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T545TR Trunked Mobile Two Way Radio

VHF FM 175-225MHz

(TM-545-98)

Issue A

TECHNICAL INFORMATION

For further information about this Manual or the equipment it describes, contact the Product Distribution Group, Tait Electronics Ltd, at the above address.

UPDATING EQUIPMENT AND SERVICE MANUALS

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

SCOPE OF MANUAL

This Manual contains general, technical and servicing information on the T545TR trunked mobile two way radio.

Ordering Tait Service Manuals

When ordering Tait Service Manuals, quote the Tait Internal Part Number (IPN) and, where applicable, the version.

Date Of Issue

IPN TM-545-98	T545TR Service Manual
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SECTION 1 GENERAL INFORMATION

1.1 INTRODUCTION

The T545TR is a high performance FM synthesised mobile two way radio with a nominal RF power output of 25 watts. It is intended for operation in the 175 to 225MHz frequency range with 12.5kHz channel spacing and ±2.5kHz deviation. The T545TR is for use on trunking systems conforming to DTI Specifications MPT1327 and MPT1343.

Operation of the T545TR is by hand-held microphone and press-to-talk switch, plus six front panel mounted controls: 'Volume', 'Call', three push buttons for ident selection and an 'On/Off' switch. Visual indication of 'Transmit', 'Go', 'System' and ident number is by illuminated front panel display.

The two injection moulded plastic covers and the plastic front panel can be easily removed to expose both of the printed circuit boards for ease of servicing.

The dual conversion receiver employs both discrete components and integrated circuits. It also includes a signal-to-noise ratio operated squelch circuit. The receiver delivers approximately 2 watts of audio power to an 8 ohm speaker.

The VCO provides about 10 milliwatts of frequency modulated RF drive to the four stage broad band RF power amplifier. An audio processor contains modulation level control and deviation limiting circuits. A timer limits transmission duration to approximately one and a half minutes.

A trunking control board is plugged onto the radio unit and together they form a radio complying with trunking specification MPT1327. A display PCB is mounted behind the front panel itself and this is plugged as a unit onto the trunking control board.

The T545TR is light and compact and is supplied with a rugged mounting system which allows easy installation in any vehicle. Mains operation is possible when the T545TR is used with the Tait T508 power supply.

The DC supply to the T545TR must be negative earth and must be between 10.8 and 16 volts. The T545TR is protected against reversal of the DC supply polarity.

1.2 SPECIFICATIONS

1.2.1 INTRODUCTION

The performance figures given are typical figures, unless otherwise indicated, for equipment operating at standard room temperature (22°C to 28°C). Unless otherwise indicated, the figures apply to all versions.

Where applicable, the test methods used to obtain the following performance figures are those described in the UK Department of Trade and Industry Specification MPT1323.

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

1.2.2 GENERAL

Modulation Type	.. Frequency Modulation
Frequency Range	.. 175 to 225MHz
Channel Separation	.. 12.5kHz
Frequency Increment	.. 12.5kHz
Number Of Channels	.. 503 (standard) [system dependent]
Switching Range (transmitter & receiver)	.. 8MHz
Supply Voltage:	
Operating Range	.. 10.8 to 16V DC
Standard Test Voltage	.. 13.8V DC
Polarity	.. negative earth only
Polarity Protection	.. internal crowbar diode
Supply Current:	
Receiver - Squelched	.. 250mA
Receiver - Full Audio	.. 700mA
Transmitter	.. 5.5A
Antenna Impedance	.. 50 ohms
T/R Changeover Switching	.. solid state
Operating Temperature Range:	
Standard	.. -10°C to +60°C
Dimensions:	
Length	.. 232mm
Width	.. 150mm
Height	.. 45mm
Weight	.. 1.2kg

1.2.3 RECEIVER

Type	.. dual conversion superhet
I.F Amplifiers:	
Frequencies	.. 21.4MHz and 455kHz
Bandwidth	.. 7.5kHz
Sensitivity:	
12dB Sinad	.. -118dBm (0.28µV pd)
20dB Sinad psophometrically weighted	.. -1dBµV emf (-114dBm)
Signal-to-Noise Ratio (RF: -107dBm, modulated at 1kHz to full system deviation)	.. 28dB
Selectivity (adjacent channel)	.. 70dB
Spurious Response Attenuation	.. 75dB
Intermodulation Response Attenuation	.. 75dB
Spurious Emissions:	
Conducted	.. -60dBm
Radiated (½ wavelength dipole)	.. -57dBm
Audio:	
Output into internal 8 ohm speaker	.. 2 watts
Output into external 4 ohm speaker only	.. 4 watts
Distortion (at rated power)	.. 2%
Minimum Load Impedance	.. 2 ohms
Audio Response	.. within +1, -3dB of a 6dB/octave de-emphasis characteristic (ref. 1kHz)
Audio Bandwidth	.. 300Hz to 3kHz
Squelch:	
Sensitivity	.. 6dB to 20dB Sinad
Ratio	.. 70dB

1.2.4 TRANSMITTER

Power Output	.. 25 watts
Transmit Timer	.. system dependent
Frequency Stability	.. (ref. 1.2.4)
Mismatch Capability:	
Stability	.. VSWR < 5:1 (all phase angles)
Ruggedness	.. 2 minute transmit into infinite VSWR (all phase angles)

Spurious Emissions:	
Conducted	.. -36dBm
Radiated (½ wavelength dipole)	.. -36dBm
Adjacent Channel Power	.. 65dB below carrier
Modulation System	.. direct FM
Deviation Response:	
In Limiting - 500Hz to 3kHz	.. within +0dB, -4dB of max. system deviation
Below Limiting - 500Hz to 3kHz	.. within +1, -3dB of 6dB/octave pre-emphasis (ref. 1kHz)
Frequencies Above 3kHz	.. greater than 25dB/octave roll-off
Deviation Limiting	.. ±2.5kHz (peak) maximum adjustable to ±2.5kHz
Audio Input For Maximum Deviation	.. 1mV rms at 1kHz
Audio Distortion (modulated at 1kHz to 60% of maximum deviation)	.. 2%
Hum & Noise (below ±3kHz peak deviation)	.. 45dB

1.2.5 FREQUENCY REFERENCE

Crystal Type:	
± 5ppm (-10°C to +60°C)	.. TE/9
Oscillator Frequency	.. 12.8MHz

1.2.6 TRUNKING CONTROL BOARD

Data Modulation	.. as per MPT1317
Data Deviation (Tx)	.. 1.5kHz

1.3 VERSIONS

1.	T545TR-39 (UK)	174-225MHz frequency range 7.5kHz IF bandwidth 12.5kHz frequency increments 2.5kHz deviation Trunking board not supplied
2.	T545TR-96 (HK)	174-225MHz frequency range 7.5kHz IF bandwidth 12.5kHz frequency increments 2.5kHz deviation Trunking board (MPT1327 band III, sub-band I)

3.	T545TR-98 (UK)	174-225MHz frequency range 7.5kHz IF bandwidth 12.5kHz frequency increments 2.5kHz deviation Trunking board (MPT1327 band III, sub-band II)

1.4 UK BAND III

Band III (174-225MHz) is itself divided into sub-bands I, II and III. The operating frequencies of sub-bands I and II are set out below (12.5kHz channel spacing).

		Mobile Tx (MHz)	Mobile Rx (MHz)
Sub-band I			
Lowest valid channel:	1	191.525	176.525
Highest valid channel:	480	197.5125	182.5125
Sub-band II			
Lowest valid channel:	1	193.2125	201.2125
Highest valid channel:	503	199.4875	207.4875

1.5 OPERATING INSTRUCTIONS

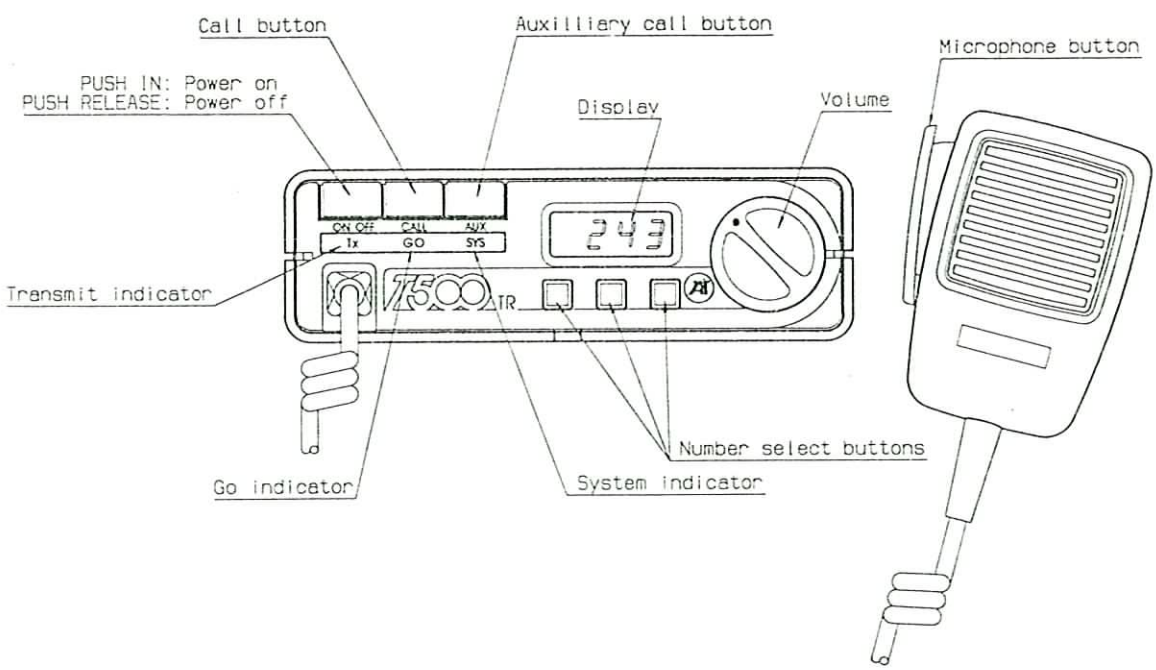


Figure 1 T545TR Front Panel

1.5.1 GENERAL

The following instructions assume that the radio is correctly installed (see Section 4). Some aspects of radio operation are dependent on the trunking system in use: contact your supplier or service facility in case of difficulty.

1.5.2 SWITCHING ON

The 'On/Off' switch turns the radio on when it is pressed, and pressing it again turns the radio off. When the radio is turned on, the software version number is initially displayed, followed by a momentary display of the mobile unit number.

The system indicator ('SYS') will light if the radio is in range of the trunked system and is receiving valid digital information from the control channel transmitter.

CAUTION: A functioning T545TR is always active and can respond automatically to an incoming call. It is therefore advisable to switch the T545TR off with the 'On/Off' button when entering a petrol station.

The T545TR should always be switched off if the aerial is disconnected.

1.5.3 MAKING A CALL

1. Enter the number of the mobile or despatcher to be called by pressing the appropriate call number buttons.

   Pressing each of the buttons alters the appropriate digit of the display in single digit increments upwards. Attempts to call invalid idents or idents of mobiles or despatchers not available to the user will cause the characters 'UA' to be displayed.

2. Momentarily press the 'Call' button or PTT switch.

   The transmit indicator will light and may flash on and off while the call is being established. If the called party is available, an audible indicator will be heard from the speaker and the display will indicate a countdown of the call time remaining in minutes and seconds.

3. If the call is not connected immediately, an audible indicator is sounded. If the indicator changes to a lower frequency, this means the call has been queued by the system and will be connected shortly.

4. To talk, press the PTT switch on the microphone.

   Speak directly into the microphone, holding it approximately 100mm from the mouth.

   To listen, release the PTT switch.

   Adjust the volume control clockwise to increase and anticlockwise to reduce the volume.

5. The call can be cleared by returning the microphone to the hook or by pressing one of the three call number buttons. During the last few seconds allowed to a call, a pip will sound each second as a warning. Cleardown will take place automatically at the termination of the countdown time.

1.5.4 MAKING A GROUP CALL

Group calls are made (if the radio is programmed for them) by entering the group call number on the front panel and making the call as normal.

1.5.5 RECEIVING A CALL

Incoming calls are audibly indicated by the ringing tone.

Lift the microphone off the hookswitch and acknowledge the call in the normal manner, pressing the PTT switch to talk and releasing it to listen.

The ident number of the mobile or despatcher making the call will be displayed for five seconds on the front panel, followed by the "call time remaining" display.

Note: A call may be cleared down if neither party transmits within a specific time period.

SECTION 2 CIRCUIT OPERATION

Refer to the Block and Circuit Diagrams at the rear of this Manual.

2.1 SYNTHESISER

The dual modulus synthesiser of the T545TR features separate on-frequency VCOs for receive and for transmit. The transmit VCO is frequency modulated by the application of audio to the varicap diode D51.

A crystal provides a stable reference frequency of 12.8MHz which is divided down to 12.5kHz and fed to one input of a phase comparator within IC8.

The VCO frequency is divided by the 40/41 prescaler, IC9, and then further divided within IC8 to provide the other input to the phase comparator. The division ratio in IC8, and hence the channel frequency, is determined by a 16 bit binary word, input to IC8.

The phase comparator output (pins 7 & 8 of IC8) is fed to both VCO varicaps via the speedup circuit (Q27, Q28) and the loop filter (R181, C177, R183, C178). Then to either varicap D35 via R187 & C186 on receive, or to varicap D50 via R233 & C226 on transmit.

A lock detect signal is made available to the trunking control board (TCB).

2.2 RECEIVER

The RF signal from the PIN switch is amplified by Q15 and fed to the balanced mixer (Q16, Q17) via a triple tuned circuit. 10mW from the receive VCO is fed in antiphase to the gates of the two mixer J-FET's.

The IF output from the mixer passes through the 21.4MHz crystal filter and is amplified by Q18 before being fed to IC7. It is also fed to the TCB for RSSI purposes.

IC7 provides the following functions: IF conversion from 21.4MHz to 455kHz with external crystal X1 (CF1 sets the 455kHz IF bandwidth); amplitude limiting; quadrature detection with CD1; and squelch. Q19 provides additional limiting gain.

2.3 SQUELCH

An input signal to the squelch circuit is obtained from the audio output of IC7 via RV149. This signal has a noise level which is inversely related to the level of an RF signal at the receiver input.

An op-amp within IC7 is used in a band pass filter configuration to select and amplify noise frequencies above the audio band. The centre frequency is approximately 4.5kHz.

The band pass filter output is rectified by Q20 to give a positive going DC voltage which is an inverse function of the RF signal strength.

This DC voltage is then fed to a threshold detector within IC7, in such a way that pin 14 of IC7 is high in the presence of noise and low in the absence of noise. The threshold point occurs at approximately 0.7 volts.

The switching signal from the threshold detector is then inverted by Q7. D9, C17 (when fitted) and R26 provide an extended tail time (to prevent squelch closure during rapid fades) while maintaining a fast opening time.

2.4 TRANSMITTER

2.4.1 RF STAGES

The 10mW output of the frequency modulated transmit VCO is amplified to a level of 25 watts by a 5 stage broad band amplifier (Q40, Q41, Q42, Q46, Q47). High level RF then passes via the aerial PIN switch through the low pass filter to the aerial connector.

The transmit power output is set at 25 watts by RV256 which, with Q44 & Q45, controls the collector voltage of Q42, and hence the gain of the broad band amplifier. The circuit utilises a power detector, D61, and a feed back loop to hold the transmitter power to 25 watts under conditions of varying supply voltage.

Transistor Q43 prevents the transmitter turning on when the synthesiser is out of lock. The TCB can also control the transmitter output via Q43.

2.4.2 AUDIO PROCESSOR

Transistor Q10 provides microphone preamplification while IC2 provides the necessary gain limiting and filter functions for the audio signal. An automatic level control (ALC) function is performed by detector Q11 and shunt elements D15 and D16. The analogue switches within IC3 allow either transmit or receive audio to be directed through the audio processor. The microphone is muted during FFSK signalling periods.

2.5 POWER SUPPLY

2.5.1 GENERAL

Note: The T545TR is suitable for negative earth applications only.

The unit is protected by a crowbar diode (D1) which will blow the fuse if the supply is reverse connected.

DC is connected to the audio output IC and the transmitter final, driver, and power turn-down stages whenever the T545TR is connected to a supply.

2.5.2 CONTINUOUS SUPPLIES

DC from the on/off switch supplies the audio output IC enable and the short circuit protected 9 volt regulator. A continuous 9 volts is applied to the audio processor and synthesiser.

2.5.3 RECEIVE

When the PTT switch is open, IC1 turns Q5 on and Q4 off, enabling the following circuits:

receive VCO
receiver
squelch control
receive diode in the aerial switch.

2.5.4 TRANSMIT

When the PTT switch is closed or the TCB enables the PTT, IC1 turns Q4 on and Q5 off, enabling the following circuits:

transmit VCO
low power transmitter stages
transmit diode in the aerial switch

Closing the PTT switch also initiates a timer circuit around IC1 which will return the T545TR to receive after 1.5 minutes of transmission.

2.6 FREQUENCY INFORMATION

The synthesiser programming is controlled by the microprocessor. 16 data bits are presented to the synthesiser A & N lines. Refer to Table 1 in Section 5.4.3 to check the synthesiser programming data.

2.7 TRUNKING CONTROL BOARD

2.7.1 ANALOGUE INTERFACES TO THE RADIO

2.7.1.1 Received Signal Strength Indicator (RSSI)

The RSSI is an analogue DC voltage produced by a detector in the receiver. The voltage enters the PCB at SKT-3 pin 3 and is fed to PE7 of the microcomputer via R95 and C85.

