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# TECHNICAL SERVICE MANUAL

for

# HF SSB TRANSCEIVER TYPE 7515

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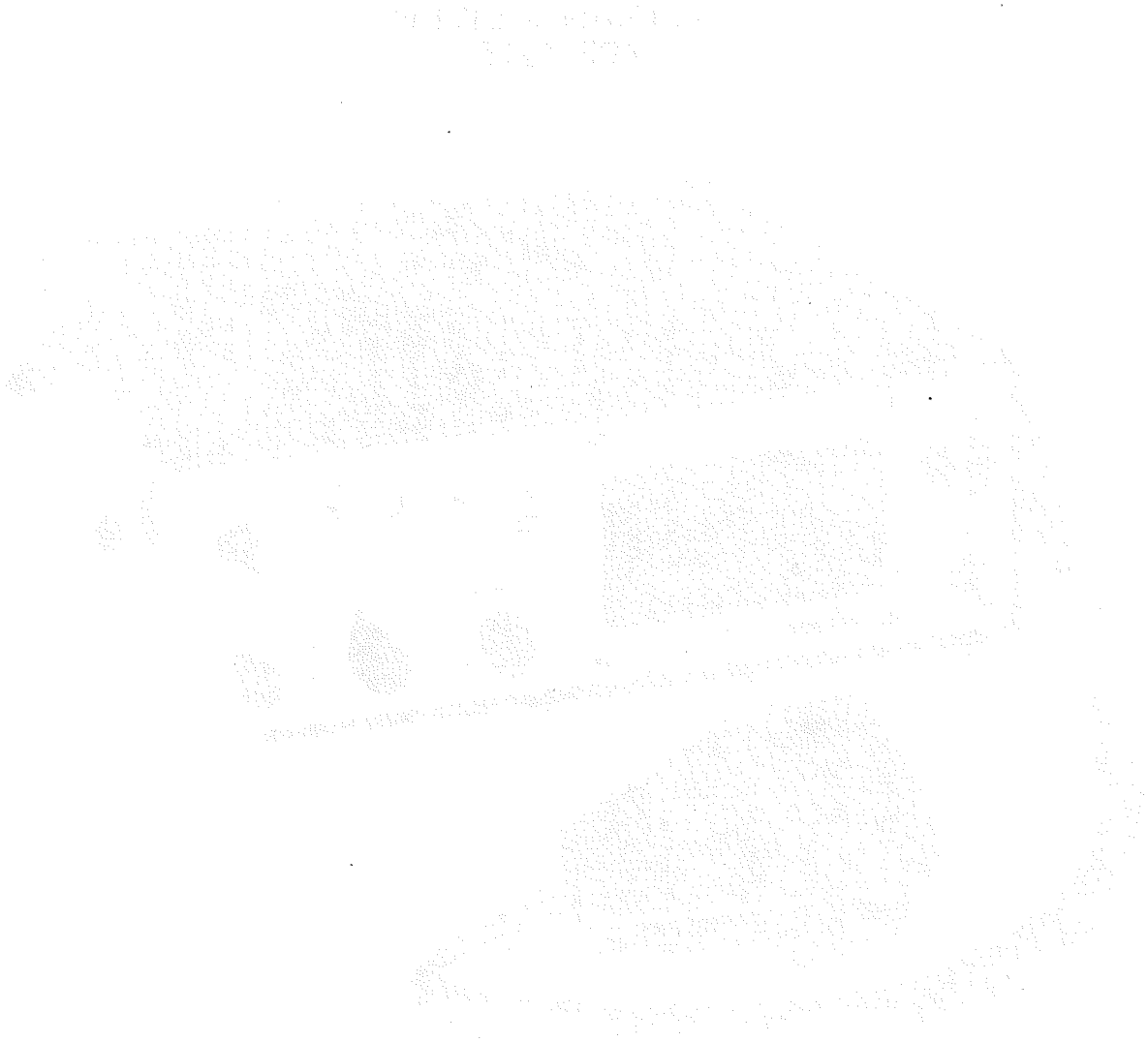
# SSB TRANSCEIVER
# TYPE 7515



# 1. GENERAL INFORMATION

## 1.1 Introduction

The 7515 SSB transceiver is a fully solid state 50 W PEP unit for fixed or mobile use in land services, using a 12 Volt dc power source. A range of options and accessories are available to cater for different applications. Special versions are available or can be manufactured where the standard equipment does not meet the operational requirements.

This manual is divided into sections covering the Specifications, Brief Description, Detailed Technical Description, Maintenance and Adjustments, Parts Lists and Circuit and Layout Diagrams. Each page of text has an indication of the contents on the top outer corner for easy reference. Special versions are not covered by this handbook.

Installation information and operating instructions are contained in the Installation Manuals and operating instruction cards supplied with each transceiver.

To minimise the chance of misunderstandings all correspondence must include the type and serial number of the transceiver and the issue number and latest amendment number of the handbook where this is referred to.

Additional unbound circuit diagrams are included at the rear of this manual. If required, full size prints (paper size A1 & B) may be purchased separately.

## 1.2 Specifications

### 1.2.1 General

Design figures are quoted with limit figures in brackets, all tests are carried out at 13.0V dc input. Specification is subject to change without notice.

| | | |
|---|---|---|
| Frequency range: | | 2...11 MHz |
| Crystal capacity: | | 10 |
| Channel capacity: | | 10 single frequency simplex, or 5 two frequency simplex, or any combination that does not exceed the crystal capacity. |
| Operating modes: | | Compatible AM (A3H)<br>Single sideband (A3J) USB or LSB |
| Frequency stability: | | ±50 Hz, in range 5...55°C<br>±60 Hz, in range 0...60°C<br>with ±10% input voltage variation |
| Controls: | | Power ON/OFF and VOLUME<br>Mode: SSB, TUNE, *AM, *LSB/USB<br>CHANNEL SELECT<br>* CLARIFIER<br>* EMERGENCY CALL (RFDS)<br>NOISE LIMITER ON/OFF<br>MUTE ON/OFF<br>(* options) |
| Indicators (illuminated) | | Power<br>Transmit |
| Connectors: | Side | Microphone |
| | Rear | Antenna<br>Power input<br>Extension LS (Optional)<br>Antenna Select (Optional) |
| RF input/output impedance: | | 50Ω nominal. The transceiver will operate with a load impedance producing a VSWR of less than 2:1. |
| Input voltage: | | Nominal 13.0V dc. The transceiver will operate with input voltages between 11V and 15V positive or negative ground, reverse polarity protection is provided. |
| Power Consumption: | | Receive, 270mA no signal<br>Transmit, A3J average 3A<br>A3J two-tone 5.5A (nominal) |

1.2.1 (cont.)

Environmental:

| Ambient Temperature °C | -10 to +30 | +30 to +60 |
|---|---|---|
| Relative Humidity % | above 95 | from 95 at 30°C to max. 50 at 60°C |
| Atmospheric Pressure | 645 millibars (3600 m above sea level) with maximum temperature derated by 1°C for every 330 m above sea level. | |

Cooling: Convection

Size and Weight:

| | |
|---|---|
| Width | 270 mm |
| Height | 95 mm |
| Depth | 325 mm |
| Weight | 4.1 kg |

1.2.2 Receiver

Type: All transistor, single conversion superheterodyne.

IF: 1650 kHz

Sensitivity: An aerial emf of less than 0.5µV from a 50Ω source will produce a signal plus noise/noise ratio of 10dB (A3J).

Maximum input: 10V rms.

Selectivity: A3J, better than 70dB (60)
-1, +5 kHz
better than 6dB (8),
300...2800 Hz.

Image Rejection: Better than 60dB (55).

Spurious Signal Rejection: Better than 65dB (60).

* Cross Modulation: A signal 75dB (65), above a signal producing a 10dB S+N/N ratio modulated 30% and removed at least 20 kHz from the wanted signal will produce an increase in receiver noise of less than 3dB.

* Intermodulation: To produce a third order inter-modulation product equivalent to a wanted signal producing a 10dB S+N/N ratio, two unwanted signals greater than 30 kHz removed from the wanted signal must have a level greater than 65dB (60) above the wanted signal.

1.2.2 (cont.)

| | | |
|---|---|---|
| * | Blocking: | A signal 85dB (70) above a signal producing a 10dB S+N/N ratio and removed at least 20 kHz from the wanted signal will cause a change in output level of the wanted signal of less than 3dB. |
| | AGC: | Less than 3dB (6) variation in output for signal strength variations between 3µV and 100mV. |
| | AF Power and Distortion: | 2.5 Watts at less than 5% THD. |
| | AF Response: | 300...2800 Hz, $^{+0}_{-3}$dB |

Clarifier Range

| | | |
|---|---|---|
| | CAN: | Nominal ±0.0007% of SCF or ±25 Hz whichever is greater, continuously variable. |
| | CAW: ** | Nominal ±0.003% of SCF, continuously variable. |

** Export Only

* These parameters are measured in terms of Australian Department of Communications Specification RB209, RB209-0.

1.2.3 Transmitter

| | |
|---|---|
| Type: | All solid state including power stages. |
| Power Output: | SSB (A3J): 50 Watts PEP ±1dB.<br>AM (A3H): 12.5 Watts ±1dB. |
| AF Response: | Overall response of transmitter rises at approximately 6dB/octave from 300 Hz...2800 Hz. At higher frequencies cut-off is very rapid. |
| Harmonic Emissions: | 55dB (45) below PEP. |
| Spurious Emissions: | Spurious emissions (not harmonics) separated from the carrier by more than 20 kHz, 50dB (43) below PEP. |
| Carrier Suppression: | 50dB (40) below PEP. |
| Unwanted Sideband: | 45dB (43) below PEP. |
| Intermodulation Products: | 33dB (31) below PEP. |

1.2.3 (cont.)

| | |
|---|---|
| ALC Range: | 30dB change in input signal produces less than 1dB change in output. |
| Clarifier Range: | As for Receiver Specifications above NOTE: Only available when Option CB fitted. |
| Microphone: | Rocking armature, with push-to-talk fitted to case. |

## 1.3 Options and Accessories

### (a) Options

| Code | Option |
|---|---|
| A | AM |
| L | LSB |
| U | USB |
| LU | LSB in addition to USB |
| BA | One single frequency simplex channel (specify frequency). |
| BB | One two frequency simplex channel (specify transmit and receive frequencies). |
| CAN | Clarifier, narrow, receive only. |
| CBN | Clarifier, narrow, transmit and receive. |
| CAW | Clarifier, wide, receive only. |
| CBW | Clarifier, wide, transmit and receive. |
| E | Emergency Call Facility. |
| AS | Antenna selector. |
| PL | Extension loudspeaker socket. |
| PB | Balanced Audio Output Low Z or 600Ω. |
| N | Noise Limiter. |
| Q | Mute facility. |
| RA | Extended local control of power, noise limiter, mute and clarifier where fitted. Requires Code 614 or Code 615 extended local control head. NOTE: Option AS is only available on 3 channels when Option RA is fitted. (Channel selection from Control Head is not available). |

### (b) Accessories

| Code | Accessory |
|---|---|
| 057 | Technical Service Manual |
| 030 | Installation Manual |

1.3 (b) (cont.)

| | |
|---|---|
| 400/1 | Centre fed dipole antenna. |
| 402 | End-fed broadband antenna system complete with 30 metres of RG58 cable and connectors. Range 2...10 MHz. |
| 403 | End-fed long wire antenna kit (specify frequencies), requires a Type 7208 Antenna Tuner. |
| 600 | Telephone handset with PTT. |
| 601 | Desk microphone with PTT. |
| 107 | Vehicle mounting kit. |
| 306/1 to 5 | Helical whip antennas 1.83 metres in length, suffix number indicates number of frequency taps provided. |
| 304 | Base loaded 2-frequency mobile whip antenna, 3.35 metres in length with automatic (relay switched) frequency selection. Supplied with base mounting assembly. Requires option AS to be fitted. |
| 301 | Spring mounting base for all Code 300 series antennas - supplied with UHF type coaxial connector. |
| 401 | "Quick-to-erect" dipole antenna kit type LW/5 supplied with 10 metres of RG58 cable and connectors. |
| 502X | AC Power Supply Type 7202 supplied with inter-connection cable. |
| 603 | Extension loudspeaker. |
| 614 | Extended local remote control head. (Desk Mounted) |
| 615 | Extended local remote control head. (Vehicle Mounted) |
| 704 | Interference Suppression Kit. |

(c) Standard Accessories

(i) Supplied with each transceiver,

Hand microphone with PTT switch,
12V dc power cable,
Installation manual.

## 1.4 Definitions

The following abbreviations may be encountered in this handbook.

| | |
|---|---|
| ac | Alternating current |
| AF | Audio frequency |
| AGC | Automatic gain control |
| ALC | Automatic level control |
| AM | Amplitude modulation |
| C | Capacitor |
| CH | Channel |
| CRO | Cathode-ray oscilloscope |
| CW | Continuous wave |
| D | Diode |
| dc | Direct current |
| DSB | Double sideband |
| emf | Electro-motive Force |
| F | Fuse |
| FL | Filter |
| IC | Integrated circuit |
| IF | Intermediate frequency |
| L | Inductor |
| LP | Lamp |
| LPF | Low pass filter |
| LS | Loudspeaker |
| LSB | Lower sideband |
| PA | Power amplifier |
| +ve | positive |
| -ve | negative |
| PCB | Printed Circuit Board |
| PEP | Peak envelope power |
| PL | Plug |
| PTT | Push-to-talk |
| R | Resistor |
| RF | Radio Frequency |
| rms | Root mean square |
| RV | Resistor, variable |
| Rx | Receive or receiver |
| SCF | Suppressed carrier frequency |
| SK | Socket |
| S+N/N | Signal plus noise, over noise |
| SSB | Single sideband |
| SW | Switch |
| T | Transformer |
| THD | Total harmonic distortion |
| TP | Test point |
| TS | Tag strip |
| Tx | Transmit or transmitter |
| USB | Upper sideband |
| V | Transistor |
| VSWR | Voltage standing wave ratio |

| | |
|---|---|
| A3 | AM, carrier plus upper and lower sidebands |
| A3H | Compatible AM, carrier plus one sideband only |
| A3J | SSB, suppressed carrier |

| | |
|---|---|
| CLARIFIER | A device to finely adjust the frequency of the received audio. |
| MODULATOR | A device used to vary the RF carrier at an AF rate. |
| DEMODULATOR | A device to detect the AF variations of a RF carrier. |
| MIXER | A device to mix two RF signals and produce the sum and difference frequencies (one of which is selected by a tuned circuit). |

# 3. BRIEF DESCRIPTION

## 3.1 General

This description should be read in conjunction with Block Diagram 03-00359.

The 7515 uses the same frequency conversions in both the transmit and receive modes, therefore many circuits are common to both modes of operation. Signal routing is determined by switching voltages according to the mode selected and the state of the microphone PTT button.

## 3.2 Transmit

The audio signal is amplified and levelled in the Microphone Compressor amplifier stage and fed to the Balanced Modulator. The Carrier oscillator provides the 1650 kHz IF carrier for the Balanced Modulator, where it is modulated by the audio signal to produce a double sideband (DSB) signal centred on 1650 kHz, the carrier being suppressed. The DSB signal is then fed to a SSB filter which passes only one sideband, either upper or lower (USB or LSB), the resultant SSB signal being fed to the IF amplifier.

In the IF amplifier, carrier may be added to the sideband to generate AM compatible signal i.e. A3H, and to facilitate antenna tuning.

The amplified IF signal then passes to the Double Balanced Mixer where it is mixed with the Channel Oscillator output to produce the sum and difference frequencies. These products are then fed to the tuned RF amplifiers which remove the sum ("image") frequency and any unwanted products generated in the previous circuitry. The remaining difference frequency is then fed to the PA.

The PA has four stages of amplification consisting of a Gain Control Amplifier, followed by a class A and two Class AB stages. Each class AB stage is biased from independent temperature compensated bias supplies. The bias supply of the output stage is also used to drive a lamp to indicate when RF power is being developed.

The signal from the output stage is fed to the load via a switchable low pass filter, which removes harmonics generated in the PA so only the wanted signal reaches the antenna.

The ALC/SWR detectors provide a control signal which is processed, amplified and used to adjust the gain of the Gain Control Amplifier. The ALC action ensures that the maximum possible power, within the ratings of the transceiver, is delivered to the antenna over a wide range of antenna loading without degradation of the quality of the output signal.

## 3.3 Receive

The RF signal from the antenna passes via the ALC detectors (inoperative in receive) to the PA Filter. The signal is then directed by the T/R relay through the Broadcast Filter to the Main PCB. The signal is then coupled via the RF tuned circuits and RF amplifier to the Double Balanced Mixer. The tuned circuits provide attenuation of unwanted signals, particularly the image frequency.

The Double Balanced Mixer mixes the Channel Oscillator with the signal to produce a signal at the IF (1650 kHz). This is amplified and then fed to the noise limiter prior to being filtered by the Crystal Filter.

The noise limiter is designed to suppress impulse noises such as motor vehicle ignition noise. The limiter operates by "breaking" the IF signal path for the duration of the noise pulses.

The Crystal Filter provides a high degree of selectivity, passing only the wanted signal on to the tuned IF amplifier. Following amplification the signal is peak detected by the AGC detector which controls the gain of the RF amplifier and the tuned IF amplifier.

The IF signal is either envelope detected in the AM mode or mixed with the carrier oscillator in the Balanced Mod/Demod in the SSB mode to produce the audio signal.

The audio signal is then passed through a Mute circuit which breaks the audio signal path when there is no signal present. The signal is then fed via a Power Amplifier to the loudspeaker.

# 4. TECHNICAL DESCRIPTION

## 4.1 General

The following description is divided into sections:

4.2 Switching
4.3 Receive
4.4 Transmit
4.5 PA

As the MAIN PCB is used in both the 7515 and 7727-B/7727-TB transceivers, some sections of the following text may appear irrelevant, since the 7515 has provision for AM whereas the 7727-B/7727-TB does not.

