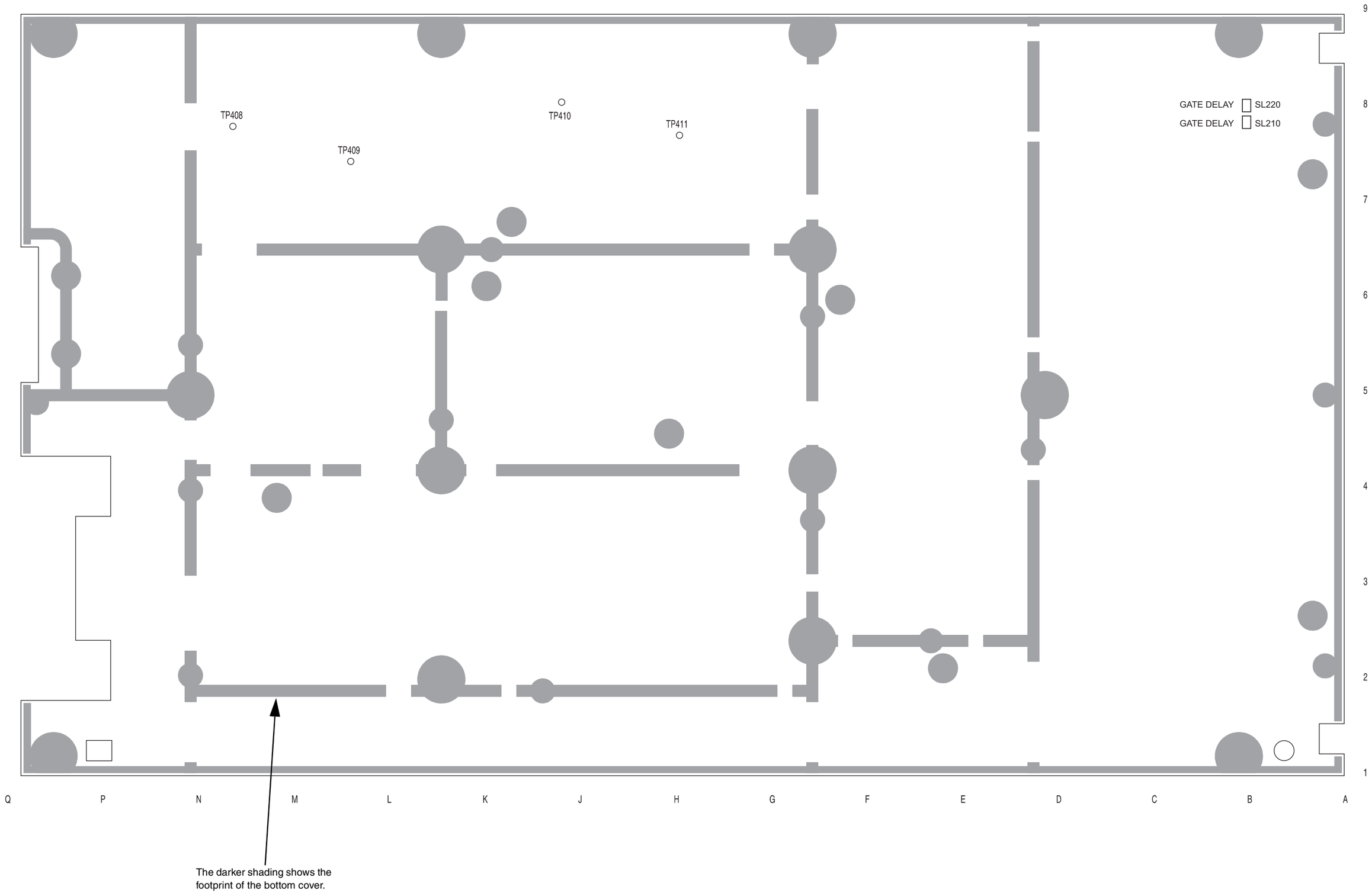
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The darker shading shows the outline of the chassis.

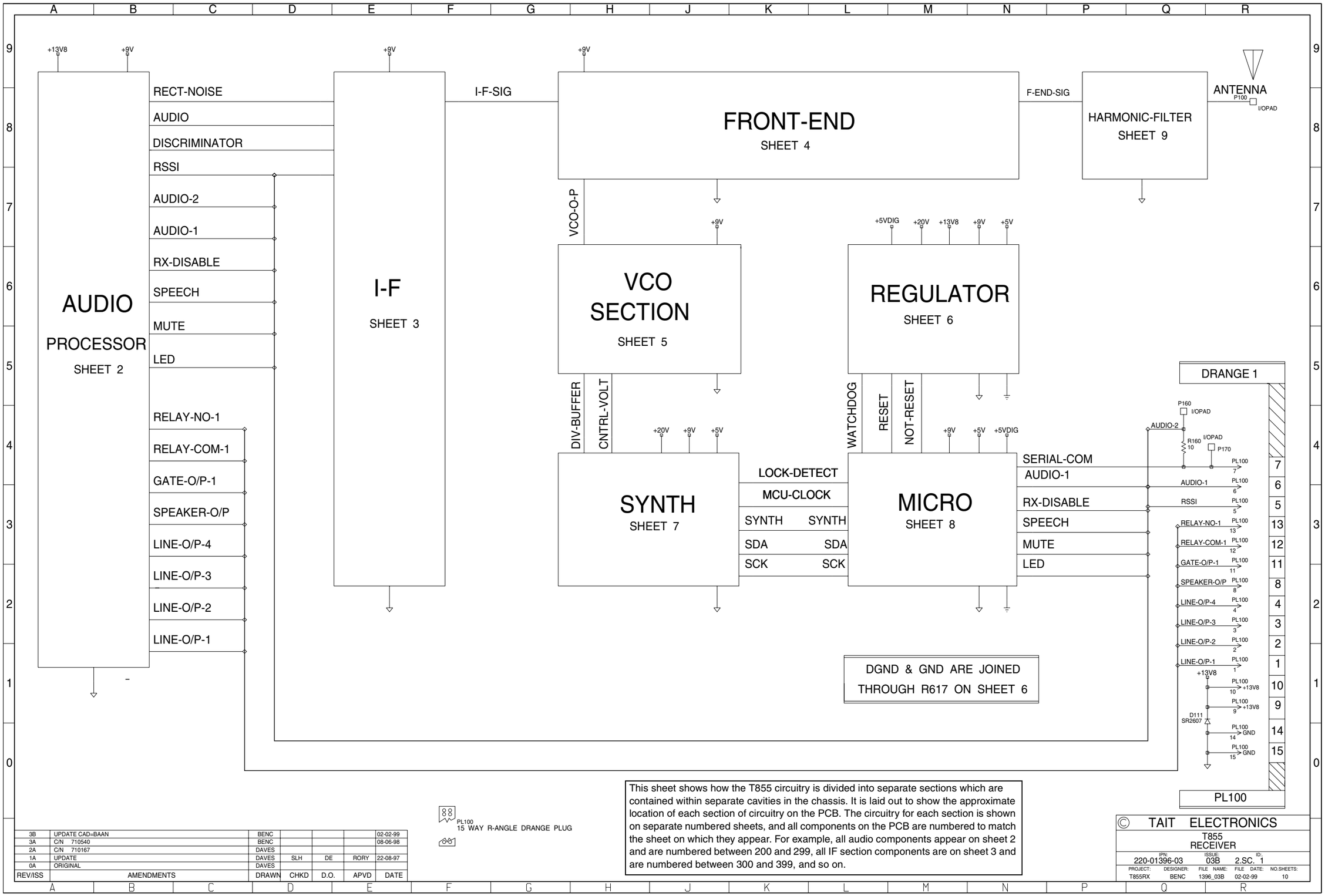
T855 Test Points and Options Connections – Top Side
220-01396-03

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T855 Test Points and Options Connections – Bottom Side
220-01396-03

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PL100
15 WAY R-ANGLE DRANGE PLUG

REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE
3B	UPDATE CAD=BAAN	BENC				02-02-99
3A	C/N 710540	BENC				08-06-98
2A	C/N 710167	DAVES				
1A	UPDATE	DAVES	SLH	DE	RORY	22-08-97
0A	ORIGINAL	DAVES				

This sheet shows how the T855 circuitry is divided into separate sections which are contained within separate cavities in the chassis. It is laid out to show the approximate location of each section of circuitry on the PCB. The circuitry for each section is shown on separate numbered sheets, and all components on the PCB are numbered to match the sheet on which they appear. For example, all audio components appear on sheet 2 and are numbered between 200 and 299, all IF section components are on sheet 3 and are numbered between 300 and 399, and so on.

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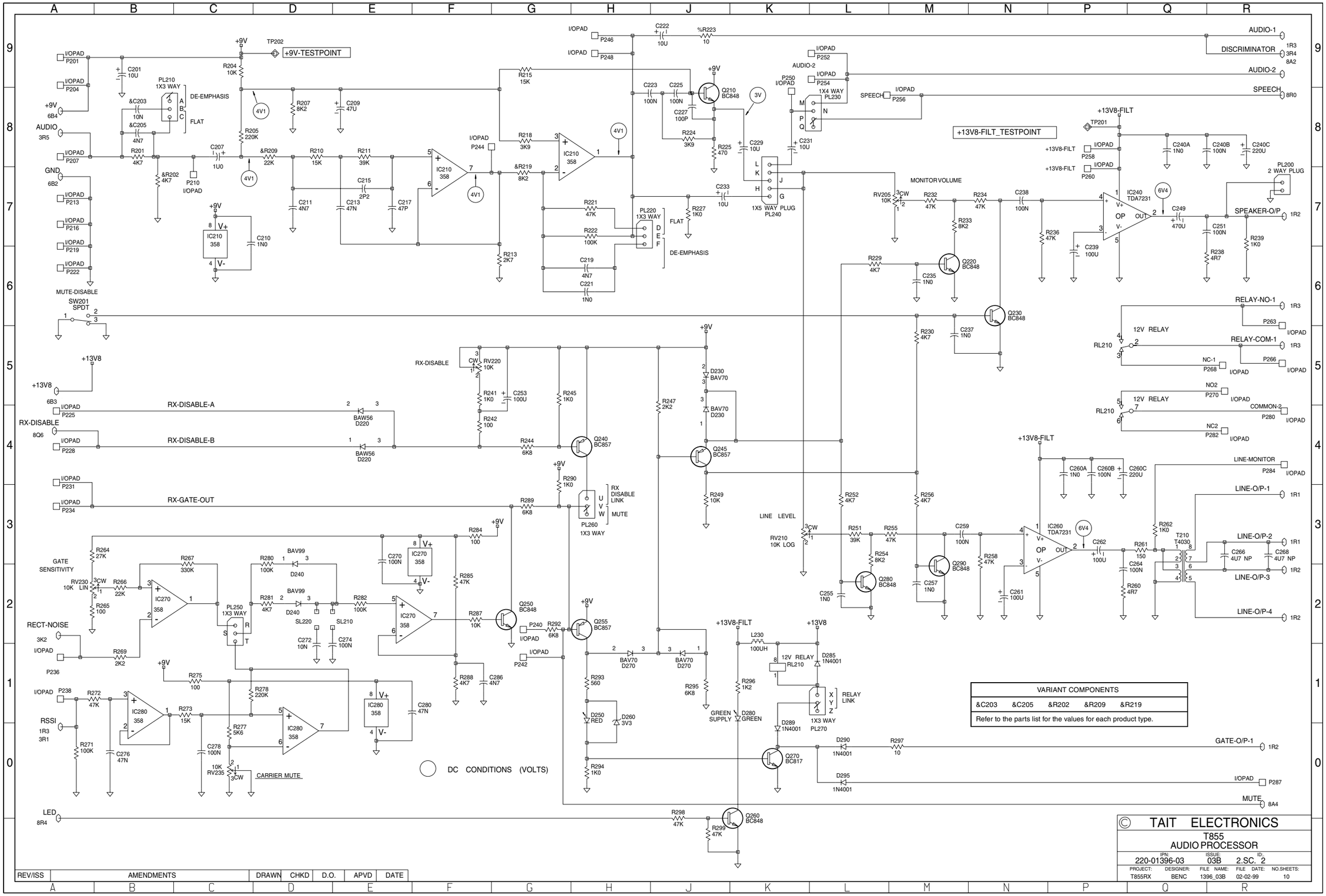
T855
RECEIVER

IPN:	ISSUE:	ID:
220-01396-03	03B	2.SC. 1

PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:	NO.SHEETS:
T855RX	BENC	1396_03B	02-02-99	10

Sheet 1 – T855 Receiver Overview
220-01396-03

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Sheet 2 – T855 Audio Processor
220-01396-03

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VARIANT COMPONENTS					
&C318	&C324	&C336	&R344	&XF300A	&XF301
&C320	&C326	&C338		&XF300B	&XF302
&C322	&C334	&C340			
Refer to the parts list for the values for each product type.					

SENSITIVITY

DC CONDITIONS (VOLTS)

REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE

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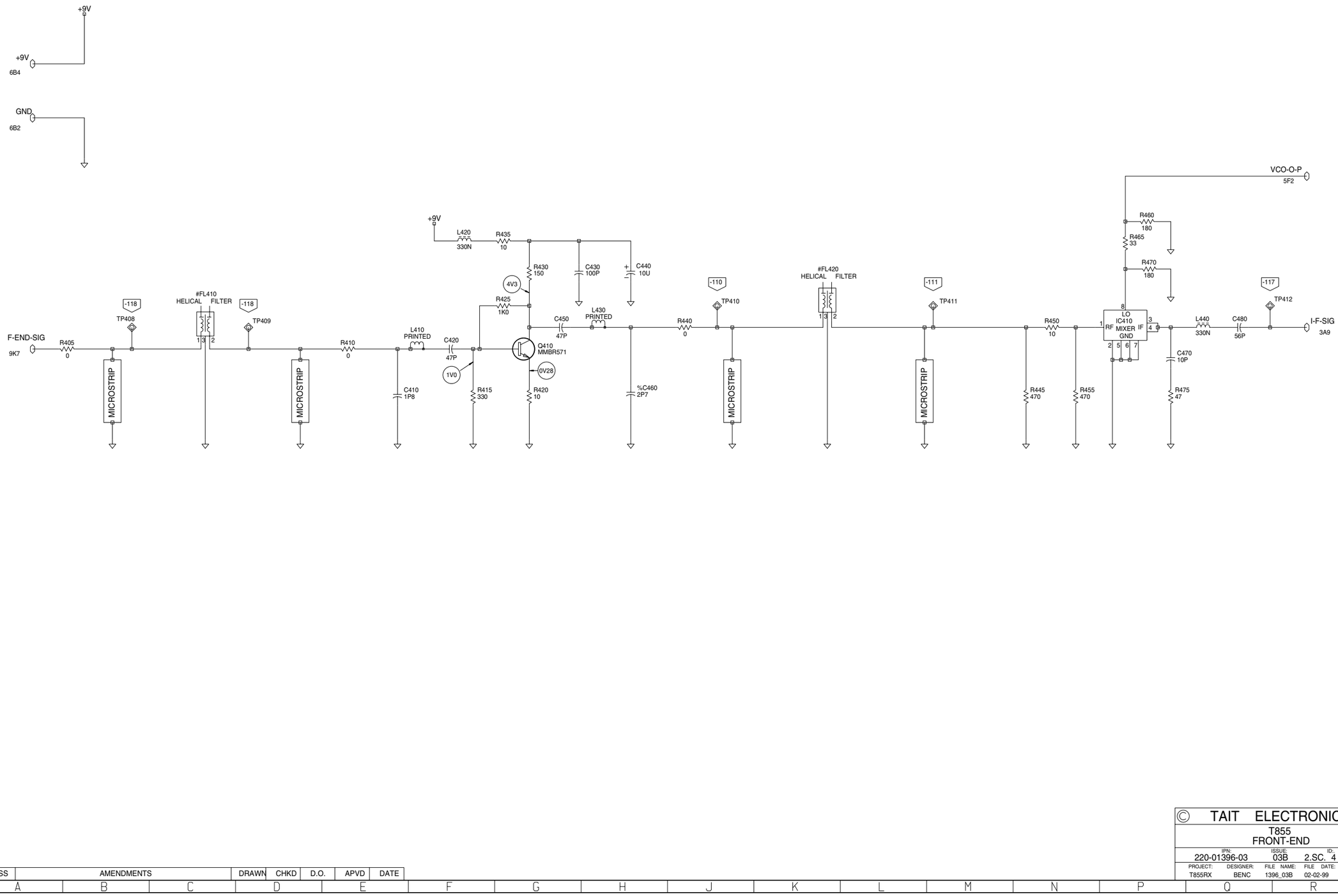
T855
I-F

IPN:	ISSUE:	ID:
220-01396-03	03B	2.SC. 3

PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:	NO.SHEETS:
T855RX	BENC	1396_03B	02-02-99	10

Sheet 3 – T855 IF Section
220-01396-03

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Sheet 4 – T855 Front End
220-01396-03

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CNTRL-VOLT
7R3
R510
2K2
C505
100N
+9V
6B4
GND
6B2
SK501
1 WAY SOCKET
GND
SK502
1 WAY SOCKET
GND
SK503
1 WAY SOCKET
GND
SK504
1 WAY SOCKET
GND
SK505
1 WAY SOCKET
RF-OUT
VCO-O-P
4R7
+9V
C515
100N
SK513
1 WAY SOCKET
VCO-BUFFER
DIV-BUFFER
7R0
SK522
1 WAY SOCKET
DIV-BUFFER
R515
56E
SK531
1 WAY SOCKET
CV-OUT
SK532
1 WAY SOCKET
GND
SK533
1 WAY SOCKET
GND
SK534
1 WAY SOCKET
GND
SK535
1 WAY SOCKET
+9V-VCO
+9V
Q540
BC848
R555
470
C530
22U
TANT
C535
100N

The circuit diagram for the VCO PCB is in Part E.

REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE

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T855
VCO SECTION

IPN:	ISSUE:	ID:
220-01396-03	03B	2.SC. 5

PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:	NO.SHEETS:
T855RX	BENC	1396_03B	02-02-99	10

Sheet 5 – T855 VCO Section
220-01396-03

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+5VDIG TESTPOINT

+5VDIG-SUPPLY

DGND CONNECTS GND THROUGH R617

+13V8-TESTPOINT

+9V-TESTPOINT

+5V REGULATOR

+5V TESTPOINT

+9V REGULATOR

CAN TO SHIELD T610

10MM SQ * 11MM
SHLD610

240KHz
24vpp

+20V TESTPOINT

+20V SUPPLY

IC640
SPARE GATE

REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE

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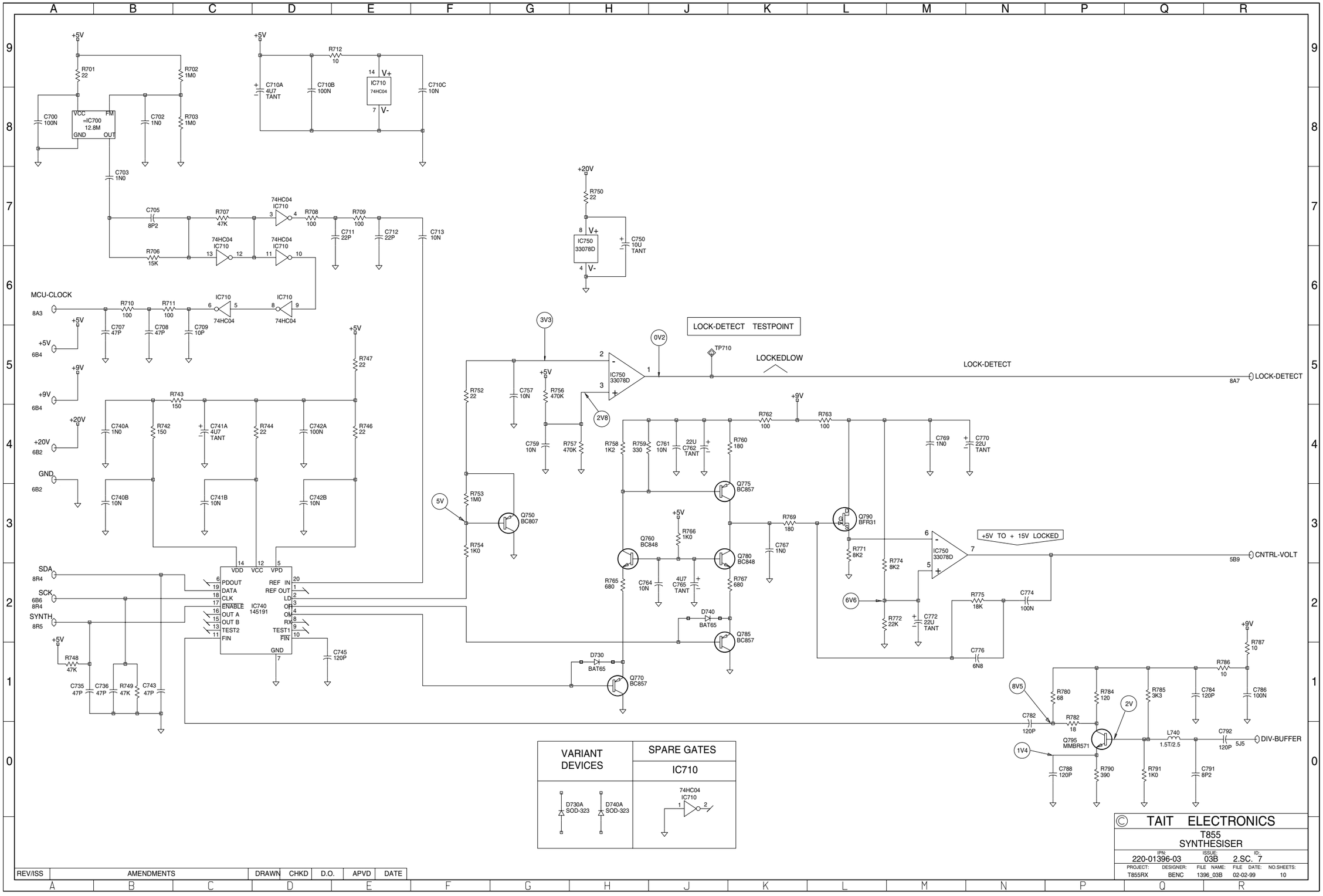
T855
REGULATORS

IPN:	ISSUE:	ID:
220-01396-03	03B	2.SC. 6

PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:	NO.SHEETS:
T855RX	BENC	1396_03B	02-02-99	10

Sheet 6 – T855 Regulators
220-01396-03

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Sheet 7 – T855 Synthesiser
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CHANNEL SELECT TO MICRO BUS

MICROMATCH TO D-RANGE2 CONNECTIONS

MICROMATCH PIN	D-RANGE2 PIN
1	1
3	2
5	3
7	4
9	5
11	6
13	7
6	11
16	NC
14	15
12	14
10	13
4	10
8	12
2	9
15	8

VARIANT DEVICES

D820A SOD-323

REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE

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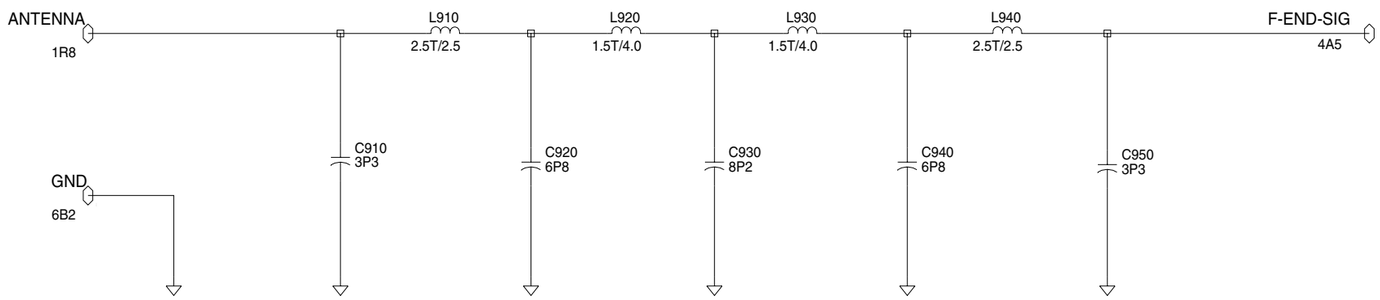
T855
MICROCONTROLLER

IPN:	ISSUE:	ID:
220-01396-03	03B	2.SC. 8

PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:	NO.SHEETS:
T855RX	BENC	1396_03B	02-02-99	10

Sheet 8 – T855 Microcontroller
220-01396-03

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HARMONIC-FILTER

DIODE PHYSICAL PIN OUTS



BAV70



BAV99
BAT17DS



BAW56

TRANSISTOR PHYSICAL PIN OUTS



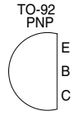
BC857
BC807



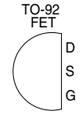
BFR31



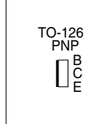
BC848
BC817
MMBR571
MMBR951L



BC557



BF247



BD234

TANTALUMS



CHIP
TANTALUMS

REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE

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T855
HARMONIC-FILTER

IPN:	ISSUE:	ID:.
220-01396-03	03B	2.SC. 9

PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:	NO.SHEETS:
T855RX	BENC	1396_03B	02-02-99	10

Sheet 9 – T855 Harmonic Filter
220-01396-03

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Part C T854 Transmitter

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 and Adjustment
4	Functional Testing
5	Fault Finding
6	PCB Information

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1 T854 General Information

This section provides a brief description of the T854 transmitter, along with detailed specifications and a list of types available.

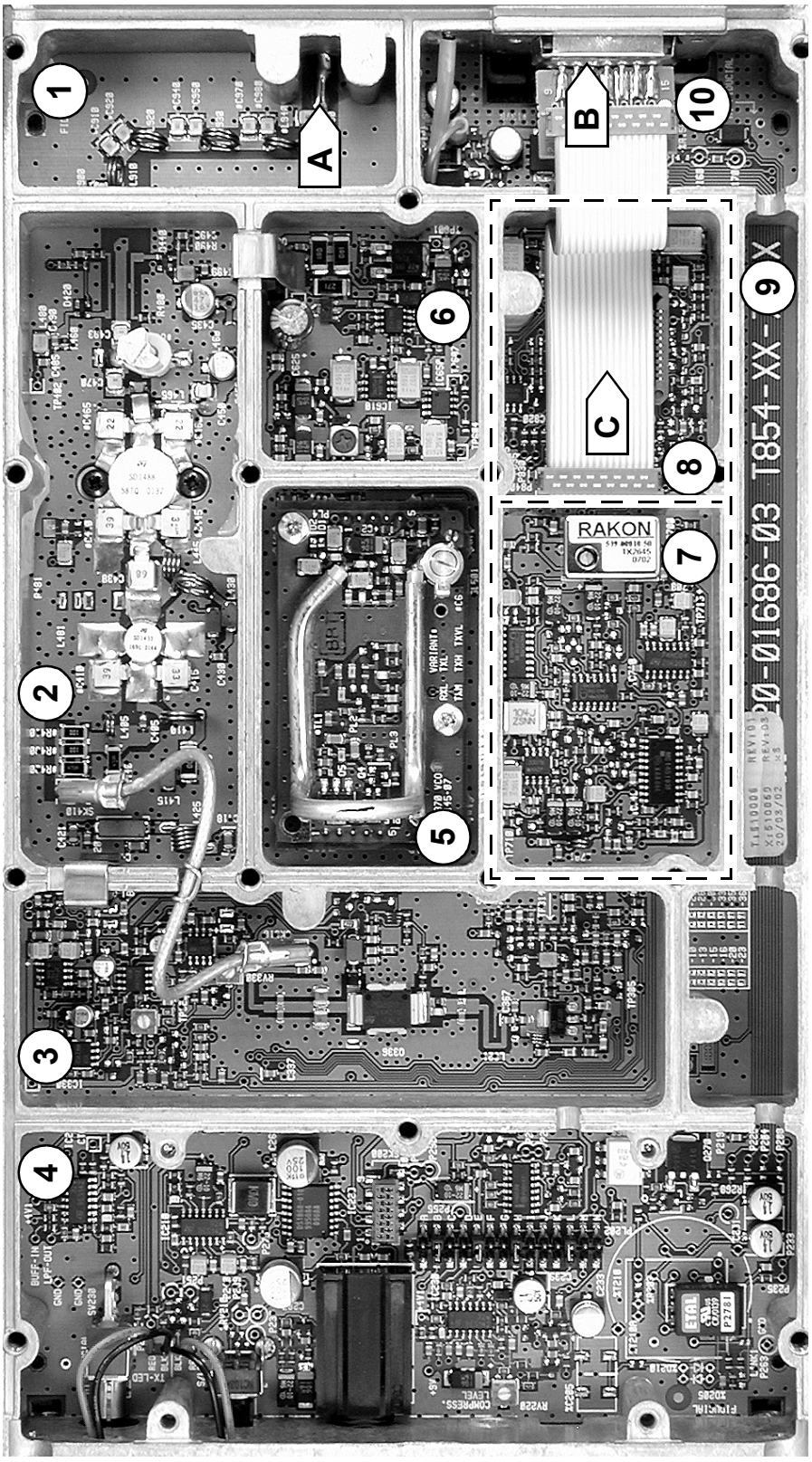
The following topics are covered in this section.

Section	Title	Page
1.1	**Introduction**	**1.5**
1.2	**Specifications**	**1.6**
1.2.1	Introduction	1.6
1.2.2	General	1.6
1.2.3	RF Section	1.7
1.2.4	Audio Processor	1.8
1.2.4.1	Inputs	1.9
1.2.4.2	Modulation Characteristics	1.9
1.2.4.3	CTCSS	1.9
1.2.5	Microcontroller	1.10
1.2.6	Test Standards	1.10
1.2.6.1	European Telecommunication Standard	1.10
1.2.6.2	DTI CEPT Recommendation T/R-24-01	1.10
1.2.6.3	Telecommunications Industry Association	1.10

Figure	Title	Page
1.1	T854 Main Circuit Block Identification	1.2
1.2	T854 Front Panel Controls	1.3

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Key:

1 low pass filter
2 PA
3 exciter drive amplifier
4 audio processor
5 VCO
6 regulators
7 synthesiser
8 microcontroller and CTCSS
9 duct for cabling to extra D-range (if fitted)
10 D-range

A RF output
B D-range connector ("D-range 1") incl. audio in and DC in (refer to Section 1.5 in Part G)
C microcontroller

Figure 1.1 T854 Main Circuit Block Identification

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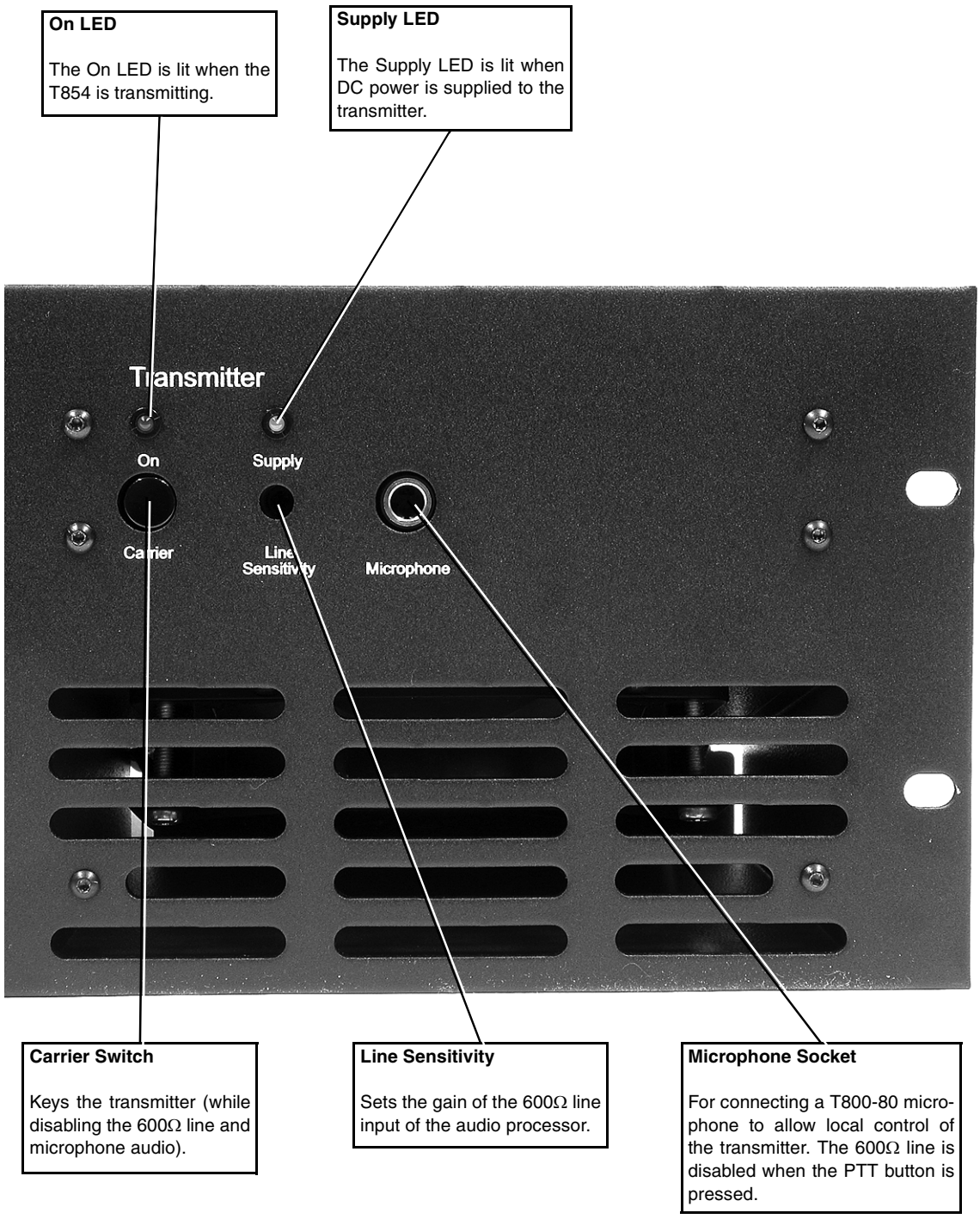


Figure 1.2 T854 Front Panel Controls

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1.1 Introduction

The T854 is a synthesised, microprocessor controlled FM base station transmitter designed for single or multichannel operation in the 400 to 520MHz frequency range[1] with a standard power output of 25W. The RF section of the transmitter comprises a frequency synthesiser which provides 100mW of frequency modulated RF drive to a two stage, wide band driver stage followed by a 25W power amplifier. A thermal shutdown feature is provided in the T854 in case operating temperatures exceed acceptable levels.

The T854 is rated for a continuous output power of 25W at +60°C. This is achieved via a high capacity heatsink, electric fan and shroud. The fan forces air across the heatsink to dissipate the heat. The heatsink replaces one of the usual T800 covers.

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 the PCB is primarily through the top cover of the radio, as all components are mounted on the top side of the PCB. 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.

1. Although capable of operating over the 400 to 520MHz frequency range, the T854 has an 8MHz switching range (see Section 1.2.3 and Section 3.1).