2.7.1.2 Lock Detect

This analogue voltage produced on the main board is fed to the TCB at SKT-3 pin 12. The signal is then fed via IC2 to microcomputer port PA2, thus enabling the synthesiser lock status to be monitored.

2.7.1.3 FFSK (Including Modem)

The received FFSK signal enters the PCB at SKT-1 pin 2 and is AC coupled to a pre-amplifier, IC2. FFSK is then passed to the modem chip via IC14 pin 16, which results in a logic '1' at IC14 pin 15 and decoded data at IC14 pin 14.

For transmit data, the modem provides a Tx sync signal at pin 3. The transmit data which originates at microcomputer port PA3 (pin 31) is applied to the modem at pin 7. It appears as FFSK at pin 5 and leaves the PCB at SKT-1 pin 5. RV1 controls the FFSK deviation, which is set a 1.5kHz peak by sending a pattern of alternate '1's and '0's while in the test mode.

2.7.1.4 Sidetone

Audible 'pips' and 'ringing' sounds are produced from the speaker during various stages of call set-up. These are generated in the microcomputer and appear at port PA4. The signals are then passed via C50/RV2 to SKT-3 pin 4 to the radio where they are mixed into the speaker amplifier. RV2 adjusts the tone level.

2.7.2 DIGITAL INTERFACE CIRCUITS TO THE RADIO

2.7.2.1 Pressel (PTT)

This signal takes one of three forms:

(a) A 12k ohm resistance to ground from the radio to the PCB when the microphone is 'on hook', i.e. when the stud on the microphone is grounded.

(b) A short circuit to ground from the radio to the PCB when the pressel is pushed.

(c) A short circuit to ground from the PCB to the radio to command the transmitter to key during signalling.

The PTT/hook signal is fed to microcomputer port PE4 (pin 44). This port samples the analogue input and the microcomputer determines the status. Tx-CRL is driven low by Q3 to enable transmission.

2.7.2.2 Microphone Mute

This signal passes from the TCB to the radio. The microphone is muted during signalling by Q2 turning on. The microphone mute signal leaves the board at SKT-3 pin 2.

2.7.2.3 Receive Audio Mute

This signal passes from the TCB to the radio and disables received audio to the speaker.

2.7.2.4 Synthesiser Control

This is a 16 bit parallel interface from the TCB to the radio to control the synthesiser frequency. The supply voltage to the synthesiser is 9V; thus IC3 and IC4, which perform the serial-parallel conversion, also run from 9V. IC10 provides the level shifting from 5V to 9V. The synthesiser data is controlled via synchronous communications with the microcomputer. Port lines PA5, PA6 and PD2 provide the serial clock (SYC), the serial data (SYD) and the latch (SYL) respectively to IC3 and IC4. The transfer command originates at microcomputer port PD2 and is also level shifted in IC10.

2.7.2.5 PA Disable

This is a signal from the TCB to the radio which disables the transmitter. The PA will be disabled when this line goes high.

2.7.2.6 Call Button

The 'Call' button initiates call requests and is passed from the radio to the TCB. It enters the board at SKT-3 pin 1 and is applied to microcomputer port PD4 (pin 24).

2.7.2.7 AUX Button

This button is connected via SKT-3 pin 14 to microcomputer port PA7 (pin 27); its function is software definable.

2.7.2.8 Emergency

This wire is taken from SKT-3 pin 13 to the rear panel power connector pin adjacent to the ground return wire. On the TCB it is connected to microcomputer port PE3 (pin 49).

2.7.3 DIGITAL INTERFACE TO THE FRONT PANEL

2.7.3.1 Clock, Data and Enable

These lines come from ports PA5 (pin 29), PA6 (pin 28) and PD5 (pin 25) respectively of the microcomputer. The lines leave the TCB at SKT-8 pins 8, 9 and 10. The data is in serial format with a synchronous clock; the enable line is necessary to update the display.

2.7.3.2 Buttons

The front panel buttons which are used to enter the called address and clear down are connected via the front panel to SKT-8 pins 3, 6 and 7 on the TCB.

2.7.4 MICROCOMPUTER CIRCUITS

2.7.4.1 The Microcomputer (IC12)

The heart of the TCB is the MC68HC1141, which controls all radio functions via software resident in the memory devices.

2.7.4.2 Memory Devices

The RAM (IC9) is a zero power device with its own internal battery.

The EPROM (IC8) is mounted in a socket for easy software updating.

The EEPROM is resident in the microcomputer (IC12).

2.7.4.3 Miscellaneous Functions

Miscellaneous functions are:

(a) 'GO' LED

This LED indicates traffic channel allocation for a call.

(b) 'SYS' & 'TX' LED's

The 'SYS' LED is switched on when the radio is receiving valid digital information from the control channel transmitter.

The 'TX' LED is switched on during transmit key.

2.7.4.4 Test Mode

The 'test mode' pins will pull microcomputer port line PD5 low when fitted with a shorting link. When shorted together on switch-on, the TCB goes into test mode to aid servicing.

2.7.4.5 Clock Circuit

The clock is generated by an on-chip oscillator and external crystal (XTAL 1). The clock is divided by 4 within the microcomputer and appears as 'E' on pin 5.

2.7.5 MICROCOMPUTER SUPERVISORY CIRCUIT

$\overline{\text{RES}}$ is driven by a three terminal LVI chip (IC15). An internal bandgap reference and external resistors R66/R67 ensure a $\overline{\text{RESET}}$ when the 5V supply falls below 4.8V.

2.7.6 POWER SUPPLIES

The supply to the TCB from the radio is taken from both the 13.8V switched and 9V regulated supplies. 13.8V is fed to a discrete regulator in the front panel to supply the 'SYS' and 'GO' LED's and IC100. 9V is further regulated by another 78L05 (VREG1) and this supplies all other TCB hardware.

2.8 FRONT PANEL DISPLAY

Data from the TCB is presented via SKT-8 to the 14499 display driver (IC100), which controls the four 7-segment displays.

SECTION 3 ANCILLARY EQUIPMENT

3.1 T508 POWER SUPPLY

The T508 Power Supply will allow operation of a T545TR two way radio from a 230V (nominal) 50Hz or a 115V (nominal) 60Hz mains supply (specify voltage when ordering):

Type Numbers:

115V Supply	.. T508/115
230V Supply	.. T508

The T508 is an attractively styled unit which matches the T545TR two way radio. The radio can be mounted on the T508 to give a compact desk top installation, or they can be separately wall mounted to save desk space.

The T508 provides a 13.8V DC 6.5A (intermittent) regulated supply for the T500 Series II two way radios and incorporates current limiting and thermal protection.

3.2 T220/2 REMOTE SPEAKER ASSEMBLY

The T220/2 remote speaker assembly may be used with the T545TR. It comprises a heavy duty 4 watt speaker mounted in a rugged enclosure which pivots on its mounting bracket. The 3.5 ohm voice coil of the speaker is connected by a short lead terminated in a 2 pin cord mounted connector. The enclosure is compact and easily mounted in any convenient position.

3.3 T500-20 SERIAL DATA INTERFACE

This is used to interface the T545TR with an IBM* XT or AT PC (or compatible) for identity programming. Circuitry to level shift the RS232 signals is built into the interface.

*IBM is a registered trademark of International Business Machines.

SECTION 4 INSTALLATION

4.1 VEHICLE INSTALLATION

Installation instructions (IPN 409-54500-00) are packed with each radio.

CAUTION: The T545TR is suitable for negative earth installation only.

4.2 T508 POWER SUPPLY UNIT

When using the T545TR with a T508 power supply, it is essential that the RF power output is adjusted so that the station effective radiated power (ERP) from the antenna complies with the licence conditions in force.

SECTION 5 SERVICING

5.1 GENERAL

5.1.1 NOTES

If further information is required about the T545TR or this Manual, it may be obtained from Tait Electronics Ltd or accredited agents. When requesting this information, please quote either the equipment type number (e.g. T545-98), or serial number (found adjacent to the aerial connector at the back of the set). In the case of the Circuit Diagrams quote the 'Title' and 'Issue' and for the Service Manual quote the internal part number (IPN) and Issue, e.g. TM-545-98, Issue A.

CAUTION: SWITCH OFF IN EXPLOSIVE ENVIRONMENTS

A functioning T545TR is always active and can respond automatically to an incoming call. It is therefore advisable to switch the T545TR off with the 'On/Off' button when entering potentially hazardous areas, such as petrol stations, or when in close proximity to quarries or tunnelling works where remote controlled explosive charges may be in use.

CAUTION: CLEANING

This is a plastic based product with a secondary finish on the front panel. Use a cloth dampened with warm, soapy water to clean. If solvent cleaners are to be used for stubborn stains, test first on a part of the set normally out of sight. Do not use solvent cleaners on the front panel.

CAUTION: AERIAL LOADING

The equipment has been designed to operate over a wide range of aerial loading conditions. However, it is strongly recommended that the transmitter is not operated in the absence of a suitable load. Failure to observe this precaution may result in damage to the transmitter power output stage.

CAUTION: BERYLLIUM OXIDE & 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 scratched, mutilated, filed, machined, or physically damaged in any way that can produce dust particles.

CAUTION: CMOS DEVICES

The equipment contains CMOS devices which are susceptible to damage from static charges. Care when handling these devices is essential. For correct handling procedures refer to the manufacturers data books, e.g. Philips data books covering CMOS devices, or Motorola CMOS data books, Section 5 'Handling', etc.

5.1.2 TECHNICAL INSTRUCTIONS

From time to time 'Technical Instructions' (TI's) are issued by Tait Electronics Engineering Division. These TI's may be used to update equipment or information, or to meet specific operational requirements.

5.2 MECHANICAL

5.2.1 POSIDRIV RECESS HEAD SCREWS

Posidriv screws are the preferred standard on all Tait manufactured equipment. The very real advantages of this type of screw will not be realised unless the correct screwdrivers are used by servicing personnel.

Posidriv No 1 screwdrivers will fit the posidriv screws used in the T545TR. Philips cross-head screwdrivers are not satisfactory for use on these screws.

5.2.2 DISASSEMBLY INSTRUCTIONS

Note 1: To carry out alignment procedures it is necessary to remove only the bottom cover as given in 5.2.2.1 below.

Note 2: To assist in separating the top and bottom covers, a thin plastic strip (such as a plastic rule) may be inserted between the covers and used as a lever.

5.2.2.1 To Gain Access To The Component Side Of The Radio PCB

Place the T545TR upside down on the bench.

Remove the 4 bottom cover retaining screws.

Gently lift both ends of the bottom cover until it clears the front panel and heatsink.

Lift away the bottom cover.

Remove the front panel as instructed below (Section 5.2.2.3).

With the power removed from the radio, carefully lift off the logic PCB.

5.2.2.2 To Gain Access To The Track Side Of The PCB

Remove the bottom cover as in 5.2.2.1 above.

Turn the T545TR over on the bench, taking care not to bend or damage any header pins on the main PCB.

Remove the 2 top cover retaining screws.

Gently raise both ends of the top cover until it clears the front panel and heatsink.

5.2.2.3 To Remove The Front Panel

Remove the microphone cord relief grommet from its seat.

Unplug the microphone.

Remove the bottom and top covers as instructed above.

Slide the front panel forward.

It is not necessary to remove the knob - it may be left in place.

5.2.2.4 To Gain Access To The PA Components

To gain access to the PA, remove the screws retaining the two PA cavity lids.

Remove the component side lid towards the right hand side of the PCB (as viewed from the front of the set) so that it clears the power supply feedthrough capacitor.

5.2.2.5 Speaker Removal/Refitting

The speaker in the T545TR is held in place with four "push-on fix" spring clips (IPN 357-00010-09, Spire No. SFP 3253) which may cause problems when the speaker is removed.

To remove the speaker, cut the spring clips off the plastic locating pegs with wire cutters. Do not attempt to prise off the spring clips as this will damage the pegs.

Fit four new clips when refitting the speaker.

5.2.3 VCO CAN

CAUTION: When loosening or tightening the 4 retaining screws of the VCO can, support the can from the component side as undue pressure on the PCB may fracture some of the chip capacitors.

5.2.4 REASSEMBLY

Reassembly is carried out in the reverse order of the above.

Replace the PA covers.

Replace the logic PCB carefully, ensuring that all header pins are located in the bottom entry sockets. The plastic pillar will click into place, securely locking the PCB in place.

Slide on the front panel.

Fit the top cover:

Gently press the cover into position, taking care to position the rim at the rear of the cover into the heatsink groove. Ensure that the rim of the front panel fits into the groove round the front of the top cover.

Replace the two "Taptite" screws at the rear of the cover.

Fit the bottom cover:

Invert the T545TR.

Gently press the cover into position, taking care to position the rim at the rear of the cover into the heatsink groove. Ensure that the rim of the front panel fits into the groove round the front of the bottom cover.

While fitting the bottom cover, check that the right hand retaining screw pillar slides into the hole in the LED PCB.

Replace the two "Taptite" screws at the rear of the cover and the two "Plastite" screws at the front of the cover.

Plug the microphone back in and reseat the cord relief grommet.

5.2.5 PA - SPECIAL INSTRUCTIONS

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

5.2.5.1 To Replace The PA Transistors

Unsolder the tabs by heating them with a soldering iron, then lifting them up towards the transistor with a thin stainless steel spike or screwdriver. Unscrew the transistor mounting screws or stud nuts and remove the transistor.

Trim the tabs of the replacement to make them similar to the faulty item, then lightly tin the underside of the tabs.

Smear the underside of the transistor with heatsink compound.

Screw the transistor tightly to the heatsink then solder the tabs.

CAUTION: Do not solder the tabs before tightening the screws or nut, as this will fracture the device.

5.3 REPAIR

5.3.1 COMPONENT CHECKS

If a transistor is suspected of faulty operation, an indication of its performance can be assessed by measuring the forward and reverse resistance of the junctions. First make sure that the transistor is not shunted by some circuit resistance (unless the device is completely unsoldered). An AVO model 8 or equivalent meter should be used for taking the measurements, using only the medium or low resistance ranges.

The collector current drawn by multijunction transistors is a further guide to their operating performance.

If an integrated circuit (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. These values can be found on the Circuit Diagram, or in the component data catalogue.

5.3.2 COMPONENT REPLACEMENT

Whenever components are removed from, or fitted to the printed circuit track, care must be taken to avoid damage to the track. If it is necessary to remove a component from the track, the following procedure is recommended:

Remove the solder from the component leads using a solder wick.
Loosen the individual leads from the printed track.
Withdraw the component from the top of the PCB.

Because of the delicate nature of the printed track, the use of solder suckers is not recommended.

Do not remove the component from the PCB while the solder is still molten.

Keep all soldering operations, and the heat and solder applied, to a minimum. A thermally controlled, fine tip soldering iron should be used. Ensure that the iron is earthed back to the frame of the set.

5.3.3 CRYSTAL FILTER REPLACEMENT

Should it become necessary to replace the crystal filter, both cans should be replaced together as the new parts are supplied as matched pairs. Observe polarity when fitting.

5.3.4 CHIP COMPONENT REMOVAL/REPLACEMENT

Note: The temperature of the soldering iron must be maintained at 320-370°C (600-700°F) and a low temperature solder should be used.

5.3.4.1 Component Removal

1. Place the soldering iron tip directly on the component in order to melt the solder and glue as shown in Figure 2. Remove the component with tweezers or long nose pliers.

2. Completely remove the old solder from the PCB, using a solder wick. Application of a small amount of flux will greatly aid in the removal of old solder. The use of 'solder suckers' is not recommended.

5.3.4.2 Replacement

1. After a component has been removed and the PCB pattern cleaned, apply a small amount of solder on the PC pattern and allow to cool, as shown in Figure 3.

2. Insert the new components and apply the soldering iron tip to the PC pattern as shown in Figure 4 (a), (b) and (c).

CAUTION: As patterns and components are close to each other, extreme care must be excercised when soldering so as not to damage components or bridge the PCB pattern paths. High soldering iron temperatures can cause component damage. Do not apply the soldering iron tip to the new component during installation.

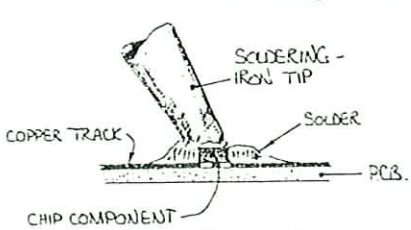


Figure 2

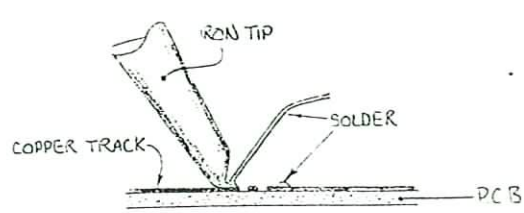


Figure 3

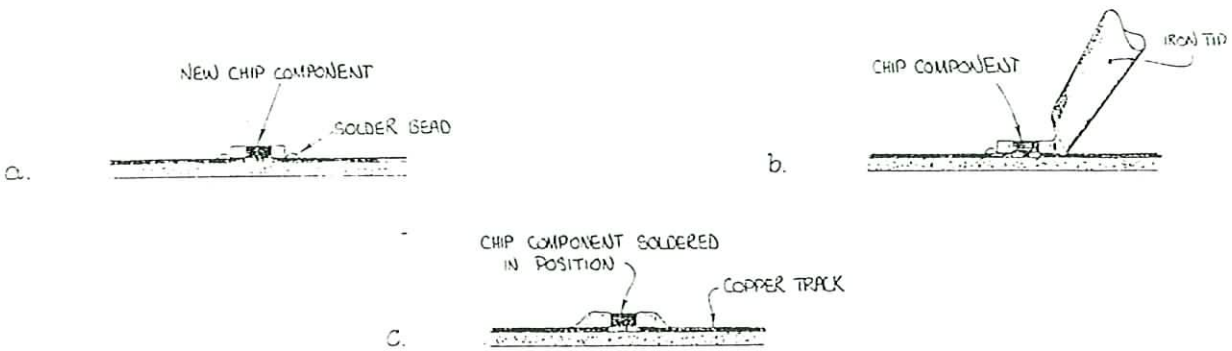


Figure 4

5.3.5 INTER-BOARD CONNECTIONS

To assist circuit tracing, all plugs and connections are shown on the outer edge of the Wiring Diagram, where the 'Function' is shown.

