TAIT ELECTRONICS LTD

Address: 558 Wairakei Road,
Christchurch,
New Zealand.

Postal Address: PO Box 1645,
Christchurch,
New Zealand.

Telegrams & Cables: 'Taitronics'

Telex: NZ 4926

Telephone: 583 399

T520 Mobile Two Way Radio

VHF FM 66-88MHz

(TM-520)

Issue B

TECHNICAL INFORMATION

For further information about this Manual or the equipment it describes, contact 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 covers the 'General', 'Technical' and 'Servicing' Information on the T520 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) viz;

IPN TM-520 T520 Service Manual (All Versions)

Issue A published September 1985
Issue B published March 1987

CONTENTS

SECTION 4 INSTALLATION

SECTION 5 SERVICING

LIST OF ILLUSTRATIONS

DIAGRAMS

SECTION 1 GENERAL INFORMATION

1.1 INTRODUCTION

The T520 is a high performance, synthesized mobile two way radio with a nominal RF power output of 25 watts. It is intended for operation in the 66 to 88MHz frequency range with channel spacing increments in multiples of 5kHz or 6.25kHz, and transmitter deviation of up to ±5kHz maximum. The standard set comes with two channels.

Operation of the T520 is by hand held microphone and press-to-talk switch, plus five front panel mounted controls: 'Volume', 'Squelch', 'Channel Change', 'Call' and 'On/Off Switch'. Visual indication of 'Channel Selected', 'Transmit', 'Busy' and 'Call' (if Selcall or CTCSS is fitted) is by illuminated front panel display.

Provision is made for Selcall or CTCSS to be incorporated within the case of the T520.

Two injection moulded plastic covers and the plastic front panel can be easily removed to expose both sides of the printed circuit board for ease of servicing.

The T520 employs the dual modulus system of frequency synthesis. Channel information is held on a plug-in diode matrix board which can be field programmed with a pair of diagonal cutters.

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 4 watts of audio power to a 4 ohm speaker.

The transmitter VCO provides about 40mW of frequency modulated RF drive to the four stage broad band RF amplifier. An audio processor provides modulation level control, deviation limiting and a transmit timer which returns the T520 to receive after approximately one and a half minutes of transmission.

The T520 is light and compact and is supplied with a versatile mounting system to allow easy installation in any vehicle. Mains operation is possible when the T520 is used with the T508 Power Supply.

The DC supply to the set must be negative earth and may be between 10.8 and 16 volts. The T520 is protected against reversal of the DC supply connections.

1.2 SPECIFICATIONS

1.2.1 GENERAL

The performance figures given are typical figures, unless otherwise indicated, for equipment tuned with the maximum switching band and operating at standard room temperature (22°C to 28°C).

Two versions of the T520 are available (Wide Band and Narrow Band) and separate performance figures are provided for several parameters.

Where applicable, the test methods used to obtain the following performance figures are those described in the UK Specification MPT1301.

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

Modulation System	.. Frequency Modulation
Frequency Range	.. 66 to 88MHz
Channel Separation:	
Narrow Band (T520C)	.. 12.5kHz
Wide Band (T520B)	.. 25kHz or 30kHz
Frequency Increment:	
Versions /3, /5, /8	.. 6.25kHz
Version /2	.. 5kHz
Number Of Channels	.. 2
Switching Range:	
Receiver	.. 3MHz
Transmitter	.. 3MHz
Supply Voltage:	
Operating Range	.. 10.8 to 16V DC
Standard Test Voltage	.. 13.8V DC
Polarity	.. negative earth only
Protection	.. internal crowbar diode
Supply Current:	
Receiver - Squelched	.. 150mA
Receiver - Full Audio	.. 700mA
Transmitter	.. 4.0A
Antenna Cable Impedance	.. 50 ohms
T/R Changeover Switching	.. solid state
Operating Temperature Range	
Standard	.. -10°C to +60°C
Optional	.. -30°C to +60°C
Dimensions:	
Length	.. 225mm
Width	.. 150mm
Height	.. 45mm

Weight	.. 1.2kg

1.2.2 RECEIVER

Type	.. dual conversion superhet
IF Amplifiers:	
Frequencies	.. 10.7MHz and 455kHz
Bandwidth:	
Narrow Band	.. 7.5kHz
Wide Band	.. 15kHz
Sensitivity (12dB Sinad)	.. -118dBm (0.28µV pd)
Signal-to-Noise Ratio: (RF: -107dBm, modulated at 1kHz to full system deviation)	
Narrow Band	.. 32dB
Wide Band	.. 35dB
Selectivity: (adjacent channel)	
Narrow Band	.. 80dB
Wide Band	.. 85dB
Spurious Response Attenuation	.. 80dB
Intermodulation Response Attenuation	.. 75dB
Spurious Emissions:	
Conducted	.. -80dBm
Radiated ($\frac{1}{2}$-wavelength dipole)	.. -67dBm
Audio:	
Output into internal 8 ohm speaker	.. 2W
Output into external 4 ohm speaker only	.. 4W
Distortion (at rated power)	.. 3%
Minimum Load Impedance	.. 2 ohms
Audio Response (all versions)	.. within +1dB, -3dB of a 6dB/octave de-emphasis characteristic (ref. 1kHz)
Audio Bandwidth:	
Versions /2, /3	.. 450Hz to 3kHz
Version /5	.. 300Hz to 3kHz
Version /8	.. 450Hz to 2.5kHz
Squelch:	
Threshold	.. -126dBm (0.11µV pd)/6dB Sinad
Hard Setting	.. -115dBm (0.4µV pd)/25dB Sinad
Ratio	.. 70dB

1.2.3 TRANSMITTER

Power Output	.. 25W
Transmit Timer	.. 1.5 minutes
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)	.. -40dBm
Adjacent Channel Power:	
Narrow Band (in 7.5kHz bandwidth)	.. 70dB below carrier
Wide Band (in 15kHz bandwidth)	.. 80dB below carrier
Modulation System	.. Direct FM
Deviation Response:	
In limiting	.. Within +0, -4dB of max system deviation
Below limiting	.. Within +1, -3dB of 6dB/octave pre-emphasis (ref. 1kHz)
Audio Bandwidth:	
Versions /2 & /3	.. 500Hz to 3kHz
Version /5	.. 300Hz to 3kHz
Version /8	.. 500Hz to 2.5kHz
Frequencies above 3kHz	.. Greater than 25dB/octave roll off
Deviation Limiting	.. ±5kHz (peak) maximum Adjustable to ±5kHz
Audio Input For Maximum Deviation	.. 1mV p-p at 1kHz
Audio Distortion (Modulated at 1kHz to 60% of maximum deviation)	.. 2%
Hum & Noise (below ±3kHz deviation)	.. 45dB

1.2.4 FREQUENCY REFERENCE

Stability:	
± 5ppm (-10°C to +60°C)	.. TE/9
± 5ppm (-30°C to +60°C)	.. TE/9 plus crystal oven
Oscillator frequency:	
For channel spacing at multiples of 6.25kHz	.. 12.8MHz
For channel spacing at multiples of 5kHz	.. 10.24MHz

1.3 VERSIONS

1.	T520B/2	66-88MHz Frequency Range IF Bandwidth 15kHz Frequency Increments 5kHz CTCSS Fitted
2.	T520B/2X	66-88MHz Frequency Range IF Bandwidth 15kHz Frequency Increments 5kHz No CTCSS Fitted
3.	T520B/3	66-88MHz Frequency Range IF Bandwidth 15kHz Frequency Increments 6.25kHz CTCSS Fitted
4.	T520B/4	66-88MHz Frequency Range IF Bandwidth 15kHz Frequency Increments 6.25kHz AF Response No. 2
5.	T520B/5	66-88MHz Frequency Range IF Bandwidth 15kHz Frequency Increments 6.25kHz AF Response No. 1
6.	T520C/3	66-88MHz Frequency Range IF Bandwidth 7.5kHz Frequency Increments 6.25kHz CTCSS Fitted
7.	T520C/3X	66-88MHz Frequency Range IF Bandwidth 7.5kHz Frequency Increments 6.25kHz No CTCSS Fitted
8.	T520C/8	66-88MHz Frequency Range IF Bandwidth 7.5kHz Frequency Increments 6.25kHz AF Response No. 2

1.4 OPERATING INSTRUCTIONS

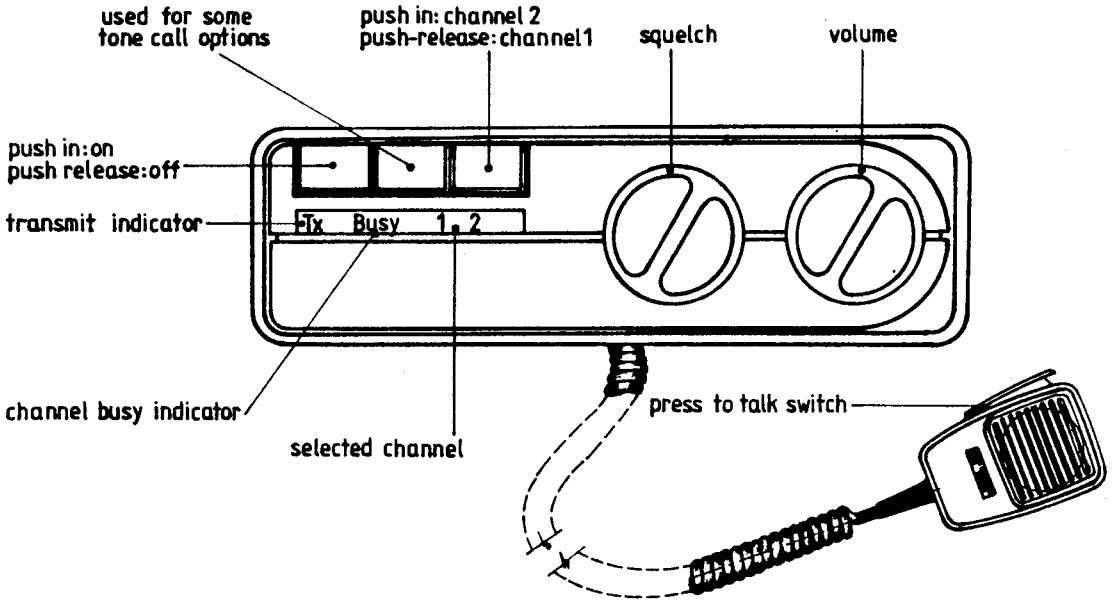


Figure 1 Front Panel Layout

To receive:

a) The front panel display will indicate which channel has been selected.

b) Turn the squelch control clockwise until noise is heard, then turn it anticlockwise 5° beyond the point at which the receiver quietens.

Note: Where CTCSS is used without a hook monitoring facility, it will be necessary to view the 'Busy' indicator when setting the squelch.

To transmit:

a) Check that the channel is vacant before transmitting.

b) Close the press-to-talk switch before beginning to speak.

c) The T520 will automatically revert to receive after 1.5 minutes of transmission. To continue transmitting, release, then close the press-to-talk switch.

d) Always replace the microphone in the clip when not in use.

SECTION 2 CIRCUIT OPERATION

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

2.1 SYNTHESIZER

The dual modulus synthesizer of the T520 features separate on-frequency VCOs for receive and transmit. Each VCO consists of a J-FET Hartley oscillator buffered by a dual gate MOSFET. 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 6.25kHz and fed to one input of a phase comparator within IC8. For applications which require high frequency stability over a wide temperature range, a crystal heater is added. The crystal and heater are mounted on the LED board. Alternatively, a 10.24MHz crystal is used to give a 5kHz reference where channel spacing in multiples of 5kHz is required.

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 the diode matrix board.

The phase comparator output (pins 7 & 8 of IC8) is fed to the speedup circuit (Q27, Q28) and the loop filter (R181, C177, R183, C178, R186), and then to either R187, C185 and D35 for receive, or R227, C226 and D50 for transmit.

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 VCO is fed in antiphase to the gates of the two mixer J-FETs.

The IF output from the mixer passes through the 10.7MHz crystal filter and is amplified by Q18 before being fed to IC7.

IC7 provides the following functions: IF conversion from 10.7MHz 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.

Audio from pin 9 of IC7 is de-emphasised by R68 and C55 and is fed through the audio processor (see Section 2.4.2) to the audio output amplifier, IC4a.

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 8kHz in the wide band T520 and 4.5kHz in the narrow band T520.

This signal 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. C17 and R26 provide an extended tail time (to prevent squelch closure during rapid fades) while maintaining a fast opening time. C17 may be removed to reduce the squelch tail time.

Q6 drives the squelch element, which is part of the audio processor, and the 'Busy' LED.

2.4 TRANSMITTER

2.4.1 RF STAGES

The 40mW output of the frequency modulated VCO is amplified to a level of 25 watts by a 4 stage broad band amplifier (Q39, Q40, Q41 & Q47). High level RF then passes via the PIN diode aerial changeover switch through the low pass filter to the aerial connector.

The transmit power output is set at 25 watts by RV256 which controls the collector voltage of Q40, 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.

The current sense transistor (Q46) can also reduce the gain of the broadband RF amplifier to limit dissipation in the driver transistor (Q41) under conditions of severe antenna mismatch.

Transistor Q43 prevents the transmitter turning on when the synthesizer is out of lock.

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. Connection points for CTCSS or Selcall options are shown on the Circuit Diagram.

2.5 POWER SUPPLY

2.5.1 GENERAL

Note: The T520 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 T520 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 synthesizer.

2.5.3 RECEIVE

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

that part of the diode matrix board containing receive channel information
receive VCO
receiver
squelch control
IC3b
receive diode in the aerial switch.

2.5.4 TRANSMIT

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

that part of the diode matrix board containing transmit channel information
transmit VCO
low power transmitter stages
IC3a and IC3d
transmit diode in the aerial switch

Closing the PTT switch also initiates a timer circuit around IC1 which will return the T520 to receive after 1.5 minutes of transmission.

2.5.5 FREQUENCY INFORMATION

The diode matrix board has four rows of diodes. A row is selected by D44 to D47 and R216 to R219, according to the channel switch position and whether the T520 is in the receive or transmit mode. The channel frequency is selected by removing diodes as described in Table 1 such that the correct pattern of '0's and '1's is presented to IC8.

SECTION 3 ANCILLARY EQUIPMENT

3.1 T508 POWER SUPPLY

The T508 Power Supply will allow operation of a T500 Series 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 T500 Series two way radios. 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 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 T520. It comprises a heavy duty 3 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 TA-500/2 TONE

The TA-500/2 Tone is a two tone signalling unit which allows a T500 Series two way radio to be selectively called by a suitably equipped base radio, and also to selectively call one other two way radio.

The TA-500/2 Tone is programmed for one transmit code and one receive code from a total of 200 possible codes and is mounted within a T500 Series two way radio.

For further details refer to the Telcall System Service Manual (TM-Telcall).

3.4 TA-101S

The TA-101S is a two tone signalling unit which allows a T500 Series two way radio to be selectively called by a suitably equipped radio, and also to selectively call other radios on the same RF channel.

The TA-101S is programmed for one receive code, and 200 transmit codes are selectable via a keyboard.

The TA-101S is mounted externally to a T500 Series two way radio with an interfacing cable.

For further details refer to the Telcall System Service Manual (TM-Telcall).

3.5 TA-500/5 TONE

The TA-500/5 Tone is a five tone signalling unit which allows a T500 Series two way radio to be selectively called by a suitably equipped radio, and also to selectively call another radio and/or transmit status information.

The TA-500/5 Tone is programmed for one receive code and two transmit codes from 100,000 possible codes, and is mounted within a T500 Series two way radio.

For further details refer to the TA-500/5 Tone Service Manual.

3.6 TA-500/CTCSS

3.6.1 INTRODUCTION

The TA-500/CTCSS unit is a plug-in option and requires no wiring to install. It will encode and decode CTCSS tone frequencies within the range 67Hz to 250.3Hz with separate adjustment for each channel. Hook switch monitoring and transmit inhibit on 'Busy' may be field selected.

The unit can be plugged into the T520 two way radio PCB using plug and sockets A and B. The metal pillar enables the unit to be bolted to the two way radio PCB, preventing it from becoming detached due to vibration, etc.

3.6.2 SPECIFICATIONS

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

Fully Tunable	.. over all Group A & B frequencies
Encode Stability	.. ±0.125% typical
Temperature Range -30°C to +60°C Supply Voltage = 8.1V to 9.9V DC	±0.5% maximum
Opening Sinad	.. 4dB typical 6dB maximum
Opening Time (Sinad >20dB)	.. 130ms typical 250ms maximum
Encoded Tone Distortion	
At 67Hz	.. 3.5% typical
At 250Hz	.. 1.0% typical
Maximum All Frequencies	.. 10%
Decoder Bandwidth	.. 8Hz typical
Over temperature -30°C to +60°C and supply voltage 8V1 to 9V9	.. Accept >5Hz Reject >9Hz

The TA-500/CTCSS may be used with interleaved tone frequencies by changing R423 to 1M ohm (1% ±50ppm MF) and R430 to 270K. This reduces the decode bandwidth to 3Hz typical, and increases opening time to 190ms typical.