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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)

Supply Voltage:

Operating Voltage	… 10.8 to 16V_{DC}
Standard Test Voltage	… 13.8V_{DC}
Polarity	… negative earth only
Polarity Protection	… crowbar diode
Line Keying Supply (if required)	… –50V_{DC}

Supply Current:

Transmit – T854	… 5.5A (typical)
Standby – T854	… 150mA (typical)

Operating Temperature Range … –30°C to +60°C

Time-Out Timer (optional) … 0 to 10 minutes adjustable in 10 second steps

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Tail Timer	… 0 to 5 seconds adjustable in 20ms steps
Transmit Key Time	… Typically 35ms
Transmit Lockout Timer	… 0 to 1 minute adjustable in 10 second steps

1.2.3 RF Section

Frequency Range	… 400 to 520MHz
Modulation Type	… FM
Frequency Increment	… 5 or 6.25kHz
Switching Range	… 8MHz (i.e. ±4MHz from the centre frequency)
Load Impedance	… 50Ω
Frequency Stability	… ±1ppm, –30°C to +60°C
Adjacent Channel Power (full deviation):	
Wide Bandwidth (WB) (±25kHz/15kHz B/W)	… –75dBc
Mid Bandwidth (MB) (±20kHz/12kHz B/W)	… –70dBc
Narrow Bandwidth (NB) (±12.5kHz/7.5kHz B/W)	… –65dBc
Transmitter Switching	… complies with ETS 300 113

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

At ±25kHz	… –95dBc
At ±1MHz	… –105dBc

Intermodulation	… –40dBc with interfering signal of –30dBc … –70dBc with 25dB isolation and interfering signal of –30dBc (PA with output isolator)

T854 Mismatch Capability:

Ruggedness	… refer to your nearest Tait Dealer or Customer Service Organisation
Stability	… 3:1 VSWR (all phase angles)

Radiated Spurious Emissions:

Transmit	… –36dBm to 1GHz –30dBm 1GHz to 4GHz
Standby	… –57dBm to 1GHz –47dBm 1GHz to 4GHz

Conducted Spurious Emissions: (T854 Only)

Transmit	… –36dBm to 1GHz –30dBm 1GHz to 4GHz
Standby	… –57dBm to 1GHz –47dBm 1GHz to 4GHz

Power Output:

T854	– Rated Power	… 25W
	– Range Of Adjustment	… 5 to 25W

Duty Cycle … 100% at 25W at +60°C

1.2.4 Audio Processor

1.2.4.1 Inputs

Inputs Available … line, microphone and CTCSS

Line Input:

Impedance	… 600Ω (balanced)
Sensitivity (60% modulation at 1kHz)	
With Compressor	… –50dBm
Without Compressor	… –30dBm

Microphone Input:

Impedance	… 600Ω

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Sensitivity (60% modulation at 1kHz)
- With Compressor … –70dBm
- Without Compressor … –50dBm

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 and 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% max.

Hum And Noise:
- Wide Bandwidth … –55dB (300Hz to 3kHz [EIA]) typical
- Mid Bandwidth … –54dB (CEPT)(typical)
- Narrow Bandwidth … –50dB (CEPT)(typical)

Compressor (optional):
- Attack Time … 10ms
- Decay Time … 800ms
- Range … 50dB

1.2.4.3 CTCSS

Standard Tones … all 37 EIA group A, B and C tones plus 13 commonly used tones

Frequency Error (from EIA tones) … 0.08% max.

Generated Tone Distortion … 1.2% max.

Generated Tone Flatness … flat across 67 to 250.3Hz to within 1dB

Modulation Level … adjustable

Modulated Distortion … <5%

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1.2.5 Microcontroller

Auxiliary Ports:

Open Drain Type	… capable of sinking 2.25mA via 2.2kΩ
V_{ds} max.	… 5V

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.

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2 T854 Circuit Operation

This section provides a basic description of the circuit operation of the T854 transmitter.

Note: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 4.02 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	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 and Regulator Circuits**	**2.10**
2.7	**Transmit Timers**	**2.11**
2.8	**T854 Drive Amplifier, Fan Control and PA**	**2.12**

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Figure	Title	Page
2.1	T854 High Level Block Diagram	2.3
2.3	T854 Microcontroller Block Diagram	2.4
2.4	T854 Synthesiser Block Diagram	2.5
2.5	T854 Two Point Modulation	2.6
2.6	T854 Audio Processor Block Diagram	2.8
2.7	T854 Power Supply and Regulators Block Diagram	2.10
2.8	T854 Transmit Timers	2.11

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2.1 Introduction

The individual circuit blocks which make up the T854 are:

- synthesiser
- VCO
- audio processor
- drive amplifier
- 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 . Refer to the circuit diagrams in Section 6.2 for more detail.

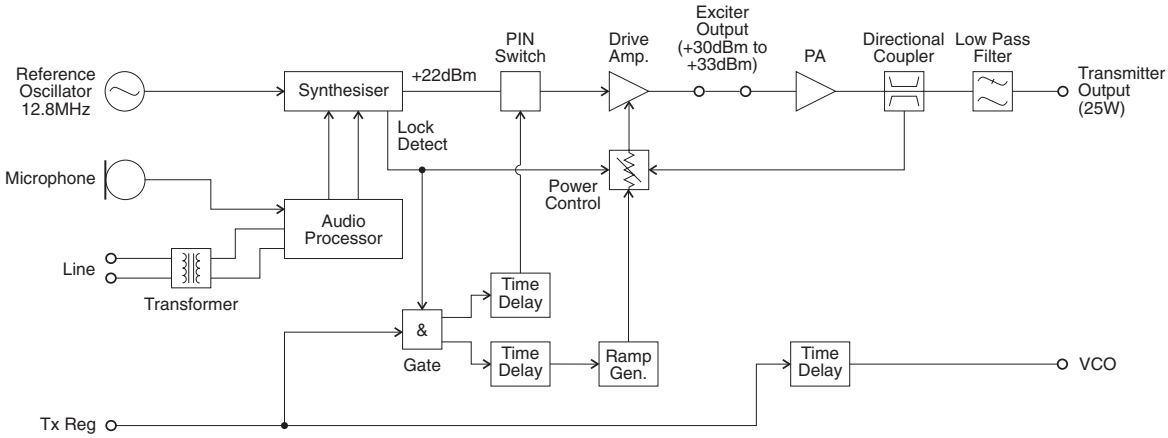


Figure 2.1 T854 High Level Block Diagram

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2.2 Microcontroller

Refer to the microcontroller circuit diagram (Sheet 8 – T854 Microcontroller) in Section 6.2

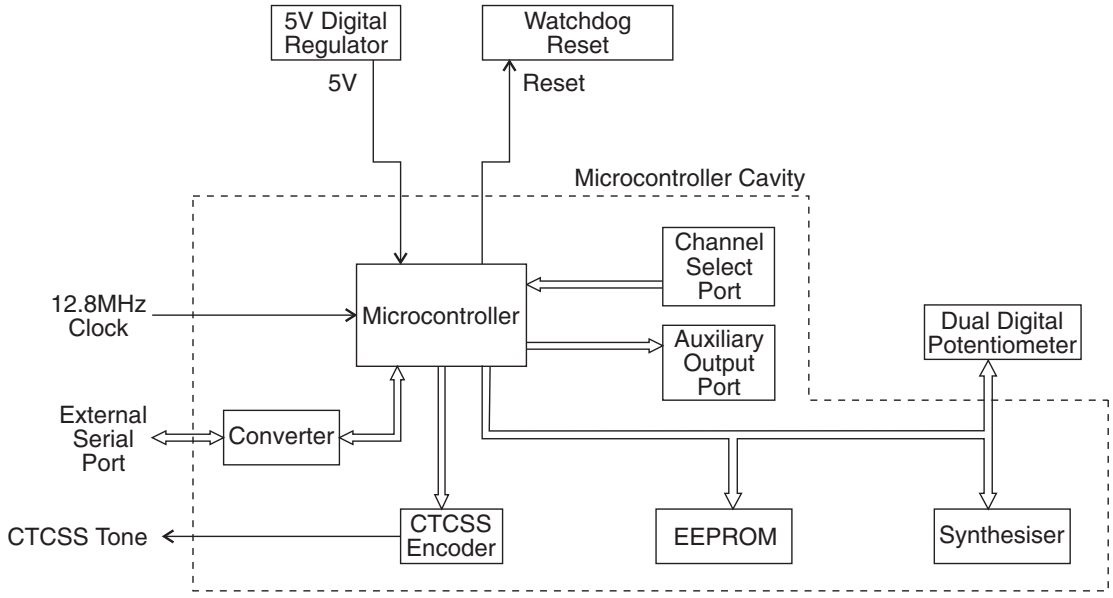


Figure 2.2 T854 Microcontroller Block Diagram

Overall system control of the T854 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) and D-range 2;
- monitor channel change inputs from D-range 2;
- generate timing waveforms for CTCSS encoding;
- coordinate and implement timing control of the transmitter.
- control the front panel “Supply” LED (refer to Section 5.3).

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2.3 Synthesised Local Oscillator

Refer to the synthesiser circuit diagram (Sheet 7 – T854 Synthesiser) in Section 6.2 and the VCO circuit diagram in Part E.

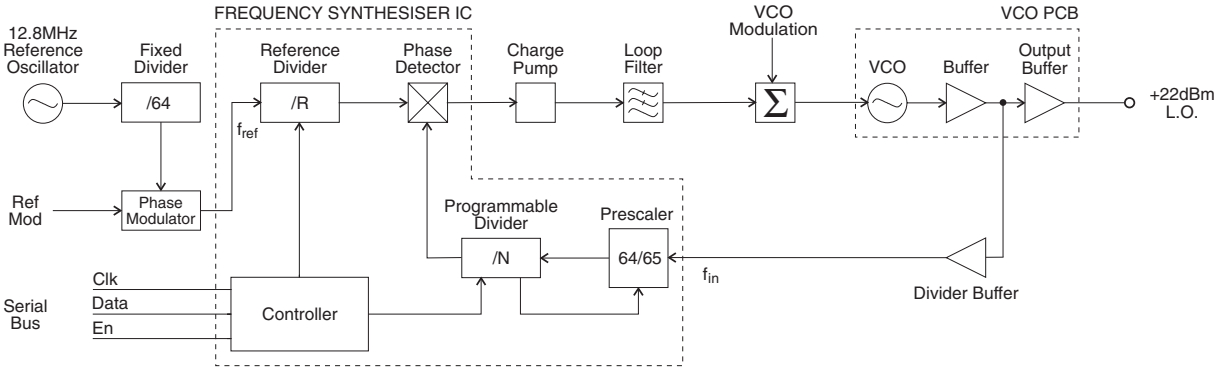


Figure 2.3 T854 Synthesiser Block Diagram

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 and 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 and 8, Q710, Q720). This produces a ramping waveform which is centred around a DC level determined by the incoming audio. IC720 pins 5 and 6 perform as a comparator, ultimately producing a phase-modulated 200kHz square wave. This is followed by another phase shifting stage (IC720 pins 3 and 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 and 7, Q790) 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 and 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.

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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 2.4 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 2.4.

The reference modulation is controlled by a 256-step 10k electronic potentiometer (EPOT) which is adjustable via PGM800Win. The EPOT is made up of 256 resistive sections (representing approximately 39Ω each) which can be individually addressed by the microcontroller. Each section can be switched in or out of circuit to achieve the required total resistance, thus giving control of the reference modulation.

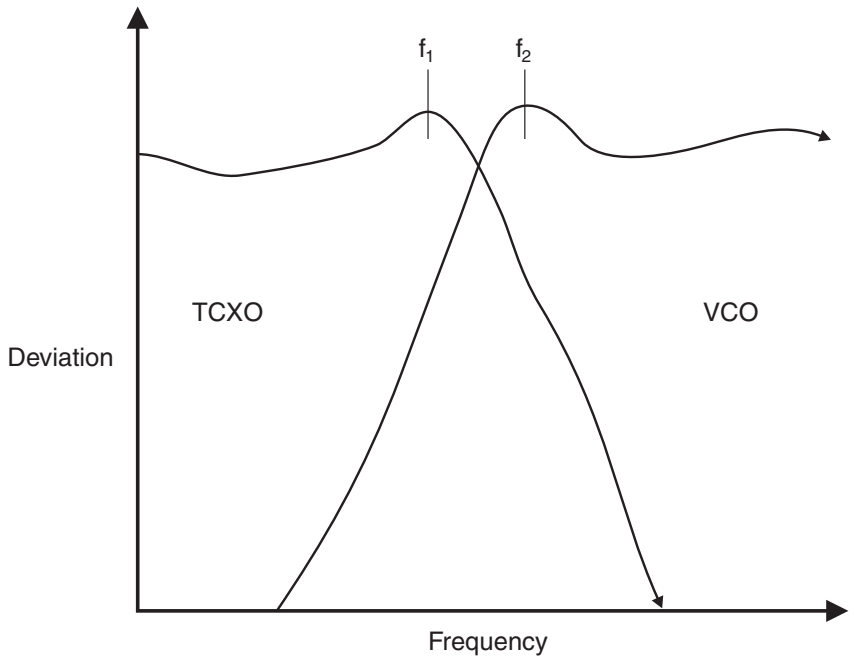


Figure 2.4 T854 Two Point Modulation

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2.4 VCO

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

The VCO transistor (Q1) operates in a common emitter 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) is applied to the varicaps (D1 and D2) to facilitate tuning within an 8MHz band of frequencies. A trimcap (C6) 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 +20dBm (typically) to the exciter drive amplifier.

A low level "sniff" is taken from the input to Q5 and used to drive the divider buffer for the synthesiser (IC740).

The VCO operates at the actual output frequency of the exciter, i.e. there are no multiplier stages. It 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 and buffer amplifier are supplied from one +9V switched supply by Q540 via the C multiplier (Q550, C530 on the T854 and C550 on the T857).

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.

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2.5 Audio Processor

Refer to the audio processor circuit diagram (Sheet 2 – T854 Audio Processor) in Section 6.2.

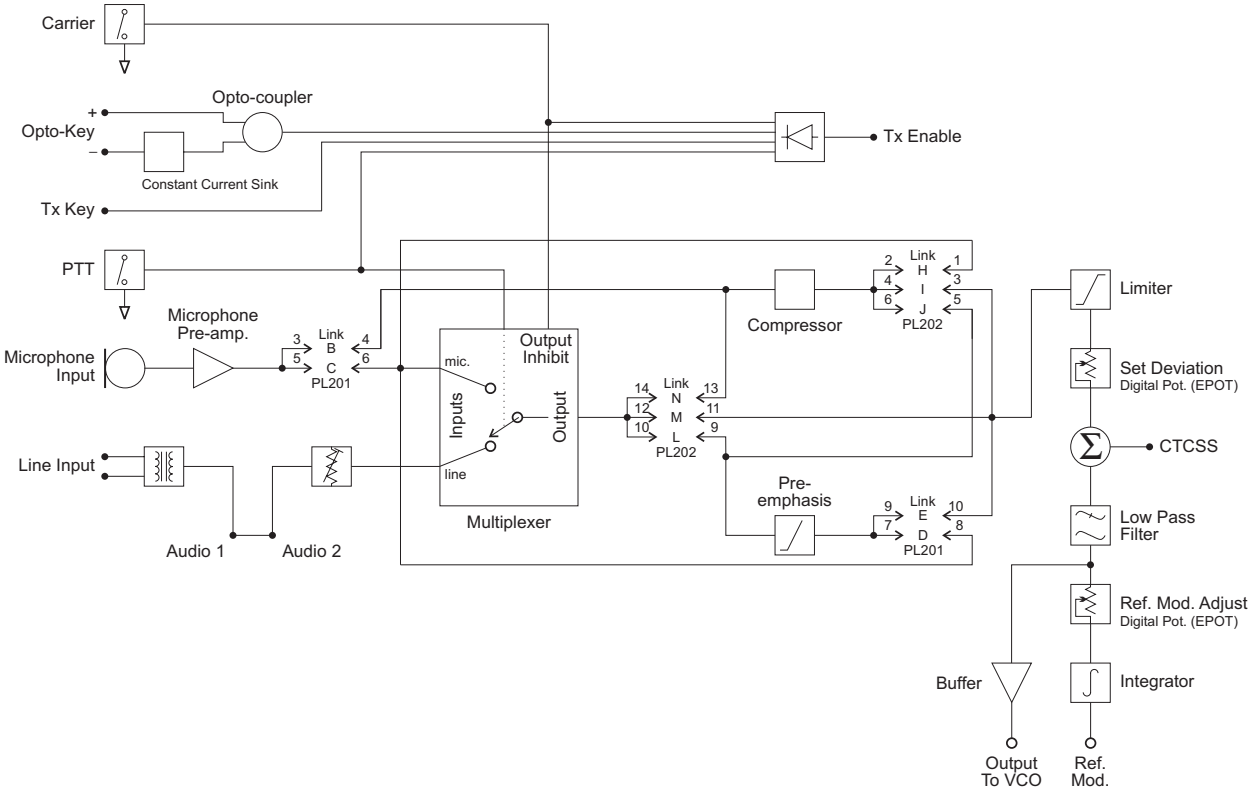


Figure 2.5 T854 Audio Processor Block Diagram

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 600Ω 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.

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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 summed 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 by IC220, a 256-step 10k electronic potentiometer (EPOT), which is controlled via PGM800Win. The EPOT is made up of 256 resistive sections (representing approximately 39Ω each) which can be individually addressed by the microcontroller. Each section can be switched in or out of circuit to achieve the required total resistance, thus adjusting the absolute deviation level.