5.3.6 MICROPROCESSOR REPLACEMENT

The microprocessor (IC12) is factory programmed and permanently bonded to the PCB. If this device fails, the trunking logic PCB must be replaced.

5.4 SETTING UP

Note: The T545TR software enables a "test mode" function which allows ease of service without requiring interaction with a trunking system. The purpose of this test mode is to enable the normal radio functions to be set up. However, a trunking test set (e.g. Marconi TF2960) or Schlumberger 4040/4041 system is required to test the trunking signalling protocols.

It is recommended that the serviced radio is field tested by the serviceman on the customer's trunking system before being returned to the customer.

5.4.1 TEST EQUIPMENT REQUIRED

1. Digital multimeter (e.g. Fluke 77)
2. DC electronic voltmeter (e.g. Tech TE65)
3. RF power meter 30 watts FSD usable to 520MHz with 5 and 30 watt elements (e.g. Bird Model 6154 or 611).
4. Power Supply - output adjustable between 9 and 16 volts DC with a capacity of at least 8 amps.
5. Modulation meter (e.g. Sayrosa 252)
6. Sinad meter (e.g. Helper Instruments Sinadder)
7. VHF signal generator. Good quality FM. Useable from 0.1µV (-127dBm) to 200mV (0dBm) pd. (e.g. HP 8640B).
8. VHF frequency counter accurate to within 2ppm.

9. 10.7MHz Crystal marker (second harmonic gives beat for 21.4MHz IF)

10. Audio oscillator, 10Hz to 10kHz (e.g. HP 204C/D)

11. Tone Box: Audio amplifier, with about 1.5 watts output, to drive a small speaker which can be coupled to the T545TR microphone. An adaptor should be made whch will hold the speaker and microphone close together.

12. AC millivoltmeter

13. Calibrated oscilloscope

14. Speaker 4 ohm voice coil

15. RF power attenuator, total attenuation 50dB
(e.g. Weinschel 40-40-33 30dB 150W, plus Coline 1200 85 20dB 1w)

16. RF diode probe (e.g. Coline M12DM modular RF detector probe)

5.4.2 TUNING HINTS

1. Diagram 1 shows the test set-up for receiver and transmitter alignment.

2. For accurate tuning, the test cable connecting the signal generator or power meter to the T545TR should be as short as practical and fitted with a 'mating' BNC connector. Do not use adaptors, 'sniffer' couplings, etc, which introduce changes to cable impedance and errors in test results.

3. Non-metallic tuning tools must be used for the alignment of all coil slugs to avoid the tuning errors introduced by the use of metallic tools. Tuning tools need to be of correct size to avoid the damage to slugs which results from the use of incorrect tuning tools.

   Tuning tool WT 11 (Tait IPN 9360112) is suitable for adjusting trimming capacitors.

4. When using the RF diode probe, the earth return should be kept as short as possible and connected as close as possible to the point at which the measurement is being taken. This is to minimise stray pick-up which may affect the reading.

5. The front panel 'on/off' switch removes power from the regulated supplies only. The RF power amplifier, the audio output IC and the DC hash filter are not controlled by this switch.

6. Check for obvious mechanical faults in the printed circuit board, controls, microphone etc.

5.4.3 CHANNEL PROGRAMMING

Note: Transmit VCO operation is restricted to an 8MHz switching range within the band covering 175 to 225MHz. Receive VCO operation is restricted to an 8MHz switching range within the band covering 153 to 204MHz.

To check that the synthesiser is programmed correctly, refer to Table 1 below.

A logic level 1 on the pins listed adds that frequency increment to the total VCO frequency.

A logic level 0 on the pin means that it is not added.

Table 1

Frequency Increment MHz	Code	Pin No. IC8 (MC14152)	Connector
256.0	N9	20	SKT-3, pin 5
128.0	N8	19	SKT-3, pin 6
64.0	N7	18	SKT-3, pin 7
32.0	N6	17	SKT-3, pin 8
16.0	N5	16	SKT-3, pin 9
8.0	N4	15	SKT-3, pin 10
4.0	N3	14	SKT-4, pin 6
2.0	N2	13	SKT-4, pin 7
1.0	N1	12	SKT-4, pin 8
0.5	N0	11	SKT-4, pin 9
0.4	A5	10	SKT-4, pin 10
0.2	A4	25	SKT-4, pin 1
0.1	A3	24	SKT-4, pin 2
0.05	A2	22	SKT-4, pin 4
0.025	A1	21	SKT-4, pin 5
0.0125	A0	23	SKT-4, pin 3

5.4.4 TEST MODE

5.4.4.1 General

The test facility enables the TCB to emulate a multichannel radio, utilising the frequencies reserved for trunking. On transmit the TCB emits a stream of 1's and 0's to set the data modulation rate.

5.4.4.2 To Enter Test Mode

Switch the radio off.

Remove the bottom cover (refer to Section 5.2.2).

Place a temporary short across the two pins labelled "TEST MODE".

Switch the radio on.

Check the the front panel flashes "----".

Remove the short.

Note: When in "test mode", connect the aerial socket to a dummy load to prevent interference with trunking systems and avoid testing on channels in use locally.

5.4.4.3 Function Selection

Use the digit entry buttons to set up the desired function number from the list below:

modem control:	10	continuous zeros
	11	continuous ones
	12	preamble
	13	modem Tx off
mute control:	20	mute the receive audio
	21	unmute the receive audio
	22	mute the microphone audio
	23	unmute the microphone audio
PA control:	30	inhibit the PA
	31	enable the PA
RSSI threshold set up:	61	set up L1 threshold value
	62	set up L2 threshold value
	63	display RSSI level (averaged)
	64	display L1 threshold value
	65	display L2 threshold value

Press the AUX button to execute the function.

For radio control functions, an "A" will appear in the display to indicate that the number is valid and that the function has been executed.

To set an RSSI threshold value:

Apply a signal to the radio at the threshold level.

Select the required function.

Two dashes will appear in the display while averaging of the RSSI signal is taking place.

When averaging is complete, the result is displayed (in decimal, full scale = 255) and stored in the radio's database. The database checksum is automatically updated.

Function 63 displays the averaged RSSI level and also indicates when the threshold values have been exceeded. The leftmost decimal point lights when L1 is exceeded, the rightmost when L2 is exceeded.

5.4.4.4 Channel Selection

Use the digit entry buttons to set up the desired one, two or three digit channel number.

Press the CALL button to execute the channel change. A "-" will appear in the display to indicate that the channel number is valid and that the channel change has been executed.

The radio can be incremented to the next channel by grounding the "EMERGENCY" line (available on the power connector). Channel incrementing starts from the last programmed channel. When the highest valid channel is reached, the radio will reset to the lowest valid channel at the next increment.

5.4.4.5 Power Up State

In test mode the radio powers up in the following state:

- modem Tx off (13)
- receive audio unmuted (21)
- microphone audio unmuted (23)
- PA enabled (31)
- receive mode (PTT released)
- lowest valid channel

5.4.4.6 General

An invalid number selection is indicated by a "UA 2" message in the display.

The microphone pressel functions as per normal radio operation. The 'TX' LED indicates that the radio is in transmit mode but does not necessarily mean that it is transmitting (e.g. the PA could be inhibited).

The 'SYS' LED indicates the synthesiser lock status, and is on whenever the synthesiser is out of lock.

The 'GO' LED indicates the squelch status and is on whenever a signal is detected on the selected channel.

5.5 VCO ALIGNMENT

Connect the T545TR to a dummy RF load.

Plug a UHF frequency counter onto radio test plug TP3:

Connect:-	centre pin	to	ground
	left pin	to	Rx VCO
	right pin	to	Tx VCO

Enter "test mode" as described in Section 5.4.4.2.

Monitor the loop voltage (centre pin of radio TP2) with a high impedance voltmeter (0-10V range).

Select the highest channel.

1. Receive Mode

   Adjust CV191 for >6.25V and <6.5V at radio TP2.

   Check that the frequency is:

   Sub-band I
   Sub-band II 207.4875MHz
   Sub-band III

2. Transmit Mode (PTT switch closed)

   Adjust CV232 for >6.25V and <6.5V at radio TP2.

   Check that the frequency is:

   Sub-band I
   Sub-band II 199.4875MHz
   Sub-band III

Note: A loop voltage of less than 0.6V or more than 7.5V indicates the synthesiser is out of lock.

3. Select channel 1.

   Check that the voltage at radio TP2 is more than 3.5V in both transmit and receive modes.

5.6 REFERENCE FREQUENCY ADJUSTMENT

The 12.5kHz reference frequency must be accurately set. This is measured indirectly by monitoring the VCO frequency.

Connect a frequency counter to the VCO output (radio TP3).

Select channel 1.

Adjust L30 for the correct VCO frequency ±100Hz.

Repeat this measurement for both receive and transmit.

5.7 TRANSMITTER ADJUSTMENTS

5.7.1 ALIGNMENT

Connect a power meter to the aerial socket.

Set RV256 (power control) fully clockwise (as viewed from the component side).

Enter "test mode" as described in Section 5.4.4.2.

Select the middle channel.

Close the PTT switch.

Adjust CV272 for maximum power.

Adjust CV289 for maximum power consistent with best efficiency.

Note: For optimum efficiency, the settings of CV272 and CV289 should be checked on the lowest, middle and highest channels.

Adjust RV256 to reduce the power output to 24W.

Check that the middle channel frequency is within 100Hz.

Select the highest channel.

Close the PTT switch.

Check that the power output is >23W and <25W.

Select channel 1.

Close the PTT switch.

Check that the power output is >23W and <25W.

Check that the transmit current does not exceed 5A for 25W output with 13.8V at the set.

5.7.2 MODULATION ADJUSTMENT (SPEECH)

Enter "test mode" as described in Section 5.4.4.2.

Select channel 1.

Disable the modem as described in Section 5.4.4.3.

Connect an audio signal source of approximately 600 ohms impedance across the microphone (level 25mV PD).

Close the PTT switch and measure the deviation.

Sweep the audio frequency between 300Hz and 3kHz to check for maximum deviation.

Note the audio frequency at which the maximum deviation occurs, and then check the deviation on the middle and highest channels.

Set the channel with the highest deviation to ±2.5kHz maximum.

5.7.3 MODULATION ADJUSTMENT (SIGNALLING)

Select the middle channel.

Disconnect the audio generator and enable "Preamble" from the modem as described in Section 5.4.4.3.

Mute the microphone as described in Section 5.4.4.3.

Set the data deviation to ±1.5kHz via RV1 on the TCB.

Check the lowest and highest channels to ensure that the deviation is between ±1.3kHz and ±1.7kHz.

5.7.4 RF POWER ADJUSTMENTS

Note: To comply with licence requirements when used in a fixed station role with the T508 power supply unit (e.g. as a despatcher), the T545TR should have the RF power output reduced.

Connect a power meter to the aerial socket.

Set RV256 (power control) to adjust the RF power output to the required level.

For use with the T508 power supply unit, the RF power output should be adjusted to the level required to achieve the correct rating (ERP) as permitted in the relevant licence document for the installation, allowing for antenna gain and feeder/connector losses.

Do **not** adjust the RF power output level for less than 5W.

5.8 RECEIVER ADJUSTMENTS

5.8.1 RECEIVER COIL TAP CHANGES

For receiver operation between 175 and 200MHz:

Disconnect receiver coil links 'b' and connect receiver coil links 'a'.

For receiver operation between 200 and 225MHz:

Disconnect receiver coil links 'a' and connect receiver coil links 'b'.

5.8.2 MIXER ALIGNMENT

Enter "test mode" as described in Section 5.4.4.2.

Select the middle channel.

Align L15 for a maximum reading, using the method described in Section 5.9.2.3.

Select the lowest channel and note the mixer injection reading.

Select the highest channel and adjust L15 for the same reading as the lowest channel.

Repeat the two previous instructions until the mixer reading is identical on the highest and lowest channels.

5.8.3 RECEIVER ALIGNMENT

Turn RV149 (squelch) fully clockwise (as viewed from the component side of the board).

Do **not** further adjust L15.

Select the middle channel.

Connect a signal generator modulated to ±1.5kHz at 1kHz AF.

Connect a Sinad meter across the speaker terminals.

Increase the signal generator output until 12dB Sinad is reached.

Tune L11, L12, L13 and L14 for best Sinad.

Repeat the above instruction while reducing the signal generator level until it reads better than -117dBm for 12dB Sinad.

Select the lowest channel.

Set the signal generator to -94dBm and monitor the RSSI voltage (SKT-3, pin 3).

Tune L11 and L13 for maximum RSSI voltage.

Select the highest channel.

Tune L14 for maximum RSSI voltage.

Check that the receiver sensitivity is better than -117dBm on the lowest, middle and highest channels.

Adjust RV149 so that the squelch opens at 12dB Sinad on the middle channel.

5.8.4 RSSI ALIGNMENT

Complete the receiver alignment as instructed in Section 5.8.3.

Select the middle channel.

Enter the L1 and L2 levels as described in Section 5.4.4.3.

Set the L1 threshold level with an input signal of -108dBm.

Set the L2 threshold level with an input signal of -94dBm.

Check the L levels as follows:

Enter "63" on the display and push "AUX": the average RSSI level will be displayed.

When the RSSI level exceeds L1, the leftmost decimal point will light.

When the L2 level is exceeded, the rightmost decimal point will light.

Ensure that the L2 level is reached with a signal generator input of -94dBm ±6dB across the band.

5.9 RADIO FAULT FINDING

5.9.1 GENERAL

During servicing it may be necessary to measure specific performance parameters as a means of verifying the presence of a fault condition.

The following performance tests provide a means for checking the various two way radio parameters. When used in conjunction with the voltage level test points which are given on the Circuit Diagrams a fault can be readily pinpointed.

5.9.2 RECEIVER PERFORMANCE TESTS

Carry out the following checks in "test mode" after the alignment has been completed.

5.9.2.1 To Check The Squelch Operation

Select the middle channel.

Connect a Sinad meter across the speaker terminals.

Connect a VHF signal generator to the aerial input terminal.

Increase the signal generator level until the squelch just opens (approx. -118dBm for 12dB Sinad).

Reduce the signal generator level until the squelch just closes.

The difference should be approximately 6dB.

5.9.2.2 To Check The Audio Output Level

Connect an AC mV/meter and an oscilloscope across the speaker terminals.

Connect a VHF signal generator to the aerial input socket, with the output set to -107dBm (1μV) modulated to ±2.5kHz deviation at 1kHz.

Set the volume control to the onset of clipping.

The receiver output should be 3.7V across 4 ohms at +13.8V supply.

Check the distortion with the aid of a distortion analyser connected across the speaker terminals.

The distortion should not exceed 5%.

5.9.2.3 To Check The VCO Injection To The Mixer

Connect a DC EVM to the junction of R107/C112 via a 33k ohm isolating resistor at the probe tip.

Short the two gates of the mixer J-FET's together.

Check that the EVM reads approximately 2V DC.

Remove the short and note the increase in EVM reading.

The EVM reading should increase by approximately 0.5V at the band edges and 2V at the band centre.

5.9.2.4 To Check The Sinad Sensitivity

Connect a Sinad meter across the speaker terminals.

Connect the signal generator to the aerial input terminal.

Set the signal generator accurately to the receive frequency.

Couple a 21.4MHz reference oscillator loosely into the receiver IF stage, tune the signal generator for a zero beat, then uncouple the reference oscillator.

Set the signal generator deviation to ±1.5kHz at 1kHz.

Set RV149 fully clockwise, as viewed from the component side of the main PCB.

Note: It is important that the modulating frequency matches the notch of the Sinad meter.

Set the signal generator output level to zero.

Increase the signal generator output level until a Sinad of 12dB is reached.

The signal generator output should not be greater than -117dBm and is typically -119dBm.

Reset RV149 so the squelch opens at 12dB Sinad.

5.9.2.5 To Check The Signal+Noise To Noise Ratio

Set the signal generator output level to -107dBm (1μV) modulated to ±2.5kHz deviation at 1kHz.

Replace the Sinad meter with a mV/meter.

Set the volume control for a reading of 0.8V ('0'dB) on a convenient scale on the mV/meter.

Switch the signal generator modulation off.

Note the reading on the mV/meter.

The fall in reading when the modulation is switched off should be at least 27dB.

5.9.2.6 To Check The Ultimate Signal To Noise Ratio

Note: A good quality low noise RF signal generator should be used for this check (e.g. HP8640B or 8656).

Set the signal generator to give an 'on channel' signal, modulated to ±2.5kHz with a 1kHz tone.

Set the signal generator output level to -47dBm.

Connect an AC mV/meter across the speaker terminals.

Adjust the volume control for a reading of 0.8V ('0'dBm) on a convenient scale.

Turn the signal generator modulation off.

Note the reading on the mV/meter.

The fall in reading when the modulation is switched off should be at least 45dB. (A low reading could be caused by a faulty IC7 or a noisy VCO).