3.6.3 CIRCUIT DESCRIPTION

Refer to Circuit Diagram A2C500 at the rear of this Manual.

Receiver audio is AC coupled to the unit via C405. IC401b then amplifies and buffers the signal, DC bias being provided by R407. The receiver audio is then filtered by a 3 pole low pass filter (centred around IC401d) to remove audio frequencies over 300Hz. The signal is then amplified until the waveform is hard clipped by limiter IC401c. The filtered and limited signal is then applied to the detect filter.

The detect filter consists of the four amplifiers found in IC402 and their associated components. The centre frequency is determined by the gain of IC402d which is set by either RV428 or RV429 depending upon which transmission gate, IC404a or IC404d, is on.

The detect filter is DC biased from the half rail voltage source based around IC401a.

The outputs of the detect filter (both DC and AC components) are attenuated by R445 and R446. The resultant level is then compared against half rail voltage by IC403a. A negative switching pulse at IC403a will then result for the period that the AC waveform at the output of the detect filter is greater than Vref (1-y)/y, where y = R446/(R446 & R445) and Vref = ½ reg.

A small amount of hysteresis in the comparator prevents 'chatter' and ensures a minimum output pulse width from the comparator.

R446 and R445 are 1% metal film resistors chosen to give a detect pulse from the output of the comparator when the incoming CTCSS tone is within the 3dB bandwidth of the detect filter. The output of the comparator, IC403a, is of the open collector type and so a 100k pull up resistor is required. C418 provides a fall-out time to prevent squelch 'chatter' in fading situations. IC403d buffers the comparator output and compares it against half rail. At the output of IC403d, R457 and C419 provide an acquisition time to prevent detection on spurious transitions of IC403a due to noise and transient shifts in the detect filter.

The detect time for the whole TA-500/CTCSS is dependent therefore on the rise time of the detect filter and acquisition time of the detect comparators. IC403c buffers R457 and C419 to provide a detect output. The detect output is then wire OR'd with the hang up detect circuit (when link is fitted) and inverted via Q405 to control the radio squelch.

The detect signal of IC403c pin 14 also prevents transmit inhibit (when D407 is fitted) when attempting to access a repeater just vacated by another user belonging to the same CTCSS tone group. Note that where hook switch monitoring is required, Tx inhibit is not necessary. Therefore the link should be fitted and D407 removed.

Where no hookswitch monitoring is allowed and Tx inhibit is required, the link must be removed and D407 fitted.

The hook switch function is integral with the PTT line on T500 Series two way radios (in common with the Tait T190 Series mobiles). On hook is detected by Q403 sensing the path to ground via the 12k ohm resistor fitted in the microphone.

When transmitting, the TA-500/CTCSS unit is made to oscillate by feeding the output of the detect filter back to the limiter input stage via IC404c transmission gate. Any noise present in the detect filter when IC404c is turned on causes transients in the limiter output. This makes the detect filter 'ring' at its tuned frequency. Positive feedback maintains the oscillation.

The rise time of the filter is constant for all tuned frequencies (due to variable Q factor) and would be about 60-80ms were R430 not used. During encoding, IC404b transmission gate turns on and shunts R423 with R430.

Varying R423 only affects the Q of the circuit and not the tuned frequency or gain. Hence, upon transmit, the Q of the detect filter is halved and so the rise time of the output is halved to 30-40ms. If the detect bandwidth of the TA-500/CTCSS is required to be lower, then R423 may be increased, resulting in a higher Q. A better noise performance will also result, but at the cost of increased detect time.

During encoding, Q401 is turned on to prevent noise from the radio feeding through to the limiter input and so causing a frequency jitter on the encode tone.

The encode tone is fed to the radio transmitter circuitry via C417 and RV447. RV447 is used to set up transmitter deviation.

3.6.4 ADJUSTMENTS

1. Set the CTCSS tone frequencies by connecting a counter to the 'tone output' (blue) wire (A5 of T520). Close the press-to-talk switch for the tone to be encoded. Adjust the appropriate potentiometer (RV429, Channel 1; RV428, Channel 2).

Note 1: For sets with CTCSS requirements for only one of two used channels, see Section 3.6.6 'Modifications To TA-500/CTCSS'.

Note 2: For accurate CTCSS tone adjustment, it is recommended that either a rate multiplier be used with the counter, or alternatively that the output be compared with a known frequency source on an oscilloscope, using the Lissajous Figures Method.

2. Modulation levels (refer also to Section 5.7.2 Modulation Adjustment)

   (a) Adjust RV447 to set the CTCSS tone deviation between ±500Hz and ±1kHz. For a ±5kHz system deviation, the recommended CTCSS deviation is ±750Hz. For a ±2.5kHz system, the CTCSS deviation may need to be greater than ½ of 750Hz for acceptable reliability.

   (b) Reset the transmitter deviation in accordance with Section 5.7.2 of this Service Manual so that the full rated system deviation (±5kHz or ±2.5kHz) is not exceeded when both normal and CTCSS modulation are present.

3.6.5 TESTING

If retrofitting a TA-500/CTCSS unit into a T520, the following tests should be carried out:

1. Set the squelch control fully clockwise.
   Earth the microphone button to check the hook switch operation.
   Ensure that the receiver reverts to a muted condition with the microphone button earthed, and unmutes when the microphone button is not earthed.

2. Set the squelch control to normal muted condition.
   Connect an RF signal generator to the aerial input connector at an output of -107dBm.

Modulate with the correct CTCSS tone for that particular channel and deviated ±500Hz.

Apply the signal from signal generator.

Ensure that the receiver unmutes while the signal is present.

3. (a) Disconnect the signal generator & replace it with an RF load.

Rotate the squelch control until the 'Busy' LED is illuminated.

Close the press-to-talk switch.

Ensure that the transmitter does not come on or the Tx LED illuminate, indicating that Tx inhibit is operational.

(b) Insert reverse protection between the signal generator and the two way radio (see Section 5.4.1, item 15).

With the unit detecting tone and 'Busy' lamp lit, press the PTT.

Check that the two way radio Tx lamp illuminates.

3.6.6 MODIFICATIONS TO TA-500/CTCSS

After testing:

If the hook switch monitoring is not required - cut the disable wire link.

If the Tx inhibit is not required - cut D407.

Where a 2 channel requirement with only one channel CTCSS control arises, a 1N4148 diode must be soldered between IC402d pin 12 (diode anode) and IC404a/d pin 12 (no tone on channel 2), or, pin 13 (no tone on channel 1). This will:

(a) prevent an encode tone being produced on Transmit;

and

(b) there will be no mute control from the CTCSS unit on Receive.

To allow Tx inhibit on the non-CTCSS channel - cut D406; but note that on the CTCSS channel the user can no longer access the repeater on the squelch tail of the same group CTCSS mobile.

3.7 TA-500/MEM

The TA-500/MEM is a replacement, plug-in memory unit complete with all diodes.

3.8 TA-500/CRDL

The TA-500/CRDL is a mounting cradle supplied with microphone clip and mounting screws to mount T500 Series two way radios.

3.9 TA-500/RC

The TA-500/RC is a rugged cradle affording a higher level of environmental and mounting security than the standard cradle. It is available in either black or white and comes complete with mounting screws and cradle unlocking key.

3.10 TA-500/10/40 MULTICHANNEL

The TA-500/10 or /40 is an add-on kit which converts a T500 Series two way radio to 10 or 40 channel operation. Compatibility is maintained with all other Tait T500 accessories.

An Erasable Programmable Read Only Memory (EPROM) is used to store channel and CTCSS data. The EPROM is field programmable using a Tait T601 Programmer.

For further details refer to TI-292A.

3.11 TA-500MC/CTCSS

The TA-500MC/CTCSS is a high performance CTCSS encoder/decoder for use with T500 Series radios equipped with a TA-500/10/40 multichannel conversion kit. It will encode and decode all 37 standard tones from groups A, B & C, permitting the use of all 37 tones on one repeater. Encode and decode tones may be the same or different on each radio channel programmed. No tone on transmit and no CTCSS mute on receive may also be programmed on any radio channel.

Hook switch monitoring is also programmable on any channel. Transmit inhibit on busy is fitted as standard.

For further details refer to TI-292A.

SECTION 4 INSTALLATION

CAUTION: The T520 is suitable for negative earth installation only.

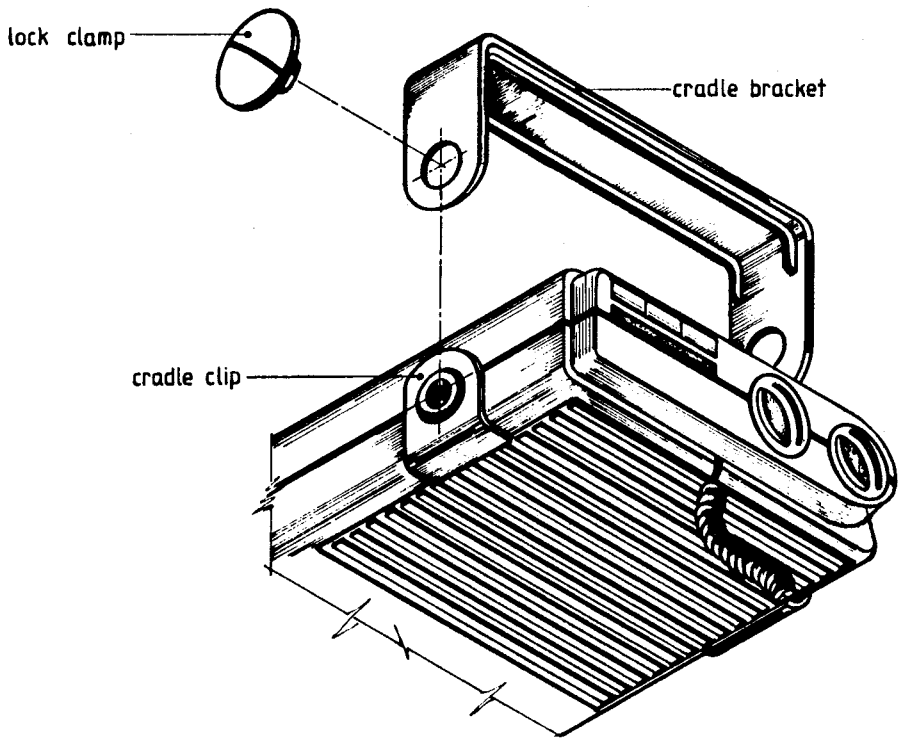


Figure 2 T520 Mounting System

4.1 MOUNTING SYSTEM

4.1.1 STANDARD MOUNTING CRADLE

The T520 is supplied complete with a versatile mounting system. The mounting hardware includes one bracket, two clamps, two clips, and an assortment of self tapping screws.

To detach the bracket, rotate each clamp ¼ turn anticlockwise with a suitable coin. The two clips which mesh into the speaker grill are now free to be removed and refitted anywhere along the sides of the T520. The bracket can be attached in any position above or below the T520.

4.1.2 RUGGED MOUNTING CRADLE

The rugged cradle kit includes the cradle assembly, 2 cradle clips, 2 plastic keys and 4 self tapping screws.

To mount the T520 in the cradle, fasten the 2 cradle clips as indicated in Figure 3, then slide the radio (heatsink first) into the cradle. The spring clips in the cradle assembly will lock into the cradle clip grooves, holding the radio securely in place. It can then be released only with the cradle unlocking key.

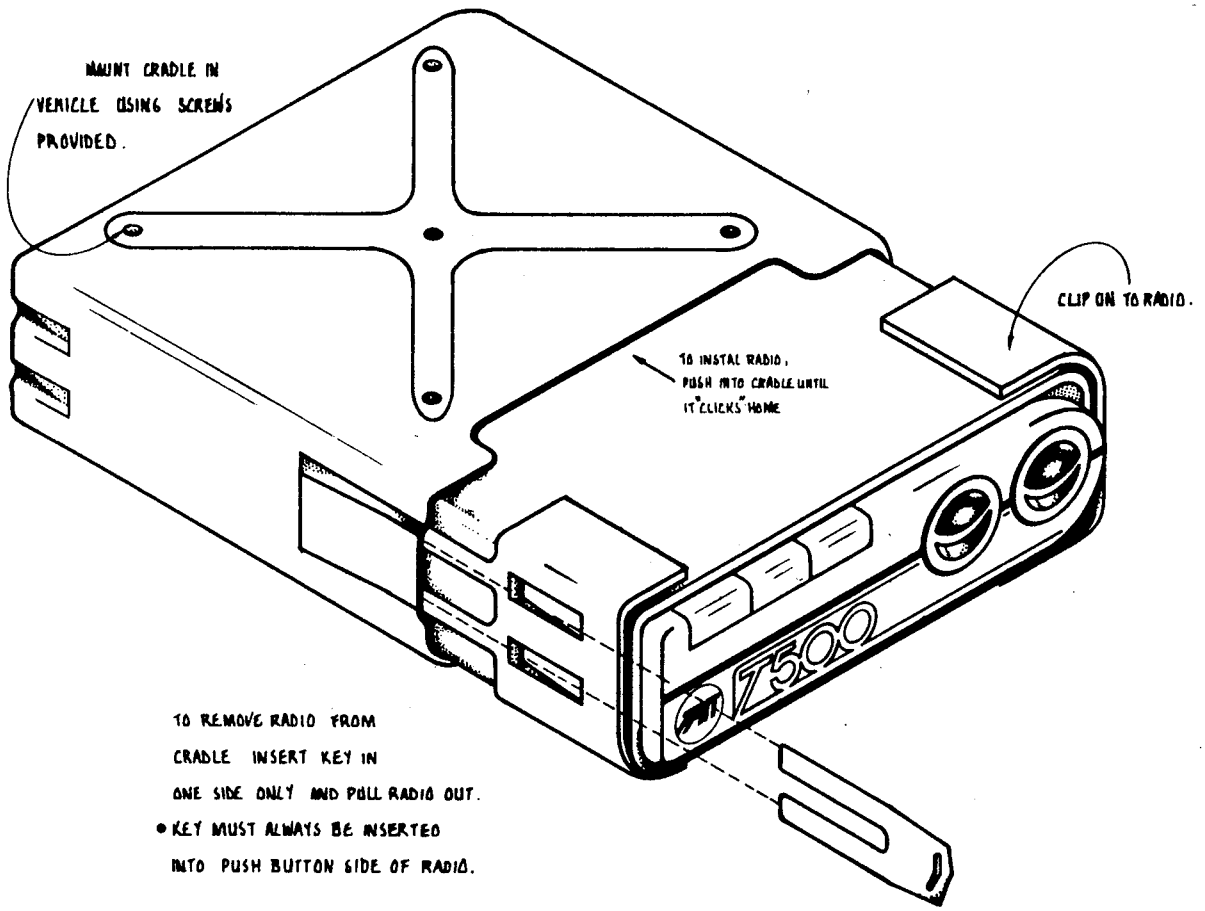


Figure 3 T520 Rugged Mounting System

4.2 VEHICLE INSTALLATION

Consider the following when looking for a suitable mounting position:

If the speaker grill is obscured an external speaker will be necessary.

The aerial and power connectors protrude beyond the heatsink fins.

The versatility of the mounting system allows the T520 to be inclined and/or moved back and forth once the bracket is mounted.

4.3 EXTERNAL SPEAKER

An external speaker may be necessary when the T520 is used is noisy conditions. Use Tait speaker type T220/2, 3.5 ohms.

Mount the speaker as close to the operator as is practicable.

Connect the speaker cable to the T520 4 way connector socket as shown in Figure 4.

The T520 speaker can be disconnected internally or may remain connected provided that the impedance presented to the audio output stage does not fall below 2 ohms.

4.4 DC SUPPLY

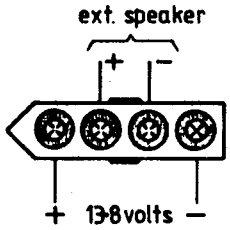


Figure 4 T520 Power Socket

The pins for the four way connector should be attached to the wires using an appropriate crimping tool.

Take both the positive (red) and the negative (black) from the 4 way socket directly to the vehicle battery (see Figure 4).

Fit an in-line fuse in the positive cable close to the battery. The fuse rating is 10 amps.

4.5 AERIAL

4.5.1 GENERAL

A quarter wave whip will be suitable for many applications, but consider a bottom loaded 2.5dB gain aerial or a centre loaded 3.5dB gain aerial where better coverage is required or when the aerial is fender mounted.