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2.6 Power Supply and Regulator Circuits

Refer to the regulators circuit diagram (Sheet 6 – T854 Regulators) in Section 6.2.

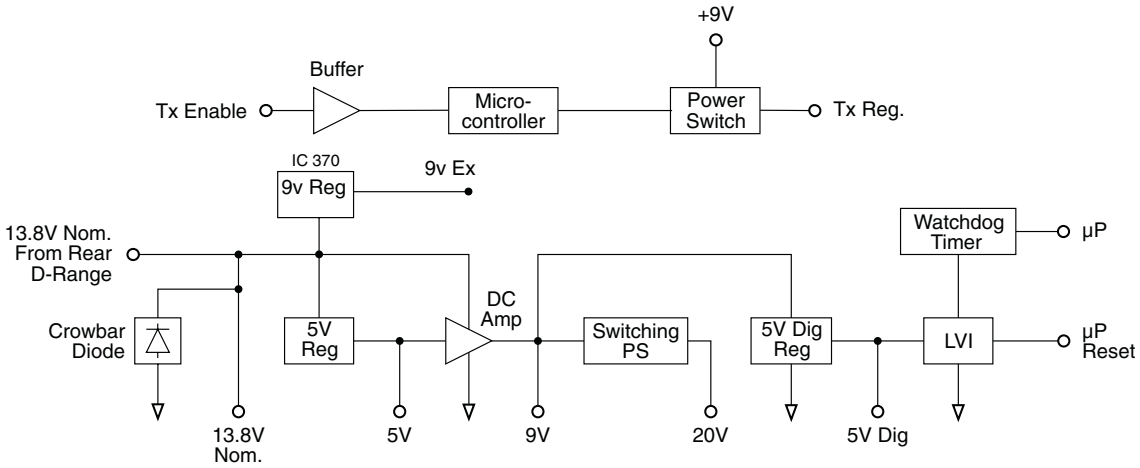


Figure 2.6 T854 Power Supply and Regulators Block Diagram

The T854 is designed to operate from a 10.8 to 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. The T854 has a regulator (IC370) which produces 9V for use in the exciter and audio circuits.

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.

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.

A crowbar diode is fitted for protection against connection to a power supply of incorrect polarity. It also provides transient overvoltage protection.

Note: A fuse must be fitted in the power supply line for the diode to provide effective protection.

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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 2.7):

Timer	Function	Adjustment
Transmit Tail	Sets the tail time during which the transmitter stays keyed after the external key source has been removed.	0 to 5 seconds in 20ms 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 to 600 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 to 60 seconds in 10 second steps

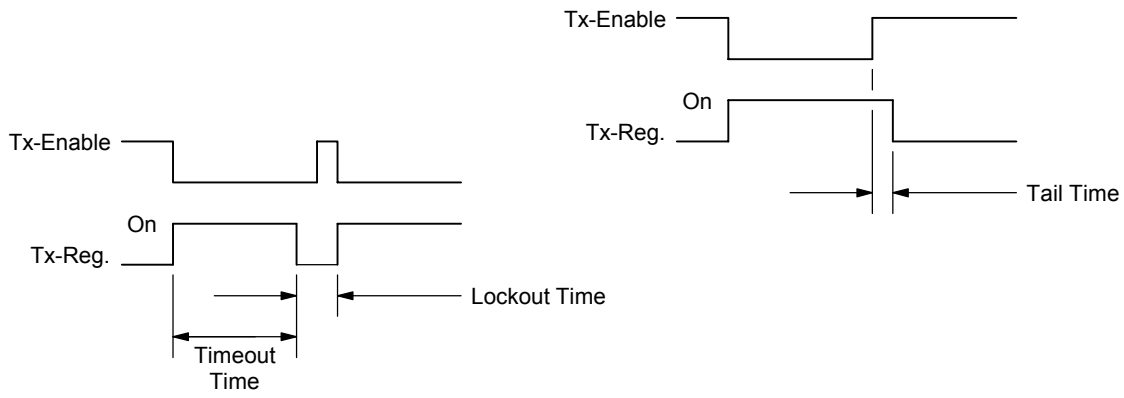


Figure 2.7 T854 Transmit Timers

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2.8 T854 Drive Amplifier, Fan Control and PA

Refer to Figure 2.1 and the exciter and PA circuit diagrams (sheets 3 and 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 (Q337, Q336). The forward and reverse RF power levels are sensed via a dual directional coupler and detector diodes (D440, D420 in the PA cavity). The detected DC signals are buffered (IC330 pins 3 and 5) and then summed with the 'power control' level and fed to the control integrator (IC350 pin 6).

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, D380, D360).

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

- Q330, IC350 power ramping
- Q326, Q325, Q341 Tx-Reg. and $\overline{\text{Lock-Detect}}$ gate
- Q335, Q340, Q345 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 1W (+30dBm) for an input of 100mW (+20dBm) from the VCO, when the power control is set to maximum.

A temperature sensor (R481) in the PA cavity presents a voltage to the comparators of IC340 pin 2 and IC350 pin 2. The fan is switched on and off by the comparator of IC340 and the power fold-back is enabled by the comparator of IC350. Power fold-back reduces the output power to a preset level that protects the PA semiconductors from excessive temperatures. Under normal operating conditions, the fan will be activated before power fold-back can occur and it will prevent the temperature from reaching damaging levels. The voltage divider ratio of R311 and R312 sets the the temperature at which the fan is switched on and off. R306 and R340 set the temperature at which power is reduced. Depending on ambient temperature and ventilation, it may take several minutes of continuous operation for the fan to be activated.

#R517, #R518 and #R519 form an attenuator to provide good VCO/exciter isolation as well as the correct exciter drive level.

The attenuator (#R395, #R396 and #R397) aids in producing the correct exciter drive level to the PA over the three frequency ranges.

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The RF output from the exciter is fed to the driver stage (Q410) and then to the final (Q420). DC is fed to the final via a low pass filter with special low frequency decoupling. CV475 tunes the output matching across the entire band.

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3 T854 Initial Tuning and Adjustment

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

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
- 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 4.02 and later of the software.

Refer to Figure 4.4 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.

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3.2	**Channel Programming**	**3.3**
3.3	**Test Equipment Required**	**3.4**
3.4	**Short Tuning Procedure**	**3.5**
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3.2	T854 Test Equipment Set-up Without T800-01-0010	3.4

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3.1 Introduction

When you receive your T854 transmitter 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 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 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's EEPROM memory (IC820) by using the PGM800Win software package and a PC. You can also use PGM800Win to select the transmitter's current operating frequency (or "default channel").

If the transmitter 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 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 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 a backplane PCB. Refer to your nearest Tait Dealer or Customer Service Organisation for further details.

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

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3.3 Test Equipment Required

You will need the following test equipment:

- computer with PGM800Win installed
- T800 programming kit
- module programming interface (e.g. T800-01-0004 – optional)
- 13.8V power supply
- digital multimeter
- audio signal generator
- RF power meter
- audio voltmeter x 2
- modulation meter
- oscilloscope (digital preferred)
- 20dB or 40dB pad

  } or RF test set (optional)

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

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

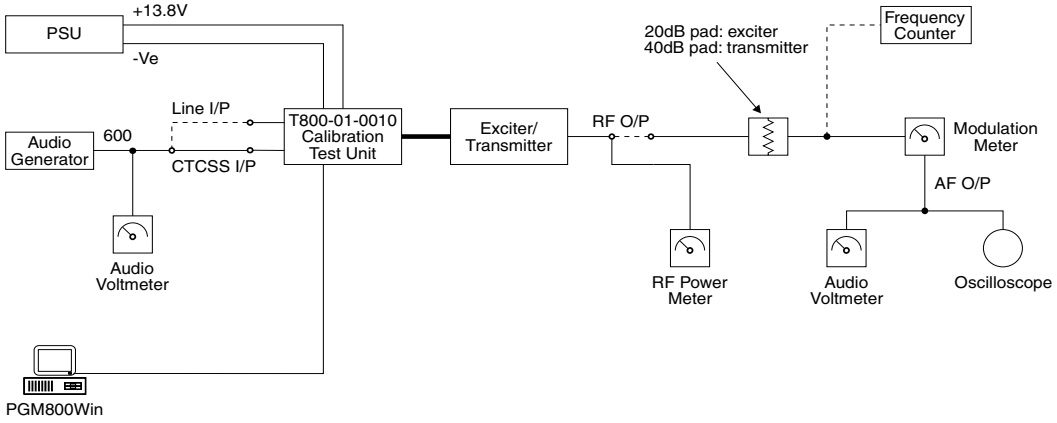


Figure 3.1 T854 Test Equipment Set-up With T800-01-0010

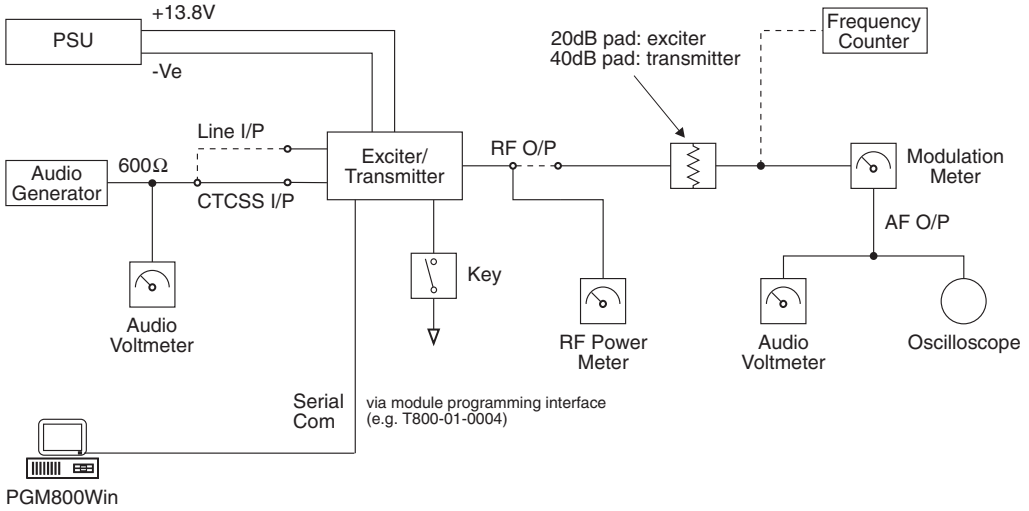


Figure 3.2 T854 Test Equipment Set-up Without T800-01-0010

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3.4 Short Tuning Procedure

Use this procedure only if you want to reprogram the T854 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.

Set up the test equipment as described in Section 3.3.

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

3.4.2 Synthesiser Alignment

- Connect a high impedance voltmeter to the long lead of L1 in the VCO (this measures the synthesiser loop voltage).
- Key the transmitter by earthing the Tx-Key line.
- **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 program channels with a greater frequency separation than the specified switching range of 8MHz.

3.4.3 Output Power Adjustment

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

Turn RV310 (power control) fully clockwise.

Tune #CV475 (output power trim) for maximum output power and check that this is >30W.

Adjust RV310 for the required output power (between 5 and 25W).

Readjust #CV475 to reduce the supply current by up to 0.5A.

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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: The reference modulation and limiter adjustments are controlled by 256-step electronic potentiometers (EPOTs), which are adjusted via the "Reference Modulation" and "Deviation" settings in PGM800Win. This allows the two point modulation and deviation settings to be adjusted for each channel.

Note 3: To optimise the modulation response across the switching range, repeat steps 1 to 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 to 4 below on the middle channel and use the "EPOT Fill" option[1] in PGM800Win to copy the value to the other channels.

Note 4: If you are using an RF test set, turn the low pass filter off and set the high pass filter to 15kHz ***before*** beginning this procedure.

1. Inject an audio signal of 300Hz 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 300Hz.

3. Change the input frequency to 100Hz and, using PGM800Win, adjust the value of the "Reference Modulation" EPOT setting for the current channel 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 300Hz.

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

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

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

– incorrect set-up
or – modulation circuitry fault.

The specification window is ±1dB relative to 150Hz from 67 to 260Hz.

1. Use the "EDIT FILL" button on the tool bar or go to "Edit", "Fill", "Epot Settings" on the menu bar.

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3.4.5 CTCSS Encoder (If Used)

Program a CTCSS tone on the default channel using PGM800Win.

If you are using an RF test set, turn off the 300Hz high pass filter.

Key the T854 with the front panel "Carrier" switch.

Adjust RV805 (CTCSS level adjust) to give ±500Hz (±350Hz) [±250Hz] deviation.

Set the maximum deviation as per Section 3.4.6.

3.4.6 FM Deviation (Limiter) Adjustment

Note: If the T854 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 "EPOT Fill" option in PGM800Win.

Inject 1kHz at –10dBm into the line input (D-range 1 (PL100) pins 1 and 4; pins 2 and 3 shorted; refer to Section 1.5 of Part G).

Adjust RV210 (line sensitivity) fully clockwise and key the transmitter by earthing the Tx-Key line. Using PGM800Win, adjust the value of the "Deviation" EPOT setting for the current channel to obtain a deviation limit of ±4.7kHz (±3.8kHz) [±2.3kHz] (you can use either the mouse or up and down arrow keys).

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

3.4.7 Line-in Level Adjustment

Remove the CTCSS signal (if used).

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.

Reapply the CTCSS signal (if required).

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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.

Plug	Link[a]		Function
PL201	1–2	A	not connected
	3–4[b]	B	microphone pre-amp output to compressor input
	5–6	C	microphone pre-amp output to multiplexer input
	7–8	D	pre-emphasis output to multiplexer input
	9–10[b]	E	pre-emphasis output to limiter input
	11–12	F	not connected
	13–14	G	not connected
PL202	1–2[b]	H	compressor output to multiplexer input
	3–4	I	compressor output to limiter input
	5–6	J	compressor output to pre-emphasis input
	7–8	K	not connected
	9–10[b]	L	multiplexer output to pre-emphasis input
	11–12	M	multiplexer output to limiter input
	13–14	N	multiplexer output to compressor input

a The letters in this column refer to the letters printed on the PCB beside each pair of pins. Note that the link names and pin numbers are different to earlier products. The lettering A to N is however the same.

b Factory Setting

3.5.2 Typical Options

microphone pre-amp	line input	PL201[a]	PL201	PL202	PL202
compressed and pre-emphasised	pre-emphasised	B[b]	E[b]	H[b]	L[b]
	unprocessed	B	D	J	M
	compressed and pre-emphasised	C	E	J	N
compressed and flat response	flat response	B	F	H	M

a The letters in this table refer to the letters printed on the PCB beside each pair of pins.

b Factory Setting

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3.6 Synthesiser Alignment

1. Ensure that the T854 has been programmed with the required frequencies using PGM800Win software.

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

   Multichannel Select the middle channel via PGM800Win.

3. Connect a high impedance voltmeter to the long lead of L1 in the VCO (this measures the synthesiser loop voltage).

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

   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 program channels with a greater frequency separation than the specified switching range (8MHz).

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



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

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3.7 PA Alignment

1. Check that the exciter is connected to the PA with the coaxial link.
2. Connect an RF power meter to the PA output (use an appropriate attenuator as necessary).
3. Turn RV310 (power control) fully clockwise.
4. Key the transmitter by earthing the Tx-Key line.
5. Tune #CV475 until maximum power is obtained. Check that the power exceeds 30W.
6. Adjust RV310 (power control) to 25W.
7. Readjust #CV475 to reduce the supply current by up to 0.5A.

3.8 Thermal Shutdown

1. Key the transmitter by earthing the Tx-Key line and set the output power to 25W as described in Section 3.7.
2. Short L481 to ground.
3. Set RV330 (shutdown power level) for an output power of 5W.

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3.9 Audio Processor and CTCSS

3.9.1 Two Point Modulation

The T854 utilises 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: The reference modulation and limiter adjustments are controlled by 256-step electronic potentiometers (EPOTs), which are adjusted via the "Reference Modulation" and "Deviation" settings in PGM800Win. This allows the two point modulation and deviation settings to be adjusted for each channel.

Note 3: To optimise the modulation response across the switching range, repeat steps 1 to 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 to 4 below on the middle channel and use the "EPOT Fill" option[1] in PGM800Win to copy the value to the other channels.

Note 4: If you are using an RF test set, turn the low pass filter off and set the high pass filter to 15kHz ***before*** beginning this procedure.

3.9.2 Modulator Adjustment

1. Inject an audio signal of 300Hz 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 300Hz.

3. Change the input frequency to 100Hz and, using PGM800Win, adjust the value of the "Reference Modulation" EPOT setting for the current channel to obtain ±3kHz (±2.4kHz) [±1.5kHz] deviation (you can use either the mouse or up and down arrow keys).

1. Use the "EDIT FILL" button on the tool bar or go to "Edit", "Fill", "Epot Settings" on the menu bar.

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4. Change the input frequency back to 300Hz.

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

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

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

– incorrect set-up
or – modulation circuitry fault.

The specification window is ±1dB relative to 150Hz from 67 to 260Hz.

3.9.3 CTCSS Encoder (If Used)

1. Program a CTCSS tone on the default channel using PGM800Win.

2. If you are using an RF test set, turn off the 300Hz high pass filter.

3. Key the T854 with the front panel "Carrier" switch.

4. Adjust RV805 (CTCSS level adjust) to give ±500Hz (±350Hz) [±250Hz] deviation.

5. Set the maximum deviation as per Section 3.9.4.

3.9.4 Limiter Adjustment

Note: If the T854 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 "EPOT Fill" option in PGM800Win.

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

2. Inject 1kHz at –10dBm into the line input (D-range 1 (PL100) pins 1 and 4; and pins 2 and 3 shorted; refer to Section 1.5 of Part G).