The circuit diagrams referred to in the text are:

04-01182 MAIN PCB
04-01236 PA & CHASSIS

## 4.2 Switching

### 4.2.1 Switching Voltages

All switching voltages are designated by a letter tabulated below. The derivation of each voltage and its function follows the table.

| Designation | Voltage state (with set ON) |
|---|---|
| A | Unregulated supply, continuous. |
| B | Regulated supply, continuous. |
| C | Positive on recieve (gnd on Tx). |
| D | Positive on transmit (gnd on Rx). |
| E | Positive only on AM receive. |
| F | Positive only on SSB receive. |
| G | Positive except during AM receive. |
| H | Positive except during AM transmit. |

A : The unregulated supply is fed to:-

(a) The PA PCB

(b) The Main PCB for the AF amplifier and Regulator.

B : is derived from A, via the regulator and is fed to:-

(a) Channel oscillator and amplifier via 2R66.

(b) Clarifier via 2R69.

(c) Channel oscillator selector, via 2R46 and SW1b.

(d) 2V25 to provide C on receive.

(e) Balanced modulator-to-filter gates 2D57 and 2D58, and the inhibit gate 2V21, via 2R115.

(f) Mode switch SW2 to provide H (during SSB).

(g) Power ON lamp (LP2) via SK7/5 and 1R1.

(h) Mode Switch SW2 to provide E (SSB)

C : is derived from B at 2V25 which is held conducting by 2R127 grounded by D. C is grounded during transmit, (D high turns 2V25 off and 2V26 on). C is fed to:-

(a) 1st IF amp via 2R37.

(b) 2nd IF amp and AGC amp.

(c) RF amp via 2R13.

(d) Balanced modulator-to-filter gate 2V21 via 2R114 to inhibit the gate during receive.

4.2.1 (cont.)

(e) Channel switch, SW1c via 1R3 for two frequency simplex receive channels.

(f) Transmit/receive gates (2D19, 2D4, 2D5) on the RF tuned circuits.

(g) Clarifier steering diode, 2D50.

(k) Noise Limiter via 2R210 and 2R206.

(l) Mode switch SW2 to provide F (SSB) and E (AM).

(m) Mode switch SW2 to provide H (AM).

D : is produced directly from B when the PTT button is operated, D is grounded during receive, (2V27 held on by C via 2R129). D is fed to:-

(a) 3V7 via 3R17 to provide power to the PA and drive the Transmit/Receive Relay.

(b) AF amp via 2D65 as an inhibit.

(c) Transmit IF amp via 2R84.

(d) Transmit RF amp via 2R23.

(e) Clarifier steering diode 2D47.

(f) Receive inhibit gate 2D2 and 2D4.

(g) 2D55 to produce G.

(h) Channel switch SW1d via 1R4 for two frequency simplex transmit channels.

E : is derived from C, via SW2 AM
or B via SW2 SSB

It is therefore positive when FL2 is required, except on AM transmit.

F : is derived from C, via SW2 during SSB and is fed to:-

(a) 2D53 to produce G.

(b) 2D54 AM detector diode (disable).

G : is received from D, via 2D55 during transmit,
or F, via 2D53 during SSB receive.

It is therefore positive except during AM receive and is fed as supply to the 1650 kHz carrier oscillator.

4.2.1 (cont.)

H : is derived from B, via SW2 SSB
or, C, via SW2 AM

It is therefore positive except during AM transmit and is fed to the carrier re-insertion gate 2V24 via 2R125, as an inhibit.

The switching table should be kept to hand when reading the Technical Description.

4.2.2 Channel Selection

Single Frequency Simplex

The B voltage at SW1b is fed to the selected contact and supplies:-

(a) The desired channel crystal,
(b) The desired channel RF coil gates.

SW1 also selects the appropriate PA Filter.

Example

Select Channel 2 with the Channel Switch. The B supply from SW1b will connect Channel 2 crystal to the oscillator circuit via R48 and D37. The Channel 2 AE coil will be enabled via the internal resistor, L3 and (a) D8,D5,R13,R9 to C on transmit,
or (b) D9,L8,R10, to D, and
D8,D2,T1 and R3 on receive.

Channel 2 RF coil will be enabled via the internal resistor, L12, and

(a) D22,R25,L10 and
(b) D23,R26,T3 for transmit and receive.

Two Frequency Simplex

In this mode, different channel frequencies are used for transmit and receive. During receive, SW1c fed from C via 1R3 (+ve Rx) selects the receive channel crystal and RF coils. During transmit SW1d fed from D via 1R4 (+ve Tx) selects the transmit channel crystal and RF coils.

## 4.3 Receive

### 4.3.1 Broadcast Filter

Fitted on the PA Filter PCB is a high pass filter designed to eliminate interference from broadcast stations below 2 MHz. The antenna is connected to the receiver via the PA filter, relay contact A1 and this filter.

### 4.3.2 RF amplifier

The received signals are fed in via T1. Diodes D1 and D3 placed back to back across T1 secondary to prevent a severe overload from damaging V3. The signal is passed via gate D2 to the selected RF coil and via C17 to the base of V3. The signal is amplified by the forward gain controlled RF amplifier V3 and fed via D19 to the selected RF coil and then via R26, C30 to the balanced mixer input at T3.

### 4.3.3 Balanced Mixer

T3 is connected across diode ring D32-35 which is in turn connected across T4. The centre tap of T4 is connected to the channel oscillator so the required mixer product, centred on 1650 kHz, is developed across the tuned side of T4.

### 4.3.4 1st IF amplifier

The IF signal from T4 is passed via C33 and R32 to the base of V8, the first stage of the feedback pair V8 and V9. The dc feedback via R38 and ac feedback via C36, R39 and R40 set the stage gain. The output signal from V9 collector is fed via the Noise Limiter to the Crystal Filters.

### 4.3.5 Noise Limiter (Option N)

A balanced series gate is formed by D204, D205 and T201, T202. In the absence of noise pulses D204 and D205 are forward biased by R205 thus forming a low impedance path through the gate and permitting normal receiver operation. A reference voltage for the cathodes of D204 and D205 is provided at the centre tap of T202 by R215 and zener diode V204.

The signal (containing noise pulses) is fed to the base of V203, the collector load of which is tuned by L201 and C206 to the 1650 kHz IF. The parallel tuned circuit at the input of V203 (L202 and C210) is also tuned to 1650 kHz to reject any channel oscillator signals which may be present at the output of the balanced mixer. Both the base and collector tuned circuits operate at low "Q" thus avoiding the need for adjustment.

The output of V203 is fed via C207 to the base of V202. The resultant signal is clamped to ground by D203 such that only the positive going peaks of the signal and noise pulses are amplified by V202.

4.3.5 (cont.)

Transistor V202 serves a dual purpose by means of two collector circuits isolated from each other by D202.

(a) The positive going noise pulse at the base of V202 produces negative going pulses across R205 which results in D204 and D205 being reverse biased thus opening the gate for the duration of the noise pulse. The RF is bypassed by C212 such that only the envelope of the noise pulse remains.

(b) The negative going signal and noise pulses at the collector of V202 charge C202 via R204. A long time constant is chosen so that the voltage fed to the base of V201 corresponds to the average level of the signal and is not affected by narrow noise pulses. This voltage is amplified by V201 and is used to control the gain of V203. The AGC voltage derived in this manner always maintains the gain of V203 so that over a very wide range of signal input levels, only noise pulses will be of sufficient amplitude to operate the gate. Divider R201 and R202 set the "no signal" AGC voltage at the base of V203.

The noise limiter is disabled by grounding the base of V201 via R203. This turns V201 hard on effectively connecting the AGC line to rail. The gain of V203 is reduced so that its output is insufficient to drive V202.

4.3.6 Crystal Filters

The SSB filters are designed to pass one sideband only, 300 Hz to 2.8 kHz either side of 1650 kHz. They attenuate the carrier frequency 20dB and the unwanted sideband approximately 55dB. The AM filter passes both sidebands plus carrier, 3 kHz both sides of 1650 kHz and can therefore pass A3 and A3H signals.

4.3.7 2nd IF amplifier

V17 is a forward gain controlled amplifier and the amplified signal is developed across the tuned primary of T5. V18 is a conventional amplifier and accepts signals from T5 via C65, the amplified signal is then developed across the tuned primary of T6.

4.3.8 AM detector (when fitted)

D54 is a conventional diode envelope detector fed by T6, the AF voltage appearing across the diode load R101, R130 and R138. C103 couples the AF signal to the VOLUME control. D54 is back-biased in the SSB mode by the G rail via R99 and R100, (derived from the F rail via D53). In the AM Mode the carrier oscillator is inhibited.

4.3.9 SSB demodulator

IF signals from T6 secondary are fed via R98, C74 and T7 (D58 gate is inhibited) to the balanced modulator/demodulator to be mixed with 1650 kHz from the carrier oscillator. The demodulated AF signal from the diode ring is fed via C76 and C103 to the VOLUME control. C75 limits the frequency response of the demodulator.

4.3.10 AGC amplifier

The IF signal from T6 in the receive mode is fed via R102 to the base of V19, which will conduct only on the positive half cycles of signals which exceed 1.2V pp. The collector current of V19 charges C71 and also C72 via R103. The voltage across these capacitors feeds the base of V20. The AGC line, in the absence of a signal is held at approximately 2.2V by the voltage divider R110 and R109; this produces the desired static gain in both controlled stages. As the signal increases, the voltage across C71 increases and turns on V20 to increase the AGC voltage developed across R109.

The AGC voltage is applied to the RF amplifier and to the first stage of the 2nd IF amplifier. The AGC loop gain is high and the IF output from T6 is held virtually constant for a 100dB change in input signal.

The attack time is very fast determined primarily by R106 and C71. The release time is controlled by a double time constant of approximately 220mS and 2.2 Secs. Wanted signals normally have time to charge C72 via R103 and when the signal ceases, C72 discharges via R103 and R105 to hold V20 conducting for the longer release time. Short static pulses only have time to charge C71 (but not C72), and discharge quickly via R105 resulting in a short release time. In this way the receiver is desensitised only for a minimal time due to static, but on wanted signals the longer time constant prevents an upsurge of background noise between words and sentences.

4.3.11 Mute

The FET 9V5 is in series with the audio path before the audio amplifier and is used as a switch, governed by the voltage at its gate.

The audio signal is buffered and limited prior to being fed to the active bandpass filters, one centred on 815 Hz and the other 2.35 kHz. The 815 Hz filter has a further amplifier, 9IC1c, to allow a wide range of adjustment of sensitivity.

The outputs from the filters are rectified and filtered by 9IC3a and 9IC3b, and the D.C. levels compared by 9IC3c. The outputs of 9IC3c and 9IC1 are then 'OR'ed and amplified by 9IC3d which in turn feeds the gate of 9V5.

4.3.11 (cont.)

When there is no voice present in the audio, the noise signal is generally wide band, so the output from the active filters/rectifiers are equal (this may be adjusted by the senstivity control). This implies the output from 9IC3c will be 0V and from 9IC3d is +10.5V. This turns 9V5 OFF. When voice is present, more energy exists in the 800 Hz area, so the outputs from the filters/rectifiers are no longer equal, the output from 9IC3b being more positive. Thus the output from 9IC3d drops to 0V turning 9V5 ON. The mute may be disabled by grounding the input of 9IC1a, permanently turning 9V5 ON.

4.3.12 Audio amplifier

The DC supply derived from the A rail (via relay contact B2) is always on. The fuse F1 is fitted only as a precaution, to guard against an accidental short circuit on the A rail.

AF signals from the volume control are fed via R139 and C93 (which with C92 limits the frequency response) to the input of IC2. The amplified output is developed across T8 primary, the amplifier frequency response is limited by the feedback capacitors C99 and C97 and the gain is set by C95 and R142. The loudspeaker is only connected when the microphone plug is inserted into SK11 and is fed from the secondary of T8. During transmit, the D rail fed via D65 and R140 causes V33 to conduct and inhibit the AF input to IC2.

## 4.4 Transmit

### 4.4.1 Microphone Amplifier

The microphone input is fed to the Main PCB at SK6/1 and 2. The common mode choke, T9, and capacitor C85, provide further rejection of R.F. before being fed to the 748 operational amplifier, via C86. The gain of IC1 is defined by the ratio of R133 to R132 and high frequency roll-off is provided by C88 and C145. The dc output voltage is set at +5.5V through R131 to the non-inverting input of IC1. When the output voltage rises to 7.5V due to audio peaks, V28 turns on and charges C90.

The FET, V29, is connected as a voltage controlled resistor and is part of a variable attenuator formed by R169 and R131. With no audio present, the gate is held at -5.5V relative to the source and drain, so V29 represents a very high resistance and the attenuator provides minimum attenuation. When the gate voltage is brought closer to the source voltage, the drain-source resistance drops giving greater attenuation. As the gate voltage is derived from C90, the FET resistance only drops when the output from IC1 exceeds +7.5V. This FET attenuator thus provides the function of an audio compressor, the audio output limited to 4V pp. R136 and R137 provide a fast attack-slow release characteristic, and the reference voltages are provided by R166, R167, R168, C87 and V39.

In the AM mode, V32 is saturated via R150, thus connecting a shunt, R151, across the output of the microphone amplifier. The value of R151 is chosen to set the output of the main PCB in the SSB and AM modes to be equal.

The audio signals also appear across the volume control but the AF amplifier is in-operative during transmit. The G rail voltage fed via R99 and R100 back bias D54 to provide isolation between the input and output of the balanced modulator.

### 4.4.2 Carrier Oscillator

The frequency of the 1650 kHz crystal oscillator V22 is adjusted by C79a, b and c in the capacitor feedback divider network (with C77 at 1/3rd capacity). Fine frequency trimming is then made by C77 alone. V22 is biased by R119, V38 and R120, with C78 and C79 providing the feedback necessary for oscillation.

The RF output is buffered by V23 emitter follower and fed via R122 and C80 to the balanced modulator. C82 adjusts the carrier re-insertion level fed out via C81 in the AM transmit mode. In other modes, V24 is held conduction to prevent carrier re-insertion (by H via R125). The carrier oscillator is supplied from the G rail and is therefore not operated in the AM receive mode.

### 4.4.3 Balanced Modulator

The carrier oscillator output is fed to the junction of R116 and R117 connected across two arms of the diode ring D59-D62. The diode ring is switched at carrier frequency, thus modulating the audio signal across the opposite arms of the ring. A double sideband (DSB) signal (1650 kHz + AF and 1650 kHz - AF) is developed across the primary of T7, with a carrier suppression of typically 30dB.

During transmit the balanced modulator-to-filter gate is enabled by the B rail fed via R115, D58, R98, T6 to ground and via D57, R113 and L18 to ground. (V21 is held non-conducting by the C rail at ground potential). The DSB signals pass via C74, D58, D57 and R113 to the filter selection network.

### 4.4.4 Filter Selection (when fitted)

With the E rail floating, V34 is held off by R160, so the collector of V34 is held high via R163. Therefore D68 and D71 are off and D69 is on resulting in the filter FL2 being isolated from RF. V35 is held on by R159, which turns D67 and D70 on and D72 off, resulting in FL1 being in the RF path. Thus, with the E rail low, FL1 is on, FL2 is off. Taking the E rail high inverts the result. C108 and C107 provide optimum operating conditions for the filters.

### 4.4.5 Transmit IF amplifier

The signal from the SSB filter is fed via C55 and R83 to the emitter of V16. V16 operates in the common base configuration for IF signals and in the common emitter configuration for the re-inserted carrier in the AM mode. Resistive divider R80, R81 and R82 set the operating point for V16 and hence V15. V15 provides a high impedance current drive to T4, thus minimising the damping of the tuned circuit. This stage is supplied by the D rail in the transmit mode.

### 4.4.6 Channel oscillator

The required channel crystal is diode switched into the crystal oscillator V11 by the B rail, (SK4/1, R47, D36 for channel 1 etc). The circuit oscillates at the crystal frequency, temperature compensated and frequency adjusted by C134b, c and d, with C134a at 1/3rd capacity. Fine frequency trim is then made by C134a alone. The RF voltage is fed via C47 to the base of the common emitter amplifier V12. The amplified RF voltage is rectified by D45, filtered by C48 and fed to the base of V13 via R145 to produce a control voltage proportional to the RF amplitude. This voltage, amplified by V13 provides the DC control voltage for the base of V11 oscillator via R55 and R53, it tends to maintain the oscillator amplitude constant.

4.4.6 (cont.)

The gain of V11 is controlled by reverse AGC. However, if V11 is not oscillating (e.g. immediately after switch-on), there will be no signal derived AGC voltage and hence V11 would be bottomed by the bias voltage developed across R61. Under this condition it would have no gain and oscillations could never start. R54 and D42 ensure that bottoming cannot occur by preventing the base voltage from exceeding the collector voltage. C44 is necessary for circuit stability.

The RF voltage at the collector of V12 is also coupled via C49 to the base of V14 and a high impedance constant current drive is obtained via C50, to the balanced mixer. Frequency control via the CLARIFIER is obtained by varying the reverse bias on the Varicap diodes D43 and D44. The variable capacity thus obtained is coupled to the oscillatory circuit via C46.

Refer to para 4.2.2 for two frequency simplex switching of channel oscillators.

4.4.7 Clarifier

Five configurations are available, the components required for each are shown in the table on the circuit diagram.

The clarifier dc supply is from the B rail via a zener stabilised circuit R69 and V37. Steering diodes D47-D50 are energised to switch between a fixed voltage source (divider R67, R68) and a variable voltage source to control the Varicap diodes.
Only those components needed for the clarifier option ordered will be fitted.

(a) No clarifier : The Varicap diodes D43 and D44 are omitted and a fixed capacitor C45 (82pF) is fitted.

(b) Narrow range clarifier, Rx only : In the receive mode, R75, R74, 1RV2 and R72 form a variable voltage divider. R74 swamps 1RV2 thus minimising variations in the limit voltage due to the tolerance of 1RV2. The variable voltage from 1RV2 wiper, varies the capacitance of D44 in parallel with C45. The D rail at ground, reverse biases D48 and grounds the voltage from the fixed divider R67 and R68 via D47.

In the transmit mode, D48 is forward biased and supplies a fixed voltage to the Varicap diode while the C rail at ground isolates the voltage from 1RV2.

