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GENERAL AND TECHNICAL INFORMATION

Promulgated by Command
of the Air Council

M. J. Dean

AIR MINISTRY

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CHAPTER I

GENERAL DESCRIPTION AND SUMMARY OF DATA

The Pye PTC 2107 V.H.F. A.M. Transistor 'Ranger' Mobile Radiotelephone is designed to provide a reliable and continuous means of communication between mobile units and base stations and can be installed in any vehicle which can provide the necessary 12 volt d.c. supply with either positive or negative ground.

The equipment is designed to operate on fixed frequencies between 25 and 174 Mc/s in schemes employing any channel spacing down to 20 kc/s. A switched version of this equipment providing up to six switch selected channels is available if required.

The transmitter provides an r.f. output of approximately 5 watts, which is adequate for most urban and rural systems.

The receiver is a single superheterodyne in the 25 to 68 Mc/s range and a double superheterodyne in the 68 to 174 Mc/s range, the following three versions being available.

Type V (Very Narrow)	20 to 30 kc/s channelling
Type N (Narrow)	40 to 60 kc/s channelling
Type W (Wide)	100 kc/s channelling or greater

The main unit comprises a robust steel case which contains the transmitter, the receiver and the transistorised power supply unit. This unit is primarily designed for mounting in the trunk of a car, but may be installed in any convenient position in any other vehicle.

The main unit may be removed from its mounting cradle after releasing two fasteners and the covers may be removed after releasing a spring catch, in order to gain access to both top and underside of the chassis.

The small control unit containing the loudspeaker and the operating controls can be fitted in the most convenient position for the operator. The fist microphone, complete with press-to-transmit switch, is independently mounted.

The Type V version of this equipment is designed to meet British Post Office Specification W6288 and the Type N version is designed to meet British Post Office Specification W6289B. Alternative versions are designed to meet existing U.S. Federal Communications Commission and Canadian Department of Transport requirements.

SUMMARY OF DATA

Operation	Single or double frequency simplex
Frequency range	25 - 174 Mc/s
Frequency bands	Band J 25-32.5 Mc/s Band H 32.5-42 Mc/s Band G 42 - 54 Mc/s Band F 54 - 68 Mc/s Band E 68 - 88 Mc/s

PTC 2107

Frequency bands (cont.)

Band D	88 -108 Mc/s	
Band C	108-132 Mc/s	
Band B	132-156 Mc/s	
Band A	148-174 Mc/s	

Channel spacing

Type V	(Very Narrow)	20 to 30 kc/s
Type N	(Narrow)	40 to 60 kc/s
Type W	(Wide)	100 kc/s or greater

Note: With the exception of receiver and transmitter crystals. only one receiver unit requires modifications to change from one channel spacing to another.

Optional features

Multi-channel operation with up to six switch-selected channels. (If all channels are within ±0.2% of the mean carrier frequency the performance of the equipment will be maintained within the quoted specification).

Thermostatically controlled crystal ovens

Squelch

Telephone handset in place of fist microphone

Shock absorbing mountings for main unit cradle

Power supply

12 volts d.c. nominal, positive or negative ground

Power consumption

Receive	Standby	Transmit
4.4A	6.3A	9.7A

When squelch is fitted, consumption will be increased by 0.5A.

Controls

On Control Unit

OFF-RX-S/BY switch
VOLUME(a.f.gain) control
SQUELCH sensitivity control (if fitted). This control can be fitted on the front panel of the main unit if required
CHANNEL selector switch (if fitted)

On Front Panel of Main Unit

I.F. gain control (fitted on power supply unit chassis when the SQUELCH control is fitted on the front panel of the main unit)
Local transmit switch (for testing)

On Microphone

Press-to-transmit switch (Pressel switch if a telephone handset is supplied)

Dimensions

Main Unit (including cradle)

15 1/16" wide x 7¼" high x 14¼" deep
(38.3cm x 18.4cm x 36.2cm)