5.9.3 TRANSMITTER PERFORMANCE TESTS

Carry out the following checks in "test mode" after the alignment has been completed.

5.9.3.1 Audio Processor

(a) TO CHECK THE LIMITER CIRCUIT

Connect an oscilloscope to monitor the waveform at pin 14 of IC2d.

Provide an audio signal to the audio processor as in Section 5.7.2.

Set the frequency of the audio signal generator to 1kHz.

Slowly increase the signal generator output level until the waveform begins to distort (squaring), indicating that limiting has commenced.

Any further increase in signal generator output level should not increase the amplitude of the waveform.

(b) TO CHECK THE AUDIO ALC OPERATION

Set up the audio signal as described above (Section 5.7.2).

Set the oscilloscope to monitor the waveform at pin 1 of IC2a.

Connect an EVM to the junction of C49/R52.

Increase the output level of the signal generator to 10dB above the limiting level [Section 5.9.3.1 (a)]. Note the amplitude on the oscilloscope, then increase the signal generator output level by another 10dB.

Check that the amplitude of the waveform does not increase or distort significantly.

The EVM should show a 'positive DC' reading.

(c) TO CHECK THE GAIN OF THE AUDIO PROCESSOR

Provide an audio signal to the audio processor as in Section 5.7.2.

Connect the T545TR antenna output through a 50dB RF power attenuator (see Section 5.4.1 item 15) to a modulation meter.

Connect a mV/meter across the microphone terminals on the main PCB (to monitor the input to the audio processor).

Set the frequency of the audio signal generator to 1kHz.

Check the deviation control, RV79, as in Section 5.7.2.

Slowly increase the output level of the audio signal generator until a deviation of ±3kHz is reached.

Check that the mV/meter reads approximately 1mV rms.

Note: The audio processor gain must be checked at a level below that at which the audio ALC or limiting are influencing the measurements.

5.9.3.2 Modulation Characteristics

(a) TO CHECK THE ABOVE LIMITING RESPONSE

Connect the T545TR aerial output via a 50dB RF power attenuator to a modulation meter.

Provide an audio signal to the audio processor.

Increase the audio signal generator output level to 20dB above the limiting level [Section 5.9.3.1 (a)].

Vary the frequency of the signal generator between 0.3 and 10kHz.

Note the deviation on the modulation meter.

Between 300Hz and 3kHz the deviation should be within 4dB of maximum.

Above 3kHz the deviation should decrease in excess of 25dB/octave.

(b) TO CHECK THE BELOW LIMITING RESPONSE

Decrease the audio signal generator output level to 10dB below the limiting level [Section 5.9.3.1 (a)].

Vary the frequency of the audio signal generator between 0.3 and 10kHz.

Note the reading on the modulation meter.

From 300Hz to 3kHz the deviation should increase at the rate of 6dB/octave (+1, -3dB relative to 1kHz).

Above 3kHz the deviation should decrease in excess of 25dB/octave.

5.9.3.3 To Check The RF Power Control Circuit

Connect an RF power meter to the transmitter output.

Close the PTT switch.

Ensure that the transmitter is correctly tuned (Section 5.7).

Vary the supply voltage between 10 and 16V.

Above 13.8V the RF power output should not increase by more than 2W.

At 10.8V the RF power output should be more than 10W.

5.9.3.4 To Check The VCO Control Range

Plug a frequency counter onto the VCO test plug (TP3).

Short the middle pin on radio TP2 alternately to each of its outer pins.

The frequency shift should be more than 10MHz.

5.9.4 SYNTHESISER FAULT FINDING

Carry out the following checks in "test mode" after the alignment has been completed.

5.9.4.1 If The VCO Gives No Output

Ensure the frequency counter is connected to the correct pin of radio TP3.

Check the supply voltages at R191 (6.5V) and L38 (8V) for the Rx VCO, and at R230 (6.5V) and L55 (8V) for the Tx VCO.

Remove the VCO box and check for shorts inside.

Check the gate and source voltages as per the Circuit Diagram.

5.9.4.2 If The Synthesiser Does Not Lock Up

Check the VCO control range following the instructions in Section 5.9.3.4.

If the control range is less than 10MHz, check the circuit for faults between radio TP2 and the varicaps. The voltage on the varicaps must be the same as the loop voltage.

Tune the Rx VCO until its programmed frequency is within the switching range.

If the loop voltage is still either less than 0.6V or more than 7.5V, check pin 7 and pin 8 of the synthesiser (IC 8):

(Under normal operating conditions the loop voltage is between 1.75 and 6.5V and both pin 7 and pin 8 are high, except for very narrow pulses [100ns] at the same rate as the reference frequency.)

(a) If pin 7 pulses low and the loop voltage is low (TP2), or if pin 8 pulses low and the loop voltage is high, check the circuitry between R176/D32 and TP2. The voltage at C176 (use a 10M ohm probe) and TP2 should differ by no more than 200mV. If not, check the behaviour of the buffer amplifier (Q29, Q30).

(b) If both stay high and the loop voltage is high, check the crystal oscillator.

Measure the VCO frequency.

Measure the prescaler output frequency (pin 3).

Check that $f_{prescaler} = f_{VCO}/40$

Note: The prescaler should not be loaded with 50 ohms - a 1M ohm input counter must be used.

Check that the input voltage of the synthesiser (pin 1) is more than 500mV pp.

5.9.4.3 To Check The VCO Output Frequency Stability

If the synthesiser locks up but does not reach a stable VCO output frequency, or if the VCO output frequency is a few channels off frequency, check:

(a) that the input power to the prescaler from the VCO is not too low;

(Check the VCO output power and the circuitry between the VCO and the prescaler.)

(b) that the modulus control pulse (pin 1 of the prescaler) is more than 4.0V;

5.9.4.4 To Check The Transmitter Switch-On

If the synthesiser locks up but there is no transmitter power, check:

(a) that, if the synthesiser is locked, the lock detect output (IC8, pin2) is high (this output pulses low if the synthesiser is out of lock);

(b) that the voltages are as shown in the Circuit Diagram (Q25, Q43).

(c) the PA inhibit circuit.

5.10 TRUNKING CONTROL BOARD FAULT FINDING

5.10.1 GENERAL

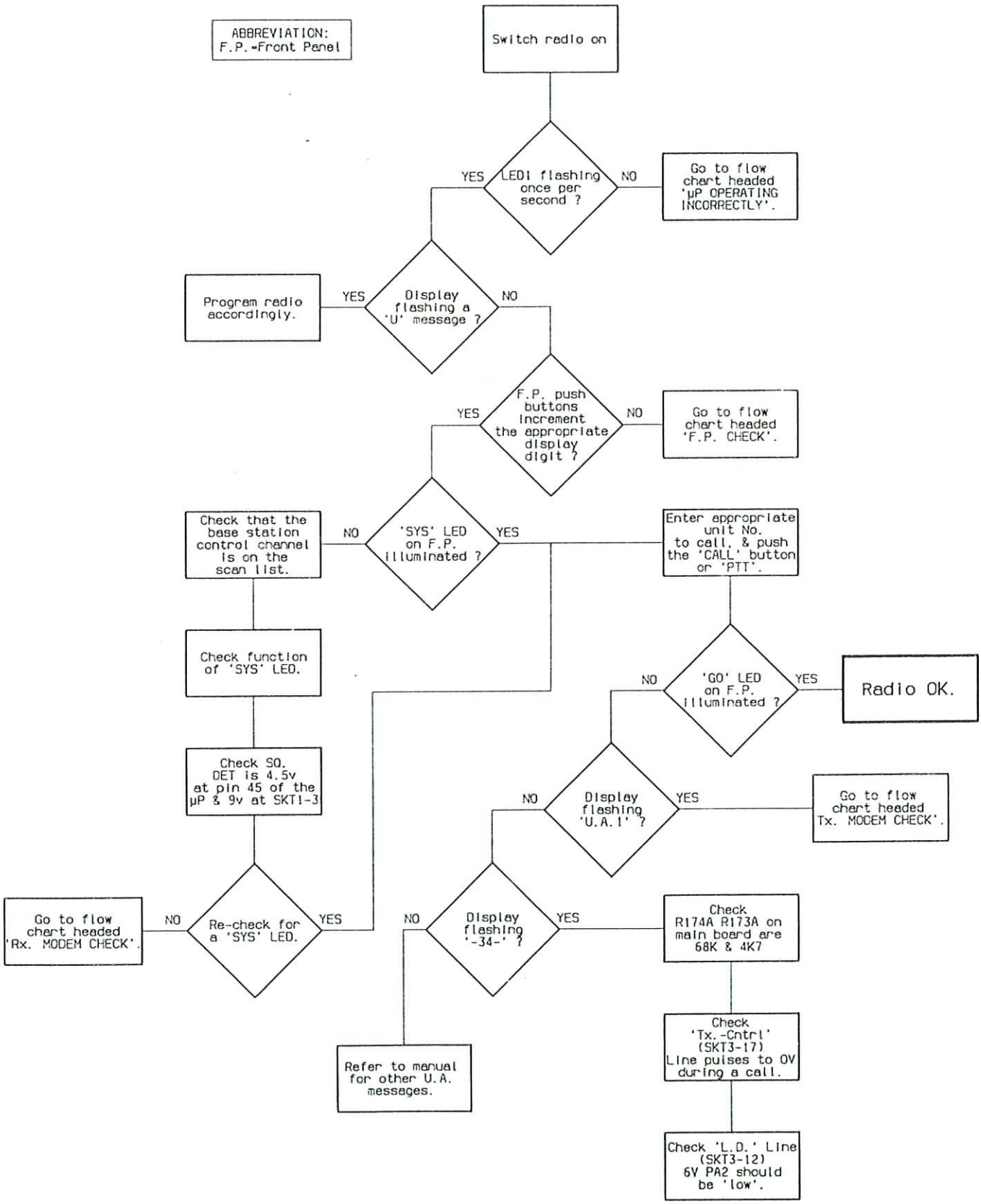
Five flow charts are provided in this Section as an aid to fault finding the TCB. The aim of these charts is to enable simple faults to be traced quickly to a certain area of the board.

If there is a regular fault that requires replacement of the TCB, please contact the Product Support Group at Tait Electronics Ltd.

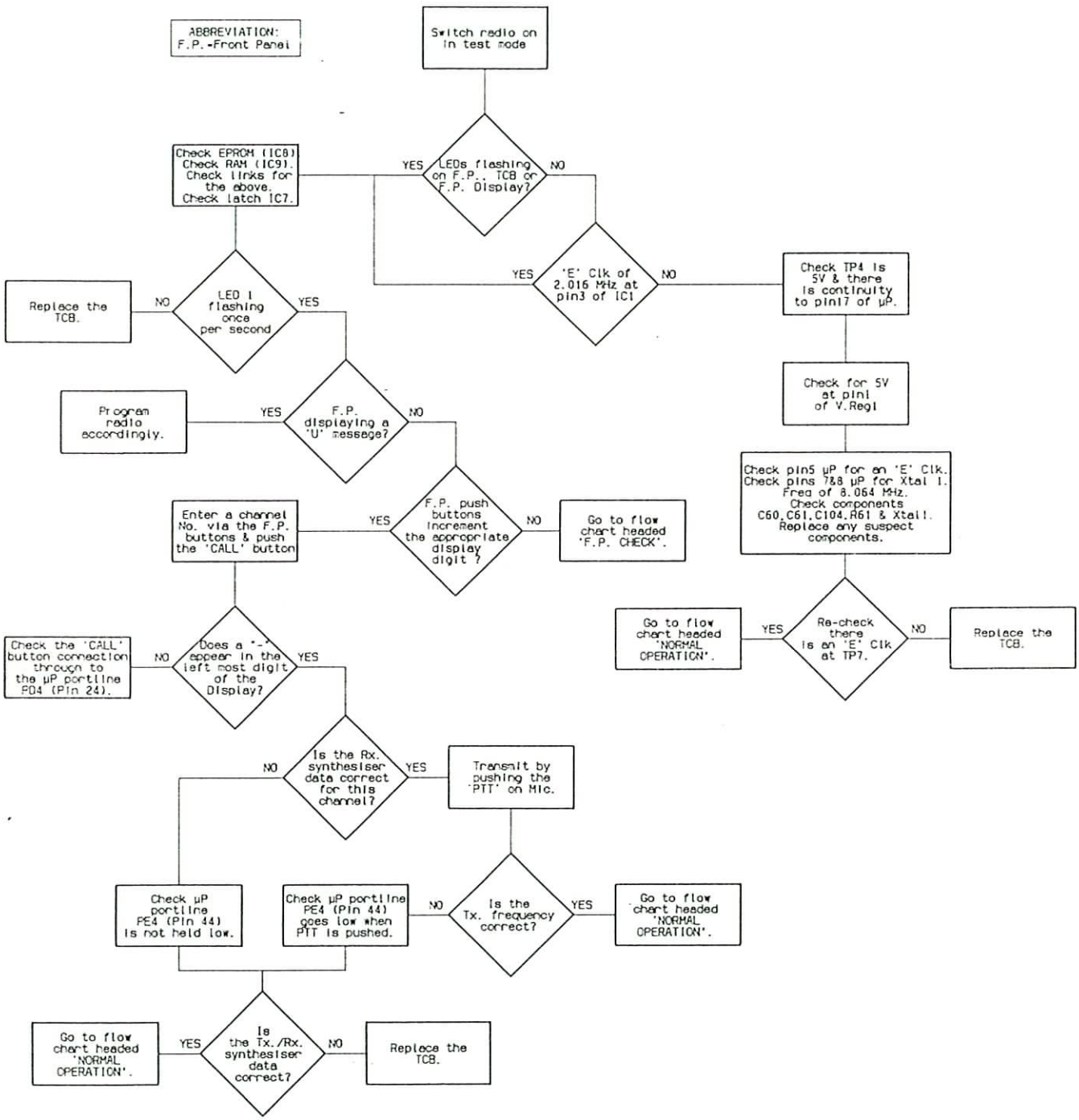
Start the fault finding by referring to Section 5.10.2, "Normal Operation", referring thereafter to the other flow charts as directed (removal of the radio covers is described in Section 5.2).

Note: When servicing is complete, always check that the "radio personality" is correct for the user. A before and after check of the "radio personality" is recommended.