(c) Narrow range clarifier, Tx and Rx : Only one diode R49 is fitted and the variable voltage from 1RV2 is fed to Varicap diode D44, (Tx and Rx).

4.4.7 (cont.)

(d) Wide range clarifier, Rx only : Operation is similar to that described in (b), except that R72, R74 and R75 are omitted giving wider voltage variation from 1RV2. In addition C45 is replaced by a Varicap diode D43. A wider frequency range is thus effected. R73 is fitted to assist linearity.

(e) Wide range clarifier, Tx and Rx : Operation is similar to that described in (d), with components as in (c), i.e. only D49 is fitted to obtain clarifier operation on transmit and receive.

4.4.8 Balanced mixer

The channel oscillator output is fed to the centre tap of T4 which is connected across diode ring D32-D35. SSB signals are also fed to the diode ring via T4. The sum and difference products from the mixer are fed via wide band transformer T3, R26 and C30 to the channel gates D21-31, 82-88 (omitting alternate numbers). The required mixer product is developed across the appropriate RF tuned circuit (L11-16, 23-26) via the corresponding gate selected by the channel switch. (See Sec. 4.2.2).

4.4.9 Transmit RF amplifiers

The dc supply is derived from the D rail via R23, this fed via R24 also opens the input gate D18 (circuit completed via R25 and L10). The signal from the RF tuned circuit (L11-16, 23-26) is coupled via D18 to the base of V4 which amplifies the signal and developes it across the second RF tuned circuit (L2-7, 19-22) which is coupled into operation by D5 conducting (via R13, L9 and C rail at ground). The signal is fed via C6 to the base of V2, the first stage of a dc coupled feedback pair V2 and V1. R1 increases the output impedance of the amplifier to 50 ohms which then drives the LPF formed by C1, C2, C148, C149, L27 and T2. This filter removes any products exceeding 16 MHz which may be generated by the mixer circuitry.

## 4.5 PA and Filter

### 4.5.1 PTT Control

Except for the output transistors V4 and V5, the supply voltage to all parts of the PA assembly is controlled by the series switch V6. In the transmit mode the PTT line is at 11.5V, thus V7 conducts causing base current to flow in V6 which is driven into saturation.

### 4.5.2 Gain Control Amplifier & Input Stage

The leakage inductance of T1 together with C1, C2 and C3 form a low pass filter to further attenuate any unwanted high frequency signals from the exciter. The gain of IC1 is determined by the voltage at pin 7 which is generated by the ALC circuitry, such that the maximum safe PEP output is maintained for any load.

The output from pin 3 is fed via R4 and C8 to the base of V1. R4 and R5 together with the feedback resistor R6 determine the gain of the stage.

### 4.5.3 Driver Stage and Driver Bias

Transistors V2 and V3 operate in push-pull class AB.

The bias voltage is provided by V8 connected as a diode. The bias voltage (and hence the driver standing current) may be increased or decreased by fitting SOT resistor R28.

### 4.5.4 Output Stage and Bias Regulator

V4 and V5 form a transformer coupled push-pull amplifier biased to operate in class AB. The dc supply to the output transistors is taken from the unregulated supply rail via a fuse and T4 which is the output transformer. Negative feedback from collector to base of the output transistors is provided by a winding from T4 and R11.

The bias regulator is a conventional series regulator, using the base-emitter junction of V9 as the reference. This is compared against a sample of the output voltage at the emitter of V10 to generate the appropriate control signal. If more current is demanded of V10, its emitter voltage and hence the base voltage of V9 will tend to fall. Thus V9 will bleed less base current from V10, enabling it to provide the extra current demanded. V9 is thermally bonded to the heatsink and provides temperature compensation for the output transistors. Zener diode V13 prevents power supply fluctuations affecting the bias voltage. Fine adjustment of the bias voltage is provided by R34.

The dc component of the drive current (i.e. the collector current of V10) passes through R36. The resulting voltage across R36 drives the TRANSMIT lamp via the emitter follower V11. Hence the lamp brilliance varies with power output. Zener diode V14 protects the lamp from overvoltage.

4.5.5 PA Filter

The PA filter is a Π-section filter. The input element consists of C1-3 and the output element is C5-7. The series element is formed by the parallel combination of C4 and the total of the inductors L1-4.

Only the value of the inductor is changed with frequency, this being achieved by selecting the appropriate tap with one wafer of the channel switch.

4.5.6 ALC Circuits

a) Detectors

A composite ALC signal is derived from three detectors.

(i) Voltage Detector
The voltage at the collectors of V4 and V5 is sampled by a winding on T4 and rectified by D2. R17 provides a constant source impedance.

(ii) Current Detector
The output current passes through the current transformer T5. The output from T5 is rectified by D3.

(iii) Reflected Power Detector
A voltage proportional to the reflected power is developed across T6 and the secondary of T7 and is rectified by D4.

Under normal load conditions (50Ω) the voltage detector and current detector outputs are nearly equal, and either one may operate the ALC and set the maximum power into a 50Ω load. These detectors also assist in selecting the required tap on the PA filter.

When a mismatch load is applied the output from the reflected power detector increases and takes control of the ALC.

b) ALC Processor

A reference voltage, which is proportional to the supply voltage when the supply voltage is low, and constant when the supply voltage is high, is generated by R26, R27 and V12. This voltage is fed to the inverting input of IC2a via R25 and R20.

The ALC detector "peak" voltage is divided by R23 and R24 and applied to D7. The detector voltage is also fed to D6 via the "averaging" circuit R22 and C21. The "peak" and "average" voltages are OR-ed by D6 and D7 and applied to the non-inverting input of IC2a. Negative feedback is applied around IC2a by R19 to set its gain.

4.5.6 (cont.)

The output of IC2a is fed via R18 and D5 to IC2b which is connected as a voltage follower. The output from IC2b controls the gain of IC1. Diode D5 generates a fast attack and slow decay characteristic. R25 is selected to set the power output.

4.5.7 Typical PA Voltages

Table 4.2 Typical PA Voltages
(Yellow dot MRF 455)

| Freq. | V4/5 | V2/3 | | V1 | Battery |
|---|---|---|---|---|---|
| MHz | Coll Vpp | Coll Vpp | Base Vpp | Coll Vpp | Curr. Amps |
| 2 | 22 | 7 | 1.5 | 11.5 | 6.2 |
| 4 | 22 | 6.5 | 1.5 | 11.5 | 5.5 |
| 6 | 22 | 7 | 1.5 | 11.5 | 5.6 |
| 8 | 22 | 8 | 1.5 | 11.5 | 5.8 |
| 10 | 22 | 8 | 1.5 | 12.0 | 6.0 |
| 11 | 22 | 8 | 1.8 | 13.0 | 6.5 |

# 5. MAINTENANCE

## 5.1 Fault Finding

The circuit diagrams and the relevant circuit notes give voltages at various points to enable the faulty section of the transceiver to be located.

The parameters listed below should always be checked first.

| | | |
|---|---|---|
| (a) | Regulator Voltage | 11.5V |
| (b) | C Rail - receive | 11.5V |
| | - transmit | 0V |
| (c) | D rail - receive | 0V |
| | - transmit | 11.5V |
| (d) | AGC (no signal) | 2.2V |
| (e) | Carrier Oscillator at TP9 | 2.5Vpp |
| (f) | Channel Oscillator at TP1 | 1.4Vpp |

## 5.2 Transmitter precautions

When making measurements on the low level stages of the transmitter it is advisable to remove the drive to the PA stages by disconnecting SK1. Supply voltage is applied to the PA at all times when the transceiver is switched on. Due care should be exercised when connecting probes.

## 5.3 Probe Precautions

(a) When connecting CRO probes to the PA assembly, wind the earth clip lead around the body of the probe such that the earth clip just reaches the probe tip. This reduces stray pick-up. Connect the earth clip to the ground plane immediately adjacent to the point of measurement to which the probe tip is connected.

(b) It is not advisable to connect two probes simultaneously, particularly where one is earthed to the PA ground plane and one is earthed to the chassis as this may cause earth loop problems.

## 5.4 Lamp replacement

The POWER and TRANSMIT indicator lamps are of the long life variety, however, if necessary they can be replaced from the front panel of the transceiver.

(a) With a pair of tweezers or small long nosed pliers, carefully unscrew anticlockwise the plastic bezel and extract the lamp bulb.

(b) Form the leads of the replacement lamp and insert into the socket in the holder, pushing the lamp well home.

(c) When re-fitting the bezel, ensure that the lamp does not twist as this may result in the leads shorting together. If necessary, trim the leads so that the lamp sits further into the holder.

## 5.5 Replacement of PA Components

To replace PA components it may be necessary to remove the PA PCB from the heatsink block. It is neither necessary nor desirable to remove the entire PA assembly, as this will avoid disturbing the thermal joint between the PA block and the rear panel heatsink.

When removing the PA PCB always remove the transistor flange fixing screws first and replace last when reassembling to minimise stressing the transistor packages. Before refitting the PCB thoroughly clean off any old thermal compound from the transistor flanges and replace with new compound (e.g. Jermyn Thermaflow A30).

## 5.6 Replacement of PA Output Transistors

The output transistors are fitted in matched pairs to optimise amplifier performance and should only be replaced in matched pairs.

The gain grouping of the Motorola transistor type MRF455 is identified by a coloured dot. Only transistors of the same dot colour should be fitted.

6BA x 1/4" cheese head screws are used to secure the output transistor flanges.

The leads of the PA transistors are folded up at the ends to facilitate removal with pliers.

(a) Remove the flange fixing screws.

(b) Using a de-soldering tool or "solder-wick" remove the bulk of the solder from each lead. Gently pull the leads away from the PCB while heating each joint. Remove the transistor.
Clear away any excess solder from the emitter, base and collector pads. Thoroughly clean the transistor mating surface on the mounting block with a cloth or tissue.

(c) Form the leads of the replacement transistors using the discarded transistor as a guide.

(d) Coat the transistor flange with a thin film of thermal compound (e.g. Jermyn Thermaflow A30).

(e) Fit the transistor (check orientation) and tighten the flange fixing screws evenly.

(f) Carefully solder the transistor leads, this should be carried out quickly using a very hot tipped soldering iron.

Silver loaded solder (e.g. "Capalloy" 62% tin, 36% lead and 2% silver) must be used to make the connection between the inner emitter leads and the ground plane. If silver loaded solder is not used the silver palladium terminations on chip capacitor C14 will dissolve. The chip capacitor may not be resoldered more than once or twice and small stocks of chip capacitors should be held if replacement of output transistors is undertaken.

(g) Readjust bias current - refer para 7.9.

# 6. CHANNEL ADDITION

## 6.1 Introduction

This section describes the procedure to be used when adding an additional channel to a working transceiver.

## 6.2 Preliminary

The table below itemises all the components required to add one single frequency simplex channel. All components are mounted on the MAIN PCB.

Table 6.1

| Circuit Annotation | Component Type | Qty (per Freq) |
|---|---|---|
| D6-17,20-31,36-41,73-92 | Diode 23-10001 | 5 |
| R47-52,170-173 | Resistor 470Ω 5% 1/3W | 1 |
| C37-42,122-125 | Capacitor 47nF 50V Ceramic | 1 |
| L2-7,11-16,19-26 | RF Coil 44-70031 | 2 |
| C8-13,24-29,C126-133 | Tuning Capacitor (ref table 6.2) | 2 |
| X2-11 | Crystal (ref para. 6.5) | 1 |
| C134-143 b,c,d | Compensation Capacitors (ref para 6.6) | 1-3 |
| C134a-143a | Trimmer 2-5pF (e.g. Philips type 808) | 1 |

The transceiver has provision for up to 10 frequencies, all of which may be used for either single frequency simplex or two frequency simplex.

The channel component positions are shown on drawing number 08-01644.

## 6.3 RF Coil Components

For each channel fit:

a) RF coils, type 44-70031

b) Four switching diodes

c) Coil taps - from junction of switching diodes to either of pin 3 (long) or pin 4 (short) of RF coils as per table 6.2.

d) Tuning capacitor as per table 6.2. Use either polystyrene capacitors, 5%, 63V or greater, or Ceramic N150.

Table 6.2

| Frequency (MHz) | Coil Type | Tap Length (ref 6.3) | | Tuning Capacitor | PA Filter Tap (approx) (ref 6.12) | |
|---|---|---|---|---|---|---|
| | | L 2-7, 17-20 | L11-16, 21-24 | | | |
| 1.92 - 2.1 | 44-70031 | Long | Long | 680 | No Tap | |
| 2.1 - 2.4 | " | " | " | 560 | | |
| 2.3 - 2.6 | " | " | " | 470 | | |
| 2.6 - 2.75 | " | " | " | 390 | 1-4 | |
| 2.75 - 3.05 | " | " | " | 330 | | |
| 3.05 - 3.35 | " | " | " | 270 | | |
| 3.35 - 3.75 | " | " | Short | 220 | 4-8 | LARGE INDUCTOR |
| 3.75 - 4.1 | " | " | " | 180 | | |
| 4.1 - 4.5 | " | " | " | 150 | 8-12 | |
| 4.5 - 4.85 | " | " | " | 120 | | |
| 4.85 - 5.4 | " | Short | " | 100 | 12-16 | |
| 5.4 - 5.8 | " | " | " | 82 | | |
| 5.8 - 6.45 | " | " | " | 68 | 16-20 | |
| 6.45 - 7.1 | " | " | " | 56 | | |
| 7.1 - 7.7 | " | " | " | 47 | 20-24 | |
| 7.7 - 8.5 | " | " | " | 39 | 0-4 | |
| 8.5 - 9.5 | " | " | " | 33 | 4-8 | SMALL INDUCTOR |
| 9.5 - 10.0 | " | " | " | 27 | | |
| 10.0 - 10.5 | " | " | " | 22 | 8-12 | |
| 10.5 - 11.0 | " | " | " | 18 | 12-16 | |

## 6.4 Channel Oscillator

For each channel fit:

a) Switching diode
b) Capacitor 47n
c) Resistor 470Ω
d) Trimmer capacitor, 2.2-5 pF
e) Channel Crystal as per para 6.5
f) Compensation Capacitors as per para 6.6

## 6.5 Channel Crystals

The Channel crystal frequency will normally be the IF frequency (1650 kHz) higher than the suppressed carrier frequency (SCF) and crystals will be marked with identification letters as follows:-

(i) CA : CODAN Specification 01-00031 for transceivers to meet Aust. Dept. of Communications specifications over the temperature range 0° to 60°C with reference to the frequency at 26°C ±2°C.

(ii) CB : CODAN specification 01-00049 for transceivers to meet New Zealand Post Office specifications over the temperature range -10°C to 50°C with reference to the frequency at 20°C ±2°C.

(iii) CC : CODAN specification 01-00044 for transceivers for use in tropical areas (not to Dept. of Communications or NZPO specifications) over the temperature range 20°C to 50°C with reference to the frequency at 26°C ±2°C.

Fit the channel crystals to the MAIN PCB in the required order.

## 6.6 Compensating Capacitors

Fit compensating capacitors selected as described below.

(a) Channel crystals below 8 MHz

All crystals supplied should be within ±40 Hz over the appropriate temperature range. Fit two 18pF P100 capacitors (e.g. Philips type 632). A 2.7pF (P100 or NP0) capacitor may be added on test in order to have the trimmer at approximately one-third capacity.

Channel crystals above 8 MHz

All crystals stamped CC, are adjusted as per para (a).

All crystals stamped CA or CB are supplied with a band-run frequency versus temperature curve chart and should be within the following limits relative to the nominal mid-temperature frequency,

| CA ref 26°C | CB ref 20°C | Limits |
|---|---|---|
| 0...26°C | -10...20°C | + (10F - 40) Hz to -40 Hz |
| 26...60°C | 20...50°C | + 40 Hz to -(10F -40) Hz |

where F is the frequency in MHz.

(i) If the band-run indicates that the crystal is within ± 40 Hz over the temperature range fit the zero ppm correction capacitors shown in the table below.

(ii) If the band run indicates a correction is required, determine the correction in ppm (parts per million) between minimum and maximum temperature and add capacitors selected from the following table.

| Correction (ppm) | Fixed capacitor & type | | Additional C type |
|---|---|---|---|
| 0 | 18pF + 18pF | P100 | P100 |
| + 2.7 | 12pF | N750 | NP0 |
| + 5.1 | 27pF | N750 | NP0 |
| + 7 | 39pF | N750 | - |
| + 8.2 | 22pF | N1500 | N150 |
| +10.4 | 22pF | N1500 | N750 |
| +13.2 | 39pF | N1500 | - |

6.6 (cont.)

In all cases the trimmer capacitor must be at approximately 1/3rd capacity.

In some cases where 39pF is indicated this may have to be reduced due to the stray capacity of additional channels. With the 39pF N1500 capacitor a series capacitor may be used to effect the reduction if other N1500 capacitors are not available.

Example: The maximum error of a 10 MHz crystal over the specified temperature range,
(deviation of max. temp - deviation at min. temp),
$-(10F-40) - (10F-40) = -120$ Hz, $\frac{-120}{10} = -12$ppm

$\therefore$ from the table fit the +10.4ppm

(iii) When all channel oscillators have been fitted, re-check the frequencies, the later channels fitted may have disturbed the earlier fitted channel frequencies.

## 6.7 Channel Switch Wiring

The channel switch wiring only needs to be modified if a two-frequency simplex channel is added. In this case, a two-frequency simplex channel switch must exist in the transceiver. If one does not, refer Section 6.8.

The front channel switch wafer has its wiper connected to be B rail and is for use with single frequency simplex channels. The second wafer wiper connected to the C rail, is for use with the receive frequency of two-frequency simplex channels, and the third wafer, wiper connected to the D rail, is for the transmit frequency.

The two frequency simplex channel must have the lead corresponding to the transmit crystal position shifted from the front channel switch wafer to the appropriate lug on the third wafer, and the lead corresponding to the receive crystal position shifted from the front wafer to the appropriate lug on the second wafer.