Note: The use of gain aerials is prohibited in some countries. The Tait agent can advise.

Mount the aerial in the centre of the vehicle roof where possible.

Use 50 ohm coax, eg. RG58 or UR76.

Use the connector supplied to connect the aerial to the T520. Otherwise use a similar good quality UHF connector such as a Greenpar GE 40001, plus GE 40008 (see Figure 5).

Tune the aerial by connecting a VSWR indicator or a thru-line wattmeter (eg. Bird 43) between the T520 and aerial cable.

4.5.2 AERIAL CONNECTOR

Remove the coupling nut from the body of the connector and place it over the cable.

Prepare the cable, with the braid folded back over the outer sheath, to the dimensions given in Figure 5.

Screw the body sub-assembly onto the cable so that the braid is visible through the two holes made accessible by removal of the coupling nut.

Solder the braid to the body sub-assembly via the two holes in the centre, then solder the centre conductor to the centre contact.

Screw the coupling nut forward over the body sub-assembly.

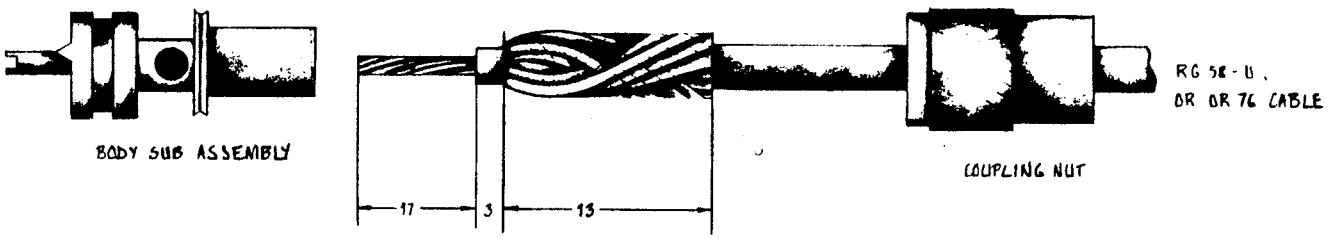


Figure 5 Aerial Connector Assembly

4.6 MICROPHONE CLIP

The mic. clip must be earthed (to negative) if the CTCSS hook monitoring facility is required.

Ensure that the mic clip is mounted in a position where the PTT switch can not be inadvertantly jammed on.

Refer to Section 1.4 for operating instructions.

SECTION 5 SERVICING

5.1 GENERAL

5.1.1 NOTES

If further information is required about the T520 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 (eg. T520C/3), 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-520, Issue B.

CAUTION: CLEANING

This is a plastic based product with a secondary finish on the outer case. 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.

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, eg. 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 T520. Philips cross-head screwdrivers are not satisfactory for use on these screws.

5.2.2 DISASSEMBLY INSTRUCTIONS

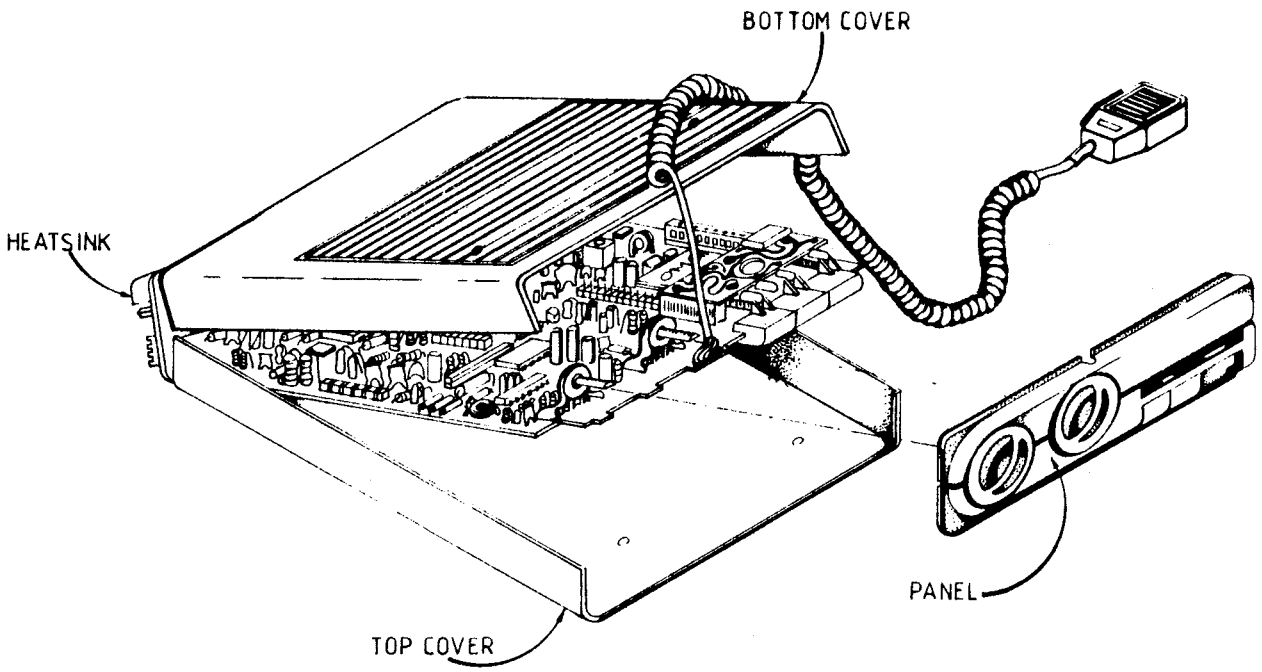


Figure 6 T520 Exploded View

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 PCB

Place the T520 upside down on the bench.

Remove the 2 bottom cover retaining screws.

Gently lift the front end of the bottom cover until it clears the front panel.

Pull the cover forward to disengage the four small plastic lugs at the rear of the bottom cover.

Lift away the bottom cover.

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 T520 over on the bench.

Gently raise the front end of the top cover until it clears the front panel.

Pull the cover forward to disengage the 4 lugs at the rear of the cover.

5.2.2.3 To Remove The Front Panel

Remove the bottom and top covers as instructed above.

Slide the front panel forward.

It is not necessary to remove the knobs, they may be left in situ.

5.2.2.4 To Gain Access To The PA Components

To gain access to the PA, remove the shield cover from its position forward of the heatsink.

5.2.2.5 Speaker Removal/Refitting

The speaker in the T520 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

Note: If the PCB has been removed, it must be refitted hard up against the heatsink along its entire length, as shown in Figure 7.

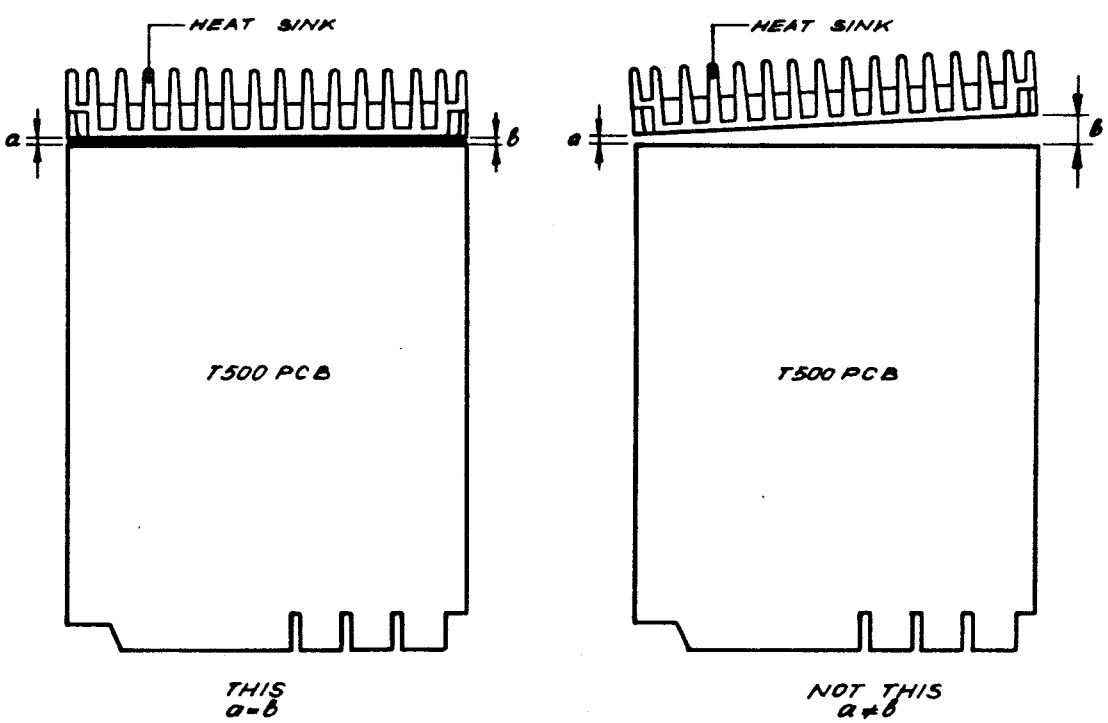


Figure 7 Fitting The Heatsink

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

Replace the PA shield.

Slide on the front panel, taking care to guide the four LEDs into their respective channels in the plastic moulding.

Press the microphone cord into its retaining slot.

Fit the top cover:

With the top cover at an angle of about 20°, slide the 4 plastic lugs at the rear of the cover into their respective slots in the heatsink.

Gently press the cover into position, taking care not to damage the 4 lugs. Ensure that the rim of the front panel fits into the groove round the front of the top cover.

Fit the bottom cover:

Invert the T520

With the bottom cover at an angle of about 20°, slide the 4 plastic lugs into their respective slots in the heat sink.

Gently press the cover into position taking care not to damage the 4 lugs. 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.

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.

5.2.5.2 To Remove Cased Mica Capacitors

Apply a heavy duty soldering iron to the top of the capacitor case.

When the solder is molten, ease the capacitor away from the PCB with a thin stainless steel spike or screwdriver.

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 8. 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.

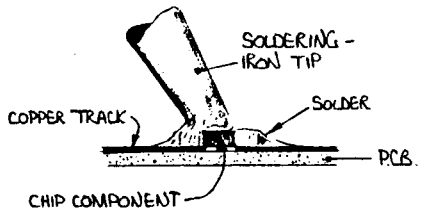


Figure 8

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 9.

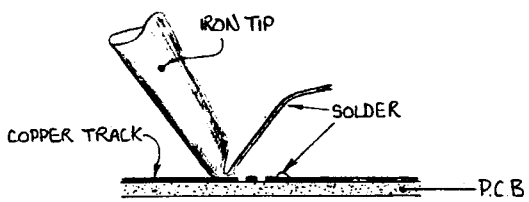


Figure 9

2. Insert the new components and apply the soldering iron tip to the PC pattern as shown in Figure 10 (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.

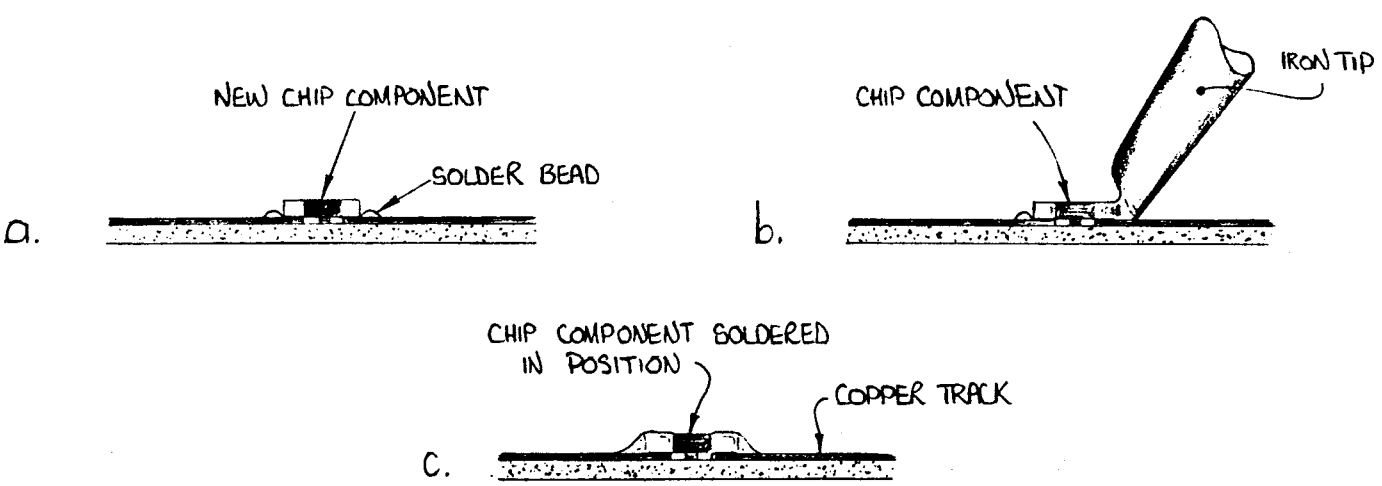


Figure 10

5.3.5 INTER BOARD CONNECTIONS

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

5.4 SETTING UP

5.4.1 TEST EQUIPMENT REQUIRED

1. Multimeter (eg. AVO Model 8)
2. DC electronic voltmeter (eg. Tech TE65)
3. RF power meter 50 ohm, 30 watts FSD usable to 100MHz with 5 & 30 watt elements (eg. 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 (eg. Sayrosa 252)
6. Sinad meter (eg. Helper Instruments Sinadder)
7. VHF signal generator. Good quality FM 50 ohm. Useable from 0.1µV (-127dBm) to 200mV (0dBm) pd. (eg. HP 8640B).
8. VHF frequency counter accurate to within 2ppm.
9. 10.7MHz Crystal marker
10. Audio oscillator, 10Hz to 10kHz (eg. 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 T520 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 50 ohm, total attenuation 50dB (eg. Weinschel 40-20-33 30dB 150W, plus Coline 1200 85 20dB 1W)
16. RF diode probe (eg. Greenpar GE 88202)

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 T520 should be as short as practical and fitted with a 'mating' UHF 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.

7. Check the printed fuse on the PCB. Its rating is about 2 amps, and it can be replaced by a 0.1mm diameter copper link.

5.4.3 66-77MHz OPERATION - LOW PASS FILTER

To maintain filter attenuation of harmonic frequencies at the bottom end of the band, remove C292 and add L86 in series with C293.

L86 is a horizontal airwound coil (1.5T/2.5mm, 0.8mm, IPN 052-08125-15), and in boards after Issue F it can be connected in circuit by cutting the tracks joining C292 and L84 to C293.

5.4.4 CHANNEL PROGRAMMING

5.4.4.1 Reference Frequency Selection

For 12.5kHz or 25kHz channel spacing use a 6.25kHz reference (12.8MHz crystal).

For 30kHz channel spacing use a 5kHz reference (10.24MHz crystal).

Note: A 1p8 capacitor must be fitted in parallel with the 10.24MHz crystal.

5.4.4.2 Programming

Note: VCO operation is restricted to a 3MHz switching range within the band covering 66 to 88MHz. Do not programme frequencies outside these limits.

The switching range is defined by the minimum change in frequency for loop voltages between 1.75 and 6.5 volts; ie, 3MHz at the bottom of the band.

For single channel applications, channel 2 should be programmed to the same frequencies as channel 1.

The programming of each of the two transmit and receive channels is accomplished by clipping diodes from each of the columns of diodes as required (see Figure 11).

A connected diode pulls IC8 input low and deletes the frequency increment.

A cut diode allows IC8 input to go high and adds the frequency increment.

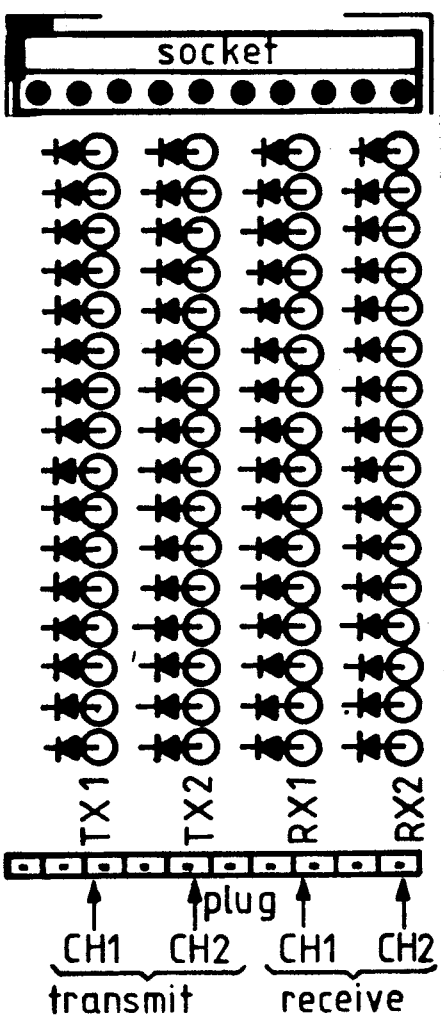
Figure 11

Table 1 shows how, when starting with A0, each successive diode influences the synthesizer frequency by a multiple of 6.25kHz (or 5kHz) in an ascending binary sequence. (Note the discontinuity between A5 and N0.)