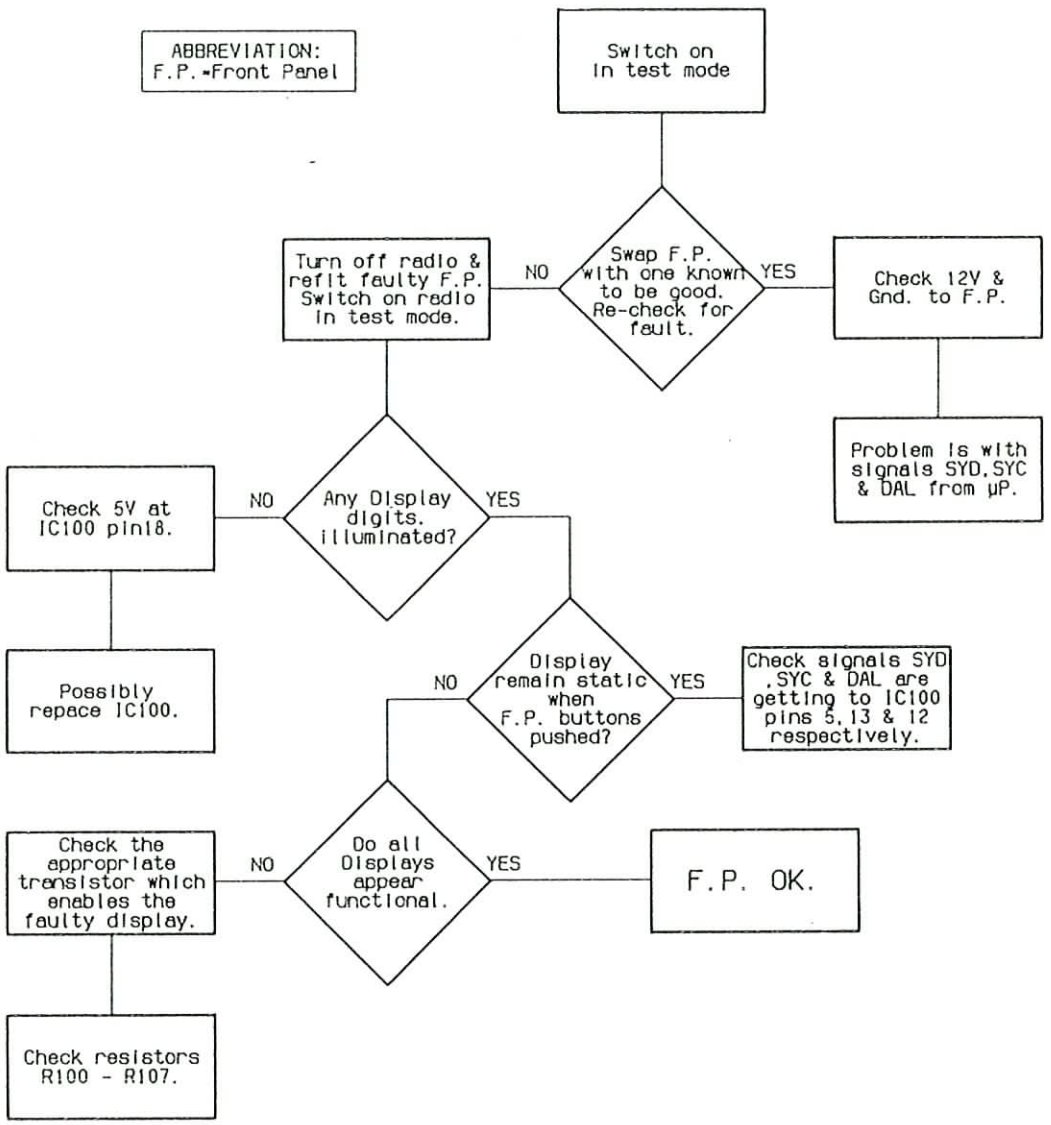
5.10.2 NORMAL OPERATION



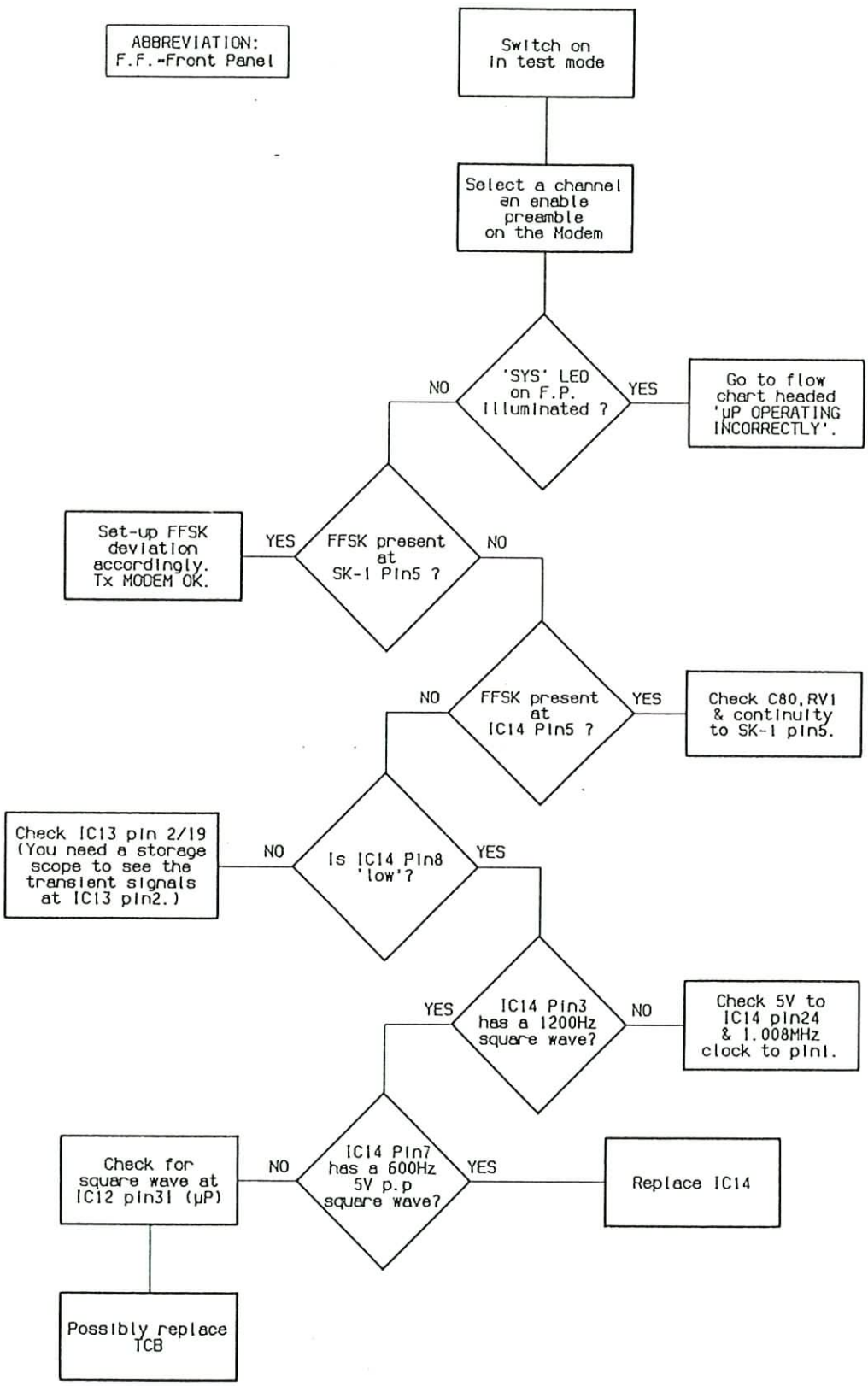
5.10.3 MICROPROCESSOR OPERATING INCORRECTLY



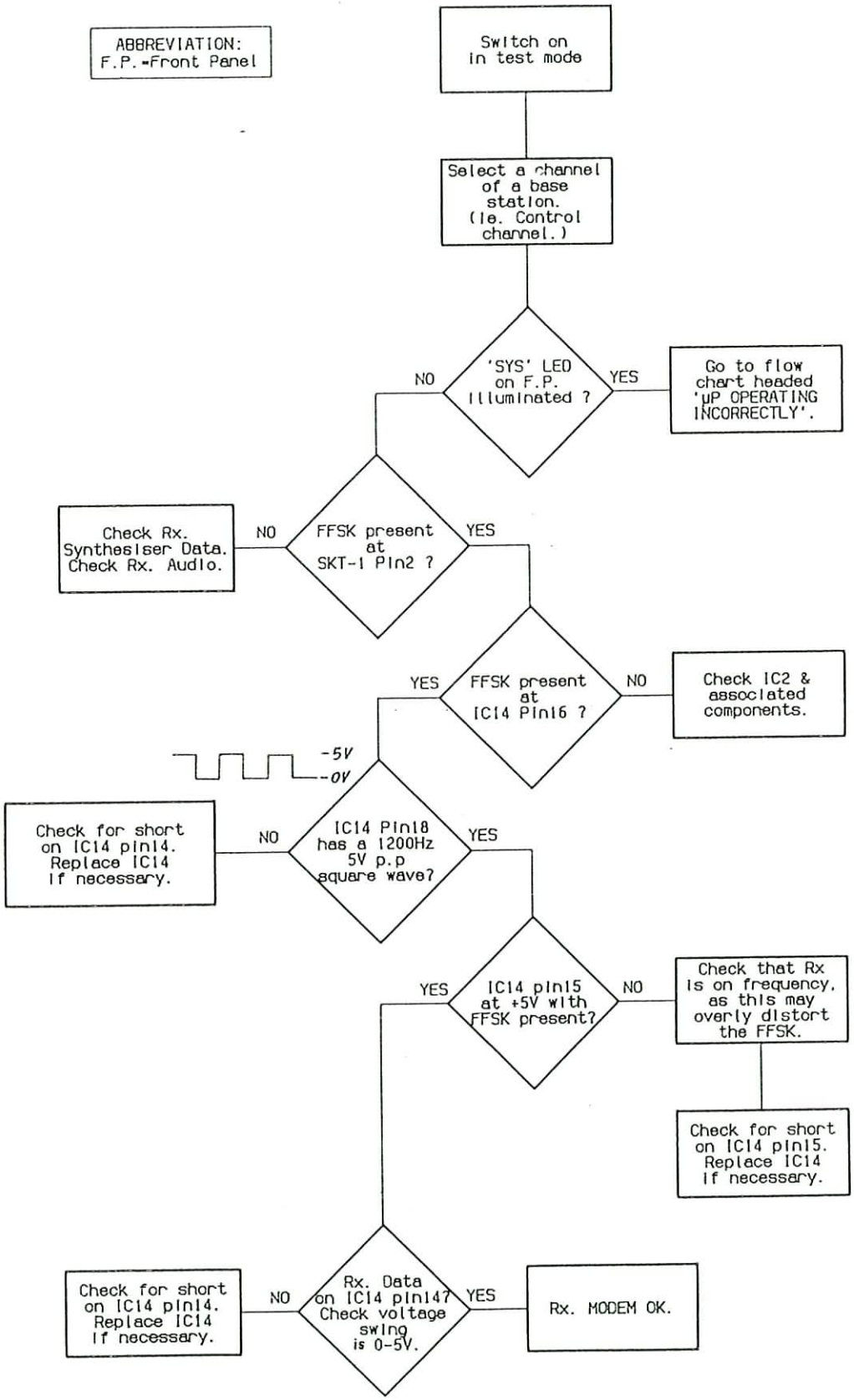
5.10.4 FRONT PANEL CHECK



5.10.5 TX MODEM CHECK



5.10.6 RX MODEM CHECK



SECTION 6 PARTS LIST

6.1 GENERAL

The 10 digit numbers (000-00000-00) in this parts list are "internal part numbers" (IPN's).

Your spare parts orders can be handled more efficiently if you quote: equipment type, circuit reference and IPN, along with a brief description of the part.

6.2 B545-91 MAIN PCB MANUAL INSERTION

6.2.1 TRANSISTORS

INTERNAL PART NO.	QTY/SET	DESCRIPTION	REFERENCE	CH/N
000-00011-70	2	BD136 TRANSISTOR	Q3, Q45	
000-00020-30	1	BF509	Q15	
000-00022-30	1	2N4427	Q42	
362-00010-05	1	GASKET, SILICONE RUBBER TO-39	Q42	
000-00031-10	1	BF981	Q18	
000-00031-75	2	3SK87K	Q34, Q37	

6.2.2 DIODES

001-00011-60	1	SR2607 DIODE	D1
001-00012-50	1	UM9401	D62
001-00012-53	3	BB405 VARICAP DIODE	D35, D50, D51
001-00012-66	1	HP5082-3080 DIODE	D63
001-00013-45	1	1SS97/2 DIODE	D61

6.2.3 INTEGRATED CIRCUITS

002-00014-40	1	MLM324 INT CCT	IC2
002-00014-70	1	MC3357	IC7
002-00014-91	1	4001B	IC1
002-00015-70	1	4066B	IC3
002-00017-50	1	MC12016	IC9
002-00017-60	1	MC145152	IC8

6.2.4 CAPACITORS

011 00500 01	1	0P5 CAP ±0.25P P100 50V CERAMIC	C286	
011 03680 01	1	680P CAP 10% N1K5 63V CERAMIC	C55	
011 04470 13	0.001	1 THOU 4m7 CAP 10% Y5B 50V DISC CERAMIC	C1	
017 15470 01	1	47m CAP 20% 50V SURFACE BARRIER	C253	
020 07100 05	4	1µ CAP 50V ELECTRO 4x7mm	C4, C17, C85, C86	
020 08470 05	10	47µ CAP 16V ELECTRO 6.3x7mm	C5, C44, C49, C90, C127, C171 C179, C181, C182, C251	
020 09100 04	5	100µ CAP 10V ELECTRO 6.3x9mm	C10A, C10B, C10C, C10D, C16	
020 09220 05	1	220µ CAP 16V ELECTRO 6.3x11mm	C92	
020 19100 02	1	1000µ CAP 16V ELECTRO 12x20mm	C2	
025 06220 01	3	220n CAP 35V TANT BEAD	C41, C183, C227	
025 07330 02	1	3µ3 CAP 16V TANT BEAD	C143	

6.2.5 RESISTORS

032 31470 00	1	4E7 RESISTOR 5% RUR M/F 10x4mm	R270
032 32100 00	1	10E " " " "	R271
041 22201 02	2	2K2 PRESET RES 10mm FLAT	RV79, RV256
042 05100 01	1	10K " " " "	RV149
042 05470 01	1	47K " " " "	RV157

6.2.6 COILS

050 00016 29	1	COIL TAIT No 629	L16
050 00016 40	1	COIL TAIT No 640	L51
050 00016 41	1	COIL TAIT No 641	L36
050 00016 42	5	COIL TAIT No 642	L11, L12, L13, L14, L15
052 08125 15	1	COIL A/W 1.5T/2.5mm HOR	L63
052 08130 15	2	COIL A/W 1.5T/3.0mm HOR	L57, L59
052 08130 25	2	COIL A/W 2.5T/3.0mm HOR	L56, L70
052 08130 35	1	COIL A/W 3.5T/3.0mm HOR	L62
052 08130 55	2	COIL A/W 5.5T/3.0mm HOR	L86, L87
052 08135 15	1	COIL A/W 1.5T/3.5mm HOR	L67
052 08135 25	1	COIL A/W 2.5T/3.5mm HOR	L79
052 08135 35	1	COIL A/W 3.5T/3.5mm HOR	L65

052 058 140 65	1	COIL A/W 6.5T/4.0mm HOR	L77
052 058 150 25	2	COIL A/W 2.5T/5.0mm HOR	L85, L88
052 058 150 55	1	COIL A/W 5.5T/5.0mm HOR	L54
056 000 010 17	1	FXD IND TAIT No 17 (6T on 3B)	L75
056 000 210 1	6	1.5μH FXD INDUCTOR	L2, L40, L58, L81, L82, L83
056 000 210 2	3	100μH " "	L31, L33, L45
056 000 210 4	2	330mH " "	L55, L60
056 000 210 7	1	33μH " "	L23
056 000 211 52	5	820mH FXD INDUCTOR (NON MAGNETIC)	L35, L37, L38, L50, L52

6.2.7 MISCELLANEOUS

062 000 010 11	5	CAN 14mm² x 19mm	FOR L11, L12, L13, L14, L15
065 000 1C0 4	2	F8 FERRITE BEAD 4x2x5	L76 1, FIT ONC IN PLACE OF R15 — 88/9 449
065 000 100 8	3	4S3 FERRITE BEAD 3x0.7x10mm	L64, L65, L74
200 000 100 4	0.1m	0.7mm TINNED COPPER WIRE	20mm FOR F8 BEAD 'R15'
220 000 111 2	1	PRINTED CCT BOARD T545-39	
240 000 200 59	1	HEADER 3WAY 1 ROW	TP3
240 000 200 72	1	HEADER 2WAY ULTREX	PL6
240 000 226 03	2	HEADER 3WAY 1 ROW 2.6mm	TP7, TP8
240 000 226 05	2	HEADER 5WAY 1 ROW 2.6mm	PL1 PL2
240 000 226 10	1	HEADER 10WAY 1 ROW 2.6mm	PL4
240 000 226 18	1	HEADER 18WAY 1 ROW 2.6mm	PL3
274 000 100 2	1	CRYSTAL 20.945MHz	X1
274 000 100 4	1	XTAL 12.8MHz TAIT SPEC. TE9.	88/9-488
276 000 101 2	1	CERAMIC DISCRIMINATOR CDB455C7	CD1
276 000 101 3	1	CERAMIC FILTER CFW455G	CF1
276 000 104 4	1	CRYSTAL FILTER 21.4MHz 7.5kHz 4Pole (2 RS)	XF1A, XF1B
369 000 020 33	8mm	TESASPONGE 12x3mm S/A ONE SIDE	88/9-488

6.3 B545-92 MAIN PCB AUTO INSERTION

6.3.1 TRANSISTORS

0005001060	2	BC327 TRANSISTOR	Q4, Q5	
0005001130	13	BC547B	Q1, Q2, Q7, Q10, Q19, Q20, Q21 Q22, Q27, Q29, Q31, Q43, Q44	
0005001130	8	BC557B	Q6, Q11, Q25, Q26, Q28, Q30 Q32, Q35	
0005002018	2	BF247A	Q16, Q17	
0005003195	2	MPS3646	Q40, Q41	
0005003310	2	J310	Q33, Q36	

6.3.2 DIODES

0015001201	0·016	1THRU 1N4148 DIODES	D2, D6, D7, D8, D14, D15, D16 D22, D23, D24, D25, D31, D31A D32, D33, D65	
0015001509	1	BZX79/C3V9 ZENER	D3	
0015001511	1	BZX79/C5V1	D48	
0015001514	1	BZX79/C6V8	D21	89/6 SK

6.3.3 CAPACITORS

0115122001	1	2P2 CAP ±0·25P NPO 50/63V CERAMIC	C300	
0115127001	3	2P7 " ±0·5P " " "	C114, C192, C234	
0115139001	1	3P9 " "	C194	
0115182001	1	8P2 " " " " "	C66	
0115210001	3	10P " " " " "	C198, C199, C250	
0115212001	2	12P CAP 5% NPO 50/63V CERAMIC	C116, C190	
0115215001	4	15P " " " " "	C113, C124, C257, C271	
0115215006	1	15P CAP 5% N750 50/63V CERAMIC	C174	
0115222006	1	22P " " N750 " "	C173	
0115227001	4	27P CAP 5% N150 50/63V CERAMIC	C130, C229, C243, C244	
0115233001	4	33P " " " " "	C63, C228, C273, C274	
0115239001	1	39P " " " " "	C131	
0115247001	2	47P CAP 5% N150 50/63V CERAMIC	C46, C196	
0115268001	1	68P " " " " "	C67	
0115310001	5	100P " " " " "	C45, C46, C108, C133, C175	
0115312001	2	120P " " " " "	C117, C119	