## 6.8 Channel Switch Replacement

For transceivers not fitted with a two frequency simplex switch, which would be the case if only single frequency simplex channels were originally fitted, the single frequency simplex switch must be replaced by switch 14-00138. Two 22 ohm CR25 resistors (1R3 & 1R4) should be mounted on the second and third wafer from the front respectively, connected between the wiper lug and the dummy lug on each wafer. The C and D rail leads which exist as a sleeved twisted pair of orange (C) and yellow (D) wires in the front panel loom, should be withdrawn and terminated on the dummy lugs, orange to the second wafer from the front, and yellow to the third wafer from the front.

## 6.9 Test Equipment Required

(a) A calibrated CRO with 10X probe giving 10MΩ and less than 12pF input impedance. Y amplifier frequency response of at least the highest channel frequency.

(b) RF dummy load, 50Ω, 50W rms minimum.

(c) RF signal generator covering the range 1 -11 MHz and capable of providing calibrated signals down to 0.5μV emf from a 50Ω source.

(d) Frequency counter capable of resolving to ±1 Hz frequencies up to 11 MHz.

(e) Regulated Power Supply which can be set to 13.0V ±0.2V and capable of supplying 10A peak current.

(f) Two-tone (i.e. 1000 Hz and 1600 Hz) audio generator capable of providing 0-100mV rms.

(g) Transceiver test unit to CODAN drawing 04-00316. (The isolating transformer should be screened to prevent pick-up from nearby mains transformers.)

6.10 Adjustments - General

(a) The power supply must be set to 13.0V ±0.2V. Codan type 7113 or type 7202 (fixed voltage) power supplies may be used.

(b) Unless otherwise stated for a particular test the mode switch is set to SSB.

(c) The microphone or transceiver control box must be plugged in to complete the loudspeaker circuit.

CAUTION :

Inadvertant operation of the PTT switch when connected to a signal generator will seriously damage that instrument. So take due care when conducting receiver tests or alternatively disconnect the microphone or transceiver control box and short circuit the slate speaker wire to chassis to complete the loud-speaker circuit.

(d) Replace all PCB fixing screws, and check the insulation resistance between the negative rail and the frame, it should be approximatley 1MΩ (R85).

6.11 Adjustments - Transmitter

(a) Disconnect SK1 from the MAIN PCB. Connect a 50Ω resistor across PL1/1 and PL1/2.

(b) Connect the two-tone generator to the transceiver control box and plug the latter into the microphone socket.

(c) Switch the transceiver on and operate the PTT switch.

(d) Observe the RF level at TP4 on the CRO and increase the output from the two-tone generator until the RF level stops increasing (compression threshold), and then increase the level by a further 10dB to 20dB.

(e) Transfer the CRO probe to monitor the RF level across the 50Ω resistor referred to in (a).

Adjust the cores of the RF coils for maximum RF output. Repeat for each channel. If two frequency simplex channels have been fitted see (h) below.

(f) Switch-off the two tone audio drive and connect the frequency counter to the RF output (PL1/1 and PL1/2 either side ground). The 50Ω resistor may be removed for the following test to provide a higher output to drive the counter.

(g) Select the AM mode and adjust the crystal trimmer for the correct channel frequency at the appropriate ambient temperature (see para 6.5). Repeat for all channels, including those already fitted.

6.11 (cont.)

If the correct frequency cannot be obtained or the trimmer is at greater than one third capacity, then adjust the value of the compensating capacitors as described in para 6.6.

(h) Two-frequency simplex channels (and receive only channels if fitted)

If the transceiver has two-frequency simplex channels, then channel selection should not be done with the channel switch, as it is necessary to be able to transmit on each frequency (including the receive frequencies of two-frequency channels) so as to tune the RF coils and to set the channel frequency.

Remove socket SK4. Construct a flying-lead with suitable connectors, one end of which should be plugged into PL7/5 or PL14/1 (i.e. B rail). Channel selection is then achieved by plugging the other end of the flying lead into PL4/1 for channel 1, PL4/2 for channel 2 and so on up to channel 10.

On completion of tests (a) to (g), replace socket SK4 and check with each position of the channel switch that the correct frequency is transmitted.

(i) Switch the supply to the transceiver off. Select the SSB mode and connect the 50Ω load and the CRO to the antenna socket. Set the CRO Y sensitivity to display 200Vpp. Replace SK1 on the MAIN PCB, and reconnect the two-tone drive, at minimum level.

(j) Select an original working channel, turn power on and switch to transmit. Increase the two-tone audio drive level while observing the output level. When the output stops increasing, increase the audio drive a further 20dB (this will ensure that the microphone amplifier is in compression, thus sufficient drive will be available from the exciter to obtain full output from the PA).

(k) For each additional channel, connect a short link (10 x 0.25mm/.010" or equivalent) from the appropriate lug on the channel switch wafer to a tap on one of the PA filter inductors.

All taps are selected to deliver maximum power to the load. This is done by connecting a short flying lead to the channel switch lug and connecting the free end to each tap of the tank coils in turn, until a maximum is reached. Use Table 6.2 as a guide. Where more than one tap can be selected to give similar maximum power output, then the tap that represents lease bypassed inductance should be used. On the large inductor, this is the tap closest to the filter capacitors, and on the small inductor, this is the tap furthest from the filter capacitors. This tap also ensures the most efficient operation of the transceiver, i.e. least current drawn.

(l) Check that the current consumption is approximately 1 Amp with no audio drive. Slowly increase the drive level from zero to maximum and check the output waveform at all levels of drive for spurious oscillations. Repeat for all additional channels.

6.11 (cont.)

(m) At full drive check that the power output is within ±1dB of 50W PEP at 13.0V (i.e. within the range 40W to 63W or 126Vpp to 158Vpp). Check the power supply current is within the range 4.5A to 7.0A. Repeat for all additional channels.

NOTE 1:- If a power meter is used in lieu of a dummy load a wide range of readings can be expected from various types when fed with a two-tone SSB signal.

NOTE 2:- Many CRO's are unable to swing a full screen diameter at the highest operating frequency of the transceiver. This can be checked by observing if "flat-topping" of the two-tone envelope changes with attenuator setting.

(n) Short circuit and open circuit the load. In general the supply current will fall to approximately 2 to 3 Amps, however on some frequencies it may be as high as 5 Amps. Repeat this test on several channels over the frequency range.

6.12 Adjustments - Receiver

All adjustments required for the receiver have been carried out during adjustments of the transmitter. It is merely necessary to conduct functional tests on the receiver. Proceed as follows.

Switch to receive and connect the RF signal generator to the antenna socket (see caution in para 6.10 (c)). Set the generator level to produce 2μV emf and adjust the generator frequency to give an audible signal (nominally 1 kHz) in the loudspeaker.

Use the CRO to check that the signal at TP8 on the MAIN PCB is not less than 100mVpp (audio with superimposed RF). Repeat this test on all additional channels.

## 7. PRE-SET ADJUSTMENTS

This section describes the factory adjustment procedure. When any component which affects a pre-set adjustment is replaced the appropriate adjustment procedure should be followed. Initial installation of channel components is described in Section 6.

### 7.1 Test Equipment Required

(a) A calibrated CRO with 10X probe giving 10MΩ and less than 12pF input impedance. Y amplifier frequency response of at least the highest channel frequency.

(b) RF dummy load, 50Ω, 50W rms minimum.

(c) RF signal generator covering the range 1 - 11 MHz and capable of providing calibrated signals down to 0.5μV emf from a 50Ω source.

(d) Frequency counter capable of resolving to ±1 Hz frequencies up to 11 MHz.

(e) Regulated Power Supply which can be set to 13.0V ±0.2V and capable of supplying 10A peak current.

(f) Two-tone (i.e. 1000 Hz and 1600 Hz) audio generator capable of providing 0 - 100mV rms.

(g) Multimeter or meters for measuring voltages (20kΩ/V or better) and current, 100 mA and 1A ranges.

(h) Spectrum Analyser suitable for SSB or EILCO type 6918A test set.

(i) Transceiver test unit to Codan drawing 04-00316. (The isolating transformer should be screened to prevent pick-up from nearby mains transformers.)

(j) Decade resistance box for ease of determining select-on-test (SOT) resistors (a resistance box constructed using the E12 values of resistors is very useful).

## 7.2 Preliminary

Before making any adjustments the supply voltage must be set to 13.0V ±0.2V.

When working on the low level stages, e.g. the receiver and exciter, the PA may be isolated by removing socket SK1 from the MAIN PCB. This will prevent unnecessary heating of the heatsink and removes the possibility of high level RF fields being picked up by test leads which could give erroneous measurements or transmitter instability.

## 7.3 Voltage Regulator

(a) With the transceiver in receive, and the volume control at minimum check that the current consumption is approximately 250 mA.

(b) Select a value for 2R30b such that the regulated voltage measured at PL14/1 (or collector TIP32) is 11.5V ±0.1V.

NOTE: The OV (ground) rail has three test points distributed on the MAIN PCB. Use the nearest test point for the test equipment ground connection.

## 7.4 Carrier Oscillator

In the receive SSB mode, connect the Frequency Counter to 2TP9 via a 10K ohm isolating resistor, (2TP6 is ground). Adjust trimmer 2C77 so that the frequency is 1650.000 kHz ±2 Hz and this should be approximately 1/3rd in mesh. To achieve this it may be necessary to fit a small capacitor 2C79b in parallel with 2C79a (18pF). Values from 2.2pF to 3.9pF Philips 632, P100, NP0, or N150 are suitable. Where 18pF + 3.9pF is not sufficient, change 2C79a to 22pF P100.

Connect the CRO to 2TP10 and check that the oscillator amplitude lies between 3.5V and 5.5V pp. To increase the oscillator amplitude, reduce 2R121 to 10K ohm. To reduce the oscillator amplitude, increase 2R121 to 15K ohm.

## 7.5 Channel Oscillators

Connect the Frequency Counter to 2TP1 (2TP3 is ground). Adjust the crystal frequency to that stamped on the crystal can (i.e. 1650 kHz above the channel SCF) as follows.

### Single Frequency Simplex

(a) No clarifier. Adjust the channel crystal trimmer (C134a) to the correct frequency.

(b) Clarifier on transmit and receive. Set the clarifier control to the mechanical centre of its range, select the highest frequency channel fitted and adjust the oscillator trimmer to the correct frequency. Measure the frequency at each end of the clarifier control. If the frequency deviation in a positive direction is less than 80% of that in a negative direction, select a value for 1R5 and fit to the clarifier control as shown on the circuit diagram to equalise the clarifier range. Re-adjust the trimmer for the correct frequency with the clarifier control at mechanical centre.

(c) Clarifier on receive only. Adjust the crystal trimmer for the correct frequency on transmit and follow (b) for receive.

If the positive frequency deviation is greater than the negative, fit 1R5 to the opposite side of 1RV2.

### Two frequency simplex

(a) No clarifier. Adjust the appropriate crystal oscillator trimmers in the transmit and receive modes.

(b) Clarifier on receive only. Adjust the transmit crystal trimmer in transmit and adjust the receive trimmer as in (b) of previous section.

NOTE : Clarifier options CBN or CBW are not admissable with two frequency simplex.

## 7.6 RF Alignment

Remove SK1 and connect a 50Ω resistor across the MAIN PCB output (SK1/1 & 2) and monitor the signal across the resistor with the CRO. Switch to AM and operate the PTT switch. Adjust 2T4 and the RF coils of each channel for maximum output, L2 & L11 for channel 1, L3 and L12 for channel 2 etc. The exciter output should be approximately 200mV pp dependant upon frequency (400mV pp for SSB two tone).

## 7.7 Carrier Re-insertion (if AM fitted)

Apply a single-frequency tone of 1 kHz to SK11 of the unit. With the transceiver in SSB transmit, set the audio drive level so that the Microphone Amplifier is at the threshold of compression, then increase by 10dB. Switch to AM and monitor the signal on the CRO (as in 7.6) and adjust 2C82 for equal carrier and tone level.

## 7.8 IF Alignment

Connect the Signal Generator to the MAIN PCB at SK1/3 & 4. Adjust to a channel frequency and of sufficient level to produce a 1 kHz tone in the loudspeaker. Connect the CRO to 2TP8 (the loudspeaker may be muted-switch to TERMINATE) and adjust 2T5 and 2T6 for maximum output. Reduce the RF signal input below AGC threshold and repeat until the best sensitivity is obtained.

## 7.9 PA Bias

Ensure SK1 is disconnected from the MAIN PCB.

(a) PA Bias
Remove the PA FUSE link and insert a dc ammeter set to the 1A range. In the SSB mode, operate the PTT switch and observe the ammeter reading. Select a value for the "PA BIAS" resistor such that the standing current is between 110 and 140mA.

(b) Driver Bias
Remove the driver stage LINK and insert a dc ammeter set to the 100mA range. In the SSB mode, operate the PTT switch and observe the ammeter reading. Select a value for the "DRIVER BIAS" resistor such that the driver standing current is between 12 and 15mA.

## 7.10 ALC

Replace SK1 and ensure that the RF dummy load is connected to the antenna socket. Connect the CRO and the distortion meter (6918A) RF input (through 47k ohms) across the dummy load. Connect the audio output of the distortion meter to the test unit (AF in). Select the lowest frequency channel on the transceiver. Switch to SSB and operate the PTT switch. Adjust the value of "SET POWER" resistor to set the two-tone SSB output to 50W PEP (i.e. 140V pp). Check the IMD (Intermodulation distortion) on all channels.
The power output may be decreased if necessary to give -27dB IMD on the worst channel.

N.B. -27dB IMD on the 6918A is relative to either tone and is equivalent to -33dB IMD with respect to PEP.

## 7.11 Receiver Performance Checks

(a) Sensitivity and Signal + Noise to Noise ratio :

Connect an AC voltmeter across the audio output. Set the signal generator to 1µV emf output and adjust the frequency to produce a 1 kHz audio output.

Check that the output is at least 1V rms with the volume control fully clockwise.

Adjust the signal generator to a frequency outside the receiver passband and check that the audio output drops by at least 10dB.

(b) AGC Check

Reset the signal generator output to 100mV emf and adjust the frequency to produce a 1 kHz audio output. Reduce the volume to a convenient level. Reduce the signal generator output until the receiver output drops by 6dB. The signal generator level should be less than 3µV emf.

(c) Audio Output

Increase the signal generator output to 100µV emf, the frequency adjusted to 1 kHz audio output. The audio output should exceed 6V rms at the onset of clipping.

(d) Selectivity (USB operation)

Centralise the Clarifier control, switch to SSB, set the signal generator output to 1µV emf and note the audio output reference level. Increase the signal generator output 60dB and using the Frequency Counter on the signal generator adjust the frequency to -1 kHz and then to +5 kHz from SCF. At these points the audio output should be less than reference level.

(e) Image rejection

With the signal generator set to produce 1 kHz audio output and 1µV emf output, note the audio output reference level. Re-adjust the signal generator frequency to the image frequency (i.e. SCF + 3301 kHz). Increase signal generator output until the reference level is again obtained. Increase should need to be greater than 45dB.

(f) Clarifier operation

Check in accordance with para 7.5.

(g) Noise Limiter operation (when fitted)

Connect a BNC T-piece into the 50Ω coax from the signal generator to the transceiver. To the unoccupied socket add a BNC to two-terminal adaptor. Connect the output from a square wave generator at a level of 5V pp at 100 Hz via a 100pF capacitor to the adaptor.

7.11 (g) (cont.)

With the signal generator output set to produce a 1 kHz audio output at a 1μV emf level switch ON and OFF the NOISE LIMITER switch. When ON, the audio tone should be clearly heard if the noise limiter is effective.

7.12 Transmitter performance checks

(a) Frequency

Connect the Frequency Meter via a 10K ohm resistor across the RF dummy load, switch to AM or Tune, transmit (no audio input) and measure the channel frequency (Clarifier at zero). Repeat for all channels.

(b) Clarifier (if fitted)

Check in accordance with para 7.5.

(c) ALC

Connect the two-tone audio output from the 6918A to the AF input of the test unit. Switch to SSB transmit, slowly increase the audio input until just beyond the point of compression. Note the PEP output and increase the audio input by 30dB. The increase in output should be less than 1dB.

(d) Power output and Intermodulation distortion

The power output on all channels should be 50W PEP ±1dB (i.e. 40 to 60W PEP) and the IMD should be better than -27dB as measured on the 6918A.

7.13 Mute adjustment (when fitted)

(a) Connect an audio generator set to 800 Hz to the output of the demodulator via a 100K ohm resistor (2TP8).

(b) Connect an ac voltmeter (preferably rms or average sensing and well damped) across the loudspeaker terminals.

(c) Switch the receiver on and select SSB. Terminate the antenna socket with 50Ω.

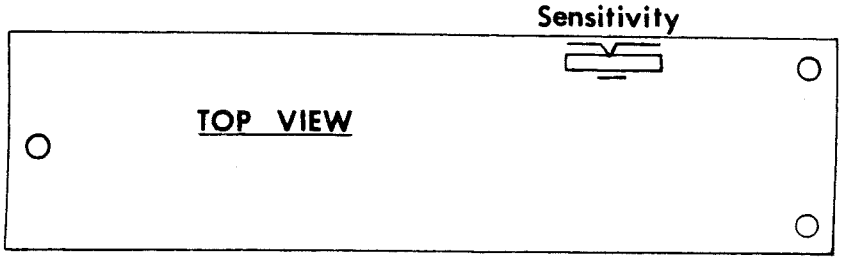
(d) With the audio generator set to zero level and the MUTE switch OFF, adjust the VOLUME control to obtain a noise reference level on the ac voltmeter. Increase the audio generator output until the reading on the voltmeter increases by 3dB, i.e. output S+N/N = 3dB.

(e) Turn the MUTE switch ON, set the front panel adjustment to mechanical centre and adjust the SENSITIVITY control on the mute assembly until the mute gate hunts.

7.13 (cont.)

If the transceiver has a mute adjustment provided on the front panel no more adjustments are required. Any adjustments to sensitivity which may be required during use can be effected with the front panel control.

NOTE: The adjustment procedure sets the system sensitivity to 0dB S/N. The sensitivity may be increased or decreased up to 3dB, by noting the audio generator level required in (d) and (g) and increasing this level by 3dB for a REDUCTION in sensitivity and vice versa.