Table 1

Frequency Increment		Code	PIN
6.25kHz Ref.	5kHz Ref.		
128MHz	102.4MHz	N9	20
64MHz	51.2MHz	N8	19
32MHz	25.6MHz	N7	18
16MHz	12.8MHz	N6	17
8MHz	6.4MHz	N5	16
4MHz	3.2MHz	N4	15
2MHz	1.6MHz	N3	14
1MHz	800kHz	N2	13
500kHz	400kHz	N1	12
250kHz	200kHz	N0	11
200kHz	160kHz	A5	10
100kHz	80kHz	A4	25
50kHz	40kHz	A3	24
25kHz	20kHz	A2	22
12.5kHz	10kHz	A1	21
6.25kHz	5kHz	A0	23

When a diode is clipped its corresponding frequency is added to the VCO frequency.



(Viewed from component side of diode board.)

The following examples show a simple method of calculating the correct diode programme.

Example 1

Tx frequency = 81.18MHz, 30kHz channel spacing

	VCO frequency:	81.18	
	subtract	51.20	cut diode N8
		29.98	
	subtract	25.60	cut diode N7
		4.38	
	subtract	3.20	cut diode N4
In each case subtract		1.18	
the largest value from	subtract	0.80	cut diode N2
Table 1 which yields a		0.38	
positive result.		0.20	cut diode N0
		0.18	
Continue the process		0.16	cut diode A5
until zero is reached		0.02	
		0.02	cut diode A2
		0.00	

To check: The sum of the extracted values should equal the required VCO frequency.

N8 + N7 + N4 + N2 + N0 + A5 + A2 = VCO
51.2 + 25.6 + 3.2 + 0.8 + 0.2 + 0.16 + 0.02 = 81.18

Example 2

Rx frequency = 85.875, 25kHz channel spacing. The receiver has a 10.7MHz IF and is high side injection.

$f_{VCO} = f_{Rx} + 10.7MHz = 96.575$

VCO frequency:	96.575	
subtract	64.000	cut diode N8
	32.575	
subtract	32.000	cut diode N7
	0.575	
subtract	0.500	cut diode N1
	0.075	
subtract	0.050	cut diode A3
	0.025	
subtract	0.025	cut diode A2
	0.000	

In each case subtract the largest value from Table 1 which yields a positive result. Continue the process until zero is reached.

Check:

N8 + N7 + N1 + A3 + A2 = VCO
64 + 32 + 0.5 + 0.05 + 0.025 = 96.575

Once the correct diode programme has been calculated, remove the diode matrix board from the T520 and clip diodes as required. Figure 11 shows where to cut the diode leads, and Table 1 shows the diode position on the matrix board.

Replace the diode matrix board in the T520.

5.5 VCO ALIGNMENT

Connect the T520 to a dummy RF load.

Ensure that a correctly programmed diode matrix PCB is fitted.

Connect 13.8 volts of the correct polarity.

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

5.5.1 SINGLE CHANNEL OPERATION

Receive Mode:

Adjust CV191 for 4 volts at TP2.

Transmit mode (PTT switch closed):

Adjust CV232 for 4 volts at TP2.

5.5.2 DUAL CHANNEL OPERATION

Receive Mode:

Adjust CV191 so that when switching between channel 1 and channel 2, the loop voltages are symmetrically placed around 4 volts, but within the limits of 1.75 and 6.5 volts.

Transmit Mode:

Adjust CV232 so that when switching between channel 1 and channel 2 the loop voltages are symmetrically placed around 4 volts, but within the limits of 1.75 and 6.5 volts.

Note: A loop voltage of 0V or 8V indicates the VCO is out of lock.

5.6 REFERENCE FREQUENCY ADJUSTMENT

The 6.25kHz (5.0kHz) reference frequency must be accurately set. This is measured indirectly by monitoring the VCO frequency.

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

Select channel 1.

Adjust L30 for the correct VCO frequency.

Repeat this measurement for receive and transmit on both channels to verify the diode programming.

5.7 TRANSMITTER ADJUSTMENTS

5.7.1 ALIGNMENT

Note: In this and the following sections, measurements are given which differ for wide band and narrow band sets. In these cases figures for wideband sets are given first, followed by figures for narrowband sets in square brackets [ ].

Connect a power meter to the aerial socket.

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

Close the PTT switch.

Adjust CV254 for maximum power.

Adjust CV287 for maximum power (normally greater than 25 watts).

Note: For two channel operation, tune CV254 and CV287 for optimum performance on both channels.

Adjust RV256 to reduce the output power to 25 watts or to reduce the power by one watt in cases where the maximum power is less than 25 watts.

Check that the transmit current does not exceed 4.5 amps for 25 watts output with 13.8 volts at the set.

5.7.2 MODULATION ADJUSTMENT

Connect the T520 antenna output through a 50dB power attenuator (see section 5.4.1) to a modulation meter.

Short circuit C49 to disable the ALC circuitry.

Connect the microphone to the tone box (see Section 5.4.1) or connect the audio oscillator to the microphone pads on the PCB.

Apply a 1kHz sine wave to give -40dBm (8mV rms) at the microphone pads.

Set the channel switch to the lowest frequency channel.

Set the modulation meter to read '-' deviation.

Close the PTT switch and adjust RV79 for approximately -5kHz [-2.5kHz] deviation.

Reduce the audio input to obtain -3kHz [-1.5kHz] deviation, and then increase it by 20dB.

Sweep the audio frequency 300Hz to 3kHz and find the frequency of maximum '-' deviation.

Set RV79 to give -5kHz [-2.5kHz] deviation at this frequency.

Set the modulation meter to read '+' deviation.

Sweep the audio signal 300Hz to 3kHz and readjust RV79 if a peak exceeding +5kHz [+2.5kHz) is found.

Set the channel switch for the other channel and check that ±5kHz [±2.5kHz] deviation is not exceeded for any modulation frequency.

Remove the short from C49.

5.8 RECEIVER ALIGNMENT

Note 1: Use only a non-metallic tuning tool.

Note 2: The coil slugs must not protrude beyond the tops of the coil cans. Maximum inductance occurs when the slugs are flush with the tops of the coil cans. Minimum inductance occurs when the slugs are tuned inwards to the PCB.

Connect a signal generator modulated to ±5kHz (wide band) [±2.5kHz] (narrow band) at 1kHz AF.

Connect a Sinad meter across the speaker terminals.

Select the lowest frequency channel.

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

Tune L16, L15, L14, L13, L12 and L11 for best Sinad while reducing the signal generator output level to maintain approximately 12dB Sinad.

Note: The signal generator frequency must be accurately set (zero beat) when tuning L16.

Repeat the above tuning.

Reduce the signal generator deviation to ±3kHz [±1.5kHz].

Check that the signal generator output does not exceed -119dBm for 12dB Sinad.

For a two channel application readjust L15, L14, L13, L12 and L11 for equal sensitivity on both channels.

Note: Sensitivity will degrade towards -116dBm (worst case) as the channel separation extends to 3MHz.

5.9 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 (shown in blue) a fault can be readily pin-pointed.

5.9.2 RECEIVER PERFORMANCE TESTS

Carry out the following checks only after the alignment has been completed.

5.9.2.1 Squelch

(a) TO CHECK THE SQUELCH OPERATION

Connect a Sinad meter across the speaker terminals.

Connect a VHF signal generator to the aerial input terminal.

Set the signal generator output level to zero and the modulation to ±3kHz [±1.5kHz] deviation at 1kHz.

Adjust the front panel squelch control until the noise just disappears.

Slowly increase the signal generator output level until the squelch gate 'opens'; this should be at about 6dB Sinad.

(b) TO CHECK THE SQUELCH RATIO

Set the signal generator output level to -107dBm (1µV), modulated to ±5kHz [±2.5kHz] deviation at 1kHz.

Replace the Sinad meter with a mV/meter across the speaker terminals.

Turn the squelch control fully anticlockwise.

Adjust the volume control to give a reading of 3 volts on the mV/meter.

Reduce the signal generator output level to zero.

The fall in output is the 'squelch ratio' and this should be at least 70dB.

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 ±5kHz [±2.5kHz] deviation at 1kHz.

Set the volume control to the onset of clipping.

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

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

The distortion should not exceed 5%.

5.9.2.3 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 on the receive frequency.

Couple a 10.7MHz 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 ±3kHz [±1.5kHz] at 1kHz.

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 -119dBm and is typically -121dBm for single channel use or two channels separated by less than 1MHz. As the channel separation extends towards 3MHz the Sinad sensitivity will degrade towards -116dBm (worst case).

5.9.2.4 To Check The Signal+Noise To Noise Ratio

Set up the signal generator and mV/meter as in section 5.9.2.1 (b).

Set the squelch control fully clockwise.

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 30dB [27dB] for single channel use or two channels separated by less than 1MHz. As the channel separation extends towards 4MHz, the signal+noise to noise ratio will degrade towards 27dB [24dB].

5.9.2.5 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 ±5kHz [±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

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 an RF power meter and a modulation meter via a 50dB attenuator to the transmitter output terminal.

Connect a mV/meter across the microphone terminals on the 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 $\pm$3kHz [$\pm$1.5kHz] 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 T520 aerial output through a 50dB 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 450Hz 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 450Hz to 3kHz the deviation should increase at the rate of 6dB/octave (+1, -3dB relative to 1kHz).

Above 3kHz the deviation rate of decrease should be 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 16 volts.

Above 13.8 volts the RF power output should not increase by more than 2 watts.

At 10.8 volts the RF power output should be more than 10 watts.

5.9.3.4 To Check The Transmission Timer

Connect an RF power meter to the transmitter output.

Close the PTT switch.

Check that the T520 reverts to 'receive' after approximately 1.5 minutes of transmission time (+15, -45 seconds).

The transmission time may be set accurately by changing the value of either C16 (100µF) and/or R17 (1M).

To increase the transmission time increase the value of resistance or capacitance as required.

5.9.3.5 To Check The VCO Control Range

Plug a frequency counter onto the VCO test plug (TP2).

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

The frequency shift should be more than 5MHz.

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.

The parts list printed below is for all versions of the T520. Different versions have different sub-groups. Check the version of your T520 (printed on a label on the back of the set). To find the correct part refer to the sub-groups listed for your version of the T520. The same circuit reference may be listed in more than one sub-group, but it will only be correct in the sub-group listed for your version.

VERSION	SUB-GROUPS	
1.	T520B/2:	
	B520	T520 PCB Assembly Parts
	B520/V	T520 Preformed Vertical Parts
	C520/B	Add With C520/BV For 15kHz Bandwidth
	C520/BV	T520 15kHz IFBW Vertical Parts
	C520B/2	T520B Australia T/A Parts
	C520/STD	T520 Standard Audio Response Parts
	B520/MECH	T520 Mechanical Parts
	B500/LED	T500 Series LED/Xtal Assembly Parts
	C500/5	Parts For 5kHz Channel Increments
	B500/MISC	T500 Cradle, Installation & Packing
	B/TA-500/MEM	T500 Series Diode Memory Parts
2.	T520B/2X:	
	B520	T520 PCB Assembly Parts
	B520/V	T520 Preformed Vertical Parts
	C520/B	Add With C520/BV For 15kHz Bandwidth
	C520/BV	T520 15kHz IFBW Vertical Parts
	C520B/2X	Add To T520 For B/2X Version
	C520/STD	T520 Standard Audio Response Parts
	B520/MECH	T520 Mechanical Parts
	B500/LED	T500 Series LED/Xtal Assembly Parts
	C500/5	Parts For 5kHz Channel Increments
	B500/MISC	T500 Cradle, Installation & Packing
	B/TA-500/MEM	T500 Series Diode Memory Parts
3.	T520B/3:	
	B520	T520 PCB Assembly Parts
	B520/V	T520 Preformed Vertical Parts
	C520/B	Add With C520/BV For 15kHz Bandwidth
	C520/BV	T520 15kHz IFBW Vertical Parts
	C520B/3	Add To T520 For B/3 Version
	C520/STD	T520 Standard Audio Response Parts
	B520/MECH	T520 Mechanical Parts
	B500/LED	T500 Series LED/Xtal Assembly Parts
	C500/12.5	Parts For 12.5kHz Channel Increments
	B500/MISC	T500 Cradle, Installation & Packing
	B/TA-500/MEM	T500 Series Diode Memory Parts

4. T520B/4:

B520	T520 PCB Assembly Parts
B520/V	T520 Preformed Vertical Parts
C520/B	Add With C520/BV For 15kHz Bandwidth
C520/BV	T520 15kHz IFBW Vertical Parts
C520B/4	Add To T520 For B/4 Version
C520/AF1	Add To B520 For AF1 Response
B520/MECH	T520 Mechanical Parts
B500/LED	T500 Series LED/Xtal Assembly Parts
C500/12.5	Parts For 12.5kHz Channel Increments
B500/MISC	T500 Cradle, Installation & Packing
B/TA-500/MEM	T500 Series Diode Memory Parts

5. T520B/5:

B520	T520 PCB Assembly Parts
B520/V	T520 Preformed Vertical Parts
C520/B	Add With C520/BV For 15kHz Bandwidth
C520/BV	T520 15kHz IFBW Vertical Parts
C520B/5	Add To T520 For B/5 Version
C520/AF1	Add To B520 For AF1 Response
B520/MECH	T520 Mechanical Parts
B500/LED	T500 Series LED/Xtal Assembly Parts
C500/12.5	Parts For 12.5kHz Channel Increments
B500/MISC	T500 Cradle, Installation & Packing
B/TA-500/MEM	T500 Series Diode Memory Parts

6. T520C/3:

B520	T520 PCB Assembly Parts
B520/V	T520 Preformed Vertical Parts
C520/C	Add With C520/CV For 7.5kHz Bandwidth
C520/CV	T520 7.5kHz IFBW Vertical Parts
C520C/3	Add To T520 For C/3 Version
C520/STD	T520 Standard Audio Response Parts
B520/MECH	T520 Mechanical Parts
B500/LED	T500 Series LED/Xtal Assembly Parts
C500/12.5	Parts For 12.5kHz Channel Increments
B500/MISC	T500 Cradle, Installation & Packing
B/TA-500/MEM	T500 Series Diode Memory Parts
B/TA-500/NB	Noise Blanker

7. T520C/3X:

B520	T520 PCB Assembly Parts
B520/V	T520 Preformed Vertical Parts
C520/C	Add With C520/CV For 7.5kHz Bandwidth
C520/CV	T520 7.5kHz IFBW Vertical Parts
C520C/3X	Add To T520 For C/3X Version
C520/STD	T520 Standard Audio Response Parts
B520/MECH	T520 Mechanical Parts
B500/LED	T500 Series LED/Xtal Assembly Parts
C500/12.5	Parts For 12.5kHz Channel Increments
B500/MISC	T500 Cradle, Installation & Packing
B/TA-500/MEM	T500 Series Diode Memory Parts
B/TA-500/NB	Noise Blanker

8. T520C/8:

B520	T520 PCB Assembly Parts
B520/V	T520 Preformed Vertical Parts
C520/C	Add With C520/CV For 7.5kHz Bandwidth
C520/CV	T520 7.5kHz IFBW Vertical Parts
C520C/8	Add To T520 For C/8 Version
C520/AF2	Add To B520 For AF2 Response
B520/MECH	T520 Mechanical Parts
B500/LED	T500 Series LED/Xtal Assembly Parts
C500/12.5	Parts For 12.5kHz Channel Increments
B500/MISC	T500 Cradle, Installation & Packing
B/TA-500/MEM	T500 Series Diode Memory Parts