T545TR Parts List

0113150 01	8	150P	C135, C247, C248, C249, C254, C255, C269, C84	
0113220 01	7	220P CAP 10% N750 50/63V CERAMIC	C15, C40, C239, C242, C267 C276, C284	
0113470 02	1	470P CAP 10% T/c B 63V CERAMIC	C93	
0114100 01	15	1n " " " "	C7, C8, C11, C109, C129, C195 C220, C221, C224, C225, C236 C240, C246, C263, C265	
0114470 13	0.017	1 THRU 4n7 CAP 10% T/c B 50V CERAMIC	C6, C9, C42, C118, C121, C89 C123, C125, C126, C132, C140 C141, C142, C172, C180, C241 C285	89/6 302
0152110 01	1	1P0 CAP NP0 50V 0805 CHIP CER	CC97	
0152118 01	2	1P8 " " " " "	CC100, CC104	
0152139 01	2	3P9	CC111, CC235	
0152156 01	6	5P6	CC98, CC99, CC101, CC103 CC106, CC107	
0152168 01	2	6P8	CC102, CC105	
0152182 01	1	8P2	CC94	
0152210 01	2	10P	CC96, CC230	
0152212 01	1	12P	CC95	
0152218 01	1	18P	CC112	
0152222 01	1	22P	CC115	
0152247 01	1	47P	CC237	
0152256 01	1	56P	CC258	
0152410 CC 03	3	1n CAP X7R 50V 0805 CHIP	CC193, CC233, CC275	
0205711 00 02	1	1µ CAP 50V ELECTRO 5x11mm.	C87	
0205810 00 03	2	10µ CAP 50V ELECTRO 5x11mm	C110, C268	
0205847 00 02	1	47µ CAP 16V ELECTRO 6x11mm	C279	
0225410 01 0	4	1n CAP 10% 63V MYLAR POTTED	C184, C186, C226, C226A	89/6 293
0225422 01 0	2	2n2 " " " "	C50, C88	89/6 293
0225447 01 0	3	4n7 " " " "	C65, C178, C238	89/6 293
0225510 01 0	6	10n " " 63V MYLAR POTTED	C64, C152, C153, C177, C264 C54	
0225515 01 0	2	15n " " " "	C51, C52	
0225522 01 0	2	22n " " " "	C47, C53	
0225547 01 0	11	47n " " " "	C43, C58, C68, C134, C136 C170, C170A, C222, C275, C280, C62 (C292)	
0225568 01 0	1	68n " " " "		89/6 296
0225610 01 0	4	100n " " " "	C91, C151, C176, C122	89/6 302

6.3.4 RESISTORS

0 3 0 5 1 2 2 0 2 0	3	2E2 RESISTOR 5% FILM 4x1.6mm	R34, R60, R89	
0 3 0 5 1 4 7 0 2 0	1	4E7 " " " "	R272	
0 3 0 5 1 8 2 0 2 0	1	8E2 " " " "	R264	
0 3 0 5 2 1 0 0 2 0	7	10E " " " "	R104, R111, R112, R113, R244, R251, R261	
0 3 0 5 2 2 2 0 2 0	1	22E " " " "	R262	
0 3 0 5 2 4 7 0 2 0	4	47E " " " "	R110, R225, R247, R269	
0 3 0 5 3 1 0 0 2 0	5	100E " " " "	R155, R191, R193, R229, R250	
0 3 0 5 3 1 5 0 2 0	3	150E " " " "	R119, R226, R260	
0 3 0 5 3 1 8 0 2 0	1	180E " " " "	R106	
0 3 0 5 3 2 2 0 2 0	3	220E " " " "	R43, R249, R252	
0 3 0 5 3 3 3 0 2 0	3	330E " " " "	R107, R118, R224	
0 3 0 5 3 3 9 0 2 0	3	390E " " " "	R141, R276, R277	
0 3 0 5 3 4 7 0 2 0	2	470E RESISTOR 5% FILM 4x1.6mm	R245, R246	
0 3 0 5 3 5 6 0 2 0	2	560E " " " "	R263, R265	
0 3 0 5 3 6 8 0 2 0	10	680E " " " "	R5, R10, R32, R40, R44, R101 R198, R243, R259, R274	
0 3 0 5 4 1 0 0 2 0	12	1K " " " "	R3, R8, R18, R52, R64, R127 R151, R154, R177, R220 R248, R267	alpha.472
0 3 0 5 4 1 2 0 2 0	2	1K2 " " " "	R2, R117	
0 3 0 5 4 1 5 0 2 0	5	1K5 " " " "	R63, R120, R121, R188, R253	
0 3 0 5 4 2 2 0 2 0	10	2K2 " " " "	R9, R11, R16, R41, R45, R73, R123 R145, R222, R257	
0 3 0 5 4 2 7 0 2 0	2	2K7 " " " "	R115, R116	
0 3 0 5 4 3 3 0 2 0	3	3K3 " " " "	R175, R190, R231	
0 3 0 5 4 3 9 0 2 0	1	3K9 " " " "	R7	
0 3 0 5 4 4 7 0 2 0	13	4K7 RESISTOR 5% FILM 4x1.6mm	R1, R6, R27, R29, R63, R100, R150 R173, R221, R258, R275, R280, R173A	alpha.472
0 3 0 5 4 5 6 0 2 0	3	5K6 " " " "	R152, R184, R227	
0 3 0 5 4 6 8 0 2 0	3	6K8 " " " "	R74, R170, R192	
0 3 0 5 4 8 2 0 2 0	2	8K2 " " " "	R80, R223	
0 3 0 5 5 1 0 0 2 0	21	10K " " " "	R21, R30, R42, R47, R53, R54, R71 R76, R81, R103, R108, R109, R124 R126, R142, R144, R146, R171 R176, R178, R179,	
0 3 0 5 5 1 2 0 2 0	1	12K " " " "	R148	
0 3 0 5 5 1 5 0 2 0	1	15K " " " "	R75, R180, R278	

T545TR Parts List

0305511520	1	15K	R77	
0305522020	4	22K	R20, R61, R159, R225	
0305527020	2	27K	R102, R152	
0305533020	2	33K RESISTOR 5% FILM 4x1.6mm	R50, R86	
0305539020	2	39K	R75, R181	
0305547020	9	47K	R4, R25, R31, R33, R46, R64, R68, R125, R156	
0305556020	3	56K	R183, R187, R233	
0305568020	1	68K	R174A	~~R174~~
0305610020	5	100K	R19, R52, R87, R196, R240	
0305612020	2	120K	R26, R66	R6-302
0305615020	1	150K	R140	
0305618020	2	180K	R67, R147	
0305622020	2	220K	R122, R155	
0305627020	1	270K	R174	R174A
0305647020	7	470K	R45, R49, R51, R65, R72, R88, R143	
0305710020	5	1M	R17, R28, R62, R153, R232	
0361310000	1	100E RESISTOR 5% M/F 0805 CHIP	RC234	
0361322000	1	220E RESISTOR 5% M/F 0805 CHIP	RC236	
0361347000	1	470E " " " "	RC194	
0361410000	1	1K	RC172	
0361456000	2	5K6	RC195, RC238	
0361610000	3	100K	RC197, RC235, RC237	

6.4 B545-93 T545TR MISCELLANEOUS & MECHANICAL

0 0 0 0 0 0 2 3 2 3	1	SIRFH1001 TRANSISTOR	Q47
0 0 0 0 0 0 3 0 6 5	1	2N6080 TRANSISTOR	Q46
0 0 2 0 0 0 1 3 7 0	1	TDA1020 INT CCT	IC4
0 1 2 0 4 1 0 0 0 1	3	1n CAP CERAMIC FEEDTHRU LEADLESS	
0 1 2 0 4 1 0 0 0 2	1	1n CAP CERAMIC FEEDTHRU WITH LEAD	
0 1 5 0 3 2 2 0 0 2	2	220P CAP 5% NPO, HQ, 1210 CHIP	CC282, CC283
0 1 5 1 2 1 0 0 0 1	2	10P CAP 200V 5x0.9mm WEDGE	C295, C299
0 1 5 1 2 2 2 0 0 1	2	22P CAP " " "	C296, C298
0 1 5 1 2 2 4 0 0 1	1	24P CAP " " "	C297
0 1 5 1 3 2 2 0 0 1	2	220P CAP " " "	C290, C293
0 1 7 1 5 4 7 0 0 1	1	47n CAP 20% 50V CERAMIC SURFACE BARRIER	C281
0 2 8 0 2 1 0 0 0 6	2	2/10P TRIM CAP, MURATA 6x8	CV191, CV232
0 2 8 0 2 1 8 0 0 1	1	2/18P TRIM CAP " "	CV289
0 2 8 0 2 3 0 0 0 3	1	5/30P TRIM CAP, N750 GREEN, MUR TZ	CV272
0 2 9 0 2 1 5 0 0 2	1	15P CAP 5mm CASE MICA	C291 (ON TOP OF C288)
0 2 9 0 2 2 2 0 0 2	1	22P CAP 5mm CASE MICA	C270 (ON TOP OF C277)
0 2 9 0 3 1 0 0 0 2	2	100P CAP 5mm CASE MICA	C277, C288
0 3 2 3 3 1 8 0 0 0	1	180E RESISTOR 5% M/F 10x4mm	R273
0 4 0 0 5 1 0 0 1 3	1	10K LOG POT. LESS SW, PCB MTG	RV85
0 5 0 0 0 0 1 6 1 7	1	COIL TAIT No 617	L30
0 5 1 0 0 0 0 6 0 3	3	FEEDTHRU LEAD A4M32230	
0 6 5 0 0 0 1 0 0 7	3	FERRITE BEAD 4x2x5mm 453 RED	
2 0 0 0 0 0 1 0 0 4	0.5gm	WIRE 0.7mm TINNED COPPER	25mm DC PWR FEED, 20mm COAX CONNECTOR
2 0 1 0 0 0 3 0 0 4	360mm	WIRE 7/0.2mm PVC YELLOW	180mm SPKR/ULTREX CONNECTOR 90mm PCB/EXT SPKR 90mm PCB/EMERGENCY SW
2 0 1 0 0 0 3 0 1 0	210mm	WIRE 7/0.2mm PVC BLACK	180mm SPKR/ULTREX CONNECTOR
2 3 2 0 0 0 1 0 1 9	1	SWITCH, PUSH, LATCHING, PCB MTG	SW1
2 3 2 0 0 0 1 0 2 0	2	SWITCH, PUSH, MOMENTARY, PCB MTG	SW2, SW3
2 3 2 0 0 0 2 0 2 3	3	KEYBASE, ALPS SW	
2 3 2 0 0 0 2 0 2 5	3	KEYTOP, ALPS SW, BLACK, A3M2563	
2 4 0 0 0 0 1 0 6 0	1	PLUG HOUSING, 4WAY PNL MTG	POWER CONNECTOR
2 4 0 0 0 0 1 0 6 1	4	PLUG TERMINALS, SOLDER TAG	POWER CONNECTOR
2 4 0 0 2 1 0 0 1 1	1	SOCKET, COAXIAL, BNC BULKHEAD MTG	
2 4 0 0 4 0 2 0 7 2	1	ULTREX 2WAY SKT HOUSING	SPEAKER CONNECTOR
2 4 0 0 4 0 2 0 7 6	2	ULTREX CRIMP SKT TERMINAL	SPEAKER CONNECTOR

250000100144	1	SPEAKER 8 ohm		
252000100364	1	MICROPHONE, GOOSE FOSTER, WITH PLUG & GROMMET		
302004000422	3	PUSH BUTTON, PLASTIC A3M1585		
302004500355	1	THREADED BOSS A4M2148		
303002000201	1	TOP COVER A1M1934		
303002000211	1	BOTTOM COVER A1M1935		
303005000711	1	CLIP, FEEDTHRU A4M2005		
308001300661	1	HEATSINK, DRIVER A4M1830		
308001300711	1	HEATSINK, DIECAST A1M1931		
311000100331	1	KNOB A3M1584		
312000100141	1	LID, T5X5 PA SOLDER SIDE A2M1932		
312000100151	1	LID T5X5 PA COMPONENT SIDE A2M1933		
312000100411	1	LENS, DIGITAL DISPLAY WINDOW A3M2286		
312010440001	1	LENS, LEDs A4A631, A4M1586		
316000630721	1	FRONT PANEL, T5X5 TRUNKING, A3M2323, SKT 1&2		
316008500941	1	BNC MOUNTING PLATE A4M2160		
316008700641	1	PILLAR 11.1mm PLASTIC SNAP IN		
319000111491	1	SHIELD BOX, VCO A1M2229		
319000111551	1	SHIELD TIN PLATE A3M2236	SOLDER TAB MUST BE CUT OFF	8/6 303
319000110991	1	SHIELD LID, VCO A3M1655		
319000111571	1	SHIELD COMPONENT SIDE A3M2320		8/6 303
319000111381	1	SHIELD, POWER SKT A4M2151		
319000111581	1	MIC SHIELD A3M2321		8/2-004
314500400081	1	SCREW M3 x 12mm PAN POZI SST B3	IC4	
349000102562	2	SCREW No4 x 3/8 PAN SUPA POLYMATE	PLASTIC COVER 2,	8/10-577 8/6 303 8/10-577 8/6 303
349000102662	2	SCREW No4 x 5/16 PAN SUPA POLYMATE		
349000202031	9	SCREW M3 x 10mm PAN POZI TAPTITE	VCO BOX/LID 4, PLASTIC COVERS 4 Q3 1	
349000202032	22	SCREW M3 x 8mm PAN POZI TAPTITE	HEATSINK/PCB 2, Q47 2 HEATSINK COVERS 16	8/6 303
352000100835	2	NUT M3 HEX	Q3, IC4	
352000103552	2	NUT 8-32 UNC	Q46, Q47	
353000101132	2	WASHER M3 FLAT	Q3, IC4	
353000101332	2	WASHER M3 SHAKEPROOF	Q3 IC4	
356000100132	2	SOLDER TAG 3mm SHORT	POWER SKT SHIELD	28/2-004
357000100944	4	PUSH ON FIX SFP3253	SPKR MTG	
357000104412	1	P CLIP NYLON 3.2mm		31/3-12
369000101232	2	FURNITURE FOOT	VCO	
399000105631	1	PLASTIC BAG 200x250mm		
400000001001	12mm	0.4mm SLEEVING SILICON RUBBER	L76	31/10-444
400000002003	20mm	1mm SILICONE SLEEVING		
400000001009	25mm	3mm SLEEVING SILICON RUBBER	R273 & C281	28/10-444
409545000001	1	T545TR INSTALLATION HANDBOOK		31/10-552
240000100131	1	PLUG BNC CRIMP		28/2-004

6.5 B545-94 CONTROL PCB MANUAL INSERTION

002 000 1720	1	MC14499 INT CCT	IC100	
002 000 1808	1	27C256 INT CCT	IC8	
002 000 1830	1	MK4-8Z 12-20 INT CCT	IC9	
005 000 1015	2	LED 3mm GREEN	LED1, LED2	
005 000 1472	3	LED 10x5mm RED (HLMP 2300)	LED100, LED101, LED102	
005 000 2010	4	LED DIGIT HDSP7503	LED103, LED104, LED105, LED106	
056 000 2101	3	FXD IND 1.5μH	L1, L2, L3	
232 000 1023	3	SWITCH KEYBOARD SP	SW100, SW101, SW102	
2+0 00C 0205 7	0.2	PLUG 10WAY 1ROW PC MTG HEADER		3M/2-VIS
240 000 2104	1	HEADER 4WAY 1 ROW (15.5mm PINS)	PL-9	
240 000 2110	1	HEADER 10WAY 1 ROW (15.5mm PINS)	PL-5	
240 040 2055	2	SOCKET 5WAY 1 ROW, BOTTOM ENTRY	SKT-1, SKT-2	
240 040 2056	1	SOCKET 10WAY 1 ROW, BOTTOM ENTRY	SKT-4	
240 040 2064	0.440	SKT, 0.98mm PIN JACK, 64WAY CARRIER	28 REQUIRED	
240 040 2091	1	SOCKET, 6WAY PHONE JACK PCB MTG MOLEX	SKT-10	
240 040 2113	1	SOCKET 3WAY 1ROW, PCB MTG, BOTTOM ENTRY	SKT-7	
240 040 2118	1	SOCKET 15WAY 1ROW, PCB MTG, BOTTOM ENTRY	SKT-3	
240 041 2124	1	SOCKET 4WAY EDGE PCB MTG SIDE ENTRY	SKT-9	
240 041 2127	1	SOCKET 10WAY EDGE PCB MTG, SIDE ENTRY	SKT-8	
274 000 1036	1	CRYSTAL 8.064 MHZ.	XL1	
304 000 7020	1	DAMPER A4M 1817 (LOW LO INSEAL)		

6.6 B545-95 CONTROL PCB SMD

000 1004 10	1	MJD41C TRANSISTOR	Q11	
000 1008 48	11	BCW60/BC848 TRANSISTOR	Q2, Q3, Q4, Q5, Q12, Q13, Q100, Q101, Q102, Q103	87/1 371
			Q104	87/5-249
000 1005 57	2	BCW70/BC857 TRANSISTOR	Q1, Q14	87/7-371
001 1000 70	4	BAV70 DIODE	D63, D64, D65, D66	
001 1008 46 2	1	BZX84/C6V2 ZENER	D62	
002 1000 32 4	1	LM324 INT CCT SMD	IC2	
002 1000 41 9	1	FX419 " " "	IC14	
002 1004 02 7	1	4027B " " "	IC1	
002 1004 09 4	2	4094 " " "	IC3, IC4	
002 1004 10 4	1	4104 " " "	IC10	
002 1007 50 5	1	78L05	V REG1	
002 1034 06 4	1	MC34064D INT CCT SMD	IC15	
002 1680 01 1	1	68HC11A1 " " "	IC12	
002 7490 00 0	2	74HC00 " " "	IC6, IC16	89/6 343
002 7490 13 9	1	74HC139 " " "	IC5	
002 7490 57 3	1	74HC573 " " "	IC7	
002 7490 57 4	1	74HC574 " " "	IC13	
015 0610 08	5	100n CAP 10% X7R 50V 1206 CHIP	C62, C78, C87, C88, C100	87/7-371
015 2218 01	1	18P CAP 5% NPO 50V 0805 CHIP	C61	87/7-371
015 2222 01	1	22P CAP 5% NPO 50V 0805 CHIP	C105	87/7-371
015 2233 01	1	33P " " " "	C76	89/7-343
015 2310 01	1	100P " " " "	C85	87/7-371
015 2227 01	1	27P " " " "	C104	87/7-371
015 2410 08	7	1n " 10% X7R 50V 0805 CHIP	C10, C11, C12, C13, C83, C84, C90,	87/7-371 87/5-269
015 2239 01	1	39P CAP 5% NPO 50V 0805 CHIP	C60	87/7-371
015 2510 08	7	10n CAP 10% X7R 50V 0805 CHIP	C65, C66, C67, C75, C95, C96 C101	
016 0710 01	5	1µ CAP 16V ELECTRO 4x5.7mm SMD	C50, C68, C77, C80, C86	87/7-371
016 0810 01	4	10µ CAP 16V ELECTRO 4x5.7mm SMD	C63, C89, C102, C103	
028 1220 01	1	20P CAP TRIMMER SMD	CV1	87/5-269
		:		87/7-371
036 1218 00	3	18E RESISTOR 5% M/F 0805 CHIP	R110, R111, R112	
036 1247 00	2	47E " " " "	R125, R126	
036 1315 00	1	150E " " " "	R66	
036 1327 00	10	270E " " " "	R82, R84, R100, R101, R102 R103, R104, R105, R106, R107	
		" " " "		87/7-371
036 1368 00	2	680E " " " "	R12, R74	87/7-371