3. Adjust RV210 (line sensitivity) fully clockwise and key the transmitter by earthing the Tx-Key line. Using PGM800Win, adjust the value of the "Deviation" EPOT setting for the current channel to obtain a deviation limit of ±4.7kHz (±3.8kHz) [±2.3kHz] (you can use either the mouse or up and down arrow keys).

4. 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.

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3.9.5 Line Level Without Compressor

This section assumes that the compressor is not used. If the compressor is required, refer to Section 3.9.6.

1. Remove the CTCSS signal (if used).

2. 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. Reapply the CTCSS signal (if required).

3.9.6 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.

3.9.6.1 Compressor On Line Input Only

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

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

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

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

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

6. 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.

3.9.6.2 Compressor On Microphone Input Only

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

2. Adjust RV220 (compression level) fully clockwise.

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

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

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

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

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

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

9. As the line is to be used without compression, set RV210 (line sensitivity) as described in Section 3.9.5.

3.9.6.3 Compressor On Both Line and Microphone Inputs

Set up as described in Section 3.9.6.1.

3.10 Power Alarms (if used)

When fitted to the T854 transmitter an alarm board monitors the transmitter output power and generates a low forward-power and/or high reverse-power alarm as appropriate.

This is achieved by monitoring the output voltages of the transmitters forward and reverse power directional coupler. A comparison between these voltage levels and user defined reference voltages generates alarm conditions accordingly. The low forward power output signal is also gated with the Tx-enable input to ensure that no alarm is generated when the transmitter is not transmitting. The high reverse power alarm output is not gated. The alarm signal is output on the T854 Aux D-range.

There are two alarms boards currently available, the recently introduced and improved T800-10-0520 Tx-Alarm/Channel Select board and the older T1500-52-0000, which it replaces. The alarm outputs of both the these boards are compatible with the T1511-20-0000 CCM module and the T803-02 Tone Remote and Alarm interface.

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The following table indicates the SL2 backplane configuration required.

Alarm board	SL2 Backplane		Notes
	Link 9	Link 10	
T1500-52-0000 (PCB 220-01426-04)	2 – 3	2 – 3	See Section 3.10.1 T1500-52-0000 Tx Alarm/Multi-channel Kit
T800-10-0520 (plug-in alarm board)	2 – 3	2 – 3	See Section 3.10.2 T800-10-0520 Tx-Alarm/Channel-Select Kit
No internal alarm board fitted but FWD and REV power sense voltages output directly on T854 Aux D-range. Could be used for an externally fitted RF power indicator/alarm.	1 – 2	1 – 2	**Cannot be used to trigger T803-02 RF power alarms.** On the T854 for S/N 13098764 or earlier: – remove R840 and R841 – fit R308 and R310 (both 10kΩ)

3.10.1 T1500-52-0000 Tx Alarm/Multi-channel Kit

When fitted, the T1500-52-0000 Tx alarm PCB monitors the transmitter output power and generates a low forward and/or high reverse power alarm signal as appropriate.

Alarm outputs are compatible with the T1511-20-0000 CCM module. On-board LED indication of alarms is also provided for trouble shooting and setup purposes.

Parts Supplied

The T1500-52-0000 should contain:

- T1500-52-0000 Alarm PCB and mounting screws.
- D-range and PCB interface.

3.10.1.1 Installation

To install this kit you will require the following tools:

- T1500-52-0000 Tx alarm/Multi-channel alarm kit
- Philips screwdriver
- Soldering iron
- Small sidecutters

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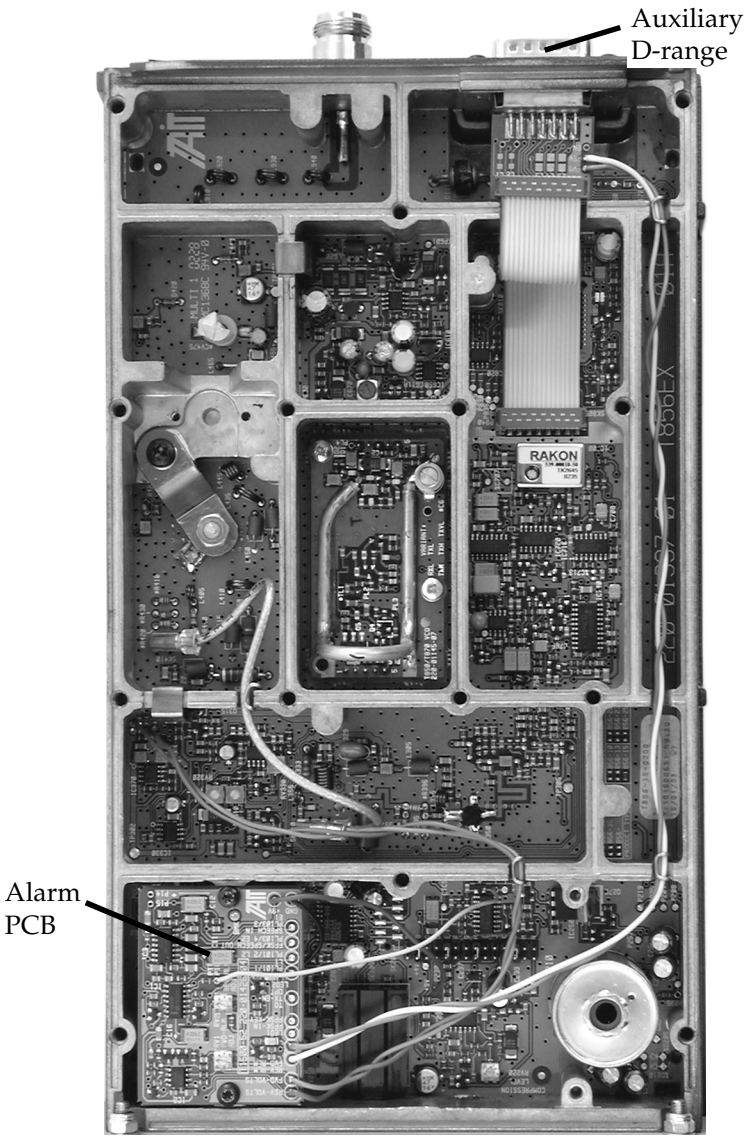


Figure 3.3 Example Transmitter (T856) Fitted with Alarm Kit

T800 connection pads		T1500-52-0000 PCB connection pads	Rear D-range pin number and PCB label	Wire colour
+9V	P230	+9V	—	Red
GND	P259	GND	—	Black
Fwd Pwr TP T826: T836: T854/T856:	 R302 (via end) TP310 TP306	Fwd Volts	—	Green
Rev Pwr TP T826: T836: T854/T856:	 R301 (via end) TP309 TP307	Rev Volts	—	Orange
—		Fwd pwr alarm	Pin 13 – Fwd	Blue
—		Rev pwr alarm	Pin 14 – Rev	White
Tx Enb	D240 pin 3	PTT	—	Yellow

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1. Remove the top and bottom cover from the T854 transmitter.

2. Remove the Aux D-range and replace with the supplied D-range socket.

3. Connect the T1500-52-0000 wires to the D-range PCB, audio processor and exciter compartments as shown in the table above.

4. Fit cable clamps to all points where wires pass through the radio's chassis.

5. Fit the wire clamp to the forward and reverse voltage input wires at the point were they cross over between compartments.

6. Mount the T1500-52-0000 component side up on the chassis lugs provided in the audio compartment, at the top (Carrier button) end.

Note: Take care not to knock the T1500-52-0000 PCB while the covers are off. A sharp knock on the SMD electro capacitors will damage the board.

7. Fit a ribbon cable if multi-channel operation is required.

8. Run up the board according to the test section below.

9. Ensure that the cable clamps hold down all wires safely so that they will not be pinched. Replace both covers.

3.10.1.2 T1500-52-0000 Testing/Alignment

Equipment required

- 50Ω power meter
- 3 or 6dB attenuator as needed.

Forward alarm

1. Connect the power meter to the transmitter output.

2. Key up the transmitter and set the output power to the desired low forward power alarm threshold point.

3. Adjust the "Fwd-alarm adjust" preset until the forward alarm LED just comes ON.

4. Reset the output power to the operational output level. Check the alarm output is now OFF.

5. Turn the transmitter OFF.

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Reverse alarm

1. Connect the power meter to the transmitter output.

2. Key up the transmitter and set the output power level to the operational output level.

3. Replace the power meter with the appropriate valued open ended attenuator. This should generate the desired return loss/reflected power for the desired high reverse power alarm threshold point.

4. Adjust the "Rev-alarm adjust" preset until the alarm LED just comes ON.

5. Turn the transmitter OFF.

3.10.2 T800-10-0520 Tx-Alarm/Channel-Select Kit

When fitted to a T854 transmitter, the T800-10-0520 Tx-Alarm/Channel-Select plug-in board provides the following features:

- The plug-in board monitors the transmitter's output power, and generates a low forward-power and/or high reverse-power alarm as appropriate.
- The plug-in board also includes channel select switches that enables the user to manually set the operational channel of the T854.

The plug-in board provides the same alarm outputs as the T1500-52-0000:

- Forward Power Alarm: Aux D-range pin 13
- Reverse Power Alarm: Aux D-range pin 14

Note: AUX-OUT-0 is disabled when the plug-in board is installed.

The Tx-Alarm function is achieved by comparing the output voltages of the transmitter's directional coupler to user-defined reference levels.

The low forward-power alarm output is gated with the Tx-Enable input, to ensure that no alarm is generated when the transmitter is not transmitting. The high reverse-power alarm is not gated.

Note: The plug-in board does not require additional wiring. It can be set up on the bench. This is possible because the Tx-Enable line is accessed from inside the T854, rather than from the backplane PCB (as on the T1500-52-0000).

Parts Supplied

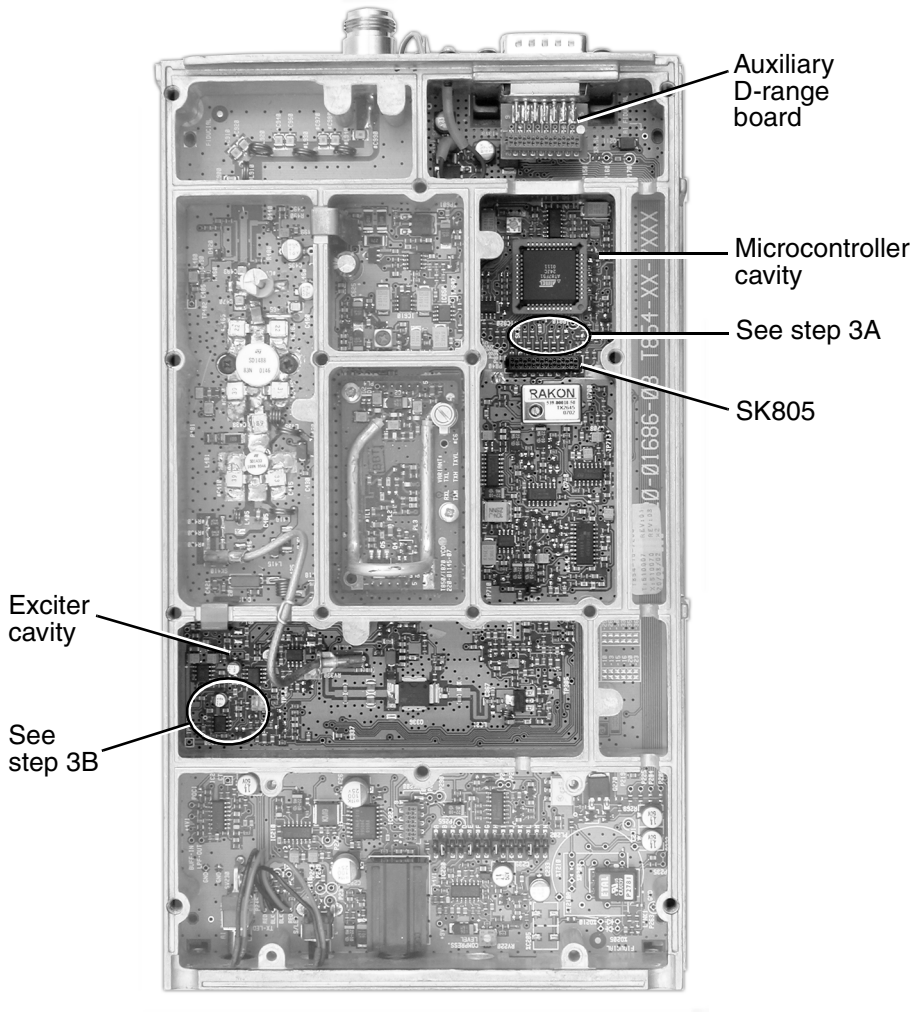
T800-10-0520 Tx-Alarm/Channel-Select Kit should contain the following:

- T800-10-0520 plug-in board

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3.10.2.1 Installation

To install this kit you will require a small flat-bladed screwdriver or similar.



1. Remove the top cover from the T854 Transmitter.

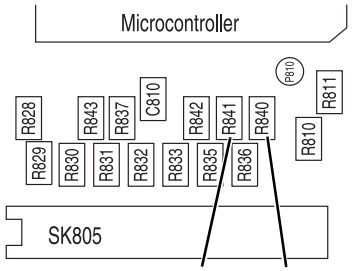
2. The auxiliary D-Range board is connected to the microcontroller cavity by a ribbon-cable. Remove the ribbon-cable.

3. **For T854 transmitters with a serial number of 13098764 or earlier:**
   These transmitters are not by default configured to work with the plug-in board. The directional coupler voltages must be routed to SK805.

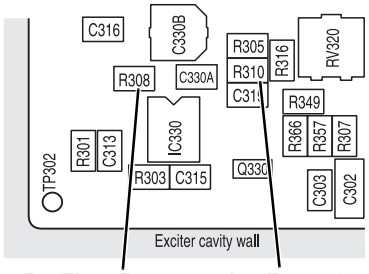
Note: This step disables AUX-OUT-1 and AUX-OUT-2.

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Remove and fit the following resistors:



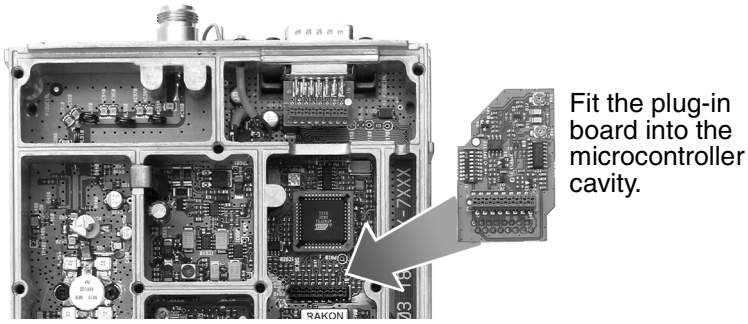
3A: Remove R841 and R840 from the microcontroller cavity.



3B: Fit %R308 and %R310 in the exciter cavity. Use 10kΩ SMD0805 (IPN: 036-15100-10).

4. Double-sided tape is attached to the bottom side of the plug-in board. Remove the protective film from the double-sided tape to expose its adhesive surface.

5. The plug-in board is mounted in the T854 microcontroller cavity. Plug J1, the connector on the bottom side of the plug-in board, into SK805 on the T854 main board.



Fit the plug-in board into the microcontroller cavity.

6. Firmly press down on the edges of the plug-in board so that the double sided tape bonds to the top of the microcontroller.

7. Connect the ribbon-cable between J2 on the plug-in board, and the auxiliary D-Range board.

3.10.2.2 T800-10-0520 Testing/Alignment

Equipment required

- 50Ω power meter
- Suitable attenuator, e.g. 3dB.

Forward alarm

1. Connect the power meter to the transmitter output.

2. Key up the transmitter and set the output power to the desired low forward-power alarm threshold-point.

3. Adjust RV2, the forward-power alarm preset, until the forward alarm LED (DS2) just turns ON.

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4. Reset the power to the operational output level. Verify that the alarm output is now OFF.

5. Turn the transmitter OFF.

Reverse alarm

1. Connect the power meter to the transmitter output.

2. Key up the transmitter and set the output power level to the operational output level.

3. Unkey the transmitter.

4. Replace the power meter with the appropriate valued open-ended attenuator. This should generate the desired return loss/reflected power for the desired high reverse-power alarm threshold-point.

5. Key up the transmitter.

6. Adjust RV1, the reverse-power alarm preset, until the reverse alarm LED (DS1) just comes ON.

7. Turn the transmitter OFF.

Channel Select Setup

In the default state of the plug-in board, no channel is selected (channel select disabled).

1. The desired channel can be selected by S1. Set the switches on S1 to the desired channel number, in binary format.

Note: The switch on position is a binary '0' and the off position a binary '1'.

2. To disable channel select, set all switches back to the off position.

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4 T854 Functional Testing

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

The following test procedures will confirm that the T854 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 4.02 and later of the software.

Refer to Figure 4.4 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**	**4.4**
4.5	**Frequency Response**	**4.5**
4.6	**Audio Level Input Sensitivity**	**4.8**

Figure	Title	Page
4.1	T854 Transmit Timers	4.4
4.2	T854 Pre-emphasis Response	4.6
4.3	T854 Limiting Response	4.7
4.4	T854 Main Tuning and Adjustment Controls	4.9

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4.1 Current Consumption

1. Connect the T854 to a 13.8V power supply.
2. Connect an RF power meter to the T854 output socket.
3. Check that the current in the 13.8V power cable is less than 150mA.
4. Key the T854 by earthing the Tx-Key line (the carrier "On" LED should light).
5. Adjust RV310 (power control) to obtain 25W output power.
6. Check that the current is less than 5.5A

4.2 Output Power

1. Connect an RF power meter with suitable attenuation to the T854 output socket.
2. Key the T854 by earthing the Tx-Key line.
3. Check that the output power adjusts to ≥25W with RV310 (power control) turned fully clockwise

4.3 Output Frequency

Connect the T854 output to a frequency counter via a 40dB attenuator pad. Measure the output frequency and, if necessary, adjust the TCXO (=IC700) to trim to the nominal frequency (±100Hz).