7.14 Emergency Call Assembly Adjustments (when fitted)

Connect the Frequency Counter to pin 6 of 6IC1 and operate the Emergency Call button. Resistor 6R4b is selected to set the frequency to 880 Hz ±5 Hz. Now connect the Frequency Counter to pin 6 of 6IC2 and select 6R10b to set the frequency the 1320 Hz approximately such that the difference frequency between the oscillators is 440 Hz ±2 Hz.

Connect the CRO to pin 6 of 6IC1 and 6IC2 alternately with the Emergency Call button operated. Fit either 6R1b or 6R7b to reduce the output of the oscillator with the highest output such that the amplitude difference is less than 0.2dB. The frequency must be adjusted before the amplitude, as the latter may vary with frequency.

It may be necessary to wait for as long as 5 minutes after soldering the frequency determining resistors, before checking the frequency.

# 8. PARTS LISTS

## 8.1 General Information

The parts lists contain the following information:-

(a) Circuit Reference Number. The component location (chassis or PCB function) must be stated when ordering, see ordering information below.

(b) Description. Gives the value and type of component.

(c) Manufacturer. States the manufacturer and component series. Where no manufacturer is stated, the number given is a CODAN part number.

NOTES: 1. All resistor values are in Ohms and are carbon film unless otherwise stated.

2. All electrolytic capacitors are aluminium foil unless otherwise stated.

### 8.1.1 Ordering Information

When ordering replacement components it is necessary to quote all of the following information to minimise the risk of obtaining the wrong part and to expedite despatch.

(i) Equipment type (i.e. 7515)

(ii) Component circuit reference number (e.g. R82)

(iii) Component location (e.g. MAIN PCB, 08-01644-001).

(iv) Full Component Description (e.g. resistor, 100k, 5%, 1/3W)

(v) Manufacturer and type (e.g. Philips CR25).

### 8.1.2 Component Substitution

Due to the continuous process of up-dating equipment and variations in component availability, minor component changes may be noted from those listed. Equipment performance is in no way adversely affected.

## 8.2 Parts List - Index


| | | |
|---|---|---|
| 8.2.1 | Final Assy. | 08-01994 |
| 8.2.2 | Main PCB. | 08-01644-001 |
| 8.2.3 | PA PCB. | 08-01838 |
| 8.2.4 | PA Filter Assy. | 08-01839 |
| 8.2.5 | Mute PCB. | 08-01361 |
| 8.2.6 | Emergency Call PCB. | 08-00889 |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| C1 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C2 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C5 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C6 | 100n 10% 250V PE Cap | Philips | 2222-342-45104 | 46-51000-500 | |
| C7 | 100n 10% 250V PE Cap | Philips | 2222-342-45104 | 46-51000-500 | |
| D2 | Diode Si | | 1N4004 | 1N4004 | |
| F1 | Fuse STD 1.5 Amp | Australux | 3AG | 63-00000-150 | |
| LP1 | Holder Red Bezel C/W Lamp | Rodan Plessey | BFK 5 5V 60MA | 65-62020-403 | |
| LP2 | Holder Green Bezel C/W Lamp | Rodan Plessey | BFK 5 5V 60MA | 65-62020-401 | |
| LS1 | Loudspeaker | Magnavox | 53T | 65-21001-503 | |
| PL10 | Plug 4Pole Panel Or Chassis Mtg | Painton | P4/MFS 310032 | 60-00040-030 | |
| R1 | 120 Ohm 5% 0,67W CF Res | Philips | CR52 | 40-21200-040 | |
| RLB2 | Relay 12V CR160 2C/O | Omron | LY2F | 64-11302-120 | |
| RV1 | Pot Dpst Rot SW 19mm Sha Log 10k | | VCS | 42-41011-719 | |
| SK1 | Socket Housing 4Way | Molex | M2695-4 | 60-00044-100 | |
| SK10 | Socket UHF Panel Mount | Acme | C32-28 | 60-11363-228 | |
| SK11 | Socket 6 Way Panel Mount | Preh | 8/6599 | 60-00063-080 | |
| SW1 | Switch Channel | | | 14-00137 | |
| SW2 | Switch SP Nonlocking Flat Toggle | NKK | M2015-ESW01AA1A | 62-01206-002 | |
| TS2 | Tagstrip | Carr Fastener | 745-7A-4 | 08-00438 | |
| | Cover Bottom | | 7515 | 05-01303 | |
| | Cover Top | | 7515 | 05-01308 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| | Edge Bottom | | 7515 | 05-01309 | |
| | Knob Small Pointer | | | 06-00014 | |
| | Knob Small Round | | | 06-00015 | |
| | Microphone | | | 08-00066 | |
| | Cable Battery | | | 08-00987 | |
| | Plug Cable Mount UHF | Acme | C32-23 MN PL259 | 60-11163-223 | |
| | Adaptor Reducing UHF | Acme | C32-24 MN UG175/u | 60-11863-224 | |
| | Connector Crimp Loose | Molex | M2759 TL | 60-90101-001 | |

| REF | DESCRIPTION | | | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|---|---|
| C52 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C53 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C54 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C55 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C56 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C57 | 470n | 10% | 250V | PE Cap | Elna | NL | 46-54700-511 | |
| C58 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C62 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C63 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C64 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C65 | 15n | 10% | 100V | PE Cap | Elna | NL | 46-41500-510 | |
| C66 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C67 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C70 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C71 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C72 | 10u | 20% | 35V | TA Cap | ITT | TAG | 47-11003-510 | |
| C73 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C74 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C75 | 15n | 10% | 100V | PE Cap | Elna | NL | 46-41500-510 | |
| C76 | 4,7u | 20% | 35V | TA Cap | ITT | TAG | 47-04703-510 | |
| C77 | 1,4-5,5p | 250V | Foil Trim | Capacito | Philips | 2222-808-11558 | 49-30101 | |
| C78 | 470p | 5% | 250V | PS Cap | Philips | 2222-426-24701 | 46-24700-320 | |
| C80 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C81 | 10p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34109 | 46-11000-012 | |
| C83 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C84 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C85 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C86 | 47n | 10% | 100V | PE Cap | Elna | NL | 46-44700-510 | |
| C87 | 4,7u | 20% | 35V | TA Cap | ITT | TAG | 47-04703-510 | |
| C88 | 10p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34109 | 46-11000-012 | |
| C90 | 10u | 20% | 35V | TA Cap | ITT | TAG | 47-11003-510 | |
| C91 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C92 | 470p | 10% | 100V | CE Cap | Philips | 2222-630-03471 | 46-24700-200 | |
| C93 | 15n | 10% | 100V | PE Cap | Elna | NL | 46-41500-510 | |
| C94 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C95 | 22u | 20% | 16V | TA Cap | ITT | TAG | 47-12201-610 | |
| C96 | 100n | | 63V | CE Cap | Elna | TL | 46-51000-210 | |
| C97 | 15n | 10% | 100V | PE Cap | Elna | NL | 46-41500-510 | |
| C98 | 1000u | | 16V | EL Cap | Elna | RB | 48-31001-651 | |

| REF | DESCRIPTION | | | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|---|---|
| C1 | 270p | 2% | 100V N750 | CE Cap | Philips | 2222-632-58271 | 46-22700-013 | |
| C2 | 330p | 2% | 100V N750 | CE Cap | Philips | 2222-632-58331 | 46-23300-013 | |
| C3 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C4 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C5 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C6 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C14 | 47p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34479 | 46-14700-012 | |
| C15 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C16 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C17 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C18 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C19 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C20 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C21 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C22 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C23 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C30 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C31 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C32 | 220u | | 16V | EL Cap | Elna | Type RB | 48-22201-651 | |
| C33 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C34 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C35 | 39p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34399 | 46-13900-012 | |
| C36 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C37 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C38 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C39 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C40 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C41 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C42 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C43 | 470p | 5% | 250V | PS Cap | Philips | 2222-426-24701 | 46-24700-320 | |
| C44 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C45 | 82p | 2% | 100V NP0 | CE Cap | Philips | 2222-632-10829 | 46-18200-011 | |
| C46 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C47 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C48 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C49 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C50 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C51 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |

8.2.2 PCB Main 16MHz ASSEMBLY 08-01644-001 PCB 07-00557 All components prefixed 2

| REF | DESCRIPTION | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|
| D32 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D33 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D34 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D35 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D36 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D42 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D45 | Diode Si fast low cap med cond | | | | 23-10002 | |
| D47 | Diode Si fast low cap med cond | | | | 23-10002 | |
| D56 | Diode Si fast low cap med cond | | | | 23-10002 | |
| D57 | Diode Si fast low cap med cond | | | | 23-10002 | |
| D58 | Diode Si fast low cap med cond | | | | 23-10002 | |
| D59 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D60 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D61 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D62 | Diode Si fast low cap high cond | | | | 23-10001 | |
| D65 | Diode Si fast low cap med cond | | | | 23-10002 | |
| FL1 | Filter | | | QFO 1602 | 65-91101-000 | |
| IC1 | Operational Amplifier | IC | National | LM748CN | XA-00748-000 | |
| IC2 | Audio Amplifier | IC | Fairchild | TBA810AS | TBA810AS | |
| L2 | Coil RF Orange Dot | | | | 44-70031 | |
| L8 | Choke 1mH | | Sigma | SC10/49 | 43-83100-051 | |
| L9 | Choke 1mH | | Sigma | SC10/49 | 43-83100-051 | |
| L10 | Choke 1mH | | Sigma | SC10/49 | 43-83100-051 | |
| L11 | Coil RF Orange Dot | | | | 44-70031 | |
| L17 | Choke 1mH | | Sigma | SC10/49 | 43-83100-051 | |
| L27 | Inductor .38uH | | | | 44-70232 | |
| PL1 | Plug 4Way Standard Wafer | | Molex | M4030-4/14,22MM | 60-00041-100 | |
| PL2 | Plug 4Way Standard Wafer | | Molex | M4030-4/14,22MM | 60-00041-100 | |
| PL4 | Plug 10Way Standard Wafer | | Molex | M4030-10/14,22MM | 60-00101-100 | |
| PL5 | Plug 10Way Standard Wafer | | Molex | M4030-10/14,22MM | 60-00101-100 | |
| PL6 | Plug 4Way Standard Wafer | | Molex | M4030-4/14,22MM | 60-00041-100 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| C99 | 3,3n 10% 100V CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C101 | 100n 63V CE Cap | Elna | TL | 46-51000-210 | |
| C102 | 1000u 16V EL Cap | Elna | RB | 48-31001-651 | |
| C103 | 1u 20% 35V TA Cap | ITT | TAG | 47-01003-510 | |
| C104 | 1n 10% 100V CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C107 | 100p 2% 100V N150 CE Cap | Philips | 2222-632-34101 | 46-21000-012 | |
| C108 | 100p 2% 100V N150 CE Cap | Philips | 2222-632-34101 | 46-21000-012 | |
| C109 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C111 | 22u 20% 16V TA Cap | ITT | TAG | 47-12201-610 | |
| C112 | 22u 20% 16V TA Cap | ITT | TAG | 47-12201-610 | |
| C113 | 3,3n 10% 100V CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C122 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C123 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C124 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C125 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C134 | 18p 2% 100V P100 CE Cap | Philips | 2222-632-04189 | 46-11800-010 | |
| C134 | 1,4-5,5p 250V Foil Trim Capacito | Philips | 2222-808-11558 | 49-30101 | |
| C135 | 18p 2% 100V P100 CE Cap | Philips | 2222-632-04189 | 46-11800-010 | |
| C144 | 100n 63V CE Cap | Elna | TL | 46-51000-210 | |
| C145 | 3,3p 0,25p 100V NPO CE Cap | Philips | 2222-632-09338 | 46-03300-011 | |
| C146 | 180p 2% 100V N750 CE Cap | Philips | 2222-632-58181 | 46-21800-013 | |
| C147 | 39p 2% 100V N750 CE Cap | Philips | 2222-632-58399 | 46-13900-013 | |
| C148 | 150p 2% 100V N750 CE Cap | Philips | 2222-632-58151 | 46-21500-013 | |
| C149 | 180p 2% 100V N750 CE Cap | Philips | 2222-632-58181 | 46-21800-013 | |
| C150 | 15p 2% 100V N150 CE Cap | Philips | 2222-632-34159 | 46-11500-012 | |
| C79a | 18p 2% 100V P100 CE Cap | Philips | 2222-632-04189 | 46-11800-010 | |
| D1 | Diode Si fast low cap med cond | | | 23-10002 | |
| D2 | Diode Si fast low cap high cond | | | 23-10001 | |
| D3 | Diode Si fast low cap med cond | | | 23-10002 | |
| D4 | Diode Si | | 1N4004 | 1N4004 | |
| D5 | Diode Si fast low cap high cond | | | 23-10001 | |
| D6 | Diode Si fast low cap high cond | | | 23-10001 | |
| D8 | Diode Si fast low cap high cond | | | 23-10001 | |
| D18 | Diode Si fast low cap med cond | | | 23-10002 | |
| D19 | Diode Si fast low cap med cond | | | 23-10002 | |
| D20 | Diode Si fast low cap med cond | | | 23-10002 | |
| D21 | Diode Si fast low cap med cond | | | 23-10002 | |

| REF | DESCRIPTION | | | | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| R39 | 2,2k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-32200-020 | |
| R40 | 68 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-16800-020 | |
| R41 | 1,5k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-31500-020 | |
| R46 | 22 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-12200-020 | |
| R47 | 470 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-24700-020 | |
| R53 | 47k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-44700-020 | |
| R54 | 1k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-31000-020 | |
| R55 | 10k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-41000-020 | |
| R56 | 47k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-44700-020 | |
| R57 | 4,7k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-34700-020 | |
| R58 | 100 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-21000-020 | |
| R59 | 470k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-54700-020 | |
| R61 | 22k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-42200-020 | |
| R62 | 820 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-28200-020 | |
| R63 | 5,6k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-35600-020 | |
| R64 | 100 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-21000-020 | |
| R65 | 1k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-31000-020 | |
| R66 | 22 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-12200-020 | |
| R76 | 270 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-22700-020 | |
| R77 | 1k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-31000-020 | |
| R78 | 2,7k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-32700-020 | |
| R79 | 10k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-41000-020 | |
| R80 | 47k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-44700-020 | |
| R81 | 47k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-44700-020 | |
| R82 | 100k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-51000-020 | |
| R83 | 1,8k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-31800-020 | |
| R84 | 100 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-21000-020 | |
| R85 | 1M | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-61000-020 | |
| R88 | 820 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-28200-020 | |
| R89 | 2,2k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-32200-020 | |
| R90 | 100 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-21000-020 | |
| R91 | 1k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-31000-020 | |
| R92 | 390 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-23900-020 | |
| R93 | 8,2k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-38200-020 | |
| R94 | 1k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-31000-020 | |
| R95 | 100 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-21000-020 | |
| R96 | 100 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-21000-020 | |
| R97 | 330 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-23300-020 | |
| R98 | 820 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-28200-020 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| PL7 | Plug 10Way Standard Wafer | Molex | M4030-10/14,22MM | 60-00101-100 | |
| PL14 | Plug 4Way Standard Wafer | Molex | M4030-4/14,22MM | 60-00041-100 | |
| R1 | 47 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-14700-020 | |
| R2 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R3 | 470 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-24700-020 | |
| R4 | 470 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-24700-020 | |
| R5 | 560 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-25600-020 | |
| R6 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R7 | 150k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-51500-020 | |
| R8 | 39k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-43900-020 | |
| R9 | 180 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21800-020 | |
| R10 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R11 | 2,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32200-020 | |
| R12 | 220 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-22200-020 | |
| R13 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R14 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R15 | 390 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-23900-020 | |
| R16 | 3,3k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-33300-020 | |
| R17 | 1,8k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31800-020 | |
| R18 | 150 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21500-020 | |
| R19 | 3,3k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-33300-020 | |
| R20 | 22 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-12200-020 | |
| R23 | 22 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-12200-020 | |
| R24 | 3,3k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-33300-020 | |
| R25 | 470 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-24700-020 | |
| R26 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R27 | 33 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-13300-020 | |
| R28 | 22k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-42200-020 | |
| R29 | 1,5k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31500-020 | |
| R31 | 220 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-22200-020 | |
| R32 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R33 | 22k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-42200-020 | |
| R34 | 15k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41500-020 | |
| R35 | 680 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-26800-020 | |
| R36 | 2,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32700-020 | |
| R37 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R38 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| R141 | 100k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-51000-020 | |
| R142 | 47 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-14700-020 | |
| R143 | 2,7 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-02700-020 | |
| R144 | 680 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-26800-020 | |
| R145 | 22k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-42200-020 | |
| R146 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R147 | 47k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-44700-020 | |
| R152 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R154 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R166 | 1,5k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31500-020 | |
| R167 | 2,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32700-020 | |
| R168 | 18k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41800-020 | |
| R169 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R170 | 100k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-51000-020 | |
| R30a | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R30b | S.O.T. 5% 0,33W CF Res | Philips | CR25 | 40-00000-020 | |
| T1 | Transformer RF | | | 44-80022 | |
| T2 | Transformer RF | | | 44-80023 | |
| T3 | Transformer RF | | | 44-80024 | |
| T4 | Transformer RF Green Dot | | | 44-70032 | |
| T5 | Transformer RF Green Dot | | | 44-70032 | |
| T6 | Transformer RF Green Dot | | | 44-70032 | |
| T7 | Transformer RF | | | 44-80073 | |
| T8 | Transformer Audio | | | 44-30642 | |
| T9 | Transformer RF | | | 44-80104 | |
| | | | | | Issue 2 |
| V1 | Transistor PNP Si | | PN4916 | PN4916 | |
| V2 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V3 | Transistor NPN White Spot BF198 | | To Spec 10-00096 | 23-20005-002 | |
| V4 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V5 | Transistor NPN | Philips | BC548 | BC548 | |
| V6 | Transistor PNP Si c/w mtg kit | Motorola | TIP32A | TIP32A | |
| V7 | Transistor NPN | Philips | BC548 | BC548 | |
| V8 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V9 | Transistor PNP Si | | PN4916 | PN4916 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| R102 | 3,3k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-33300-020 | |
| R103 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R104 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R105 | 220k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-52200-020 | |
| R106 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R107 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R108 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R109 | 2,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32700-020 | |
| R110 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R111 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R112 | 220 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-22200-020 | |
| R113 | 820 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-28200-020 | |
| R114 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R115 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R116 | 560 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-25600-020 | |
| R117 | 560 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-25600-020 | |
| R118 | 47 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-14700-020 | |
| R119 | 3,9k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-33900-020 | |
| R120 | 47k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-44700-020 | |
| R121 | S.O.T. 5% 0,33W CF Res | Philips | CR25 | 40-00000-020 | |
| R122 | 470 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-24700-020 | |
| R123 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R124 | 47 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-14700-020 | |
| R125 | 3,3k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-33300-020 | |
| R126 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R127 | 2,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32200-020 | |
| R128 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R129 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R130 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R131 | 33k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-43300-020 | |
| R132 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R133 | 270k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-52700-020 | |
| R134 | 12k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41200-020 | |
| R135 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R136 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R137 | 470k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-54700-020 | |
| R138 | 2,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32200-020 | |
| R139 | 22k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-42200-020 | |
| R140 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |

PCB Main 16MHz  Option Clarifier  ASSEMBLY 08-01644-001 PCB 07-00557  All components prefixed  

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| D43 | Diode Si | | MV2209 | 23-40001 | |
| D44 | Diode Si | | MV2209 | 23-40001 | |
| D48 | Diode Si fast low cap med cond | | | 23-10002 | |
| D49 | Diode Si fast low cap med cond | | | 23-10002 | |
| D50 | Diode Si fast low cap med cond | | | 23-10002 | |
| R5 | S.O.T. 5% 0,33W CF Res | Philips | CR25 | 40-00000-020 | |
| R60 | 220k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-52200-020 | |
| R67 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R68 | 6,8k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-36800-020 | |
| R69 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R70 | 470k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-54700-020 | |
| R71 | 5,6k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-35600-020 | |
| R72 | 6,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-36200-020 | |
| R74 | 12k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41200-020 | |
| R75 | 8,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-38200-020 | |
| Z2 | Diode Zener Si 6,8V | Philips | BZX79-C6V8 | BZX79C6V8 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| V11 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V12 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V13 | Transistor PNP Si | Philips | BC558 | BC558 | |
| V14 | Transistor PNP Si | | PN4916 | PN4916 | |
| V15 | Transistor PNP Si | | PN4916 | PN4916 | |
| V16 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V17 | Transistor NPN Red Spot BF198 | | To spec 10-00096 | 23-20005-001 | |
| V18 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V19 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V20 | Transistor PNP Si | Philips | BC558 | BC558 | |
| V21 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V22 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V23 | Transistor PNP Si | | PN4916 | PN4916 | |
| V24 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V25 | Transistor PNP Si | Philips | BC328 | BC328 | |
| V26 | Transistor NPN | Philips | BC548 | BC548 | |
| V27 | Transistor NPN | Philips | BC548 | BC548 | |
| V28 | Transistor PNP Si | Philips | BC558 | BC558 | |
| V29 | Fet Junction P Channel Si | | BF245B | BF245B | |
| V33 | Transistor NPN | Philips | BC548 | BC548 | |
| V36 | Diode Zener Si 9,1V | Philips | BZX79-C9V1 | BZX79C9V1 | |
| V38 | Diode Zener Si 3,9V | Philips | BZY88-C3V9 | BZY88C3V9 | |
| V39 | Diode Zener Si 6,8V | Philips | BZX79-C6V8 | BZX79C6V8 | |
| X1 | Crystal 1650 KHZ C.A. 01-00031 | | To Spec 01-00031 | 65-90001-000 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| T201 | Transformer RF | | | 44-80037 | |
| T202 | Transformer RF | | | 44-80037 | |
| V201 | Transistor PNP Si | Philips | BC558 | BC558 | |
| V202 | Transistor NPN Si | Philips | BF494 | BF494 | |
| V203 | Transistor NPN White Spot BF198 | | To Spec 10-00096 | 23-20005-002 | |
| Z201 | Diode Zener Si 5,6V | Philips | BZX79-C5V6 | BZX79C5V6 | |

| REF | DESCRIPTION | | | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|---|---|
| C201 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C202 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C203 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C204 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C206 | 82p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34829 | 46-18200-012 | |
| C207 | 470p | 10% | 100V | CE Cap | Philips | 2222-630-03471 | 46-24700-200 | |
| C208 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C209 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C210 | 560p | 5% | 500V | PS Cap | Philips | 2222-427-25601 | 46-25600-330 | |
| C211 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C212 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C213 | 100p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34101 | 46-21000-012 | |
| D202 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D203 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D204 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D205 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| L201 | Choke 0,1mH | | | | Sigma | SC60/25 | 43-82100-071 | |
| L202 | Transformer RF | | | | | | 44-80007 | |
| R201 | 10k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-41000-020 | |
| R202 | 2,7k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-32700-020 | |
| R203 | 10k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-41000-020 | |
| R204 | 33k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-43300-020 | |
| R205 | 1k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-31000-020 | |
| R206 | 100 | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-21000-020 | |
| R208 | 2,2k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-32200-020 | |
| R210 | 1k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-31000-020 | |
| R211 | 3,3k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-33300-020 | |
| R212 | 390 | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-23900-020 | |
| R213 | 100 | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-21000-020 | |
| R214 | 820 | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-28200-020 | |
| R215 | 3,3k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-33300-020 | |

PCB Main 16MHz OPT A/LU ASSEMBLY 08-01644-001 PCB 07-00557 All components prefixed 2

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| R151 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R155 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R156 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R157 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R158 | 6,8k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-36800-020 | |
| R159 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R160 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R161 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R162 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R163 | 6,8k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-36800-020 | |
| R164 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R165 | 47 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-14700-020 | |
| V32 | Transistor NPN | Philips | BC548 | BC548 | |
| V34 | Transistor NPN | Philips | BC548 | BC548 | |
| V35 | Transistor NPN | Philips | BC548 | BC548 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| C59 | 3,3n 10% 100V CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C68 | 1u 20% 35V TA Cap | ITT | TAG | 47-01003-510 | |
| C69 | 1n 10% 100V CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C82 | 2-22p 250V Foil Trim Capacitor | Philips | 2222-808-11229 | 49-30102 | |
| C114 | 3,3n 10% 100V CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C115 | 3,3n 10% 100V CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C116 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C117 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C118 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C119 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C120 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| C121 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| D53 | Diode Si fast low cap med cond | | | 23-10002 | |
| D54 | Diode Signal Ge | Philips | OA91 | OA91 | |
| D55 | Diode Si fast low cap med cond | | | 23-10002 | |
| D67 | Diode Si fast low cap high cond | | | 23-10001 | |
| D68 | Diode Si fast low cap high cond | | | 23-10001 | |
| D69 | Diode Si fast low cap med cond | | | 23-10002 | |
| D70 | Diode Si fast low cap med cond | | | 23-10002 | |
| D71 | Diode Si fast low cap med cond | | | 23-10002 | |
| D72 | Diode Si fast low cap med cond | | | 23-10002 | |
| FL2 | Filter | | QFO1601 | 65-91100-000 | |
| | | | QFO 1606 | 65-91102-000 | |
| L18 | Choke 1mH | Sigma | SC10/49 | 43-83100-051 | |
| R86 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R99 | 5,6k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-35600-020 | |
| R100 | 5,6k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-35600-020 | |
| R101 | 4,7k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-34700-020 | |
| R148 | 22 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-12200-020 | |
| R149 | 22 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-12200-020 | |
| R150 | 47k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-44700-020 | |

8.2.3 PCB 50 Watt P.A. ASSEMBLY 08-01838 PCB 07-00575 All components prefixed 3

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| R1 | 15 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-11500-020 | |
| R2 | 180 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21800-020 | |
| R3 | 220k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-52200-020 | |
| R4 | 390 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-23900-020 | |
| R5 | 10 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-11000-020 | |
| R6 | 5,6k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-35600-020 | |
| R7 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R8 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R9 | 4,7 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-04700-020 | |
| R10 | 4,7 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-04700-020 | |
| R11 | 56 Ohm 5% 0,5W CF Res | Philips | CR37 | 40-15600-030 | |
| R12 | 220 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-22200-020 | |
| R13 | 150 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21500-020 | |
| R14 | 680 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-26800-020 | |
| R15 | 560 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-25600-020 | |
| R16 | 150 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21500-020 | |
| R17 | 1k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31000-020 | |
| R18 | 220 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-22200-020 | |
| R19 | 68k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-46800-020 | |
| R20 | 15k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41500-020 | |
| R21 | 100k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-51000-020 | |
| R22 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R23 | 1,5k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31500-020 | |
| R24 | 3,3k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-33300-020 | |
| R25 | S.O.T. 5% 0,33W CF Res | Philips | CR25 | 40-00000-020 | |
| R26 | 820 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-28200-020 | |
| R27 | 1,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31200-020 | |
| R28 | S.O.T. 5% 0,33W CF Res | Philips | CR25 | 40-00000-020 | |
| R29 | 3,3 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-03300-020 | |
| R30 | 3,3k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-33300-020 | |
| R31 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R32 | 120 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21200-020 | |
| R33 | 100 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21000-020 | |
| R34 | S.O.T. 5% 0,33W CF Res | Philips | CR25 | 40-00000-020 | |
| R35 | 820 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-28200-020 | |
| R36 | 180 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-21800-020 | |
| R37 | 560 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-25600-020 | |
| R38 | 680 Ohm 5% 0,33W CF Res | Philips | CR25 | 40-26800-020 | |

| REF | DESCRIPTION | | | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|---|---|
| C1 | 150p | 2% | 100V N750 | CE Cap | Philips | 2222-632-58151 | 46-21500-013 | |
| C2 | 270p | 2% | 100V N750 | CE Cap | Philips | 2222-632-58271 | 46-22700-013 | |
| C3 | 330p | 2% | 100V N750 | CE Cap | Philips | 2222-632-58331 | 46-23300-013 | |
| | | | | | | | | Issue 2 |
| C4 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C5 | 68u | | 16V | EL Cap | Philips | 2222-030-25689 | 48-16801-611 | |
| C7 | 4,7u | 20% | 35V | TA Cap | ITT | TAG | 47-04703-510 | |
| C8 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C9 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C10 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C11 | 68u | | 16V | EL Cap | Philips | 2222-030-25689 | 48-16801-611 | |
| C12 | 100n | | 63V | CE Cap | Elna | TL | 46-51000-210 | |
| C13 | 68u | | 16V | EL Cap | Philips | 2222-030-25689 | 48-16801-611 | |
| C14 | 470n | 20% | 50V | CC Cap | Vitramon | VJ2321X474MF | 46-54700-280 | |
| C15 | 100n | 10% | 100V | CC Cap | Vitramon | VJ1808Y104KF | 46-51000-280 | |
| C18 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C19 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C20 | 1n | 10% | 100V | CE Cap | Philips | 2222-630-03102 | 46-31000-200 | |
| C21 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C22 | 3,3n | 10% | 100V | CE Cap | Philips | 2222-630-03332 | 46-33300-200 | |
| C23 | 10u | 20% | 35V | TA Cap | ITT | TAG | 47-11003-510 | |
| C24 | 47n | | 63V | CE Cap | Samwha | TL | 46-44700-210 | |
| C25 | 10u | 20% | 35V | TA Cap | ITT | TAG | 47-11003-510 | |

| | | |
|---|---|---|
| D1 | Diode Si fast low cap high cond | 23-10001 |
| D2 | Diode Si fast low cap high cond | 23-10001 |
| D3 | Diode Si fast low cap high cond | 23-10001 |
| D4 | Diode Si fast low cap high cond | 23-10001 |
| D5 | Diode Si fast low cap high cond | 23-10001 |
| D6 | Diode Si fast low cap high cond | 23-10001 |
| D7 | Diode Si fast low cap high cond | 23-10001 |

| | | |
|---|---|---|
| L1 | Inductor | 44-80044 |
| L2 | Inductor | 44-80044 |
| L3 | Inductor | 44-80044 |
| L4 | Inductor | 44-80044 |

| REF | DESCRIPTION | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|
| R39 | 1k Ohm 5% 0,33W CF Res | | Philips | CR25 | 40-31000-020 | |
| T1 | Transformer RF | | | | 44-80087 | |
| T2 | Transformer RF | | | | 44-80074 | |
| T3 | Transformer Driver | | | | 44-80144 | |
| T4 | Transformer Output | | | | 44-80146 | |
| T5 | Transformer RF | | | | 44-80021 | |
| T6 | Transformer Reverse Power | | | | 44-80145 | |
| T7 | Transformer RF | | | | 44-80021 | |
| IC1 | Amplifier AGC | IC | Plessey | SL610CT | SL610C | |
| IC2 | Operational Amplifier Dual | IC | National | LM358N | XA-00358-100 | |
| V1 | Transistor NPN Si | | | BF199 | BF199 | |
| V2 | Transistor NPN Si c/w mntg kits | | | BD135 | BD135 | |
| V3 | Transistor NPN Si c/w mntg kits | | | BD135 | BD135 | |
| V4 | Transistor NPN Si | | Motorola | MRF455 Flange mount | MRF455 | |
| V5 | Transistor NPN Si | | Motorola | MRF455 Flange mount | MRF455 | |
| V6 | Transistor PNP Si | | Philips | BC640 | BC640 | |
| V7 | Transistor NPN Si | | Philips | BC338 | BC338 | |
| V8 | Transistor NPN Si c/w mntg kits | | | BD135 | BD135 | |
| V9 | Transistor NPN | | Philips | BC548 | BC548 | |
| V10 | Transistor NPN Si c/w mntg kits | | Philips | BD675 | BD675 | |
| V11 | Transistor PNP Si | | Philips | BC328 | BC328 | |
| V12 | Diode Zener Si 6,8V | | Philips | BZX79-C6V8 | BZX79C6V8 | |
| V13 | Diode Zener Si 5,6V | | Philips | BZX79-C5V6 | BZX79C5V6 | |
| V14 | Diode Zener Si 5,1V | | | 1N5338B | 1N5338B | |
| | Can Transistor Screen | | Philips | T05 | 30-06000-001 | |
| | RELAY 12V 1C/O HORI.MOUNT | | OMRON | G2L-113P CR306 | 64-10301-120 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| C1 | 330p 2% 100V N750 CE Cap | Philips | 2222-632-58331 | 46-23300-013 | |
| C2 | 330p 2% 100V N750 CE Cap | Philips | 2222-632-58331 | 46-23300-013 | |
| C3 | 330p 2% 100V N750 CE Cap | Philips | 2222-632-58331 | 46-23300-013 | |
| C4 | 180p 2% 100V N750 CE Cap | Philips | 2222-632-58181 | 46-21800-013 | |
| C5 | 330p 2% 100V N750 CE Cap | Philips | 2222-632-58331 | 46-23300-013 | |
| C6 | 330p 2% 100V N750 CE Cap | Philips | 2222-632-58331 | 46-23300-013 | |
| C7 | 330p 2% 100V N750 CE Cap | Philips | 2222-632-58331 | 46-23300-013 | |
| C8 | 1,5n 5% 125V PS Cap | Philips | 2222-425-21502 | 46-31500-310 | |
| C9 | 6,8n 5% 63V PS Cap | Philips | 2222-424-26802 | 46-36800-300 | |
| C10 | 1n 5% 125V PS Cap | Philips | 2222-425-21002 | 46-31000-310 | |
| C11 | 2,2n 5% 125V PS Cap | Philips | 2222-425-22202 | 46-32200-310 | |
| C12 | 1,8n 5% 125V PS Cap | Philips | 2222-425-21802 | 46-31800-310 | |
| C18 | 47n 63V CE Cap | Samwha | TL | 46-44700-210 | |
| L1 | Inductor | | | 44-70088 | |
| L2 | Inductor P.A. | | | 44-70208 | |
| L3 | Transformer | | | 44-70209 | |
| L4 | Inductor .25uH | | | 44-70220 | |
| L5 | Inductor | | | 44-70101 | |
| L6 | Inductor | | | 44-70188 | |
| R1 | 470 Ohm 5% 0,5W CF Res | Philips | CR37 | 40-24700-030 | |

| REF | DESCRIPTION | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|
| R8 | 390k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-53900-020 | |
| R9 | 100k Ohm 2% 0,5W MF Res | Philips | MR30 | 40-51000-510 | |
| R10 | 91k Ohm 2% 0,5W MF Res | Philips | MR30 | 40-49100-510 | |
| R11 | 1M Ohm 5% 0,33W CF Res | Philips | CR25 | 40-61000-020 | |
| R12 | 33k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-43300-020 | |
| R13 | 470k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-54700-020 | |
| R14 | 1M Ohm 5% 0,33W CF Res | Philips | CR25 | 40-61000-020 | |
| R15 | 2,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32200-020 | |
| R16 | 100k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-51000-020 | |
| R17 | S.O.T. 5% 0,33W CF Res | Philips | CR25 | 40-00000-020 | |
| R18 | 1,5k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-31500-020 | |
| R19 | 100k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-51000-020 | |
| R21 | 1M Ohm 5% 0,33W CF Res | Philips | CR25 | 40-61000-020 | |
| R22 | 120k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-51200-020 | |
| R23 | 3,3M Ohm 10% 0,33W CF Res | Philips | CR25 | 40-63300-020 | |
| R24 | 560k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-55600-020 | |
| R25 | 150k Ohm 2% 0,5W MF Res | Philips | MR30 | 40-51500-510 | |
| R26 | 150k Ohm 2% 0,5W MF Res | Philips | MR30 | 40-51500-510 | |
| R27 | 1M Ohm 5% 0,33W CF Res | Philips | CR25 | 40-61000-020 | |
| R28 | 220k Ohm 2% 0,5W MF Res | Philips | MR30 | 40-52200-510 | |
| R29 | 240k Ohm 2% 0,5W MF Res | Philips | MR30 | 40-52400-510 | |
| R30 | 1M Ohm 5% 0,33W CF Res | Philips | CR25 | 40-61000-020 | |
| R31 | 33k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-43300-020 | |
| R32 | 470k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-54700-020 | |
| R33 | 1M Ohm 5% 0,33W CF Res | Philips | CR25 | 40-61000-020 | |
| R34 | 2,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32200-020 | |
| R35 | 100k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-51000-020 | |
| R36 | 2,2k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-32200-020 | |
| R37 | 1M Ohm 5% 0,33W CF Res | Philips | CR25 | 40-61000-020 | |
| R38 | 2,7M Ohm 10% 0,33W CF Res | Philips | CR25 | 40-62700-020 | |
| R39 | 10k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-41000-020 | |
| R40 | 470k Ohm 5% 0,33W CF Res | Philips | CR25 | 40-54700-020 | |
| R41 | 1M Ohm 5% 0,33W CF Res | Philips | CR25 | 40-61000-020 | |
| RV1 | Potentiometer Vert Trim Lin 10K | Philips | 2322-410-05007 | 42-41078-000 | |
| IC1 | Operational Amplifier Quad IC | National | LM3900N | XA-03900-000 | |
| IC2 | Operational Amplifier Quad IC | National | LM3900N | XA-03900-000 | |
| IC3 | Operational Amplifier Quad IC | National | LM3900N | XA-03900-000 | |
| V5 | Fet Junction P Channel | | 2N5461 | 2N5461 | |