T545TR Parts List

0	3	6	1	4	1	0	0	0	0	1	1K RESISTOR 5% M/F 0805 CHIP	TR60	
0	3	6	1	4	1	5	0	0	0	2	1K5 " " " " "	R10, TR88	
0	3	6	1	4	2	2	0	0	0	8	2K2 " " " " "	TR5, R6, R7, R8, R9, R87, R124, R130	m/a-432
0	3	6	1	4	4	7	0	0	0	2	4K7 " " " " "	TR67, R121	87/9-37 m/a-432
											" " " " "		87/7-371
0	3	6	1	5	1	0	0	0	0	22	10K " " " " "	TR11, , TR62, R63, R64, R65, R68, R75, R76, R77, R79, R80, R81 R83, R91, R92, R93, R95, R116 R119, R122, R127, R130	m/a-432 87/5-247 87/7-371
0	3	6	1	5	1	2	0	0	0	1	12K " " " " "	R94	
0	3	6	1	5	2	2	0	0	0	1	22K " " " " "	TR117	
0	3	6	1	6	1	0	0	0	0	11	100K " " " " "	P/P P1, P2, R3, R4, R128, TR65, TR89, TR90, TR123 R129	87/5-247
0	3	6	1	6	2	7	0	0	0	1	270K " " " " "	TR115	
0	3	6	1	6	5	6	0	0	0	1	560K RESISTOR 5% 0805 CHIP M/F	R86	MM-965 87/7-371
0	3	6	1	7	1	0	0	0	0	2	1M " " " " "	TR61, TR115	
0	4	2	1	5	2	0	0	0	1	2	20K PRESET RESISTOR SMD	TRV1, RV2	
2	2	0	0	0	0	1	1	6	3	1	PRINTED CCT BOARD, TEL TR CONTROL		

6.7 B500/RC T545TR CRADLE/INSTALLATION/PACKING

205 0001 06	3.0M	AUTO CABLE 153 2/28/0.3	
240 0201 60	1	SKT HOUSING, 4WAY MOLEX	
240 0201 61	2	SKT RECEPTACLE, 152 AUTO	
240 0201 62	2	SKT RECEPTACLE, 7/0.2	
252 0001 02	1	CLIP, MIC MTG	
265 0001 17	1	FUSE, 10 AMP CARTRIDGE 6x32mm	
303 0030 04 7	1	CRADLE ASSEMBLY, A2M1920, A3M1921,	A3M1955
303 0030 04 9	2	CLIP, PLASTIC A2M1922	
303 0030 05 2	2	KEY, PLASTIC A4M1925	
340 0001 10	1	FUSEHOLDER, IN LINE BOOK HOUSING	
340 0001 11	2	BOOK FUSEHOLDER CRIMP TERMINAL	
349 0001 04 9	4	SCREW No 10 x 3/4" PAN POZI SELFTAP	CRADLE MTG.
353 0001 03 2	4	WASHER M5 SHAKEPROOF, EXTERNAL	CRADLE MTG.
369 0001 02 7	2	NYLON CABLE TIE 140mm x 2.6mm	BATTERY LEAD TIE
399 0001 05 1	1	PLASTIC BAG 75 x 140mm.	
410 0001 03 7	1	T500 PACKAGING, CARD SLEEVE A4M1814	
410 0001 05 0	1	T500A PACKAGING, POLYSTYRENE - 2 PCS A1M2037	
410 0001 05 5	0.1	PACKAGING, CARTON, 10 T500 RADIO'S	
359 0001 03 7	4	RIVET 3x5mm ST FLAT HD TINNENS No7	SUPPLIED TO MANUFACTURER OF CRADLE ASSY.