6.2 B520 T520 PCB ASSEMBLY BASIC PARTS

6.2.1 TRANSISTORS

INTERNAL PART NO.	QTY/SET	DESCRIPTION	REFERENCE		CH/N
		A1C512			
0 0 0 0 0 0 1 0 6 0	2	BC327 TRANSISTOR	Q4, Q5		
0 0 0 0 0 0 1 1 1 0	11	BC548B TRANSISTOR	Q1, Q2, Q7, Q10, Q19, Q20 Q27, Q29, Q31, Q43, Q44		
0 0 0 0 0 0 1 1 3 0	9	BC557B TRANSISTOR	Q6, Q11, Q25, Q26, Q28, Q30, Q32, Q35, Q46		
0 0 0 0 0 0 1 1 7 0	2	BD136 TRANSISTOR	Q3, Q45		
0 0 0 0 0 0 2 0 1 8	2	BF247A TRANSISTOR	Q16, Q17		
0 0 0 0 0 0 2 0 3 5	1	BF324 TRANSISTOR	Q15		
0 0 0 0 0 0 2 2 3 0	1	2N4427 TRANSISTOR	Q40		
0 0 0 0 0 0 2 3 1 3	1	MRF237 TRANSISTOR	Q41		
0 0 0 0 0 0 3 0 7 0	1	2N6082 TRANSISTOR	Q47		
0 0 0 0 0 0 3 1 1 0	1	BF981 TRANSISTOR	Q18		
0 0 0 0 0 0 3 1 7 5	2	3SK87K TRANSISTOR	Q34, Q37		
0 0 0 0 0 0 3 1 9 5	1	MPS 3646 TRANSISTOR	Q39		
0 0 0 0 0 0 3 3 0 9	2	JF1033 TRANSISTOR	Q33, Q36		

6.2.2 DIODES

0 0 1 0 0 0 1 1 6 0	1	SR2607 DIODE	D1		
0 0 1 0 0 0 1 2 0 0	5	1N4148 DIODE	D32, D44, D45, D46, D47		
0 0 1 0 0 0 1 2 5 0	2	UM9401 DIODE	D62, D63		
0 0 1 0 0 0					
0 0 1 0 0 0 1 5 1 1	1	BZX79/C5V1 ZENER	D48		
0 0 8 0 0 0 1 0 1 3	1	LED TLY124 YELLOW LEGS MTG			85/5-166

6.2.3 INTEGRATED CIRCUITS

0020001370	1	TDA 1020 INT CCT	Ic 4	
0020001440	1	MLM 324 INT CCT	Ic 2	
0020001470	1	3357 INT CCT	Ic 7	
0020001491	1	4001B INT CCT	Ic 1	
0020001570	1	4066 INT CCT	Ic 3	
0020001755	1	8793 INT CCT	Ic 9	
0020001760	1	145152 INT CCT	Ic 8	

6.2.4 CAPACITORS

0102120001	1	12P CAP NPO 5% 500V CERAMIC	C292	
0102220001	1	22P CAP N150 5% 500V CERAMIC	C295	
0102270001	1	27P CAP N150 5% 500V CERAMIC	C290	
0102470003	2	47P CAP N750 5% 500V CERAMIC	C285, C293	
0102560001	3	56P CAP N750 5% 500V CERAMIC	C280, C291, C294	
0104100001	3	1n CAP, T/C B, 10% 500V CERAMIC	C268, C288, C289	
0111150001	2	1P5 CAP P100 ±0.25P 50/63V CERAMIC	C231, C282	
0111220001	4	2P2 CAP NPO ±0.25P 50/63V CERAMIC	C108, C110, C192, C234	
0111270001	1	2P7 CAP NPO ±0.25P 50/63V CERAMIC	C114	
0111680001	2	6P8 CAP NPO ±0.5P 50/63V CERAMIC	C102, C237	
0111020001	5	10P CAP NPO ±0.5P 50/63V CERAMIC	C99, C196, C198, C245, C253	
0111120001	1	12P CAP NPO 5% 50/63V CERAMIC	C103	
0111150001	2	15P CAP NPO 5% 50/63V CERAMIC	C190, C244	
0111150006	1	15P CAP N750 5% 50/63V CERAMIC	C174	
0111180001	1	18P CAP N150 5% 50/63V CERAMIC	C104	
0111222000	1	22P CAP NPO 63/50V 5% CERAMIC	C230	86/W 350
0111222001	5	22P CAP N150 5% 50/63V CERAMIC	C100, C109, C111, C266A, C266B,	
0111222006	1	22P CAP N750 5% 50/63V CERAMIC	C173	
0111227001	3	27P CAP N150 5% 50/63V CERAMIC	C101, C243, C229	85/9-350
0111233001	4	33P CAP N150 5% 50/63V CERAMIC	C63, C116, C251, C278	86/9-360
0111239001	2	39P CAP N150 5% 50/63V CERAMIC	C113, C130	
0111247001	2	47P CAP N150 5% 50/63V CERAMIC	C48, C115,	
0111256001	4	56P CAP N150 5% 50/63V CERAMIC	C67, C250, C258, C259	

T520 Parts List

011 0268 001	1	68P CAP N150 5% 50/63V CERAMIC	C131	
011 0282 001	3	82P CAP N150 5% 50/63V CERAMIC	C112, C266, C267	
011 0310 001	3	100P CAP N150 5% 50/63V CERAMIC	C45, C46, C133	85/7-247
011 0315 001	1	150P CAP N150 5% 50/63V CERAMIC	C135	
011 0347 001	2	470P CAP N1K5 10% 50/63V CERAMIC	C117, C119	
011 0347 002	2	470P CAP T/C B 10% 63V CERAMIC	C93, C175	
011 0368 001	3	680P CAP N1K5 10% 63V CERAMIC	C256, C270, C274	
011 0410 001	19	1n CAP T/C B 10% 63V CERAMIC	C7, C8, C11, C15, C40, C56, C105, C129, C194, C195, C222, C225, C235, C236, C240, C246, C261, C262, C265	86/02-040
011 0447 003	27	4n7 CAP T/C B 10% 50V CERAMIC DISC	C1, C6, C9, C42, C65, C107, C118, C121, C122, C123, C125, C128, C132, C172, C180, C193, C197, C220, C224, C233, C241, C242, C248, C249, C252, C281, C286	85/11-418; 85/7-247; 85/7-264
015 0327 002	1	270P CAP NPO 5% 100V HiQ CHIP 3·2×2·54mm	CC284	
015 0356 002	1	560P CAP NPO 5% 100V HiQ CHIP 3·2×2·54mm	CC271	
017 1547 001	5	47n CAP T/C B 20% 50V SURFACE BARRIER	C255, C260, C269, C272, C275	
020 0710 002	6	1µ CAP 50V ELECTRO 5×11mm VERT	C4, C17, C41, C85, C86, C87	86/02-273; 85/8-270
020 0733 001	1	3µ3 CAP 50V ELECTRO 5×11mm VERT	C143	
020 0810 003	4	10µ CAP 50V ELECTRO 5×11mm VERT	C106, C181, C183, C227	
020 0847 002	9	47µ CAP 16V ELECTRO 6×11mm VERT	C44, C49, C90, C127, C171, C179, C182, C257, C273	85/9-322
020 0847 005	1	47µ CAP 16V ELECTRO 6·3×7mm VERT	C5	85/9-322
020 0910 003	1	100µ CAP 16V ELECTRO 8×11mm VERT	C16	
020 0922 001	1	220µ CAP 16V ELECTRO 10×12·5mm VERT	C92	
020 1910 002	2	1000µ CAP 16V ELECTRO 12×25mm VERT	C2, C10	
022 0422 001	3	2n2 CAP 50V MYLAR VERT	C50, C88, C239	85/11-418
022 0447 001	1	4n7 CAP 50V MYLAR VERT	C178	
022 0510 001	6	10n CAP 50V MYLAR VERT	C53, C64, C185, C226, C238, C263	
022 0522 001	2	22n CAP 50V MYLAR VERT	C47, C61	
022 0547 001	10	47n CAP 50V MYLAR VERT	C43, C54, C55, C68, C134, C136, C170, C177, C223, C264	

0220568002	1	68n CAP 50V MYLAR VERT	C62	
0220610001	1	100n CAP 50V MYLAR VERT	C91	
0220710002	1	1µ CAP 20% 50V MYLAR VERT	C176	
0280218001	2	2/18P TRIM CAP 6×6mm 2THS. PH809.	CV191, CV232	
0280230003	2	5/30P TRIM CAP N750, TOP ADJ, GREEN.	CV254, CV287	

6.2.5 RESISTORS

0300122000	1	2E2 RESISTOR 5% C/F 7×2.5mm	R271	
0300210000	8	10E RESISTOR 5% C/F 7×2.5mm	R99, R101, R102, R110 R111, R113, R253, R243	85/7-264
0300222000	1	22E RESISTOR 5% C/F 7×2.5mm	R245	
030		5% C/F 7×2.5mm		
0300247000	3	47E RESISTOR 5% C/F 7×2.5mm	R112, R229, R230,	
0300310000	2	100E RESISTOR 5% C/F 7×2.5mm	R185, R191,	
0300315000	3	150E RESISTOR 5% C/F 7×2.5mm	R119, R199, R226	85/8-287
0300322000	1	220E RESISTOR 5% C/F 7×2.5mm	R15	
0300333000	2	330E RESISTOR 5% C/F 7×2.5mm	R107, R224	
0300347000	1	470E RESISTOR 5% C/F 7×2.5mm	R251	
0300368000	8	680E RESISTOR 5% C/F 7×2.5mm	R5, R10, R32, R40, R44 R269, R272, R273	
0300410000	3	1K RESISTOR 5% C/F 7×2.5mm	R52, R177, R220	
0300415000	5	1K5 RESISTOR 5% C/F 7×2.5mm	R216, R217, R218, R219 R195	85/8-287
0300418000	1	1K8 RESISTOR 5% C/F 7×2.5mm	R239	
0300422000	3	2K2 RESISTOR 5% C/F 7×2.5mm	R9, R11, R222	
0300439000	2	3K9 RESISTOR 5% C/F 7×2.5mm	R7, R170	
0300447000	5	4K7 RESISTOR 5% C/F 7×2.5mm	R80, R173, R221, R270 R241	85/7-264
0300468000	1	6K8 RESISTOR 5% C/F 7×2.5mm	, R171	
0300482000	1	8K2 RESISTOR 5% C/F 7×2.5mm	R223	
0300510000	3	10K RESISTOR 5% C/F 7×2.5mm	R142, R176, R179	
0300522000	2	22K RESISTOR 5% C/F 7×2.5mm	R187, R227	
0300539000	1	39K RESISTOR 5% C/F 7×2.5mm	R81	
0300547000	3	47K RESISTOR 5% C/F 7×2.5mm	R25, R33, R68	

030061000	1	100K RESISTOR 5% C/F 7x2.5mm	R235	
030071000	1	1M RESISTOR 5% C/F 7x2.5mm	R17	
032321000	1	10E RESISTOR 5% M/F 12x4.5mm	, R266	
032331000	1	100E RESISTOR 5% M/F 12x4.5mm	R268	
032331800	2	180E RESISTOR 5% M/F 12x4.5mm	R254, R265	
040051003	1	10K LOG POT L/SW PCB MTG (MARKED '10KA')	RV85 VOLUME	
040051004	1	10K LIN POT L/SW PCB MTG (MARKED '10KB')	RV149 SQUELCH	
042042200	2	2K2 PRE-SET RES FLAT 10mm CARBON	RV79, RV256	

6.2.6 COILS

050001617	1	COIL TAIT No 617	L30	
050001623	5	COIL TAIT No 623	L11, L12, L13, L14, L15	
050001635	2	COIL TAIT No 635	L36, L51	
052081255	1	COIL A/W 1.5T/2.5mm HOR 0.8mm	L86	86/4-010
056000210	4	FXD IND 3.3µH TAIT 100	L10, L37, L76, L80	
056000211	1	FXD IND 1.5µH TAIT 101	L2	
056000212	2	FXD IND 100µH TAIT 102	L31, L45	
056000214	2	FXD IND 330mH TAIT 104	L64 (VERT MTG) L54 (HOR MTG)	
056000211	4	FXD IND 3.3µH VERT MTG. TAIT 110	L35, L50, L52, L58	
056000211	2	FXD IND 100µH VERT MTG TAIT 112	L23, L33	
065000108	4	FERRITE BEAD 3x0.7x10mm 4S3 RED	L63, L65, L69, L70	
065000111	2	FERRITE BEAD 3x1x4mm 4S3 RED	L71 L72	
052081255	1	COIL A/W 1.5T/2.5mm HOR	L74	
052081302 5	1	COIL A/W 2.5T/3.0mm HOR	L67	
052081305 5	1	COIL A/W 5.5T/3.0mm HOR	L75	
052081306 5	1	COIL A/W 6.5T/3.0mm HOR	L60	
052081356 2 5	1	COIL A/W 2.5T/3.5mm HOR	L62	
052081406 5	1	COIL A/W 6.5T/4.0mm HOR	L61	
052081407 5	1	COIL A/W 7.5T/4.0mm HOR	L56	
052081456 5	2	COIL A/W 6.5T/4.5mm HOR	L82, L84	
052081554 5	2	COIL A/W 4.5T/5.5mm HOR	L81, L85	
052081605 5	1	COIL A/W 5.5T/6.0mm HOR	L66	
052082409 5	1	COIL A/W 9.5T/4.0mm VERT	L73 (L71, L72	

6.7 MISCELLANEOUS

220000101097	1	PRINTED CCT BOARD T520	
232000101019	2	SWITCH, PUSH DPDT, LATCHING PCB MTG	SW1, SW3
232000101020	1	SWITCH, PUSH, DPDT, MOMENTARY PCB MTG	SW2
240000202058	2	PLUG, 5WAY HEADER PCB MTG	
240000202059	3	PLUG, 3WAY HEADER PCB MTG	
240000202060	1	PLUG, 18WAY HEADER PCB MTG	
240040202057	1	SOCKET 10WAY TOP ENTRY PCB MTG	
274000101010	1	CRYSTAL 10.245 MHZ TE4	X1
276000101012	1	CERAMIC DISCRIMINATOR CDB455C7	CD1
356000202017	17	PIN 1.5mm PCB MOUNTING	85/8-788
356000101027	118	HARWIN TRACK PINS	86/02-024
362000100018	1	SILPAD	UNDER Q40

6.3 B520/V T520 VERTICALLY MOUNTED PARTS

6.3.1 DIODES

001000012000	15	1N4148 DIODE	D2, D6, D7, D8, D15, D16, D22, D23, D24 D25, D30, D31, D42, D43 D60,
001000012533	1	BB405 VARICAP DIODE	D51
001000012633	2	BB409 VARICAP DIODE	D35, D50
001000013455	1	15597/2 DIODE	D61
001000015099	1	BZX79/C3V9 ZENER	D3
001000015133	1	BZX79/C6V2 ZENER	D21

6.3.2 RESISTORS

030000000000	1	0E RESISTOR 5% C/F 7x2.5mm	(D9)
030012200000	2	2E2 RESISTOR 5% C/F 7x2.5mm	R89, R261
030013300000	2	3E3 RESISTOR 5% C/F 7x2.5mm	R250, R260
030014700001	2	4E7 RESISTOR 5% C/F 10x4mm	R263, R264
030021000000	3	10E RESISTOR 5% C/F 7x2.5mm	R252, R253A, R255
030024700000	2	47E RESISTOR 5% C/F 7x2.5mm	R225, R249
030031000000	1	100E RESISTOR 5% C/F 7x2.5mm	R242
030032200000	2	220E RESISTOR 5% C/F 7x2.5mm	R244, R246
030033300000	2	330E RESISTOR 5% C/F 7x2.5mm	R100, R118

T520 Parts List

030036800	3	680E RESISTOR 5% C/F 7×2.5mm	R103, R215, R259	
030041000	8	1K RESISTOR 5% C/F 7×2.5mm	R8, R18, R84, R186 R236, R267, R3, R43	86/5-122 84/5-104
030041200	1	1K2 RESISTOR 5% C/F 7×2.5mm	R2	
030041500	3	1K5 RESISTOR 5% C/F 7×2.5mm	R120, R121, R188,	85/8-237
030041800	1	1K8 RESISTOR 5% C/F 7×2.5mm	R198	
030042200	10	2K2 RESISTOR 5% C/F 7×2.5mm	R16, R41, R45, R73, R123 R145, R172, R240, R248 R257	85/7-264
030043300	5	3K3 RESISTOR 5% C/F 7×2.5mm	R106, R190, R192, R231 R175	84/09-104
030044700	8	4K7 RESISTOR 5% C/F 7×2.5mm	R1, R6, R21, R27, R29 R63, R66, R150, (R220 TRANSFERRED TO C520 ETC)	85/7-264
030045600	1	5K6 RESISTOR 5% C/F 7×2.5mm	R71	
030046800	1	6K8 RESISTOR 5% C/F 7×2.5mm	R182	
030051000	15	10K RESISTOR 5% C/F 7×2.5mm	R30, R42, R47, R53, R54 , R104, R108, R109 R124, R126, R144, R146 R178, R180, R184.	
030051200	1	12K RESISTOR 5% C/F 7×2.5mm	R105	
030051500	1	15K RESISTOR 5% C/F 7×2.5mm	R75,	
030052200	9	22K RESISTOR 5% C/F 7×2.5mm	R20, R61, R189, R196 R197, R228, R237, R238 R258	85/7-264
030053300	2	33K RESISTOR 5% C/F 7×2.5mm	R50, R86	
030053900	1	39K RESISTOR 5% C/F 7×2.5mm	, R181	
030054700	7	47K RESISTOR 5% C/F 7×2.5mm	R4, R31, R46, R67, R125 R183 R88	
030061000	5	100K RESISTOR 5% C/F 7×2.5mm	R19, R64, R82, R87, R274	
030061200	1	120K RESISTOR 5% C/F 7×2.5mm	R26	
030061500	1	150K RESISTOR 5% C/F 7×2.5mm	R70	
030062200	1	220K RESISTOR 5% C/F 7×2.5mm	R122	
030064700	7	470K RESISTOR 5% C/F 7×2.5mm	R48, R49, R51, R65, R72 R143, R232	
030071000	3	1M RESISTOR 5% C/F 7×2.5mm	R28, R62, R174	
032331800	1	180E RESISTOR 5% M/F 12×4.5mm	R262	