Dimensions (cont.)	Control Unit 9" wide x 3 3/16" high x $3\frac{3}{4}$" deep (22.9 cm x 8.1 cm x 9.5 cm)
Weight	Main Unit (including cradle) 31 $\frac{1}{4}$ lb (14.2 kg) Control Unit 4 lb (1.8 kg)
Construction	Main Unit Steel chassis enclosed in 'lazy U' quick-release hinged covers. Mounted on steel cradle with optional shock-absorbing mountings Control Unit Pressed steel case made in two sections. Separate microphone mounting
Finish	Main Unit Covers: Blue hammertone End panels: Smoke grey (tint No. 692 to B.S. 381C) Control Unit Smoke grey (tint No. 692 to B.S. 381C) with satin chrome escutcheon External metal fittings are chromium plated and all materials have been chosen to ensure that the equipment will provide reliable operation under the most severe climatic conditions.
Metering	A meter socket is provided on the front panel of the main unit to allow connection to a Pye PTC 409 Test Set for routine testing
Antenna	A quarter-wave vertical whip antenna for vehicle mounting is normally supplied with the equipment, connection to which is by 39Ω co-axial cable

RECEIVER

Sensitivity	Approximately 1 watt output for 2μV e.m.f. input with the following signal-to-noise ratios:- 25 to 68 Mc/s — 11dB 68 to 156 Mc/s — 9dB 148 to 148 Mc/s — 8dB
Noise limiter	Series type which effectively suppresses impulse interference such as that caused by motor vehicle ignition systems

Valve and semiconductor complement

		British	American
V1	R.F. amplifier	EC91	6AQ4
V2	R.F. amplifier	EC91	6AQ4
V3	R.F. amplifier (25-68 Mc/s)	EC91	6AQ4
	1st mixer (68-174 Mc/s)	EC91	6AQ4
V4	Mixer (25-68 Mc/s)	ECF80	6BL8
	2nd mixer/oscillator (68-174 Mc/s)	ECF80	6BL8
V5	1st i.f. amplifier	6BJ6	6BJ6
V6	2nd i.f. amplifier	6BJ6	6BJ6
V7	3rd i.f. amplifier	6CB6	6CB6
V8	Detector, a.g.c. and 1st a.f. amplifier	EBC90	6AT6
V9	A.F. output	EL90	6AQ5
V10	Oscillator/multiplier (68-174 Mc/s)	ECF80	6BL8
V11	Oscillator (25-68 Mc/s)	6BH6	6BH6
MR1	Noise limiter	OA200	

Squelch (if fitted)

V1	D.C. amplifier and squelch	ECC81	12AT7
MR3	Noise rectifier	WX6	

TRANSMITTER

Power output — 4 to 6 watts, depending on operating frequency

Modulation — High level amplitude modulation is employed

Valve complement

		British	American
V1	Crystal oscillator	6BH6	6BH6
V2	Multiplier (68 to 174 Mc/s only)	6BH6	6BH6
V3	Multiplier	QQV03-10	6360
V4	Power amplifier	QQV03-10	6360
V5	Microphone and audio amplifiers	ECC83	12AX7
V6	Modulator amplifier	EL84	6BQ5

POWER SUPPLY

Semiconductor complement

VT1	Oscillator	OC35 or NKT404
VT2	Oscillator	OC35 or NKT404
MR1	Rectifier	OA214, 60AS or 50AS
MR2	Rectifier	OA214, 60AS or 50AS

COMPONENT CODING

In order to identify the location of components a sub-assembly prefix number appears before each code reference throughout this handbook.

The four main sub-assemblies have been allocated numbers as follows:-

Transmitter	1
Power supply unit	2
Receiver	3
Control unit	4

For example:- R1 located on the transmitter is designated 1R1

R1 located on the receiver is designated 3R1, etc.