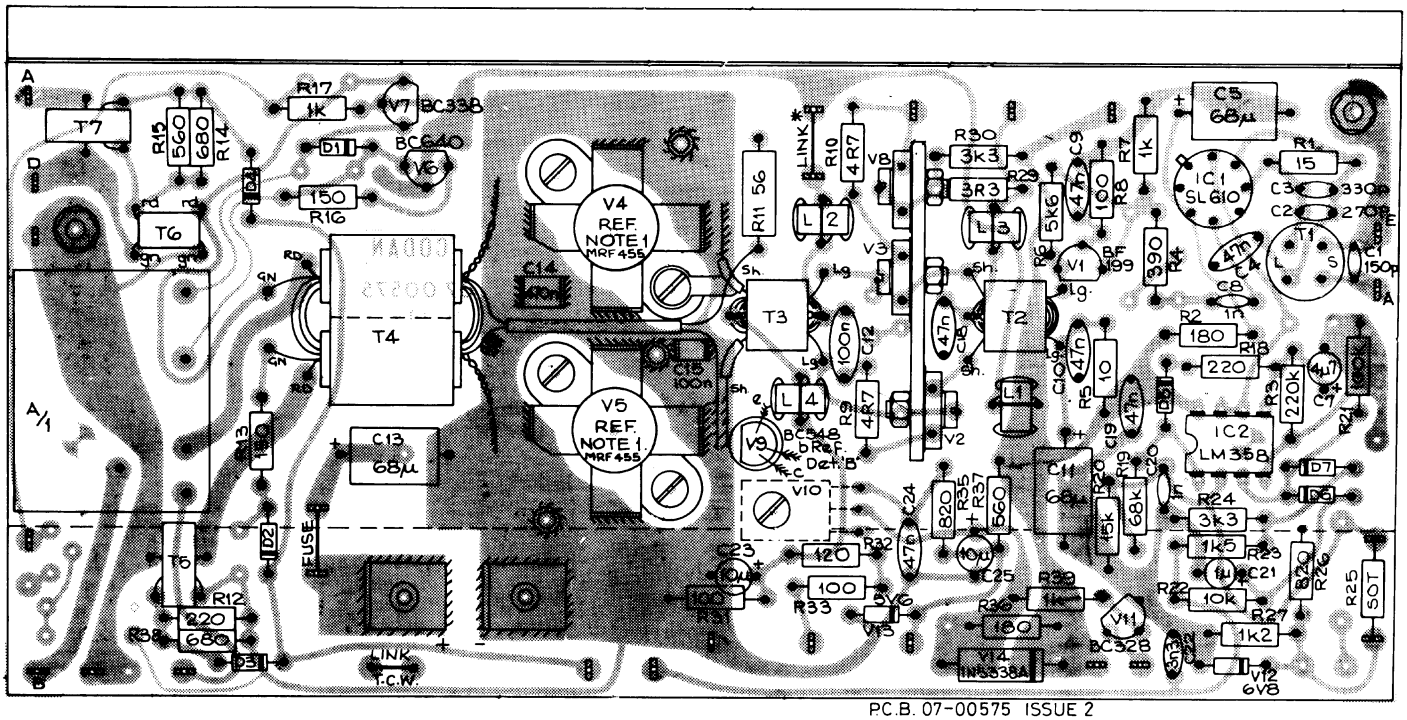
| REF | DESCRIPTION | | | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|---|---|
| C1 | 10n | 10% | 250V | PE Cap | Philips | 2222-342-45103 | 46-41000-500 | |
| C2 | 10n | 10% | 250V | PE Cap | Philips | 2222-342-45103 | 46-41000-500 | |
| C3 | 390p | 5% | 250V | PS Cap | Philips | 2222-426-23901 | 46-23900-320 | |
| C4 | 56p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34569 | 46-15600-012 | |
| C5 | 6,8n | 5% | 63V | PS Cap | Philips | 2222-424-26802 | 46-36800-300 | |
| C6 | 390p | 5% | 250V | PS Cap | Philips | 2222-426-23901 | 46-23900-320 | |
| C7 | 56p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34569 | 46-15600-012 | |
| C8 | 6,8n | 5% | 63V | PS Cap | Philips | 2222-424-26802 | 46-36800-300 | |
| C9 | 47n | 10% | 250V | PE Cap | Philips | 2222-342-45473 | 46-44700-500 | |
| C10 | 1u | 20% | 35V | TA Cap | ITT | TAG | 47-01003-510 | |
| C11 | 47n | 10% | 250V | PE Cap | Philips | 2222-342-45473 | 46-44700-500 | |
| C12 | 47n | 10% | 250V | PE Cap | Philips | 2222-342-45473 | 46-44700-500 | |
| C13 | 1,2n | 5% | 125V | PS Cap | Philips | 2222-425-21202 | 46-31200-310 | |
| C14 | 150p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34151 | 46-21500-012 | |
| C15 | 6,8n | 5% | 63V | PS Cap | Philips | 2222-424-26802 | 46-36800-300 | |
| C16 | 1,2n | 5% | 125V | PS Cap | Philips | 2222-425-21202 | 46-31200-310 | |
| C17 | 150p | 2% | 100V N150 | CE Cap | Philips | 2222-632-34151 | 46-21500-012 | |
| C18 | 6,8n | 5% | 63V | PS Cap | Philips | 2222-424-26802 | 46-36800-300 | |
| C19 | 47n | 10% | 250V | PE Cap | Philips | 2222-342-45473 | 46-44700-500 | |
| C20 | 2,2u | 20% | 35V | TA Cap | ITT | TAG | 47-02203-510 | |
| C21 | 2,2u | 20% | 35V | TA Cap | ITT | TAG | 47-02203-510 | |
| D1 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D2 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D3 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D4 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D5 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D6 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| R1 | 100k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-51000-020 | |
| R2 | 680k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-56800-020 | |
| R3 | 330k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-53300-020 | |
| R4 | 100k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-51000-020 | |
| R5 | 470k | Ohm 5% | 0,33W | CF Res | Philips | CR25 | 40-54700-020 | |
| R6 | 120k | Ohm 2% | 0,5W | MF Res | Philips | MR30 | 40-51200-510 | |
| R7 | 120k | Ohm 2% | 0,5W | MF Res | Philips | MR30 | 40-51200-510 | |

| REF | DESCRIPTION | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|
| IC2 | Operational Amplifier | IC | National | LM741CN | XA-00741-100 | |
| V3 | Transistor PNP Si | | Philips | BC558 | BC558 | |
| V4 | Transistor PNP Si | | Philips | BC328 | BC328 | |

| REF | DESCRIPTION | | | | MAN. NAME | MAN. PARTNO | PARTNO | REMARKS |
|---|---|---|---|---|---|---|---|---|
| C3 | 330p | 5% | 250V | PS Cap | Philips | 2222-426-23301 | 46-23300-320 | |
| C6 | 330p | 5% | 250V | PS Cap | Philips | 2222-426-23301 | 46-23300-320 | |
| C7 | 4,7u | 20% | 35V | TA Cap | ITT | TAG | 47-04703-510 | |
| C8 | 4,7u | 20% | 35V | TA Cap | ITT | TAG | 47-04703-510 | |
| C9 | 10n | 2% | 63V | PS Cap | Philips | 2222-424-31003 | 46-41000-301 | |
| C10 | 10n | 2% | 63V | PS Cap | Philips | 2222-424-31003 | 46-41000-301 | |
| D1 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D2 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D3 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| D4 | Diode Si fast low cap med cond | | | | | | 23-10002 | |
| R2 | 100k | Ohm | 2% | 0,5W | MF Res | Philips | MR30 | 40-51000-510 |
| R3 | 33k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-43300-020 |
| R5 | 4,7k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-34700-020 |
| R6 | 4,7k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-34700-020 |
| R8 | 68k | Ohm | 2% | 0,5W | MF Res | Philips | MR30 | 40-46800-510 |
| R9 | 33k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-43300-020 |
| R11 | 4,7k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-34700-020 |
| R12 | 4,7k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-34700-020 |
| R13 | 82k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-48200-020 |
| R14 | 100k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-51000-020 |
| R15 | 22k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-42200-020 |
| R16 | 470 | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-24700-020 |
| R17 | 10k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-41000-020 |
| R1a | 10k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-41000-020 |
| R1b | S.O.T. | | 5% | 0,33W | CF Res | Philips | CR25 | 40-00000-020 |
| R4a | 100k | Ohm | 2% | 0,5W | MF Res | Philips | MR30 | 40-51000-510 |
| R4b | S.O.T. | | 5% | 0,33W | CF Res | Philips | CR25 | 40-00000-020 |
| R7a | 10k | Ohm | 5% | 0,33W | CF Res | Philips | CR25 | 40-41000-020 |
| R7b | S.O.T. | | 5% | 0,33W | CF Res | Philips | CR25 | 40-00000-020 |
| R10a | 68k | Ohm | 2% | 0,5W | MF Res | Philips | MR30 | 40-46800-510 |
| R10b | S.O.T. | | 5% | 0,33W | CF Res | Philips | CR25 | 40-00000-020 |
| IC1 | Operational Amplifier | | | | IC | National | LM741CN | XA-00741-100 |

## 9. DRAWINGS

| | |
|---|---|
| Main PCB Circuit Diagram | 04-01182 |
| Main PCB Layout | 08-01644-001 |
| PA & Chassis Circuit Diagram | 04-01236 |
| PA PCB Layout | 08-01838 |
| PA Filter PCB | 08-01839 |
| Mute Circuit Diagram | 04-00719 |
| Mute PCB | 08-01361 |
| Emergency Call PCB | 08-00889 |



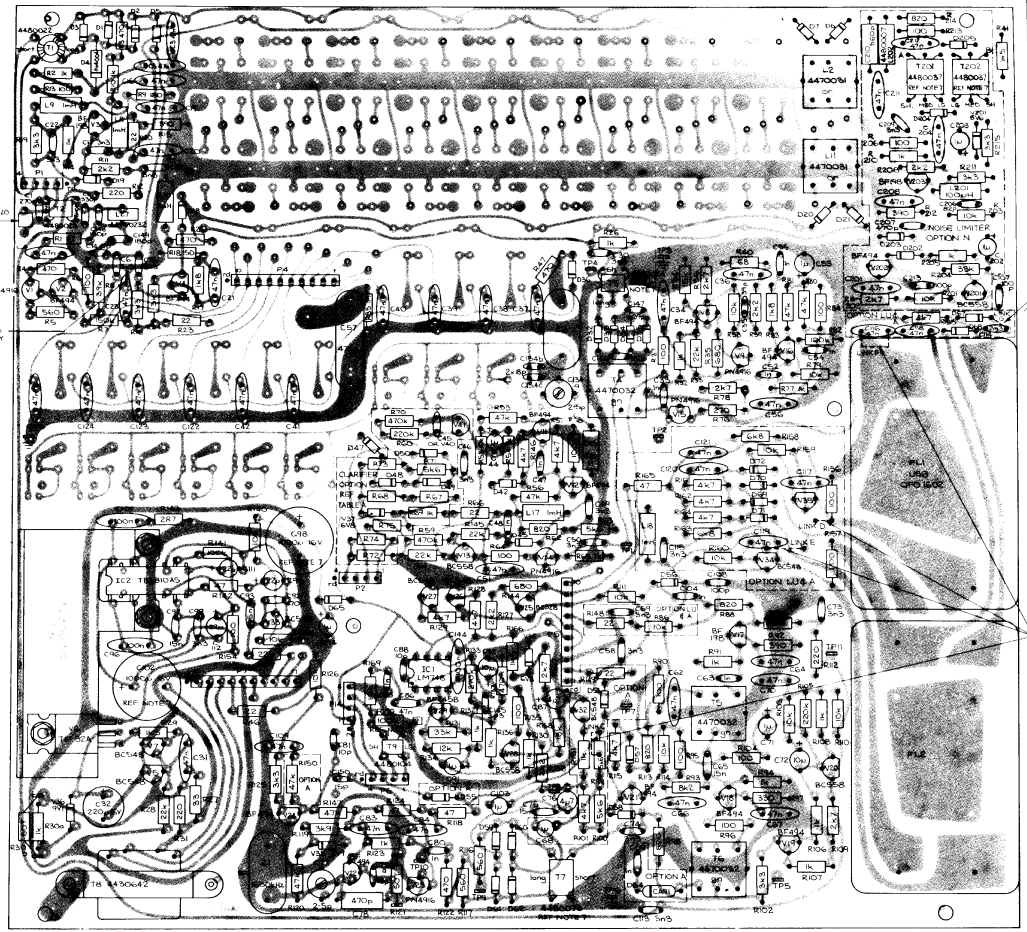

P.C.B. 07-00575 ISSUE 2

| TRANSFORMER | | WINDINGS |
|---|---|---|
| T1 | 44-80087 RED | Short Green Long Red |
| T2 | 44-80074 RD/YEL | Short Red Long Red |
| T3 | 44-80144 SL/BL | Short Red Long Red |
| T4 | 44-80146 SL/BK | |
| T5 | 44-80021 ORANGE | Short-T.C.W long-Green |
| T6 | 44-80145 SL/YL | Short Red Long Green |
| T7 | 44-80021 ORANGE | Short-T.C.W Long-Green |

NOTES:-

1. COAT V4&5 FLANGE WITH THERMAFLOW COMPOUND BEFORE FIXING TO HEATSINK.
2. FOR SOLDERING C14 & 15 AND ASSOCIATED TRANSISTORS & TRANSFORMERS, USE CAPALLOY 62% Sn, 36% Pb, 2% Ag.
3. L1-4 ARE 44-80044.
4. V2,3 & 8 ARE BD135.
5. V10 IS BD675.
6. ENSURE SPACE BETWEEN V9 & HEATSINK IS FILLED WITH THERMAFLOW

P.A. P.C.B. ASSY. 08-01838




| OPTION No | CODE | OPTION |
|---|---|---|
| 15-10058 | A | AM |
| 15-10047 | U | USB |
| 15-10048 | LJ | LSB |
| 15-10049 | LJ | LSB & USB |
| 15-10051 | | NO CLARIFIER |
| 15-10052 | CAN | NARROW RX ONLY |
| 15-10053 | CBN | RX & TX |
| 15-10054 | CAW | WIDE RX ONLY |
| 15-10055 | CBW | RX & TX |
| 15-10058 | N | NOISE LIMITER |

| TRANSFORMER | | WINDINGS | |
|---|---|---|---|
| T1 | 44-80022 | ye | SHORT - ye<br>LONG - gn |
| T2 | 44-80025 | gn | SHORT - rd<br>LONG - gn |
| T3 | 44-80024 | bl | SHORT - gn<br>LONG - rd |
| T7 | 44-80073 | bk or rd | SHORT - rd<br>LONG - gn |
| T9 | 44-80104 | bk or bn | SHORT - gn<br>LONG - rd |
| T201<br>T202 | 44-80037 | bk or bn | SHORT - gn<br>MEDIUM - rd<br>LONG - rd |

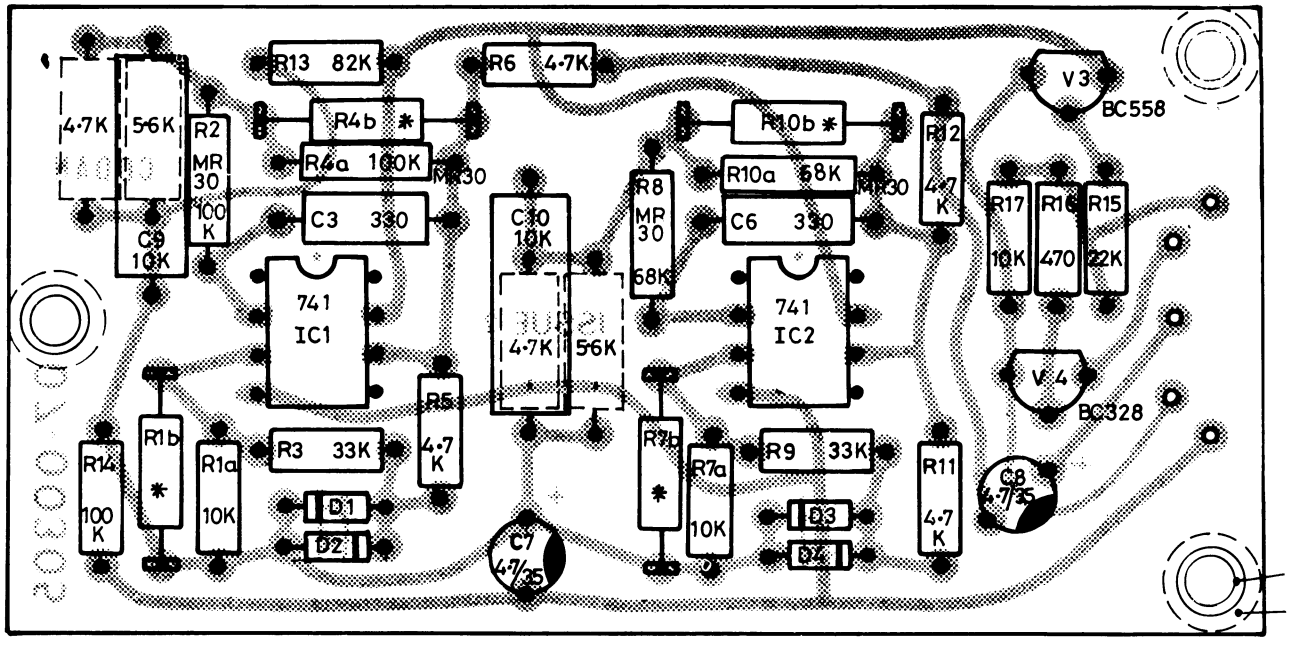
PCB 07-00557 ISS.6

TABLE A

| CODE | CLARIFIER | C45 | V40 | V41 | R48 | R49 | R60 | R66 | R67 | R68 | R69 | R70 | R71 | R72 | R73 | R74 | R75 | V37 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NOT FITTED | 82p | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| CAN | NARROW RX ONLY | 39p | – | MV2109 | ✓ | ✓ | ✓ | ✓ | 10K | 6k8 | ✓ | ✓ | ✓ | 6k2 | – | 12k | 8k2 | ✓ |
| CBN | NARROW RX & TX | 39p | – | MV2109 | ✓ | ✓ | ✓ | ✓ | – | – | ✓ | ✓ | ✓ | 6k2 | – | 12k | 8k2 | ✓ |
| CAW | WIDE RX ONLY | | MV2109 | MV2109 | ✓ | ✓ | ✓ | ✓ | 10k | 6k8 | ✓ | ✓ | ✓ | LINK | 33k | – | LINK | |
| CBW | WIDE RX & TX | | MV2109 | MV2109 | – | ✓ | – | ✓ | – | – | ✓ | ✓ | ✓ | LINK | 33k | – | LINK | |

NOTES :-
1. FIT TOW LINK BETWEEN A & B WHEN OPTION 'N' IS NOT FITTED.
2. ALL DIODES IN914A OR EQUIVALENT UNLESS SHOWN OTHERWISE.
3. TIN ON TOP OF BOARD AROUND MOUNTING HOLES BEFORE FITTING FILTERS.
4. FIT LINKS C,D,E,F & G WHEN OPTION 'U' OR 'A' NOT FITTED. FIT LINK C WHEN OPTION 'LU' FITTED.