6.4 C520/B T520 15kHz BANDWIDTH PARTS

011014700 01	1	4P7 CAP NPO ±0·25P 50/63V CERAMIC	C124	
011041000 01	1	1n CAP T/C B 10% 63V CERAMIC	C142	
022043300 01	2	3n3 CAP 50V MYLAR VERT	C140, C141	
030033300 00	1	330E RESISTOR 5% C/F 7×2·5mm	R141	
030048200 00	1	8K2 RESISTOR 5% C/F 7×2·5mm	R148	
050000163 9	1	COIL TAIT No 639	L16	
276000101 4	1	CERAMIC FILTER CFW455E	CF1	
276000103 6	1	CRYSTAL FILTER 10·7MHz 15KHz 4 POLE	XF1	

6.5 C520/BV T520 15kHz BANDWIDTH VERTICAL PARTS

030036800 00	1	680E RESISTOR 5% C/F 7×2·5mm	R127	
030047000 00	1	4K7 RESISTOR 5% C/F 7×2·5mm	R117	
030051000 00	2	10K RESISTOR 5% C/F 7×2·5mm	R115, R116	
030061200 00	1	120K RESISTOR 5% C/F 7×2·5mm	R140	
030062700 00	1	270K RESISTOR 5% C/F 7×2·5mm	R147	

6.6 C520/C T520 7.5kHz BANDWIDTH PARTS

011021000 01	1	10P CAP NPO 5% 50/63V CERAMIC	C124	
011047003 3	3	4n7 CAP T/C B 10% 50V CERAMIC	C140, C141, C142	
030033900 00	1	390E RESISTOR 5% C/F 7×2·5mm	R141	
030051200 00	1	12K RESISTOR 5% C/F 7×2·5mm	R148	
050000163 4	1	COIL TAIT No 634	L16	
276000101 3	1	CERAMIC FILTER CFW455G 9KHz B/W	CF1	
276000103 7	1	CRYSTAL FILTER 10·7MHz 7·5KHz 4 POLE	XF1	

6.7 C520/CV T520 7.5kHz BANDWIDTH VERTICAL PARTS

030041000 00	1	1K RESISTOR 5% C/F 7×2·5mm	R127	
030042200 00	1	2K2 RESISTOR 5% C/F 7×2·5mm	R117	
030047000 00	2	4K7 RESISTOR 5% C/F 7×2·5mm	R115, R116	
030061500 00	1	150K RESISTOR 5% C/F 7×2·5mm	R140	
030061800 00	1	180K RESISTOR 5% C/F 7×2·5mm	R147	

6.8 C520/STD T520 STANDARD AUDIO RESPONSE PARTS

011018200 01	1	8P2 CAP NPO ±0·5P 50/63V CERAMIC	C66
022051000 1	2	10n CAP 50V MYLAR	C51, C52
030044700 00	1	4K7 RESISTOR 5% FILM 7×2·5mm	R234 (VERT)
030046800 00	1	6K8 RESISTOR 5% C/F 7×2·5mm	R74 (HORIZONTAL MTG)
030051000 00	1	10K RESISTOR 5% C/F 7×2·5mm	R76 (VERT)
030051500 00	1	15K RESISTOR 5% C/F 7×2·5mm	R77 (VERT)
030053900 00	1	39K RESISTOR 5% C/F 7×2·5mm	R78 (VERT)

6.9 C520/AF1 T520 AF1 AUDIO RESPONSE PARTS

022051000 1	1	10n CAP 50V MYLAR	C51
022052200 1	1	22n CAP 50V MYLAR	C52
030044700 00	1	4K7 RESISTOR 5% FILM	R234 (VERT)
030046800 00	2	6K8 RESISTOR 5% FILM 7×2·5mm	R74 (HORIZONTAL) R76 (VERT)
030051200 00	1	12K RESISTOR 5% FILM 7×2·5mm	R77 (VERT)
030054700 00	1	47K RESISTOR 5% FILM 7×2·5mm	R78 (VERT)

6.10 C520/AF2 T520 AF2 AUDIO RESPONSE PARTS

011021500 1	1	15P CAP NPO 5% 50/63V CERAMIC	C66
022051000 1	2	10n CAP 50V MYLAR	C51, C52
030048200 00	1	8K2 RESISTOR 5% FILM 7×2·5mm	R74 (HORIZONTAL)
030051200 00	1	12K RESISTOR 5% FILM 7×2·5mm	R76 (VERT)
030051800 00	1	18K RESISTOR 5% FILM 7×2·5mm	R77 (VERT)
030052200 00	1	22K RESISTOR 5% FILM 7×2·5mm	R234 (VERT)
030056800 00	1	56K RESISTOR 5% FILM 7×2·5mm	R78 (VERT)

6.11 C500/5 T520 5kHz CHANNEL INCREMENT PARTS

274000100 8	1	CRYSTAL 10·24MHz TE9	X3 FITTED TO 'LED ASSY'
011011800 1	1	18P CAP P1/0 ±·25P 50/63V CERAMIC	C300 - MOUNT IN ADJACENT UNUSED XTAL HOLES

6.12 C500/12.5 T520 12.5kHz CHANNEL INCREMENT PARTS

274000107	1	CRYSTAL 12·8MHz TE9	X3 FITTED TO 'LED ASSY'

6.13 B520/MECH T520 MECHANICAL PARTS

0120410001	2	1n CAP, CERAMIC FEED THRU	C298, C299	
0650001007	2	FERRITE BEAD 5x2x4mm 4S3 RED	L98, L99	
2000001004	100mm	0.7mm TINNED COPPER WIRE	FOR FERRITE BEADS - L98 & L99	85/8-282
2010003004	240mm	WIRE 7/0.2 PVC YELLOW	90mm PCB/SPKR CONNECTOR	
			150mm PCB/INT SPKR	
2010003010	160mm	WIRE 7/0.2 PVC BLACK	160mm PCB/INT SPKR	
2010004012	50mm	WIRE 0.5mm² PVC RED (16/0.2 OR 10/0.85)	50mm PCB/PWR CONNECTOR	
				85/7-229
2400001060	1	PLUG HOUSING, 4WAY, PANEL MTG		
2400001061	4	PLUG TERMINALS, SOLDER TAIL		
2400210035	1	SKT, COAXIAL, UHF PNL MTG		
				85/7-229
2500001014	1	SPEAKER 8 OHM A3M1599		
2520001012	1	MICROPHONE 600Ω FOSTER		
3020005175	1	BRACKET, FEED THRU A3M1597		
3020040042	3	PUSH BUTTON, PLASTIC A3M1585		
3080012028	1	HEATSINK, CLIP ON, REDPOINT 5F	FOR Q41	
3080013055	1	HEATSINK, DIE CAST, A1M1579		
3111001033	2	KNOB A3M1584		
3120001035	1	LENS A3M1586		
3190001100	1	SHIELD, PA, COMPONENT SIDE A2M1592		
3190001101	1	SHIELD, PA, SOLDER SIDE A3M1593		
3190001104	1	SHIELD, PA COVER, COMPONENT SIDE, A2M1594		
3190001108	1	SHIELD, VCO BOX A3M1654		
3190001109	1	SHIELD, VCO LID A3M1655		
3190001110	1	SHROUD, INDICATOR, PLASTIC. A4M1587		
3190001114	1	SHIELD, PA COVER, SOLDER SIDE A3M1675		
3490001022	2	SCREW No4x3/8" PAN PLASTITE 2-50	COVER	86/2-047
3490002030	4	SCREW M3x6mm PAN PZ1 TAPTITE	UHF SKT MTG 2, IC4 MTG 1, H/S PCB 1	85/9-288
3490002031	4	SCREW M3x10mm PAN PZ1 TAPTITE	VCO LID 4	86/5-139
3490002032	3	SCREW M3x8mm PAN PZ1 TAPTITE	H/S PCB 2, Q3 1	85/9-288

3520001008	4	NUT M3 HEX	H/S PCB 2, Q3 1, IC4 1	
3530001010	1	WASHER M3 FLAT B2. 006·75	FOR 80136 XSTR MTG	86/10-294
3530001013	2	WASHER M3 SHAKEPROOF	Q3 1, IC4 1	
3560002014	6	RECEPTACLE 1·5mm	MICROPHONE 4, SPKR 2.	85/6-277 85/8-288 85/9-345
3570001009	4	PUSH-ON-FIX SFP3253		
3690001012	2	FOOT, FURNITURE, BLACK. R/C R359		85/9-349
3990001056	1	PLASTIC BAG 200×250mm	RADIO	
4000002007	55mm	2mm SILICON SLEEVING	4×13mm	85/6-268 85/11-408
409TM500HB	1	T500 SERIES OPERATORS HANDBOOK		85/8-287
3650010002	1	LABEL, BLANK, METALISED POLYESTER, 12·7×25·4mm.	FOR 'TITLE' PRINT IN HOUSE	

6.14 C520B/2 T520B/2 VERSION PARTS

3650001168	1	LABEL T520B/2 TITLE A4A381	PRINT IN HOUSE, REFER B520/MEN FOR BLANK.
3650001179	1	LABEL T520B RUST DOC T/A A4A409	PRINT IN HOUSE.
3650010002	1	LABEL, BLANK METALISED POLYESTER, 12·7×25·4mm.	FOR LABEL ABOVE.
3030020015	1	COVER BOTTOM PLASTIC A1M1582	86/9-246 86/11-330
3030020014	1	COVER TOP PLASTIC A1M1581	86/9-246
3160006303	1	PANEL FRONT T500 A1M1583	86/9-246
5360001002	1	TA-500/CTCSS	

6.15 C520B/2X T520B/2X VERSION PARTS

3650001264	1	LABEL T520B/2X TITLE A4A478	PRINT IN HOUSE, REFER B520/MEN1 FOR BLANK.)
3650001179	1	LABEL T520B RUST DOC T/A A4A409	(PRINT IN HOUSE)
3650010002	1	LABEL, BLANK METALISED POLYESTER 12·7×25·4mm.	FOR ABOVE LABEL.
3030020014	1	COVER TOP PLASTIC A1M1581	86/9-246
3030020015	1	COVER BOTTOM PLASTIC A1M1582	86/9-246
3160006303	1	PANEL FRONT T500 A1M1583	86/9-246

6.16 C520B/3 T520B/3 VERSION PARTS

3650001189	1	LABEL T520B/3 TITLE A4A352	(PRINT IN HOUSE, REFER B520/MEN FOR BLANK)
3030020024	1	COVER TOP METALISED A1M1581	86/9-246
3030020025	1	COVER BOTTOM METALISED A1M1582	86/9-246
3160006333	1	PANEL FRONT METALISED A1M1583	86/9-246
5360001002	1	TA-500/CTCSS	

6.17 C520B/4 T520B/4 VERSION PARTS

365000128 3	1	LABEL T520B/4 TITLE A4A499	(PRINT IN HOUSE, REFER BS20/MECH FOR BLANK)	
303002001 4	1	COVER TOP PLASTIC A1M1581		86/9-246
303002001 5	1	COVER BOTTOM PLASTIC A1M1582		86/9-246
316000630 3	1	PANEL FRONT T500 A1M1583		86/9-246
538000100 2	1	TA-500/CTCSS		

6.18 C520B/5 T520B/5 VERSION PARTS

365000124 0	1	LABEL T520B/5 TITLE A4A447	(PRINT IN HOUSE, REFER BS20/MECH FOR BLANK)	
303002001 4	1	COVER TOP PLASTIC A1M1581		86/9-246
303002001 5	1	COVER BOTTOM PLASTIC A1M1582		86/9-246 86/14-330
316000630 3	1	PANEL FRONT T500 A1M1583		86/9-246

6.19 C520C/3 T520C/3 VERSION PARTS

365000119 0	1	LABEL T520C/3 TITLE A4A353	(PRINT IN HOUSE. REFER BS20/MECH FOR BLANK)	
303002002 4	1	COVER TOP METALISED A1M1581		86/9-246
303002002 5	1	COVER BOTTOM METALISED A1M1582		86/9-246
316000633 3	1	PANEL FRONT METALISED A1M1583		86/9-246
538000100 2	1	TA-500/CTCSS		

6.20 C520C/3X T520C/3X VERSION PARTS

365000126 5	1	LABEL T520C/3X TITLE A4A479	(PRINT IN HOUSE, REFER BS20/MECH FOR BLANK)	
303002002 4	1	COVER TOP METALISED A1M1581		86/9-246
303002002 5	1	COVER BOTTOM METALISED A1M1582		86/9-246
316000633 3	1	PANEL FRONT METALISED A1M1583		86/9-246

6.21 C520C/8 T520C/8 VERSION PARTS

365000124 1	1	LABEL T520C/8 TITLE A4A468	(PRINT IN HOUSE, REFER BS20/MECH FOR BLANK)	
303002001 4	1	COVER TOP PLASTIC A1M1581		86/9-246
303002001 5	1	COVER BOTTOM PLASTIC A1M1582		86/9-246 86/14-330
316000630 3	1	PANEL FRONT T500 A1M1583		86/9-246

6.22 B500/LED T500 LED/CRYSTAL ASSEMBLY PARTS

0008011132	4	LED, 3mm, RED, HIGH INTENSITY	D302, D303, D304, D305	84/8-365
			R303, R306, R307	86/12-379
0320000000	3	ZERO OHM 5% 7x2·5mm C/F	TO REPLACE LINKS CONNECTED TO L3 & L4	86/07-365
2400402059	1	SKT 3WAY 1 ROW, PCB MTG, TOP ENTRY		
2400402061	1	SKT 7WAY 1 ROW, PCB MTG, TOP ENTRY		
			XTAL - ROAR CS20/12·5 OR CS20/5	
2250001136	1	PRINTED CCT BOARD		

6.23 B/TA-500/XO T500 LED/CRYSTAL HEATER PARTS

0000001110	1	BC548B TRANSISTOR	Q300	
0000001170	1	BD136 TRANSISTOR	Q301	
0010001200	2	1N4148 DIODE	D300, D301	
0010001509	1	BZX79/C3V9 DIODE	D306	85/9-353
0008001132	4	LED, 3mm RED, HIGH INTENSITY	D302, D303, D304, D305	
0300000000	2	RES ZERO OHM 5% 7x2.5mm C/F	R305, R306	86/12-379
0300111001	1	1E RESISTOR 5% 10x4mm C/F	R304	86/01-007
0300356000	1	560E RESISTOR 5% C/F 7x2·5mm	R303	85/9-353
0300515000	1	15K RESISTOR 5% C/F 7x2·5mm	R302	85/9-353
0300527000	1	27K RESISTOR 5% C/F 7x2·5mm	R300	85/10-374 85/9-353
0450447001	1	4K7 RESISTOR NTC 20% 5mm DISC	R301	85/10-374
2000001004	25mm	TINNED COPPER WIRE 0·7mm	1 x 25mm LINK (REPLACES R307)	86/01-007
2400402059	1	SOCKET 3WAY 1 ROW, PCB MTG, TOP ENTRY		
2400402061	1	SOCKET 7WAY 1 ROW, PCB MTG, TOP ENTRY		
2250001136	1	PRINTED CCT BOARD	CCT DIAGRAM A4C509	
3690002004	1mm	TAPE S/A POLY FILM UHMW 9421	5mm x 10mm (REFER TO P·A·N A4P504)	86/01-007
3030050063	1	CLIP, XTAL/XISTOR A4M1648		

6.24 B/TA-500/MEM T500 DIODE MEMORY PARTS

0010001200	64	1N4148 DIODE		
2250001135	1	PRINTED CCT BOARD TA-500/MEM		
2400000205 7	1	PLUG 10WAY 1ROW PCB MTG HEADER		
2400402057	1	SKT 10WAY 1ROW PCB MTG, TOP ENTRY		

6.25 B500/MISC T500 CRADLE & INSTALLATION PARTS

2050001006	3·2M	AUTO CABLE 153 2/28/0·3 RED/BLK		84/1-013
2400010035	1	PLUG, COAXIAL UHF		
2400201060	1	SKT HOUSING		
2400201061	2	SKT RECEPTACLE, 152 AUTO.		