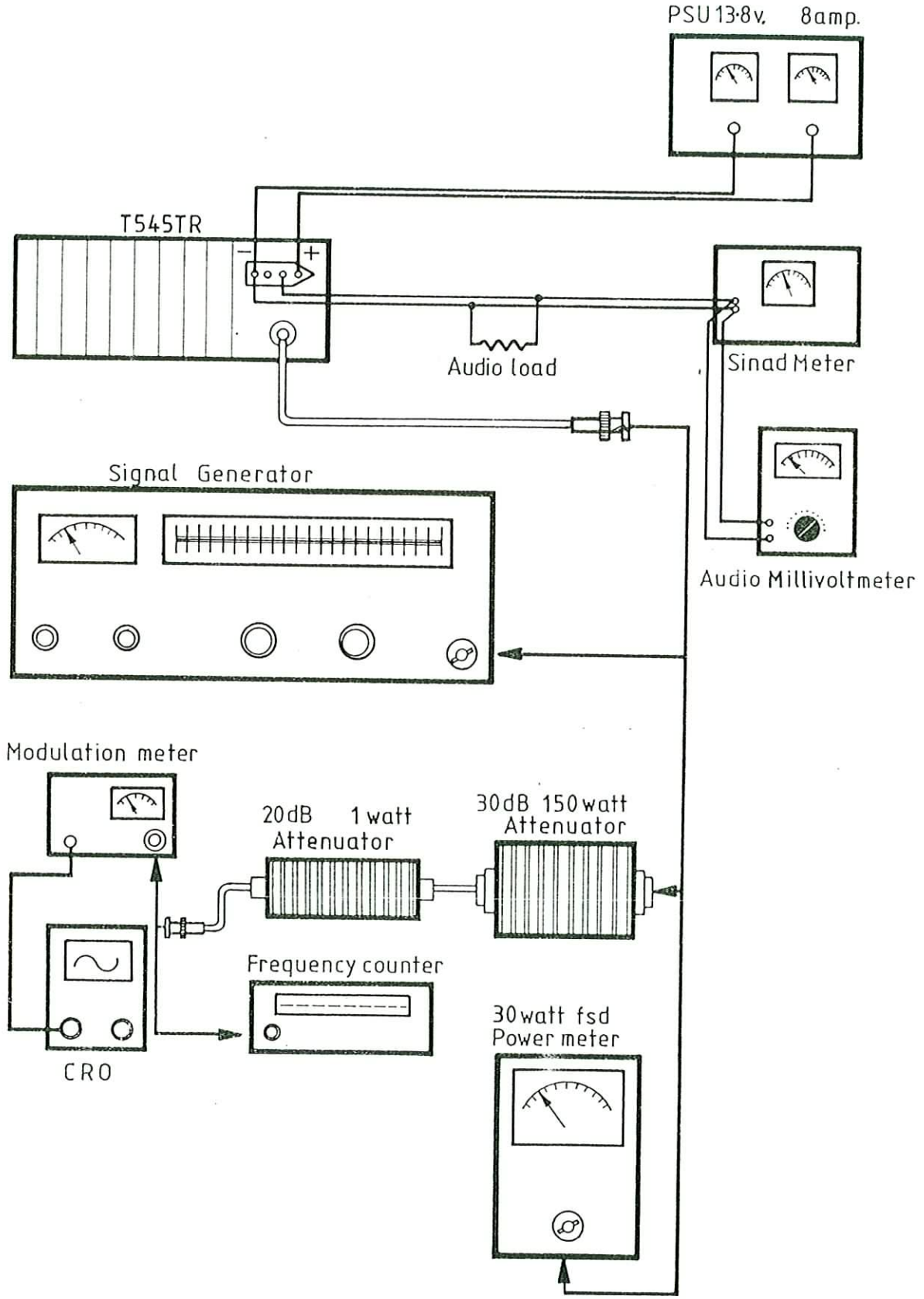


Diagram 1 Suggested Test Equipment Set-Up

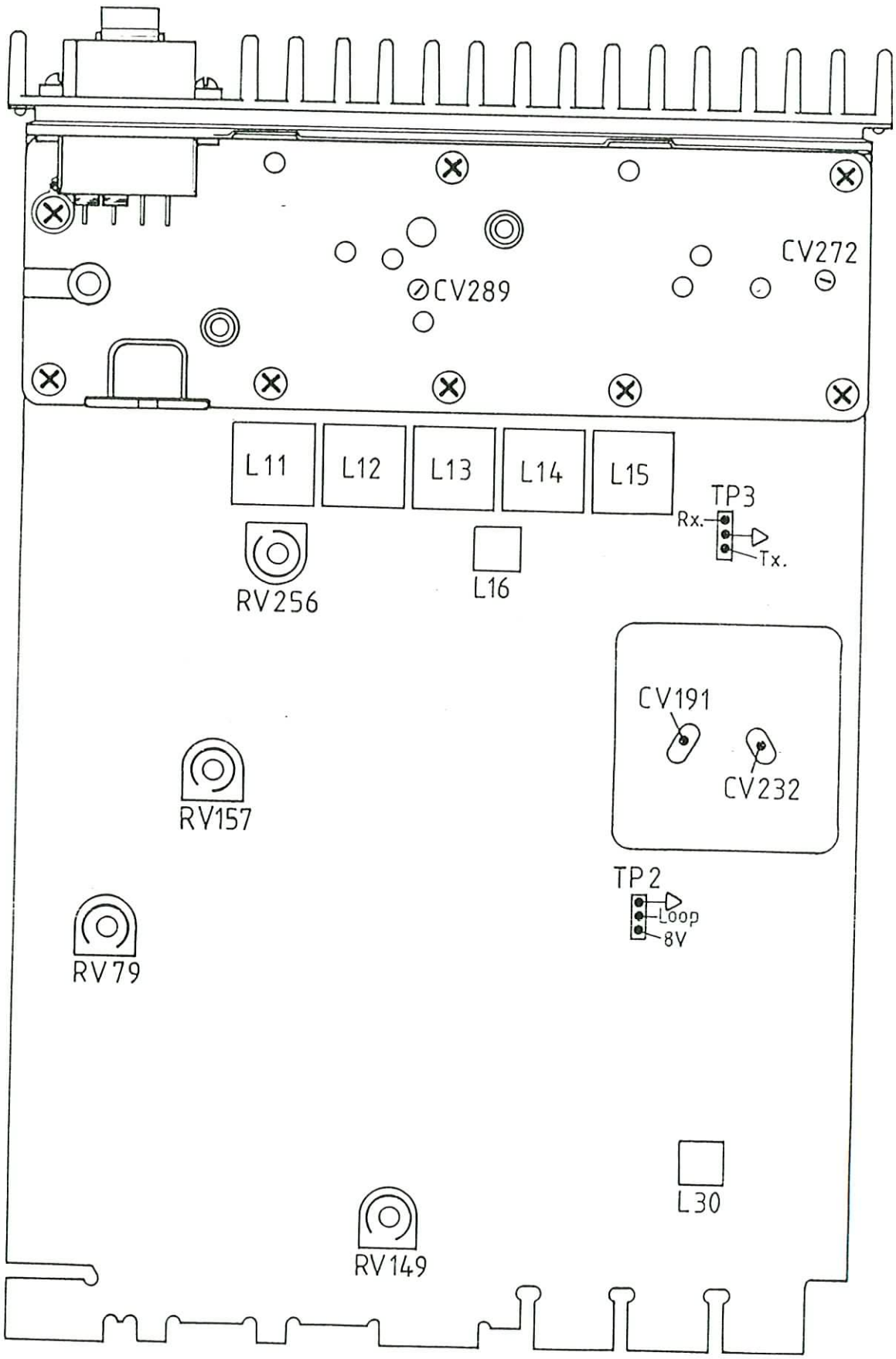


Diagram 2 T545TR Tuning Points

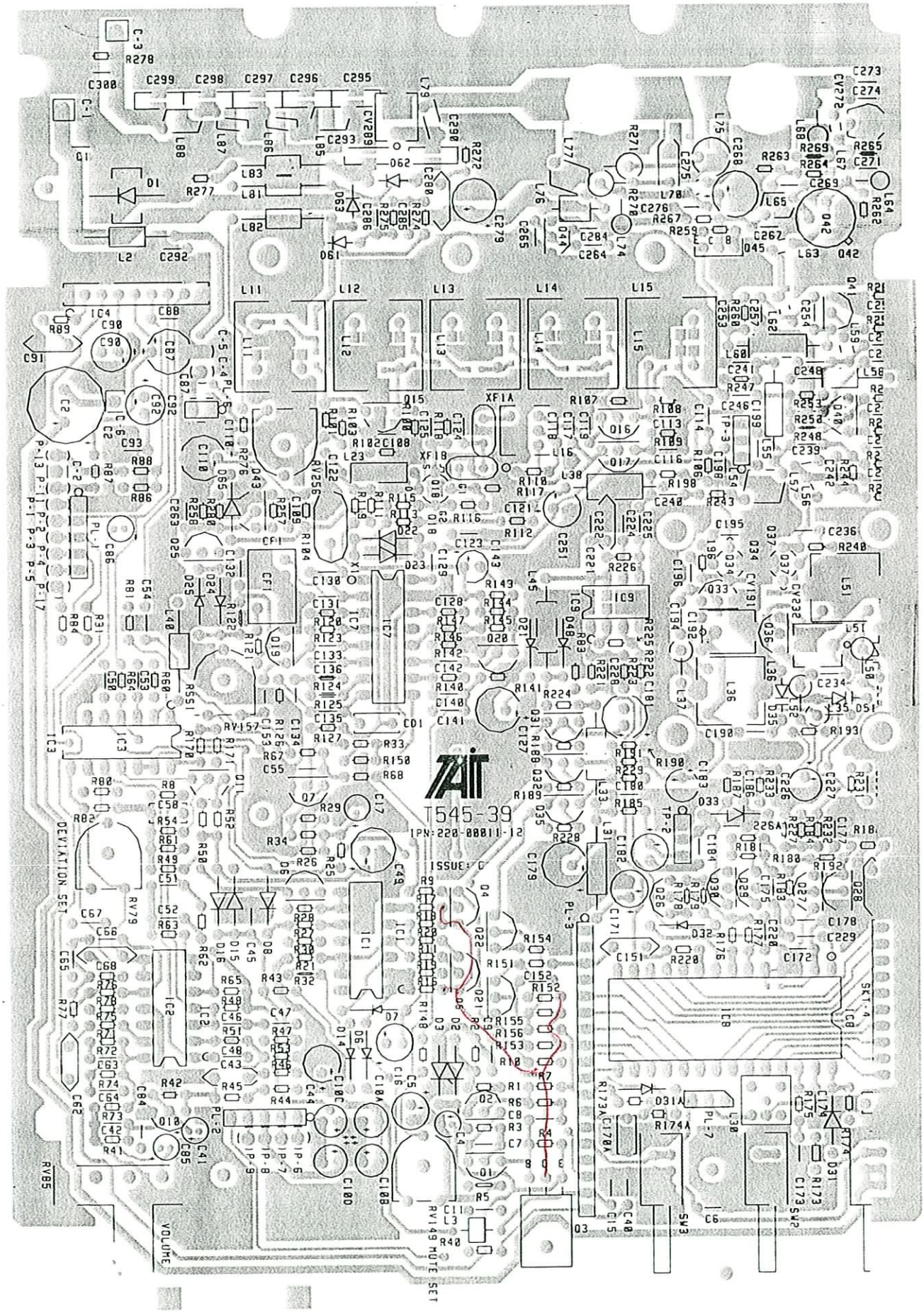


Diagram 3 T545TR PCB Layout

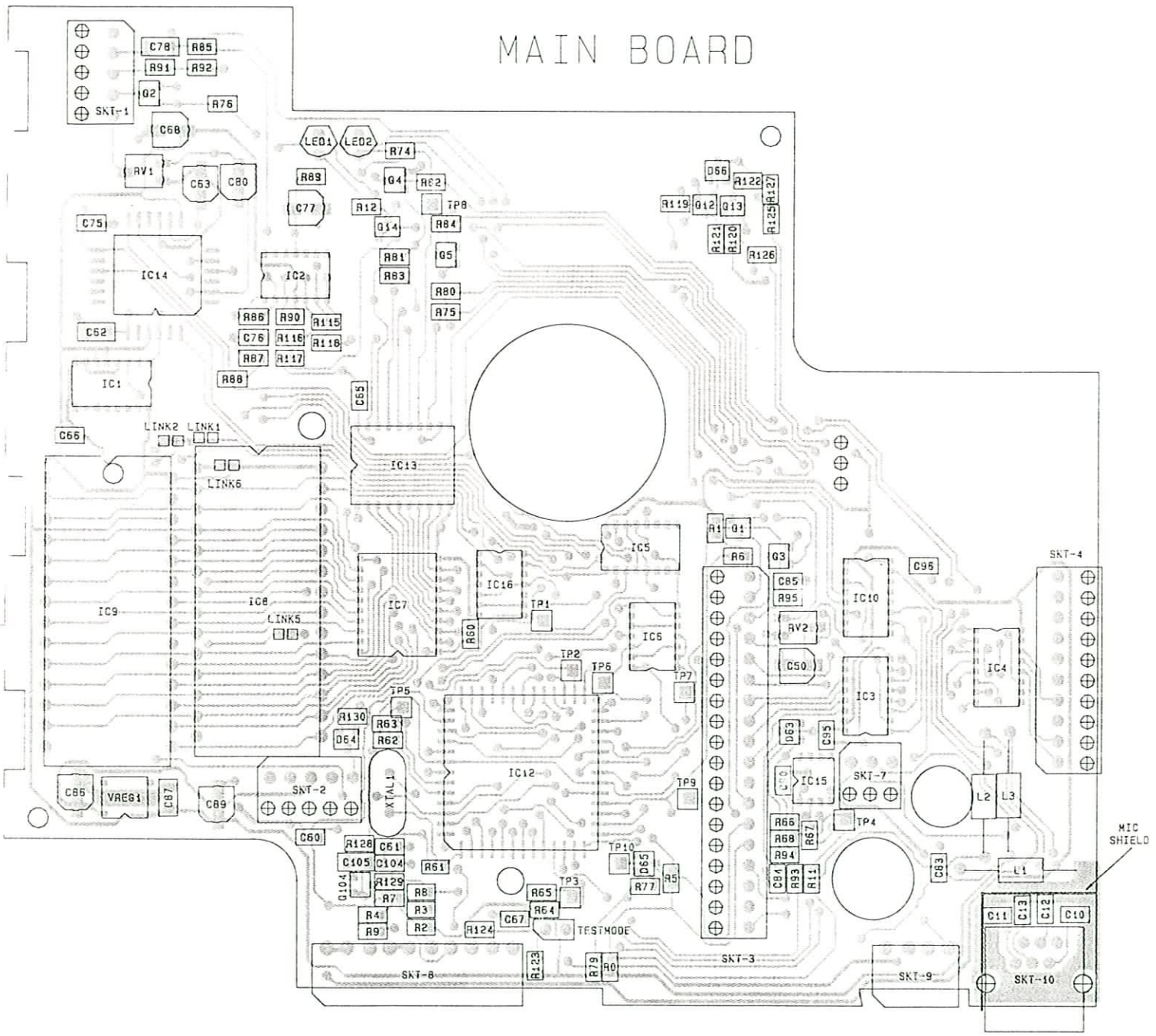


Diagram 4 Trunking Control Board Layout

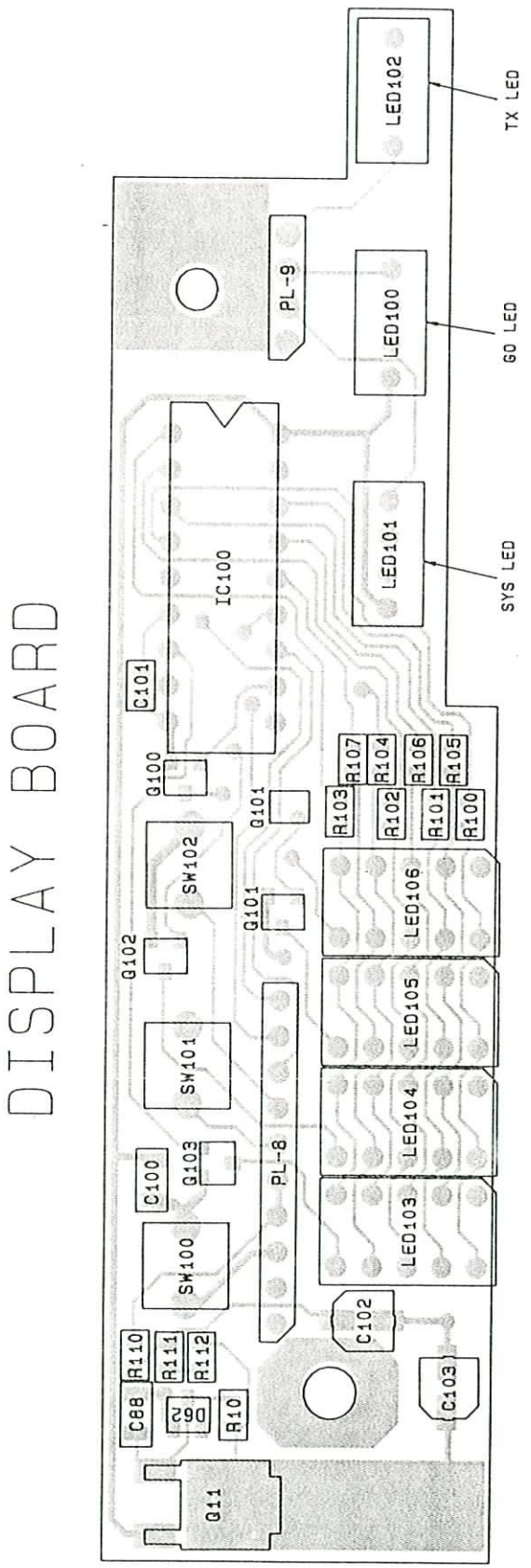


Diagram 5 Trunking Display Board Layout

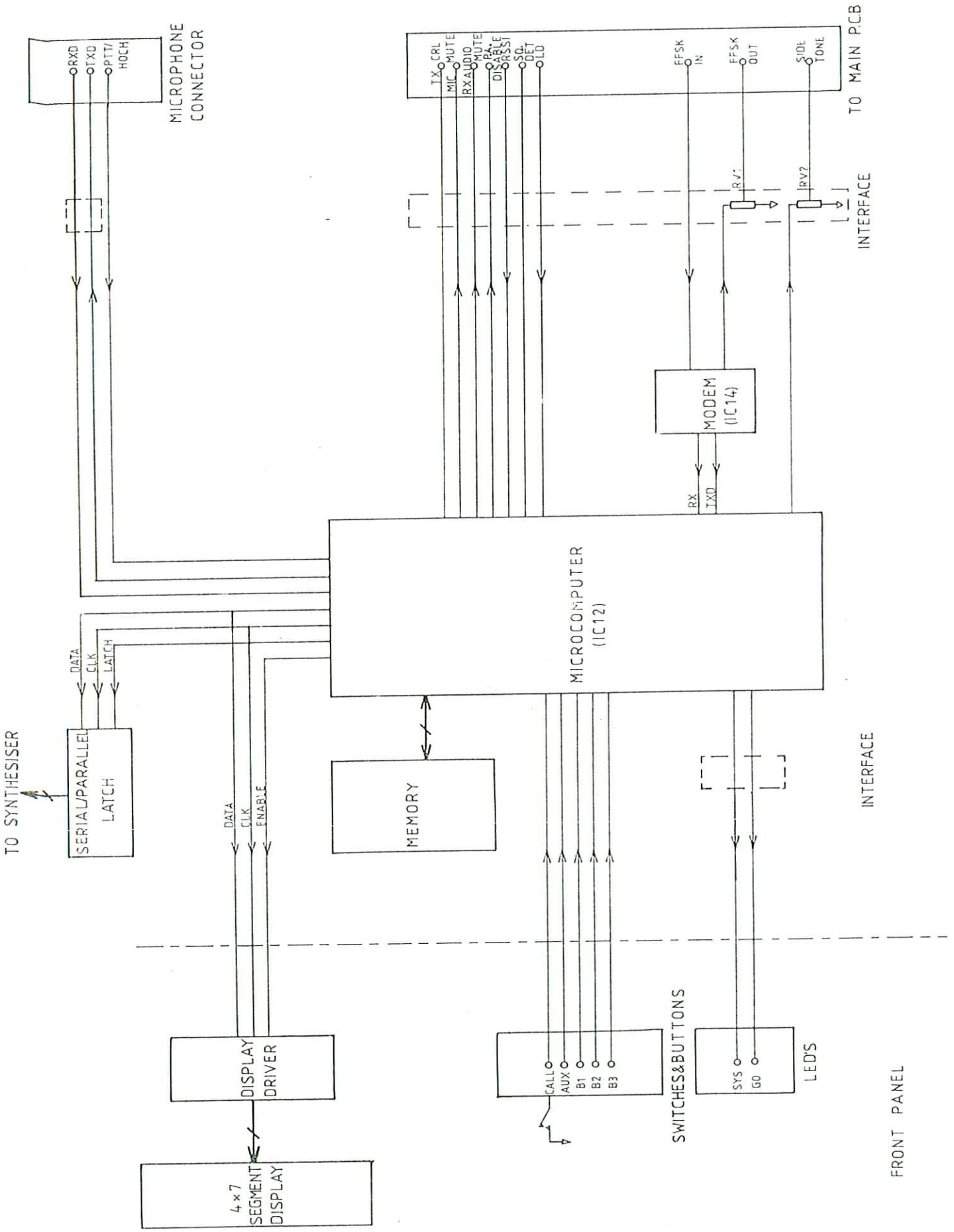
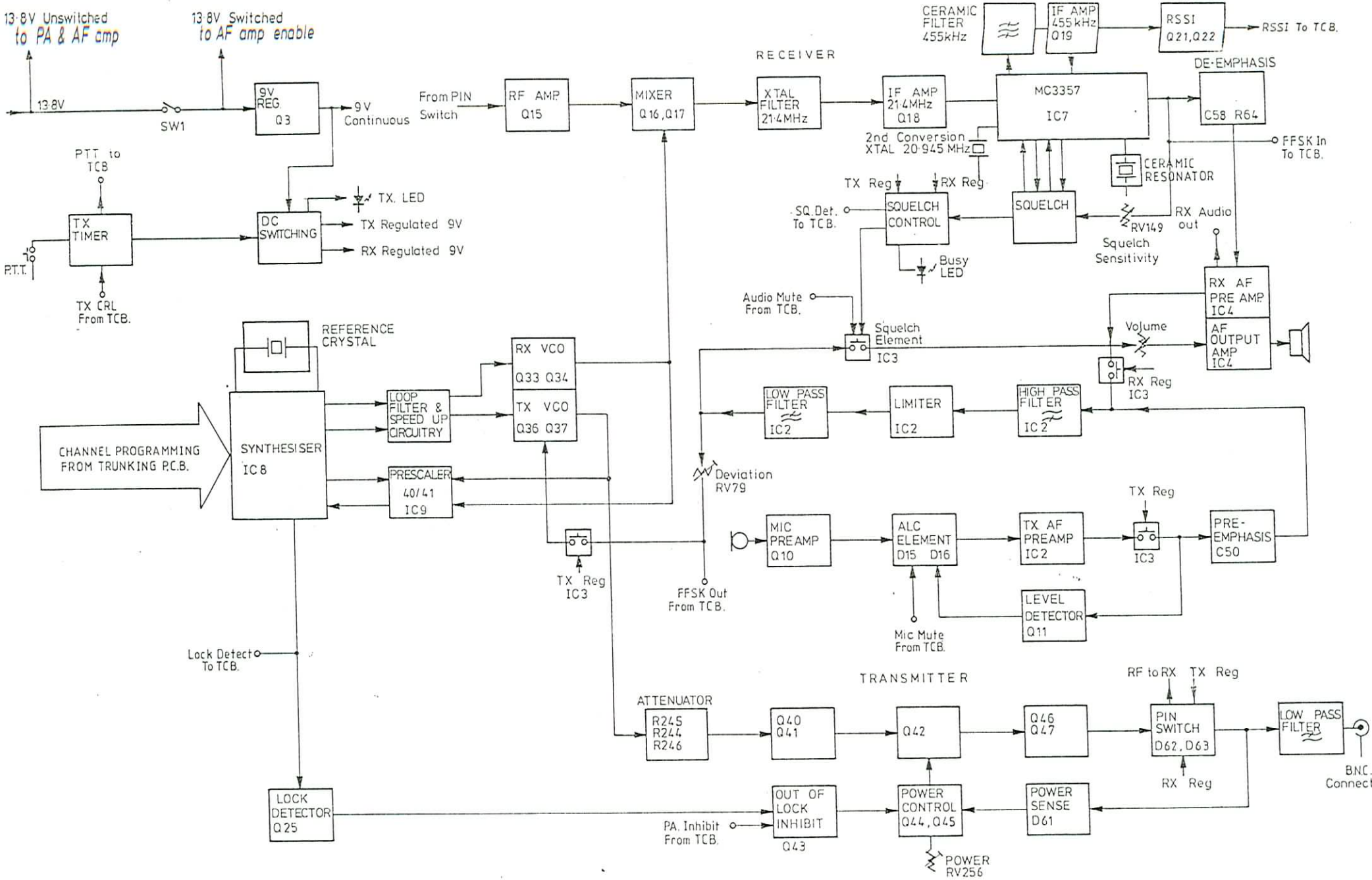


Diagram 6 Trunking Control Board Block Diagram



ISSUE	AMENDMENTS	DRN.	CHKD	APVD	DATE
A	ORIGINAL				
B	Updated.				

ISSUE	AMENDMENTS	DRN.	CHKD	APVD	DATE

BLOCK DIAGRAM T545

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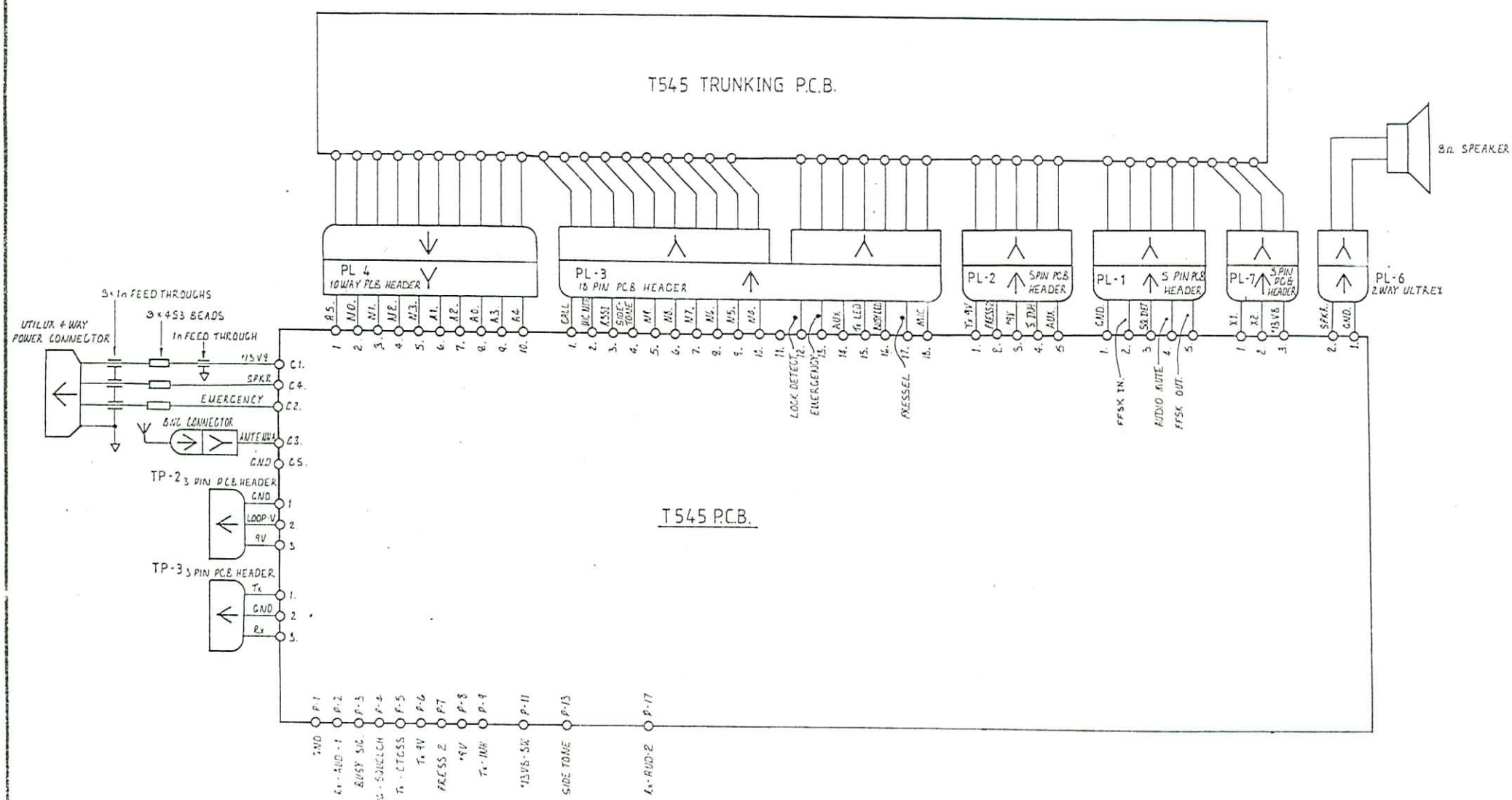
DRAWING NUMBER A2C633

ISSUE B



SCALE: x Full Size
MATERIAL:
FINISH
GEN LIMITS:

THIRD ANGLE PROJECTION

ISSUE	AMENDMENTS	DRN	CHKD	APVD	DATE
A	DIGITAL	WB			
B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ISSUE	AMENDMENTS	DRN	CHKD	APVD	DATE

T545 WIRING DIAGRAM

ARTWORK	IPN	USED ON
		T545

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DRAWING [illegible] ISSUE