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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):

Timer	Function	Adjustment
Transmit Tail	Sets the tail time during which the transmitter stays keyed after the external key source has been removed.	0 to 5 seconds in 20ms 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 to 300 seconds in 20 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 to 60 seconds in 10 second steps

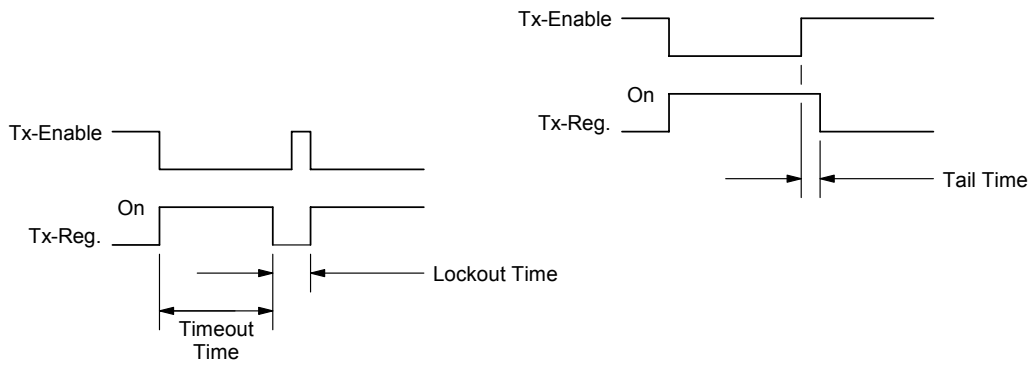


Figure 4.1 T854 Transmit Timers

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4.5 Frequency Response

If the T854 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.

1. If you are using an RF test set, turn off all filters.

2. Measure the pre-emphasis response as follows:

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

   Sweep the modulation frequency.

   The response should closely match that shown in Figure 4.2.

3. Measure the limiting response as follows:

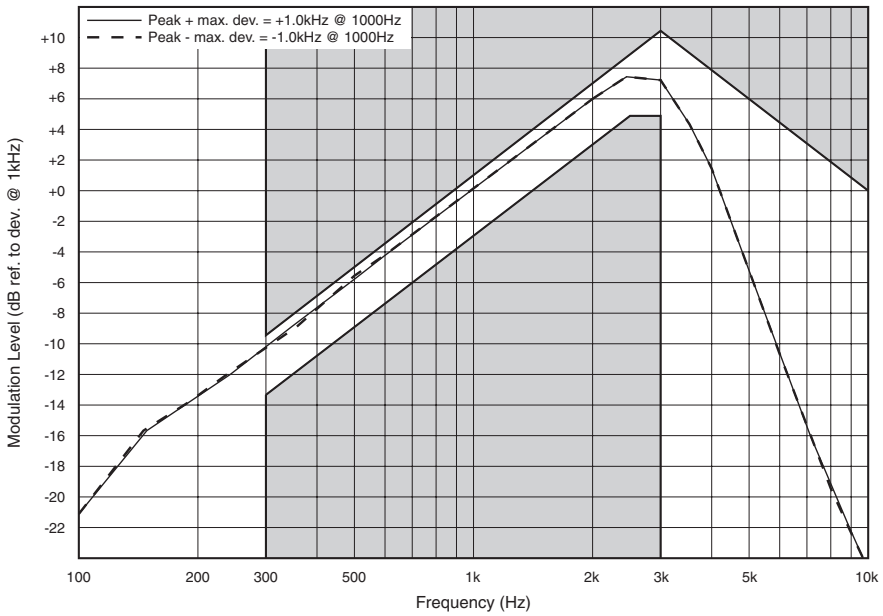
   Set the line level to give ±3kHz (±2.4kHz) [±1.5kHz] deviation at 1kHz.

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

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The response should closely match that shown in Figure 4.3.

Wide Bandwidth



Mid Bandwidth

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

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

Narrow Bandwidth

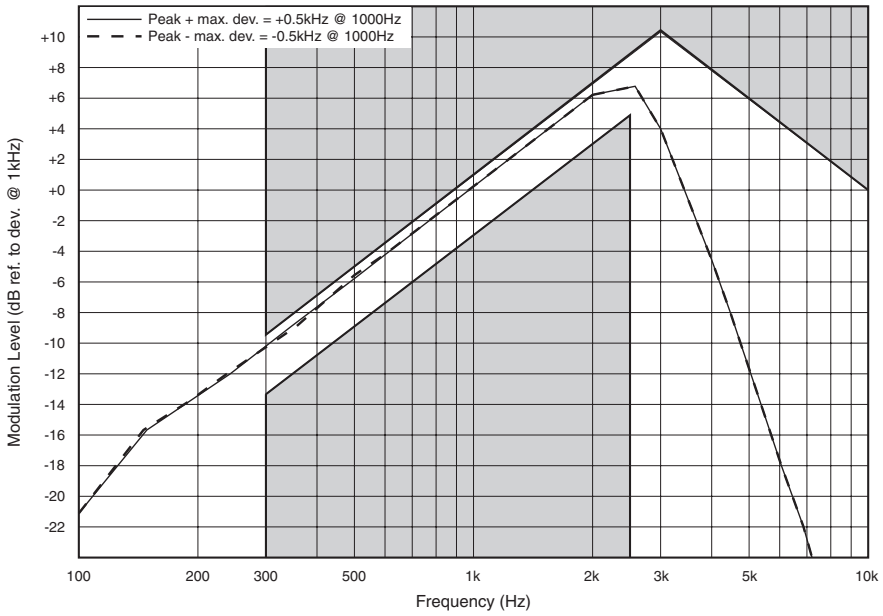
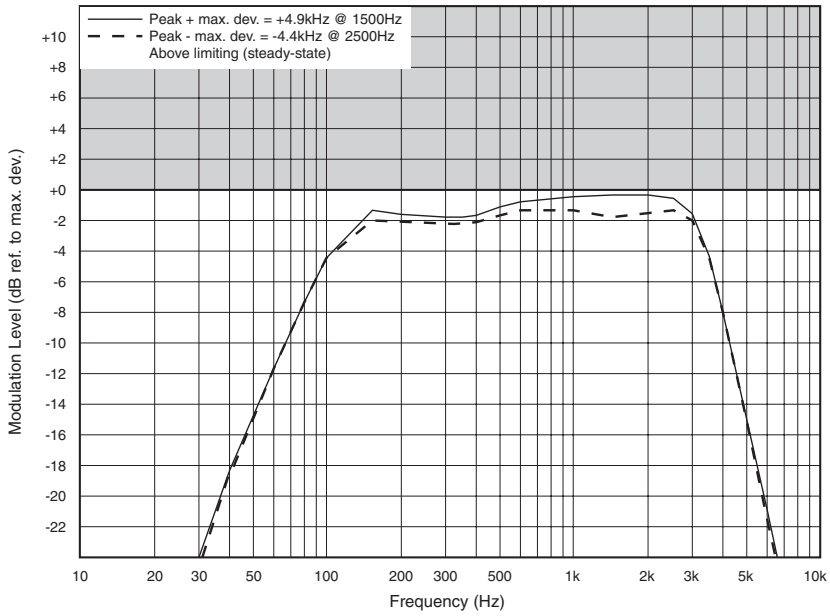


Figure 4.2 T854 Pre-emphasis Response

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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

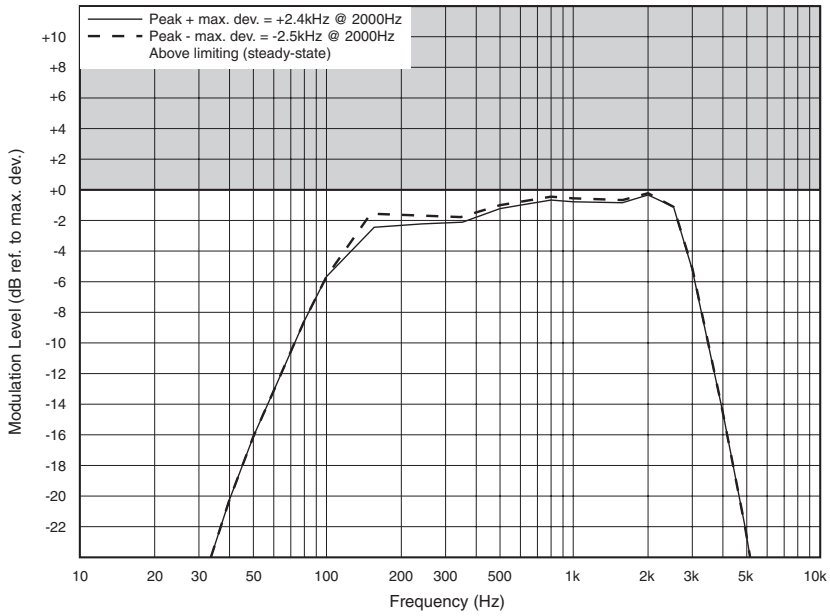


Figure 4.3 T854 Limiting Response

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4.6 Audio Level Input Sensitivity

1. Adjust RV210 (line sensitivity) fully clockwise.

2. Check that the input sensitivities are better than those specified below:

Line Input	600Ω, ±3kHz (±2.4kHz) [±1.5kHz] deviation at 1kHz:	
	with compressor	–50dBm
	without compressor	–30dBm
Microphone Input	600Ω, ±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.

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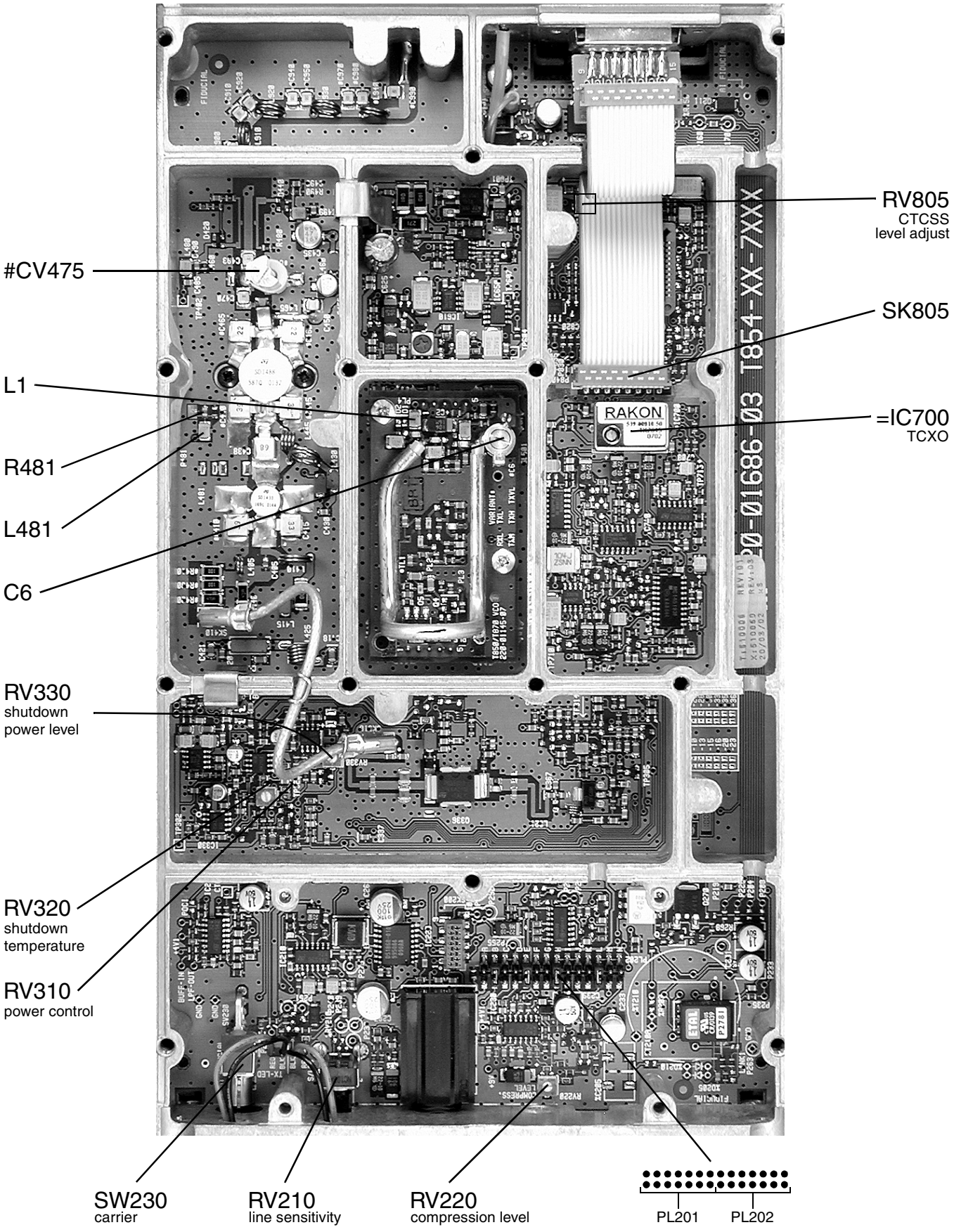


Figure 4.4 T854 Main Tuning and Adjustment Controls

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5 T854 Fault Finding



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

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 Customer Service Organisation. If necessary, you can get additional technical help from Technical Support, 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 4.02 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	Page
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	T854 Drive Power	5.5
5.5.2	T854 PA Output Power	5.5
5.5.3	Audio And Modulation	5.5
5.6	**PGM800Win Generated Errors**	**5.6**

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Section	Title	Page
5.7	**Fault Finding Charts**	**5.7**
5.7.1	Microcontroller	5.7
5.7.1.1	Basic Checks	5.7
5.7.1.2	Serial Communications	5.8
5.7.1.3	CTCSS Encode	5.9
5.7.2	Regulator	5.10
5.7.3	Synthesiser	5.11
5.7.4	T854 Drive Amplifier	5.14
5.7.5	T854 PA and Power Control	5.15
5.7.7	Audio Processor	5.16
5.8	**To Replace The T854 PA Transistors (Q410 and Q420)**	**5.17**

Figure	Title	Page
5.1	RF Diode Probe Circuit	5.5
5.2	Typical Transistor/Capacitor Spacing (Not To Scale)	5.17

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5.1 Visual Checks

Remove the top cover from the T854 and inspect the PCB for damaged or broken components, paying particular attention to the surface mounted devices (SMDs).

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 20kΩ/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 T854 front panel will flash according to the conditions described in the following table:

Flash Rate		Condition
fast	(⅓ s on/ ⅓ s off approx.)	T854 is linked with PGM800Win
unequal	(⅓ s on/1s 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. T854 linked has the highest priority, followed by internal error).

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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 the 9V supply (IC370 pin 1) with a DMM.

Check for short circuits.

5.4.2 VCO Locking

Key the exciter.

Using a DMM, monitor the VCO control voltage between between L1 and PL14 pin1 on the VCO PCB.

If the synthesiser is locked and the VCO aligned, the voltage at this point should be between 3 and 16V.

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

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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.

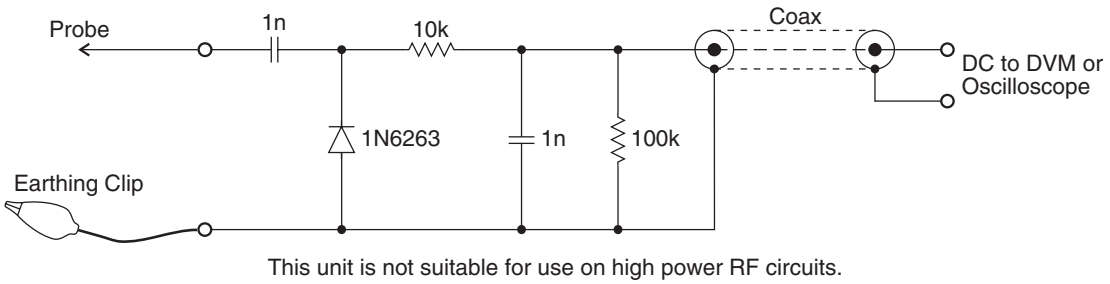


Figure 5.1 RF Diode Probe Circuit

5.5.1 T854 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 exciter output power (SK310) is >1.5W.

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 (Q336, Q337).

5.5.2 T854 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 RV310 (power control) adjusted fully clockwise.

5.5.3 Audio And Modulation

Refer to the audio processor fault finding chart (Section 5.7.6).

Set up the audio processor as described in Section 3.9.

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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 dual point modulation is incorrectly adjusted or a fault condition exists.

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.