240020106 2	2	SKT RECEPTACLE, 7/0.2	
252000101 6	1	CLIP, MIC MTG A3M1888	85/4-275
265000101 7	1	FUSE 10 CARTRIDGE 6x32 NON SPEC	86/3-062
303003004 6	1	CRADLE, BRACKET SHRT PLASTIC A3M1887	86/1-009
303003004 3	2	CRADLE CLIP, PLASTIC A3M1656	303300 43 00
303003004 4	2	CRADLE LOCKING CLAMP PLASTIC A3M1657	303300 44 00
340000101 0	1	FUSEHOLDER INLINE BOOK HOUSING	86/3-062
340000101 1	2	BOOK FUSEHOLDER CRIMP TERMINAL	86/3-062
349000103 9	2	SCREW No6 x 5/16 PAN POZI SELFTAP	MIC CLIP MTG 85/4-275
349000104 9	2	SCREW No10 x 1/2" PAN POZI SELFTAP	
353000102 0	2	WASHER M4 SHAKEPROOF	MIC CLIP MTG 85/4-275
353000103 2	2	WASHER M5 SHAKEPROOF, EXTERNAL	
369000101 4	2	CABLE TIE NYLON 100MM X 2.6MM	BATTERY LEAD TIE 86/04-090
399000105 1	1	PLASTIC BAG 75x100mm	
410000103 7	1	T500 PACKAGING SLEEVE A4M1814	
410000104 8	1	T500 PACKAGING, POLYSTYRENE 2 PCS. A1H1382	86/01-012

6.26 B/TA-500/RC T500 RUGGED CRADLE PARTS

303003004 7	1	CRADLE ASSEMBLY A2M1920, A3M1921, A3M1955	
303003004 9	2	CLIP, PLASTIC. A2M1922	
303003005 2	2	KEY, PLASTIC A4M1925	
349000104 9	4	SCREW No10 x 1/2" PAN POZI SELFTAP	
353000103 2	4	WASHER M5 SHAKEPROOF	
359000103 7	4	RIVET 3x5mm ST FLAT HD. TINMENS No7	SUPPLY TO MANUFACTURER OF CRADLE ASSEMBLY.
[illegible] 11			
399000105 4	1	PLASTIC BAG 175 x 225 mm	
399000105 6	1	PLASTIC BAG 200 x 250mm	
409TM500RC	1	OPERATORS INSTRUCTIONS TA-500RC	86/9-768

6.27 B/TA-500/CTCSS TA-500/CTCSS PCB ASSEMBLY PARTS

000000111 0	3	BC548B TRANSISTOR	Q401, Q405, Q402
000000113 0	1	BC557B TRANSISTOR	Q403
001000012 0 0	2	1N4148 DIODE	[illegible], D406, D407

T520 Parts List

0 0 2 0 0 0 1 0 6 0	1	LM339 INT CCT	Ic403	
0 0 2 0 0 0 1 4 4 0	2	MLM324 INT CCT	Ic401, Ic402	
0 0 2 0 0 0 1 5 7 0	1	4066 INT CCT	Ic404	
0 1 1 0 3 2 2 0 0 1	1	220P CAP NPO 10% CER CHIP RH	C404 (Across pins 5 & 6 of IC401b).	86/06-150
0 1 1 0 3 6 8 0 0 1	2	680P CAP 10% N1500 63V CER	C408, C416	
0 1 9 0 5 1 0 0 0 1	2	10n CAP 5% COG 50V MONO CER	C414, C415	
0 2 0 0 7 1 0 0 0 2	2	1µ CAP 50V ELECTRO 5x11mm VERT	C409, C418	
0 2 0 0 8 1 0 0 0 3	4	10µ CAP 50V ELECTRO 5x11mm VERT	C401, C402, C417, C403	86/08-206
0 2 2 0 5 2 2 0 0 1	3	22n CAP 50V MYLAR VERT	C405, C406, C407	
0 3 0 0 0 0 0 0 0 0	2	ZERO OHM RESISTOR 7x2.5mm 5% CF		86/07-182
0 3 0 0 4 1 0 0 0 0	4	1K RESISTOR 5% C/F 7x2.5mm	R443, R448, R455, R458 (R443, R455 HORIZONTAL)	
0 3 0 0 5 1 0 0 0 0	12	10K RESISTOR 5% C/F 7x2.5mm	R408, R415, R416, R418 , R440, R442, R451 R456, R457, R459, R460 R436 (R418 HORIZONTAL)	85/10-380
0 3 0 0 5 4 7 0 0 0	4	47K RESISTOR 5% C/F 7x2.5mm	R403, R410, R433, R435	
0 3 0 0 6 1 0 0 0 0	9	100K RESISTOR 5% C/F 7x2.5mm	R405, R406, R432, R434 R441, R461, R462 R424, R427	86/10-468 85/10-380 86/02-021
0 3 0 0 6 1 5 0 0 0	5	150K RESISTOR 5% C/F 7x2.5mm	R407, R409, R411, R412 R426	
0 3 0 0 6 4 7 0 0 0	2	470K RESISTOR 5% C/F 7x2.5mm	R454, R430	85/02-021 86/10-468
0 3 0 0 7 1 0 0 0 0	4	1M RESISTOR 5% C/F 7x2.5mm	R417, R444, R449, R463	
0 3 2 0 4 8 2 0 0 0	2	8K2 RESISTOR 1% M/F 7x2.5mm	R420, R445	
0 3 2 0 5 4 7 0 0 0	2	47K RESISTOR 1% M/F 7x2.5mm	R421, R446 (R446 HORIZONTAL)	
0 3 2 0 6 1 2 0 0 0	2	120K RESISTOR 1% M/F 7x2.5mm	R425, R431	
0 3 2 0 6 1 5 0 0 0	4	150K RESISTOR 1% M/F 7x2.5mm	R401, R402, R419, R422 (R422 HORIZONTAL)	
0 3 2 0 6 4 7 0 0 0	1	470K RESISTOR 1% M/F 7x2.5mm	R423	
0 4 2 0 4 2 2 0 0 3	1	2K2 PRESET RES. 10mm VERT C/F	RV447	85/9-334
0 4 4 0 6 1 0 0 0 2	2	100K PRESET RES, MULTITURN, 10mm sq. VERT.	RV428, RV429	
2 0 0 0 0 0 1 0 0 5	0.02gm	1/0.5mm T/C WIRE	LINK (15mm)	
2 2 5 0 0 0 1 1 3 8	1	PRINTED CIRCUIT BOARD TA-800 CTCSS		
2 4 0 0 4 0 2 0 5 8	2	SKT 5way 1 ROW PCB MTG MOLEX		
3 0 9 0 0 0 1 0 3 9	1	INSULATOR TA-800/CTCSS A4M1828		86/03-090

T520 Parts List

3	1	6	0	0	8	7	0	5	7	1	PILLAR 11·5mm M3 A4M1600		
3	4	9	0	0	0	2	0	3	0	2	SCREW M3×6mm PAN PZ1 TAPTITE		
3	5	6	0	0	0	1	0	2	6	29	HARWIN TRACK PINS.		86/7-184
3	6	5	0	0	0	1	1	3	8	1	LABEL, STATIC WARNING, YELLOW A4A315		
3	9	9	0	0	0	1	0	5	5	1	PLASTIC BAG 150 × 300mm		84/4-132