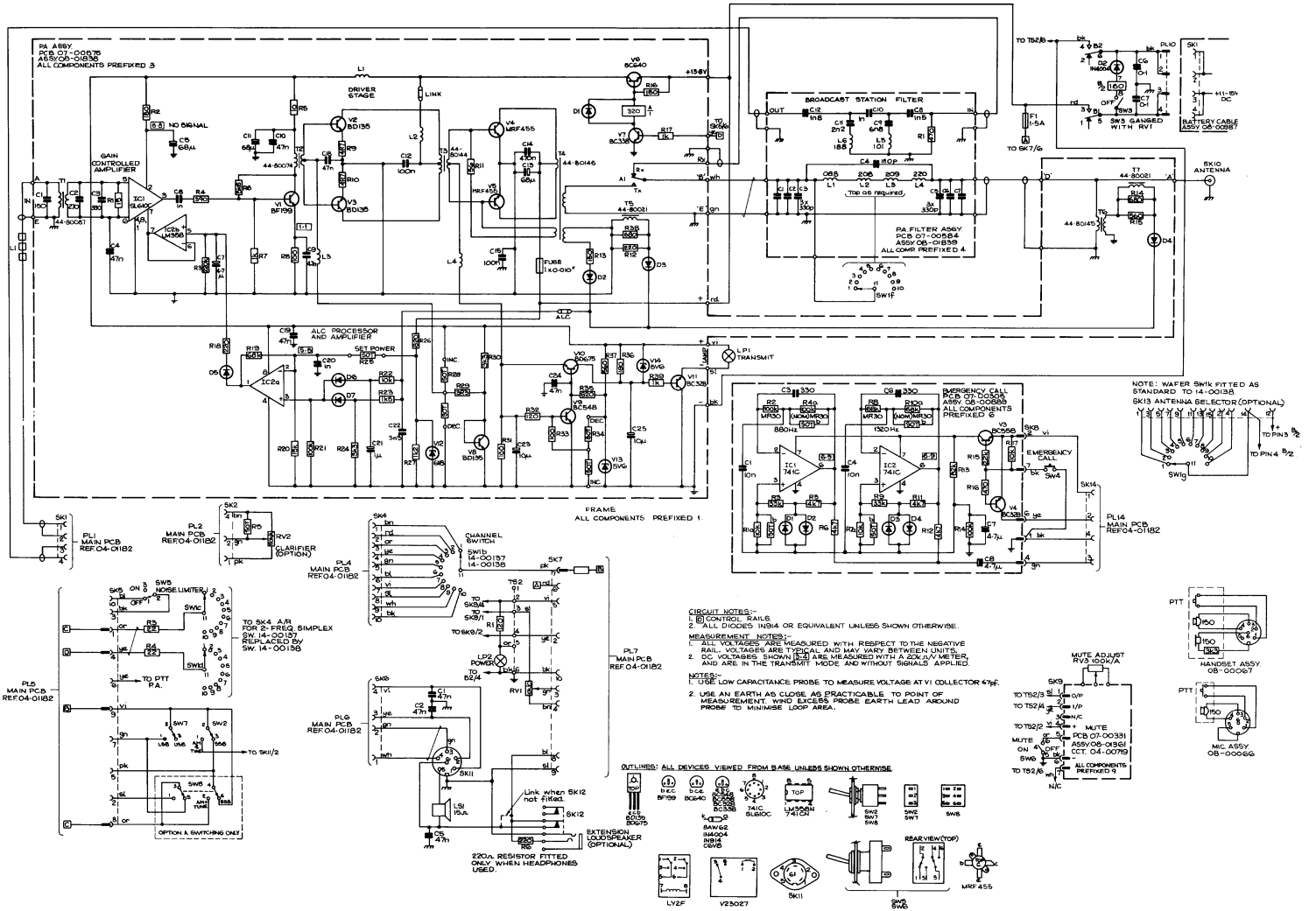
MAIN P.C.B. ASSY. 08-01644-001 ISS.2



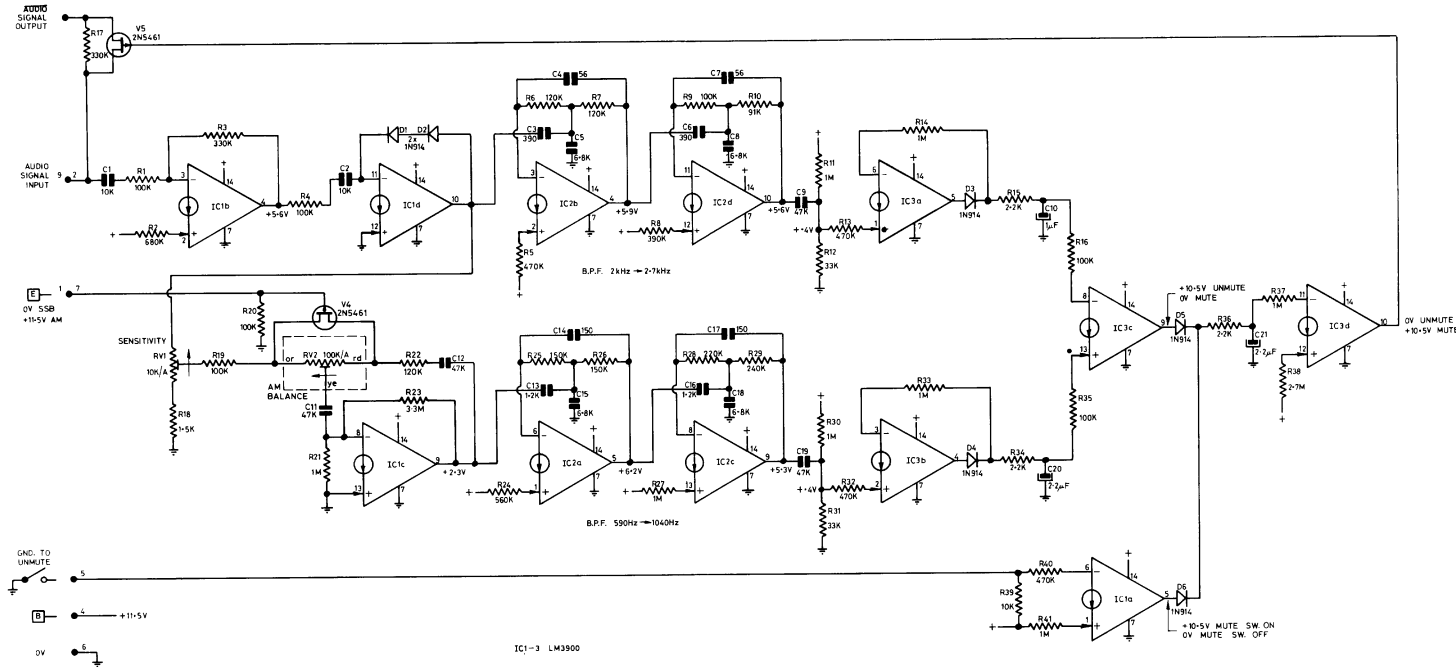

P.C.B. 07-00305 ISS. 2.

* SELECT ON TEST.
R4a 100K NOM.
R10a 68K NOM.

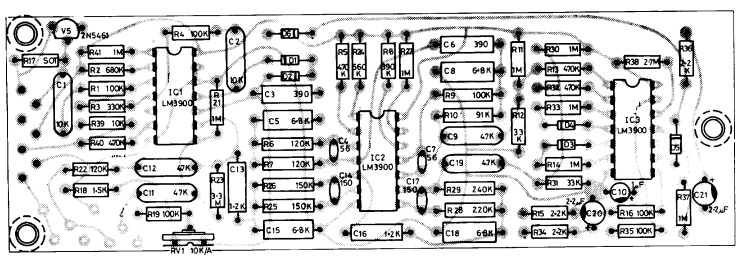
EMERGENCY CALL P.C.B. ASSY. 08-00889 ISS. 4




P.A. & CHASSIS 04-01236 ISS.1

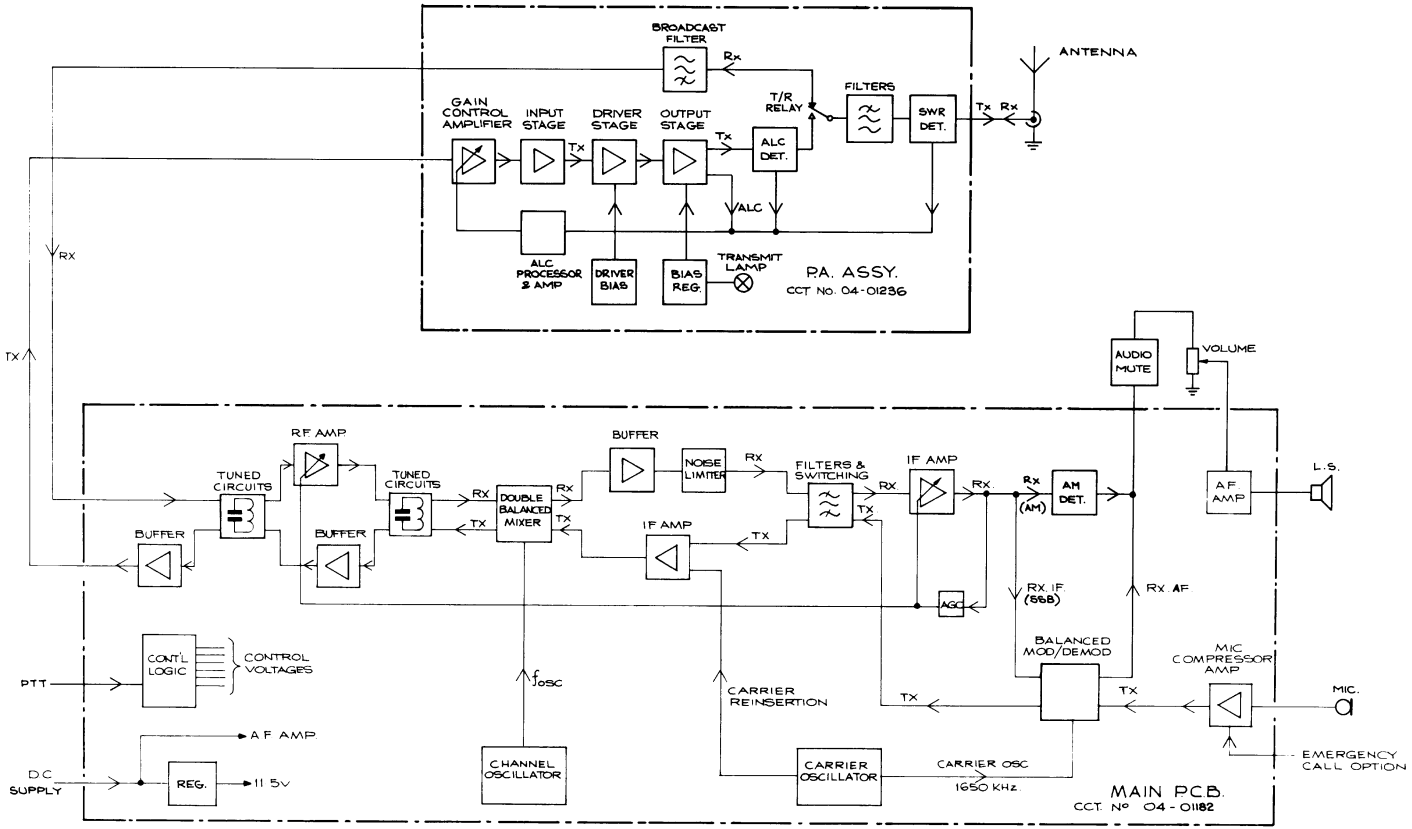



MUTE 04-00719 ISS. 4

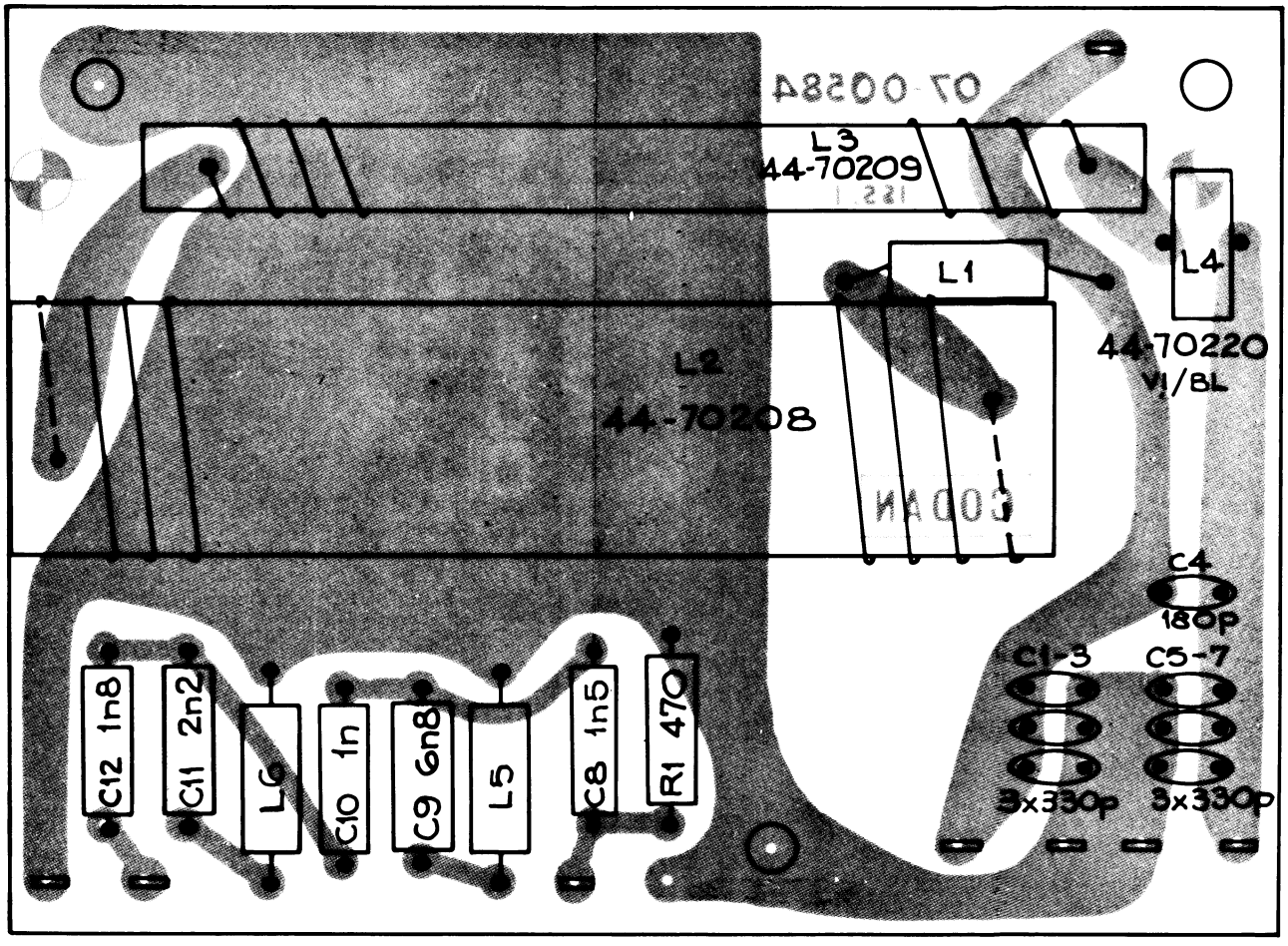


P.C.B.07-00331 ISS.1.

MUTE P.C.B. ASSY. 08-01361 ISS.2




BLOCK DIAGRAM 03-00359




P.C.B. 07-00584 ISS.1

| | |
|---|---|
| L1 | 44-70088 |
| L5 | 44-70101 |
| L6 | 44-70188 |

FILTER P.C.B. ASSY. 08-01839 ISS.1