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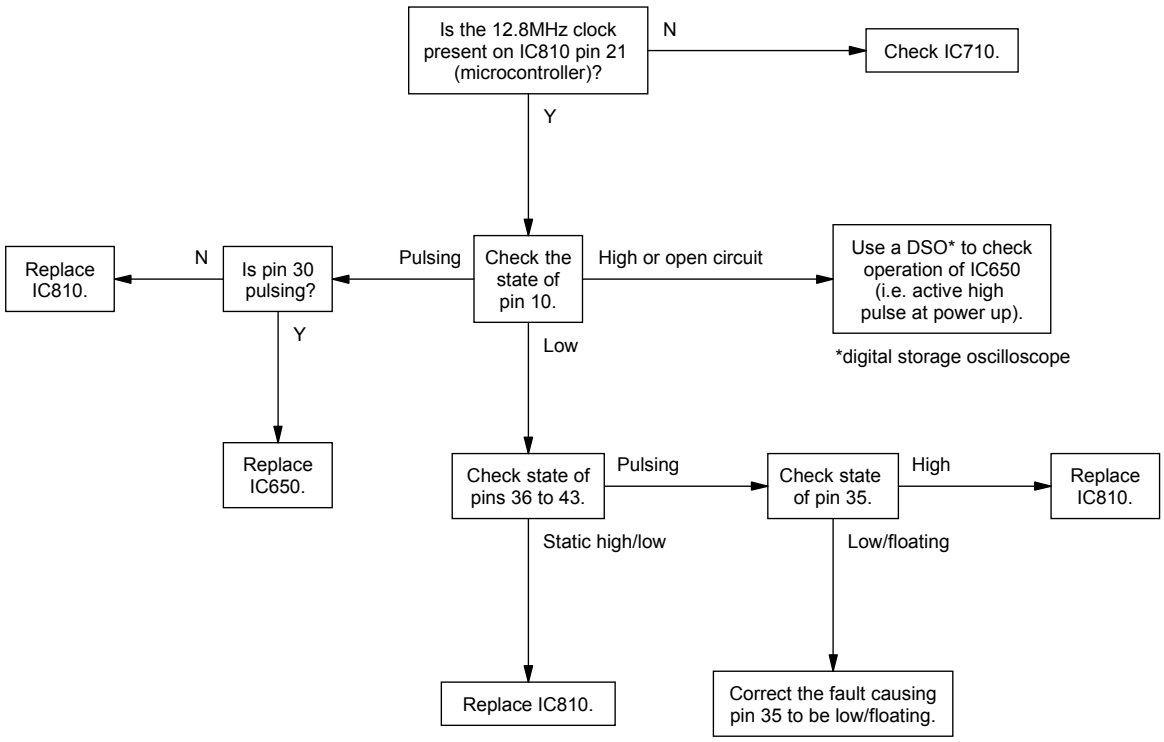
5.7 Fault Finding Charts

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

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

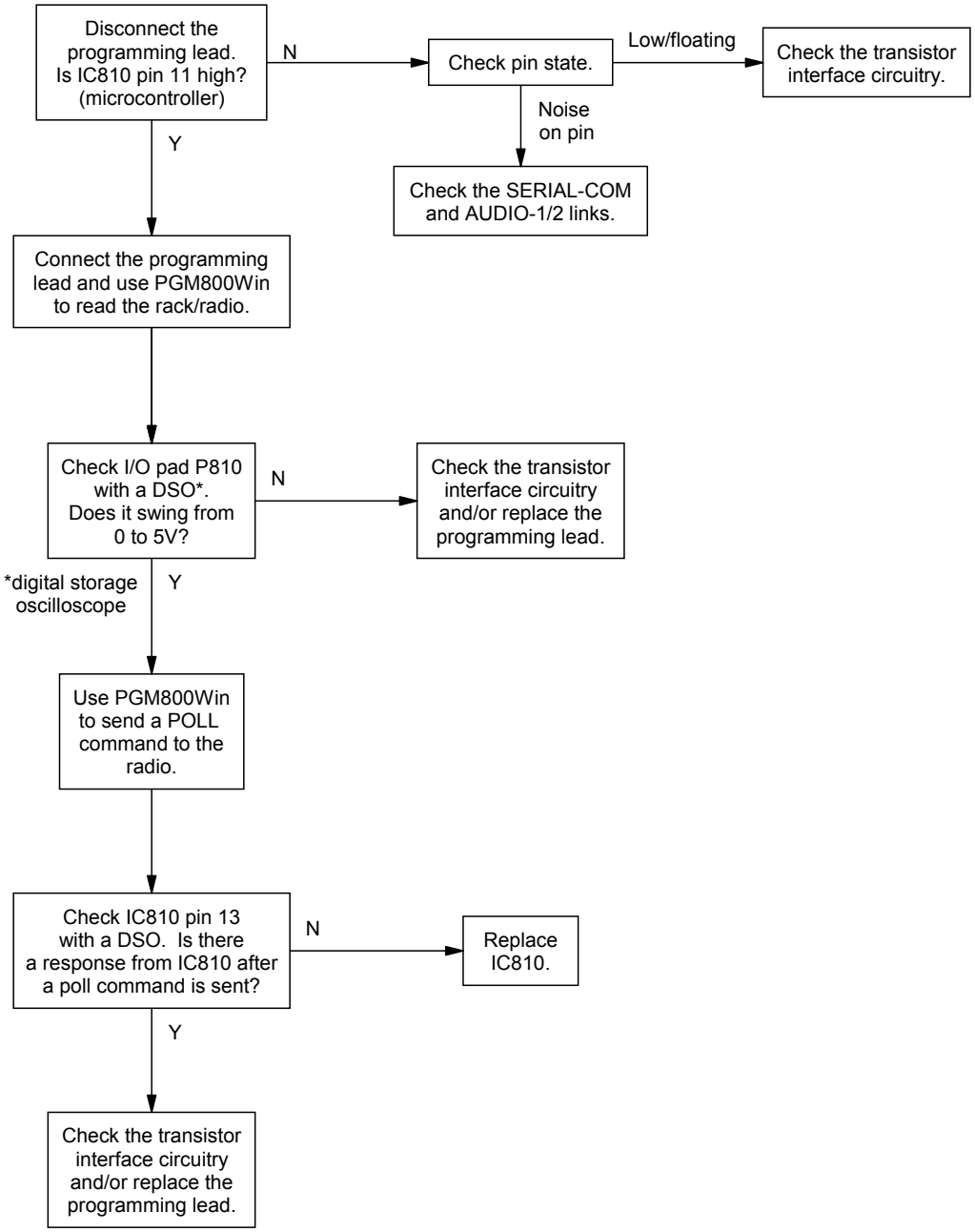
5.7.1 Microcontroller (IC810)

5.7.1.1 Basic Checks



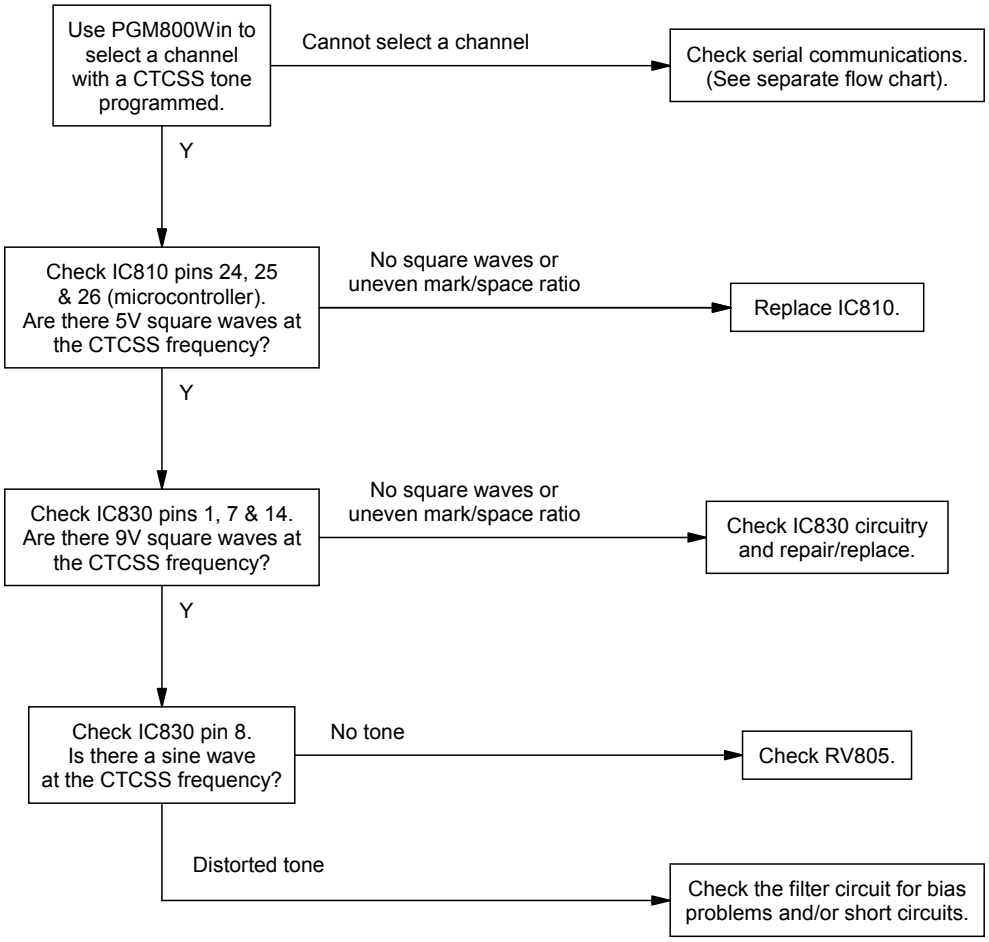
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5.7.1.2 Serial Communication



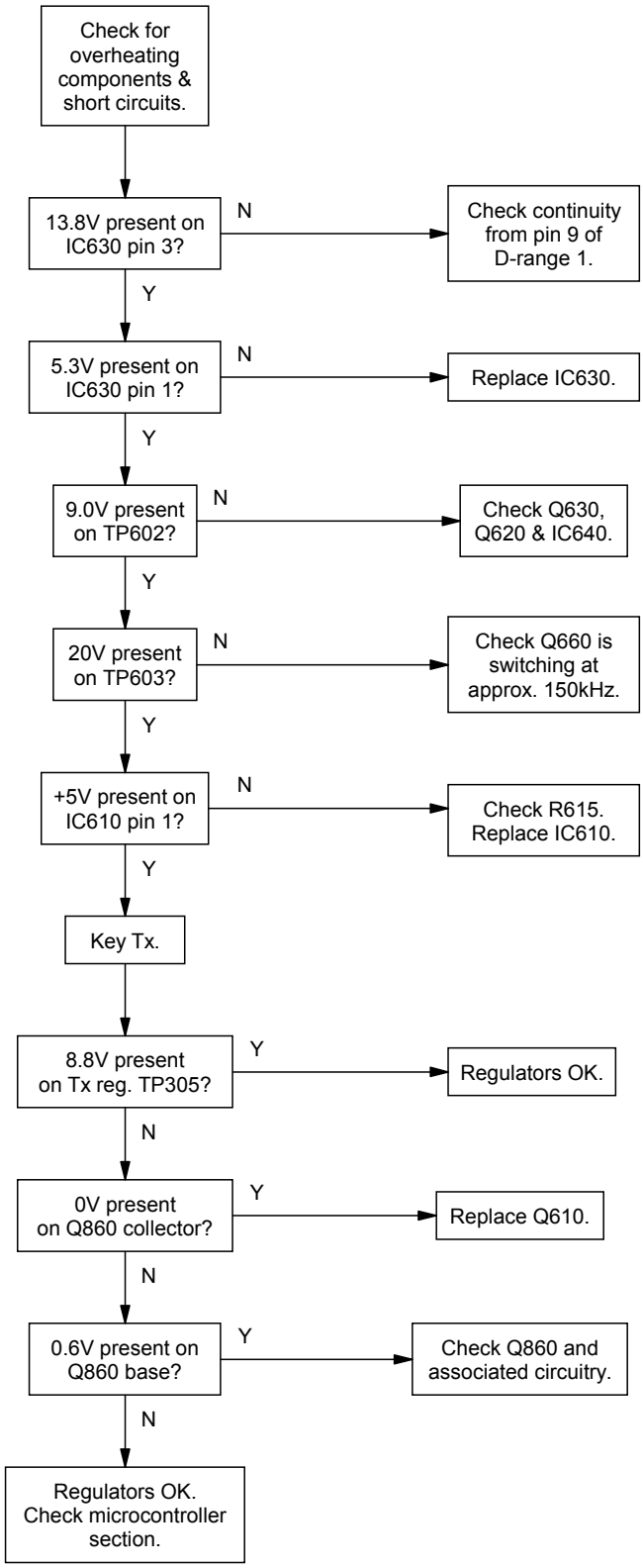
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5.7.1.3 CTCSS Encode



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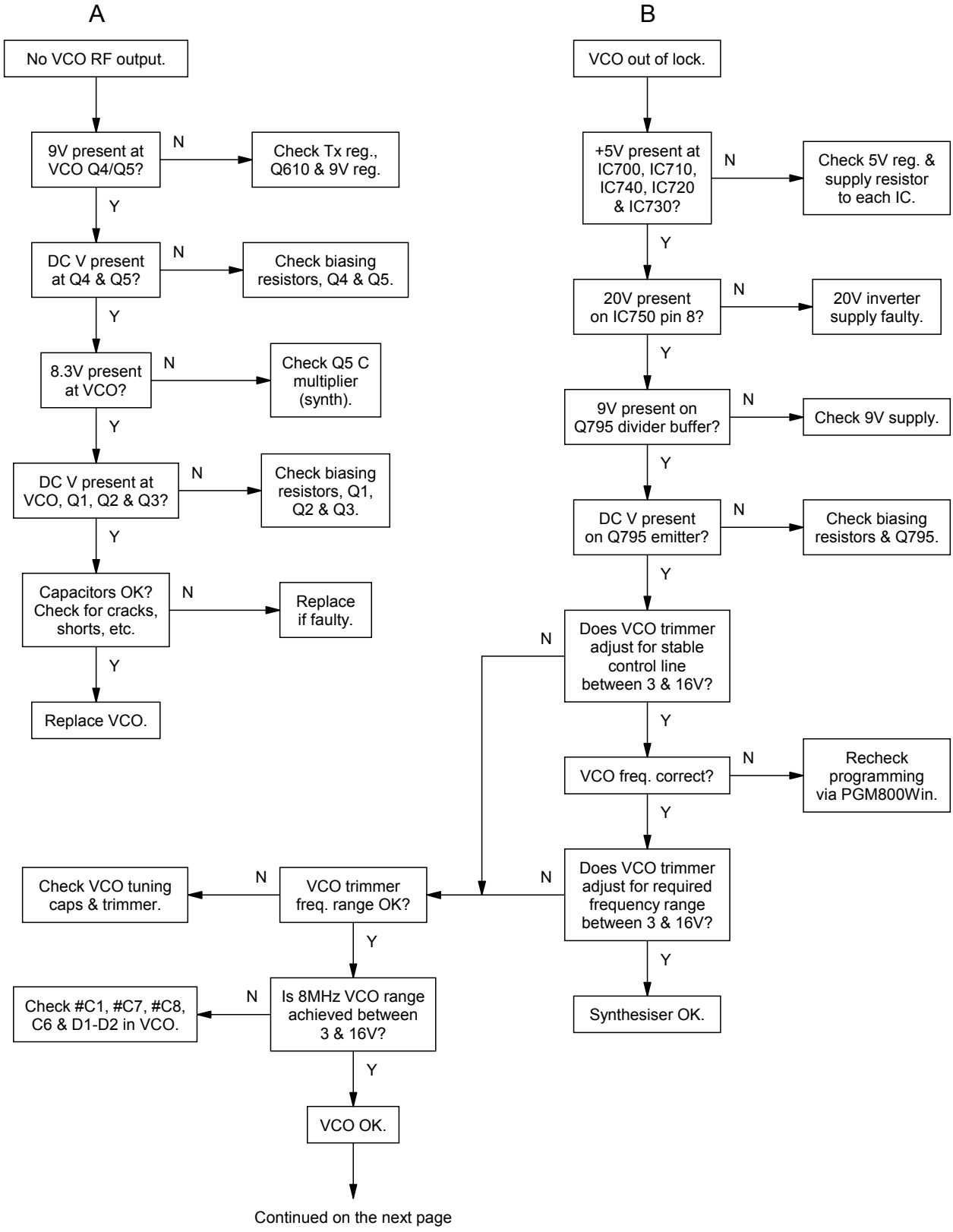
5.7.2 Regulator



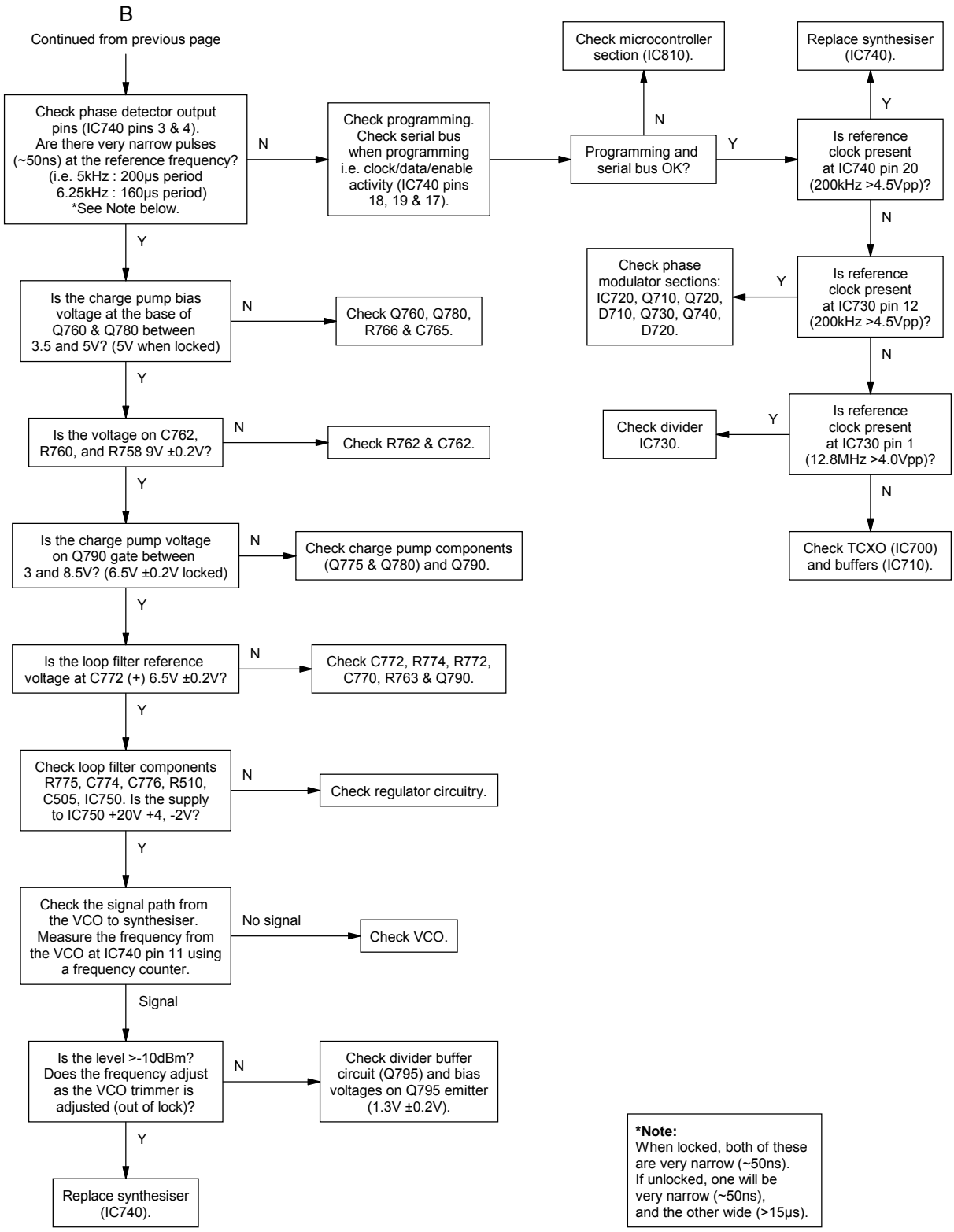
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5.7.3 Synthesiser