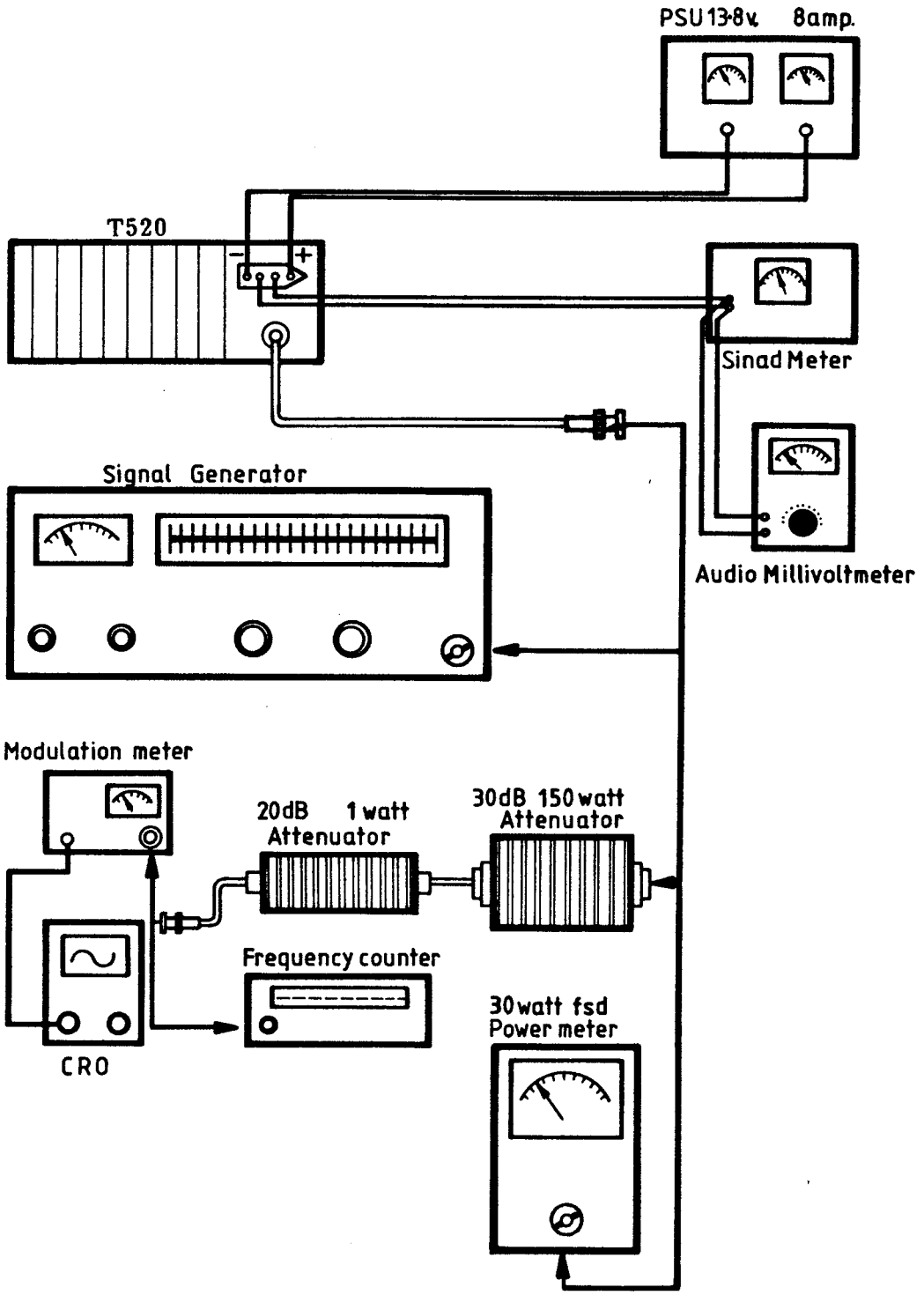


Diagram 1 Suggested Test Equipment Set-Up

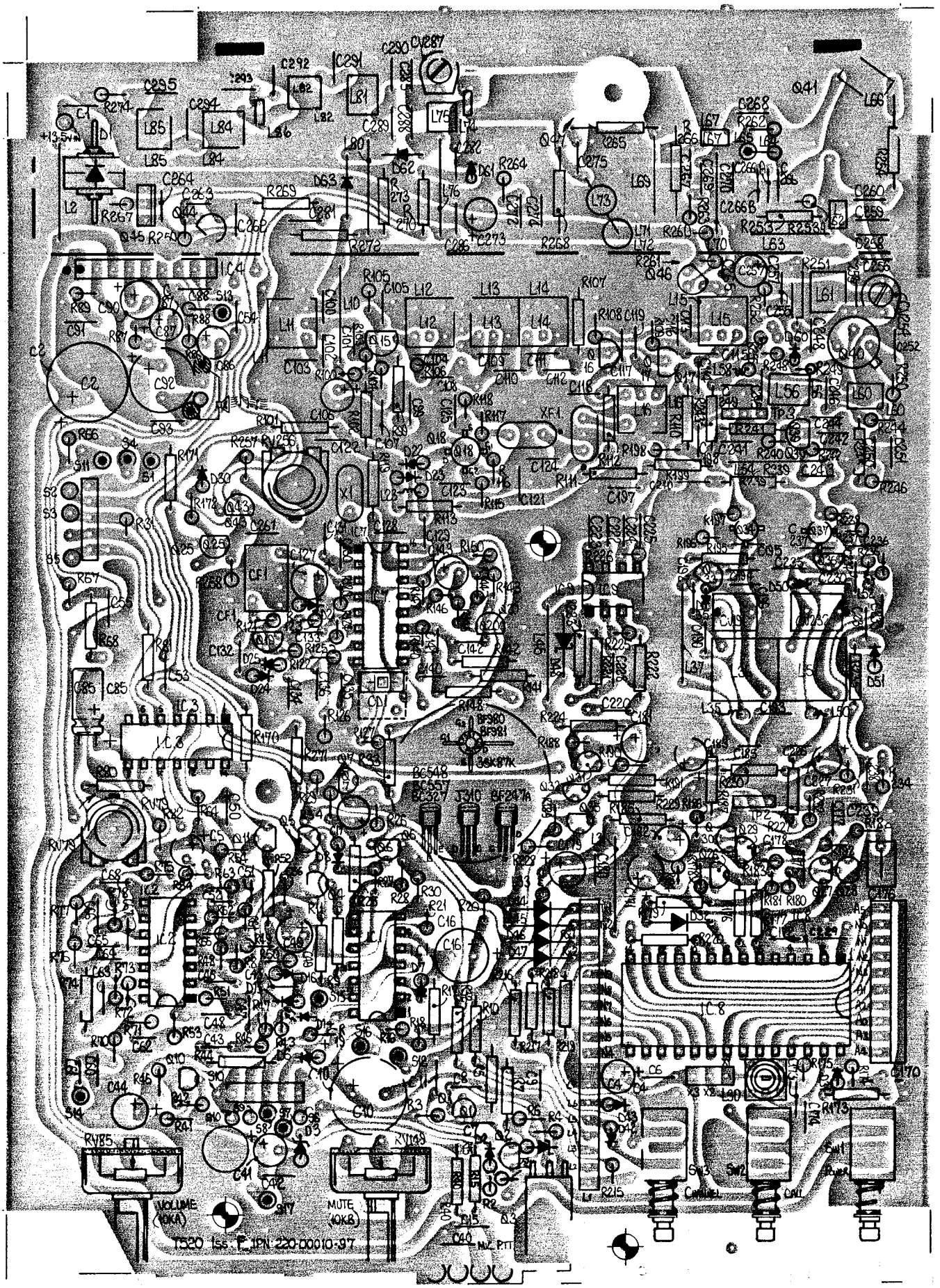


Diagram 2 T520 PCB Encoding

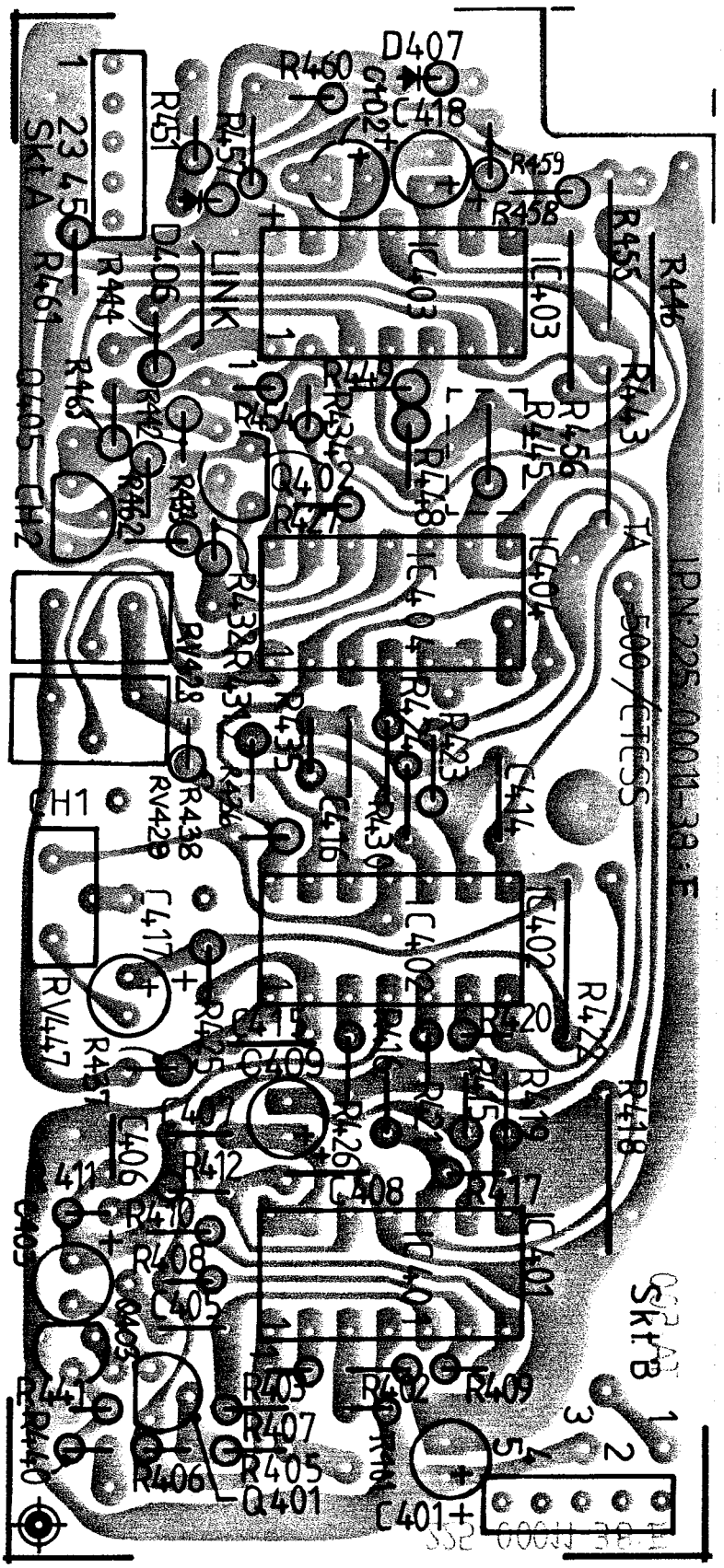


Diagram 3 TA-500/CTCSS PCB Encoding

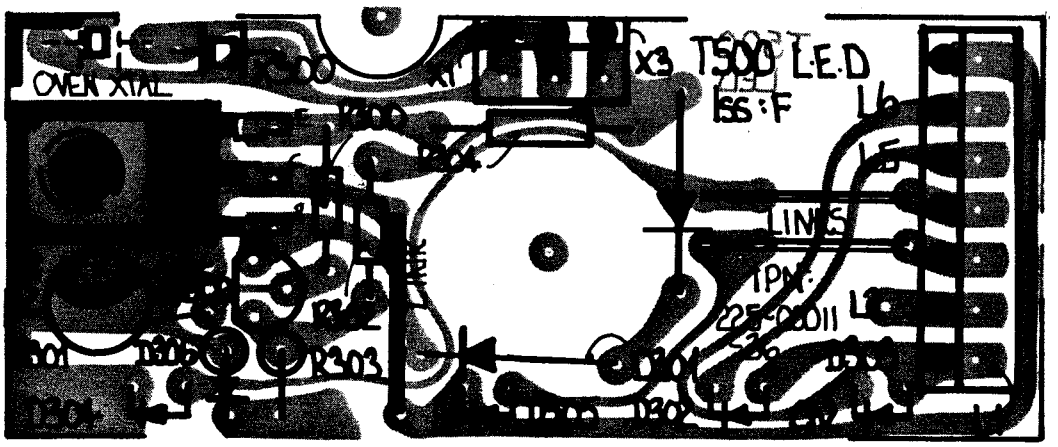
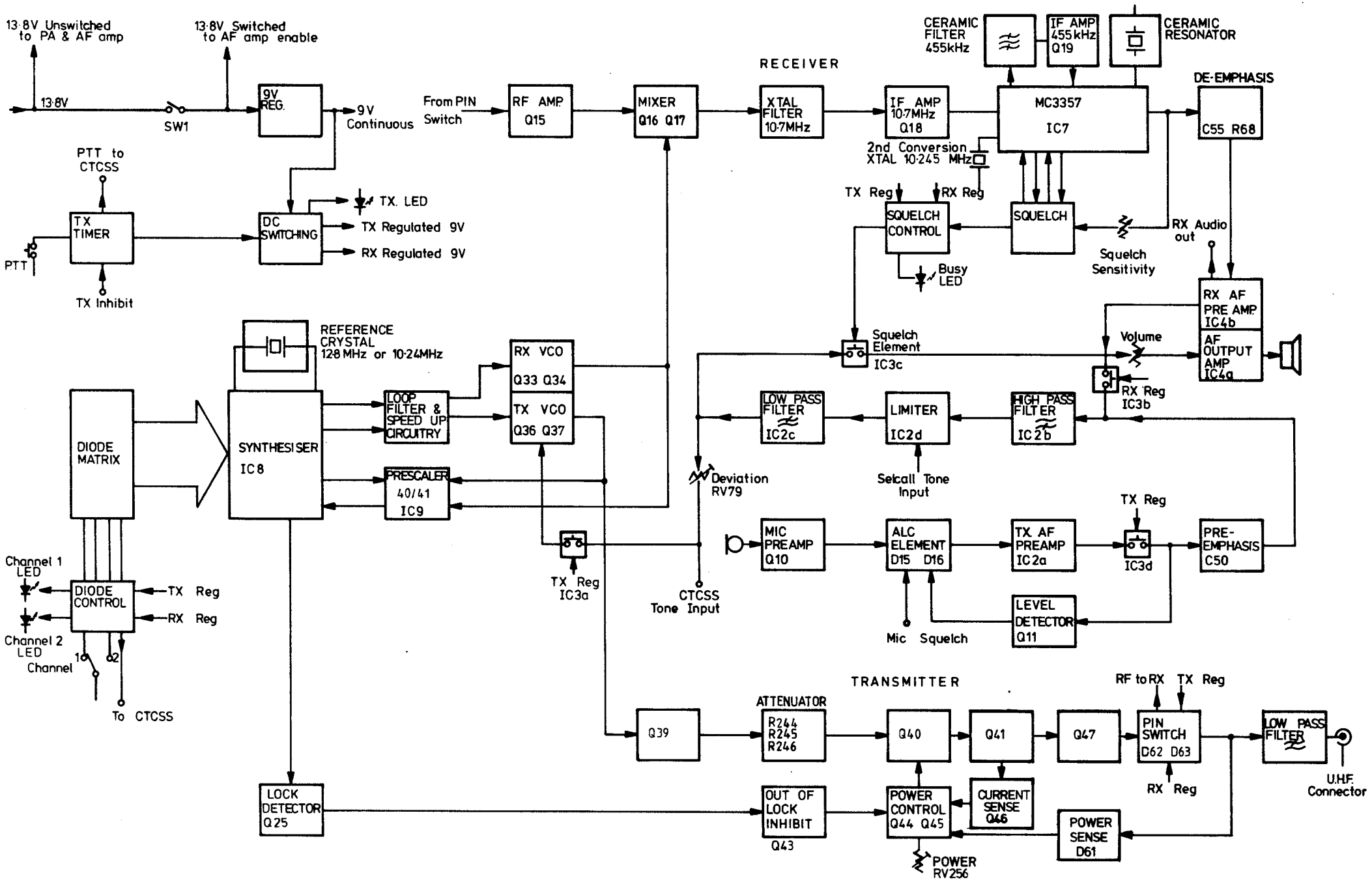


Diagram 4 T500/LED & Crystal Heater PCB Encoding



ISSUE	AMENDMENTS	DRN.	CHKD	APVD	DATE
A	ORIGINAL	D.H	D.S	D.S	26-8-85

ISSUE	AMENDMENTS	DRN.	CHKD	APVD	DATE

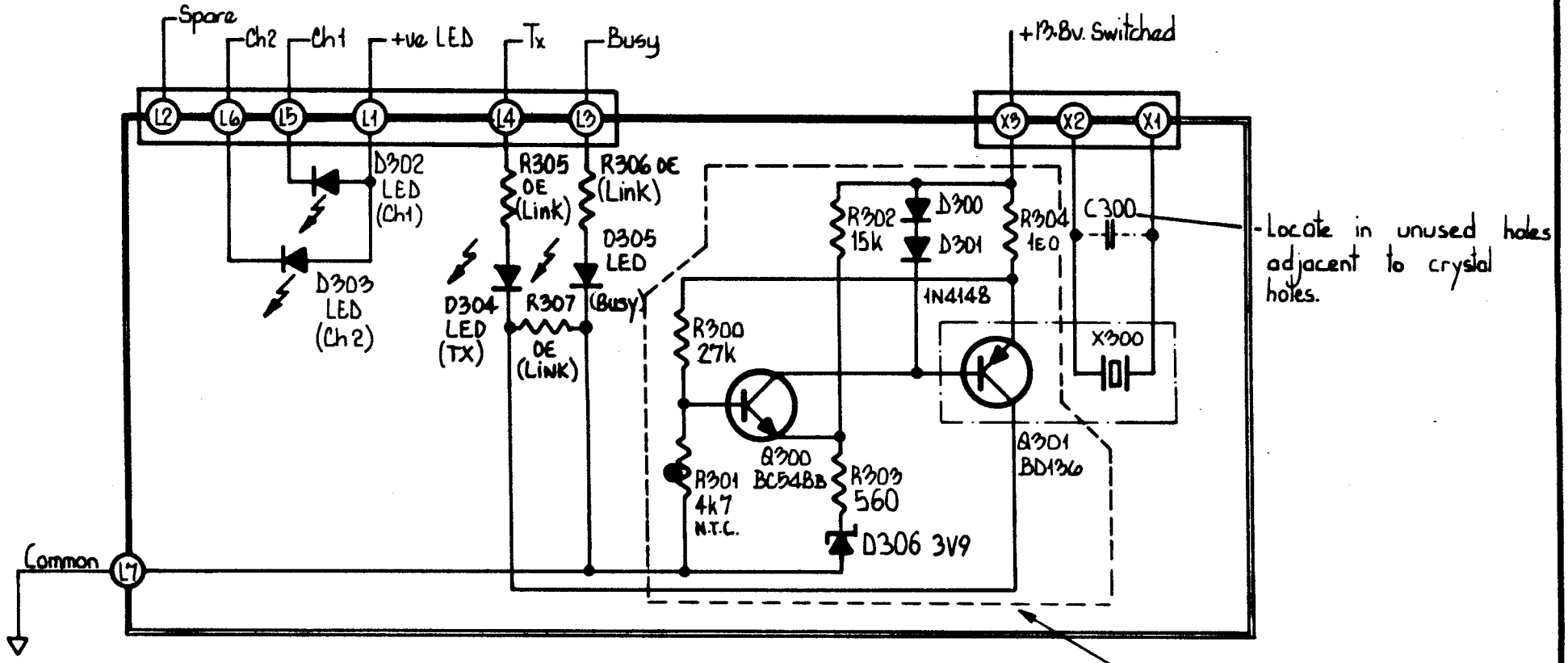
BLOCK DIAGRAM T520

TAIT ELECTRONICS Ltd.
Christchurch New Zealand

DRAWING NUMBER A2M 1820

ISSUE A

DO NOT SCALE OFF DRAWING



CH. SPACE	X300	C300
6.25 KHz	12.8	not fitted
5kHz	10.24	1p8

USED ON
T510
T520
T530
T540
T550

	E	ChN: 86-12-379	[illegible]	S.C.	S.C.	19.1.87

SCALE :
MATERIAL :
FINISH :
GEN. LIMITS :

IPN

ISS	AMENDMENTS	DRN	CHKD	APVD	DATE
A	ORIGINAL	[illegible]	MM	[illegible]	30.8.85
B	Ch/N 85708 304, 09 353 10 374, 10 384	D.H.	H.O.	S.C.	24.10.85
C	Ch/N 86-07-175	[illegible]	S.C.	S.C.	5.9.86
D	Ch/N 86-07-165	[illegible]	S.C.	S.C.	7.10.86

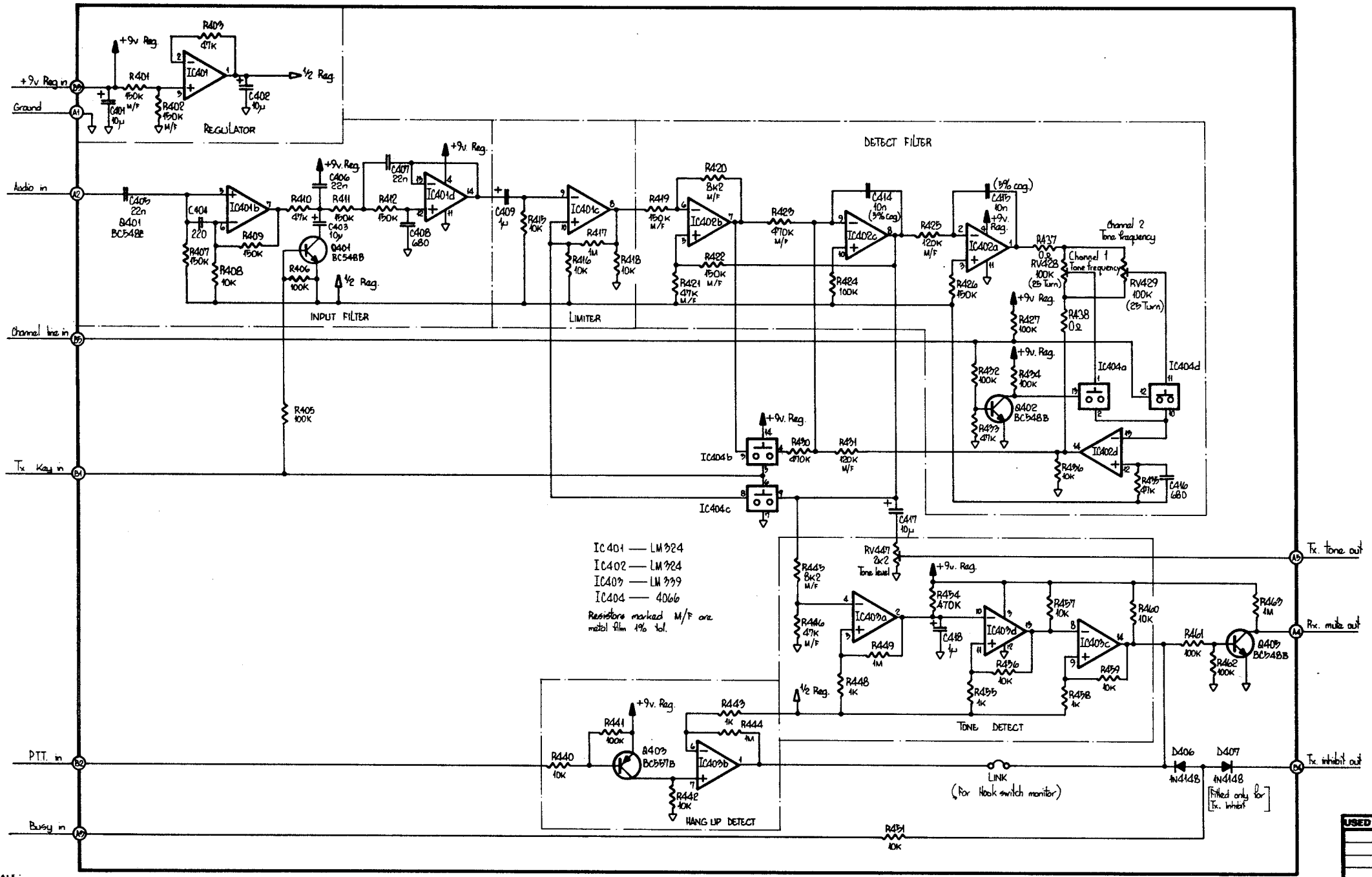
CIRCUIT DIAGRAM—T500/LED & OPTIONAL CRYSTAL HEATER.

TAIT ELECTRONICS LTD.

DRAWING NUMBER A4 C509

ISSUE A B C D E

DO NOT SCALE OFF DRAWING



ISSUE	AMENDMENTS	DRN.	CHKD	APVD	DATE
A	ORIGINAL	W.W.	MM	SCK	7/4/86
B	Ch/N 86/002 021	A.G.	S.C.	S.C.	15.5.86
C	Ch/N 86/006 150, 07/182	D.R.	A.C.	S.C.	16.7.86
D	Ch/N 86-09-206	[illegible]	D.C.	S.C.	2.9.86

ISSUE	AMENDMENTS	DRN.	CHKD	APVD	DATE

SCALE :
MATERIAL :
FINISH :
GEN. LIMITS :

CIRCUIT DIAGRAM: TA-500/CTCSS

TAIT ELECTRONICS Ltd.
Christchurch New Zealand

DRAWING NUMBER A2C500

ISSUE D

IPN

USED ON