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

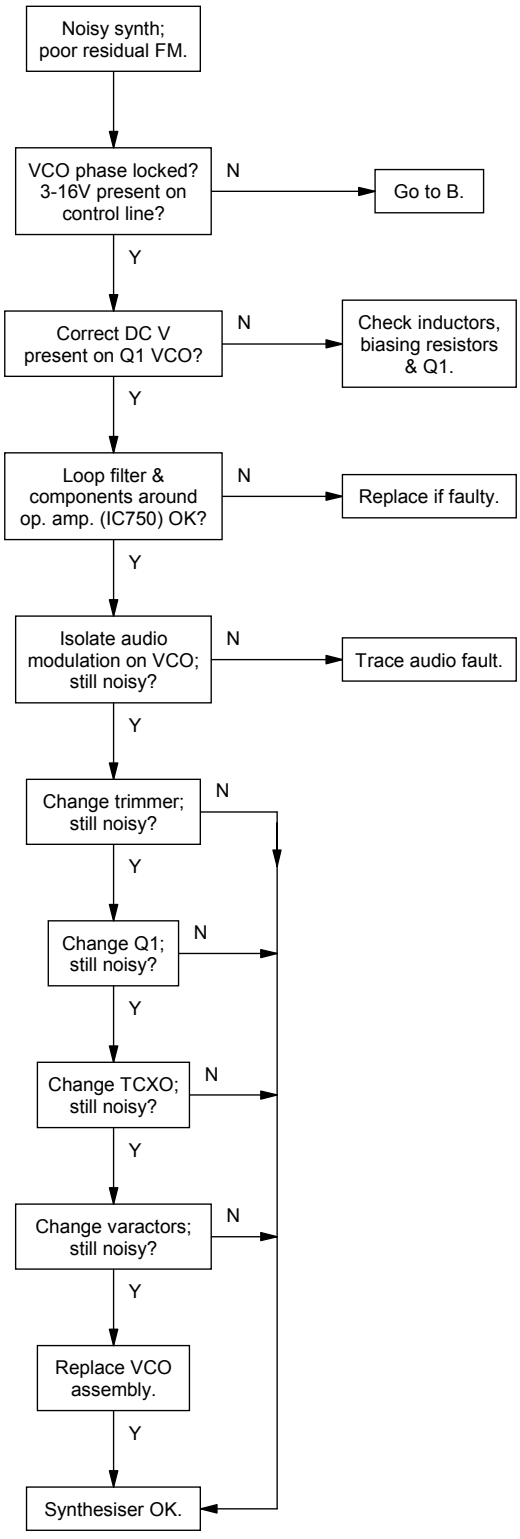


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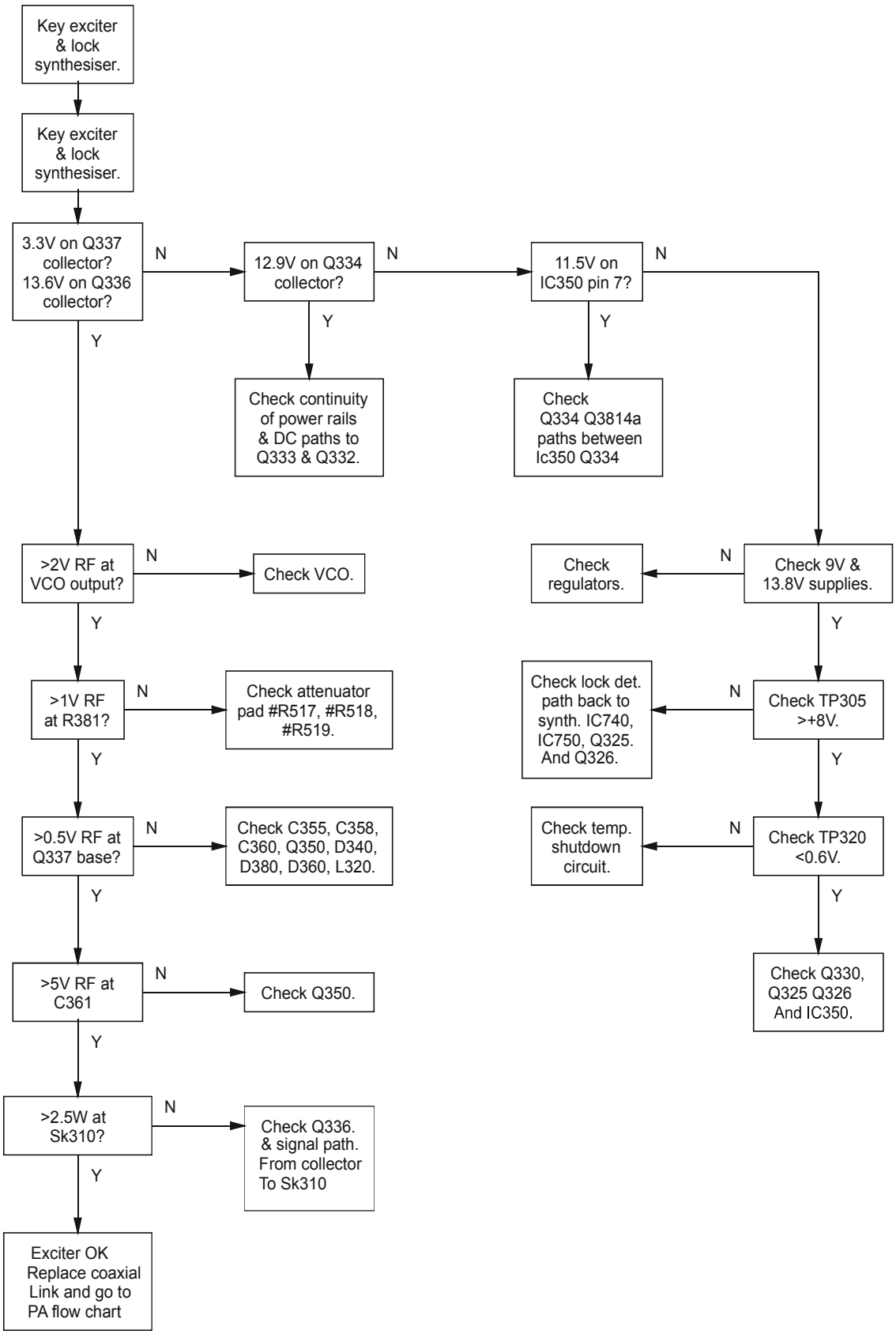
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C



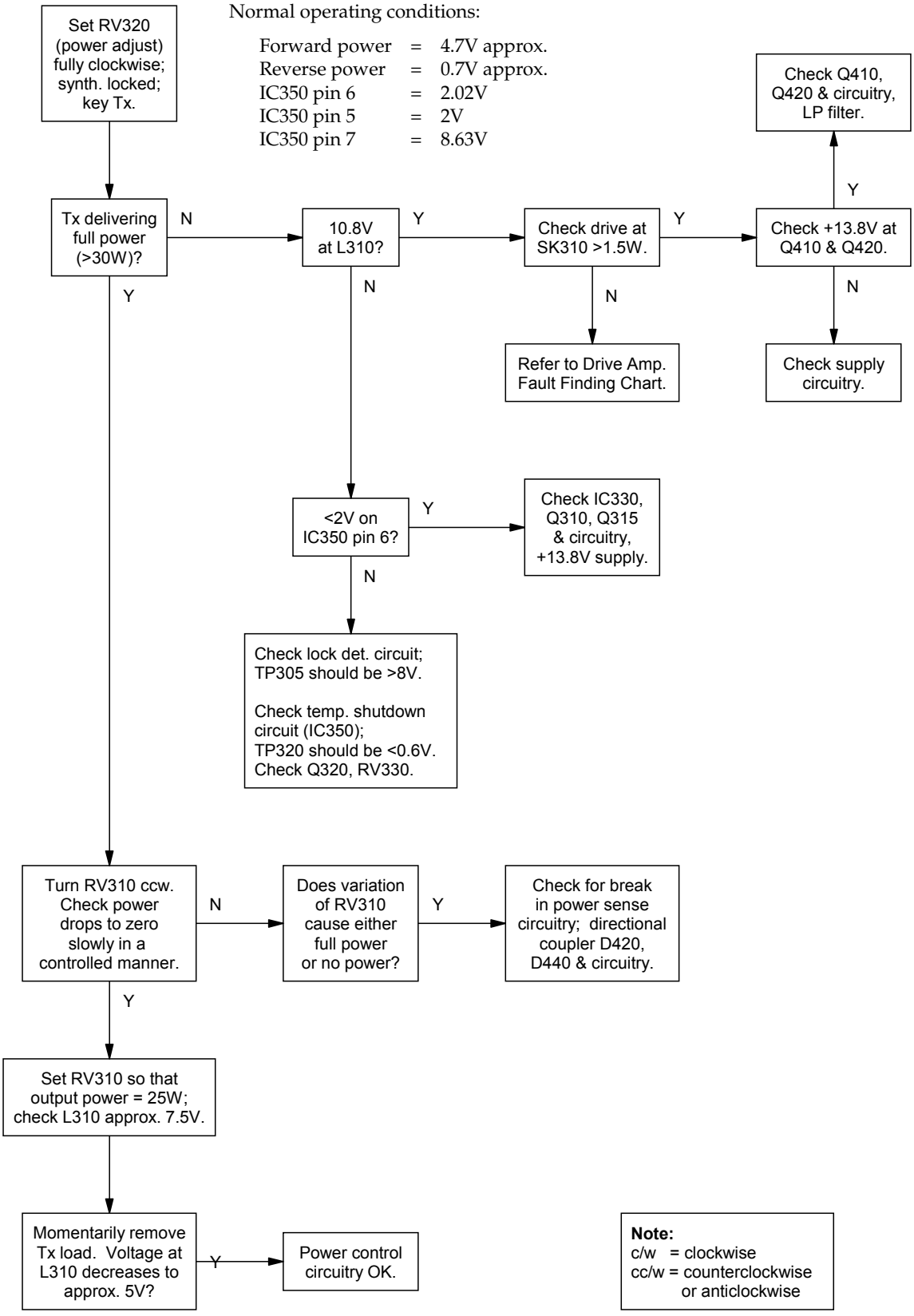
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5.7.4 T854 Drive Amplifier



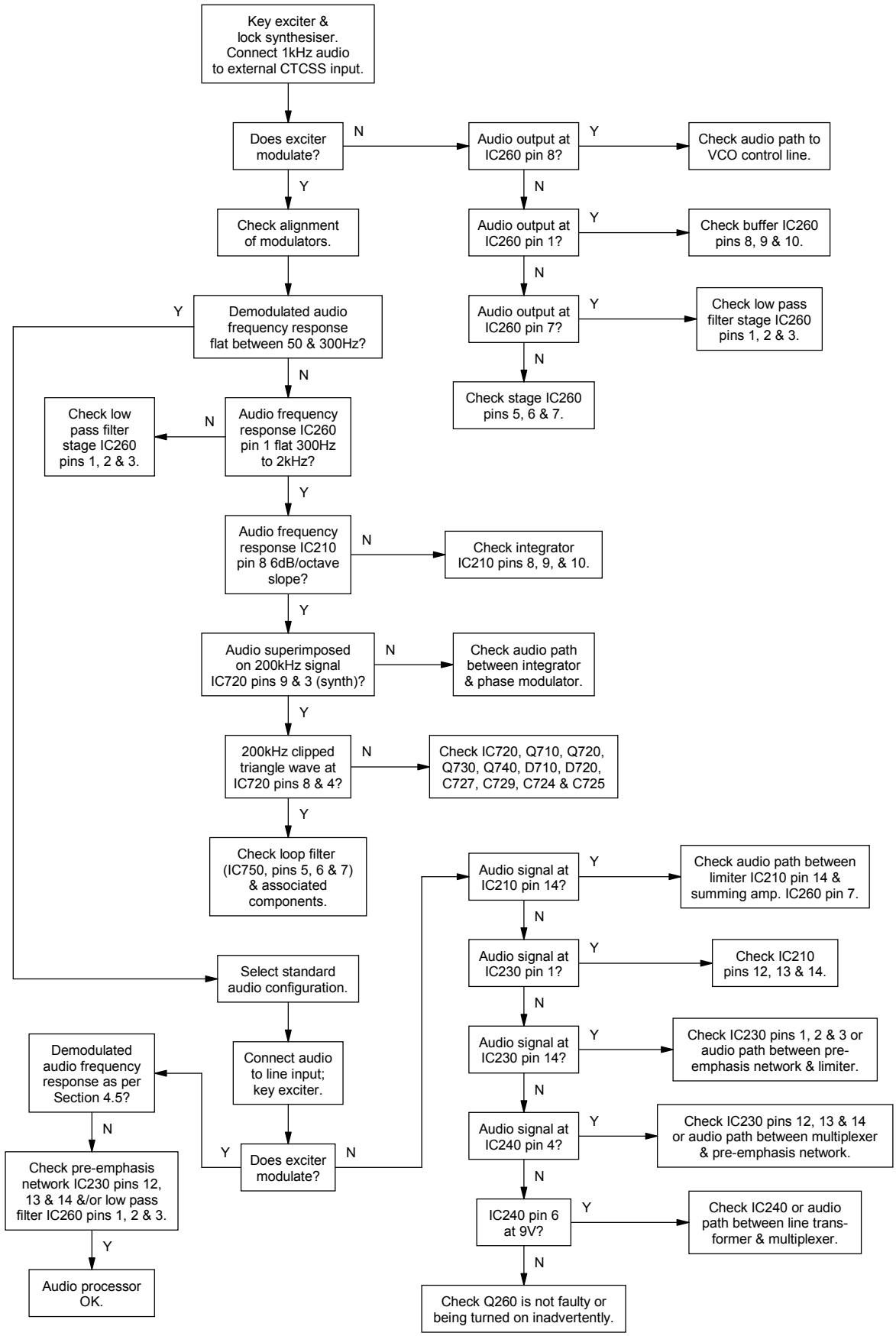
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5.7.5 T854 PA and Power Control



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5.7.6 Audio Processor



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5.8 To Replace The T854 PA Transistors (Q410 and Q420)

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.**

Before attempting to remove a transistor, measure the distance between the capacitors and transistor body to the nearest 0.5mm (measurement "A" in Figure 5.2) so that the capacitors can be replaced in *exactly* the same position. These measurements are shown in Figure 5.2 for the 6LFL package, however the same procedure applies for the SOE (stud) package.

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.**

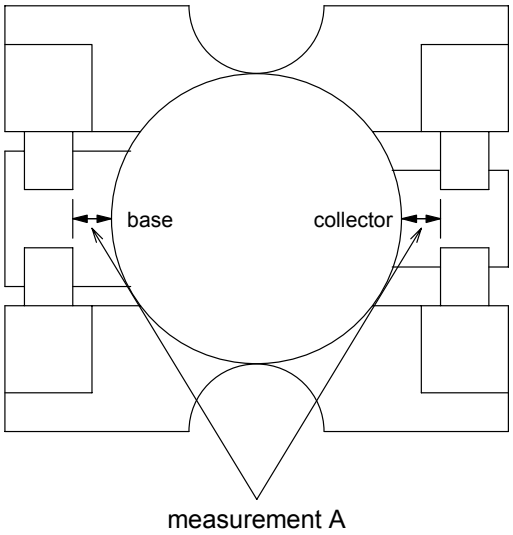


Figure 5.2 Typical Transistor/Capacitor Spacing (Not To Scale)

Desolder and remove the components from around the transistor.

Q420 Only: Desolder and remove the two solder tags.

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

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Q410 Only: 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. Remove any excess solder to leave a thin, even layer on the 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.

Q410 Only: Lightly solder one tab to the PCB, then torque down the retaining nut to the correct torque (0.7Nm/6in.lbf.).



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

Q420 Only: Refit the solder tags.

Solder all transistor tabs to the PCB.

Replace each component in exactly the same position as noted previously.

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