CHAPTER II

CIRCUIT DESCRIPTION

RECEIVER

CIRCUIT FEATURES

25 to 68 Mc/s

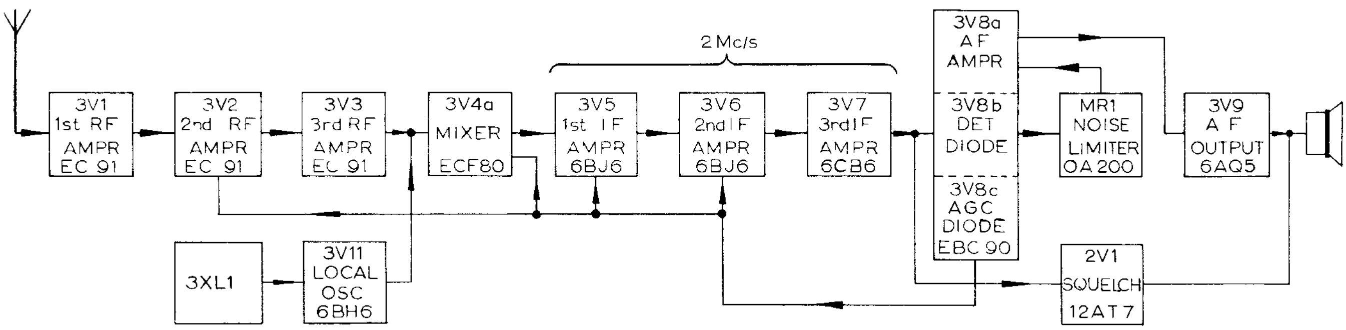


Fig.1 Receiver Block Diagram - 25 to 68 Mc/s

This receiver employs ten valves in a single superheterodyne circuit. Three grounded grid r.f. amplifiers are followed by a mixer stage employing a crystal controlled overtone oscillator, which produces the i.f. of 2 Mc/s. This is amplified in a three stage i.f. amplifier before detection and a.f. amplification.

Interposed between the detector and the first a.f. amplifier is a series noise limiter designed to suppress pulse type interference such as that caused by vehicle ignition systems. The audio signal from the first a.f. amplifier is capacity coupled to a beam tetrode for final amplification.

68 to 174 Mc/s

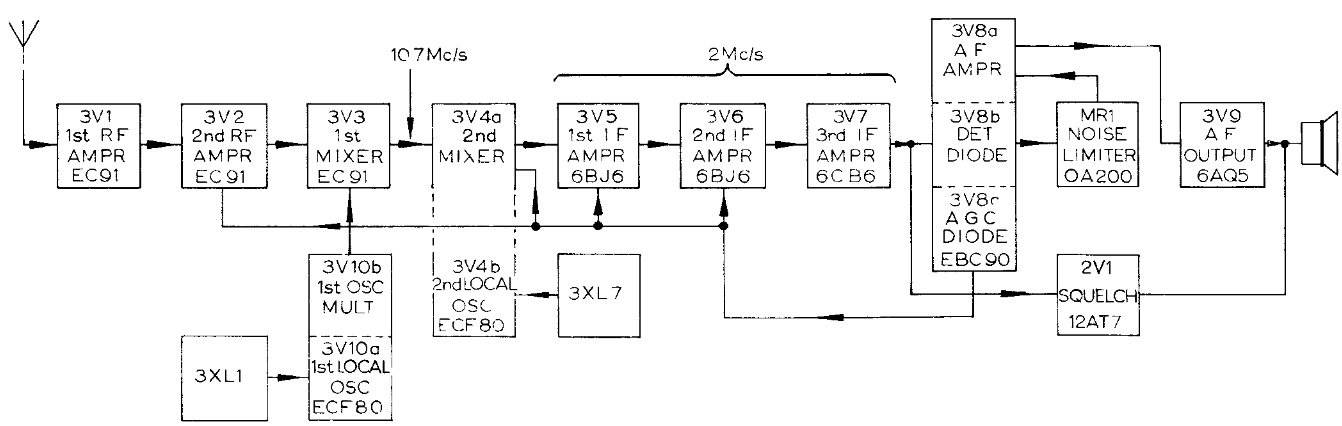


Fig.2 Receiver Block Diagram - 68 to 174 Mc/s

This receiver employs ten valves in a double superheterodyne circuit. Two grounded grid r.f. amplifiers are followed by two mixer stages employing crystal controlled oscillators which produce the first and second intermediate frequencies of 10.7 Mc/s and 2 Mc/s respectively. The second i.f. is amplified in a three stage i.f. amplifier, this and all succeeding stages being identical with the 25 - 68 Mc/s receiver.

DETAILED DESCRIPTION

Figs.14, 16 & 18.

R.F. Amplifiers (25 to 68 Mc/s)

3V1, 3V2 and 3V3 are grounded grid, low noise r.f. amplifiers. The antenna circuit is connected via the contacts of the antenna changeover relay 1RLD and a low pass filter to the cathode of the first r.f. amplifier 3V1. Inductive interstage coupling between 3V1 and 3V2 is provided by the tuned circuits associated with 3L5 and 3L6, and between 3V2 and 3V3 by the tuned circuits associated with 3L10 and 3L11. The amplified signal developed at the anode of 3V3 is coupled by 3T1 to the signal grid of the pentode section of the triode-pentode mixer 3V4.

The r.f. coils used in these amplifier stages are wound on ceramic formers fitted with adjustable cores, the separate frequency bands being covered by using cores composed of different types of iron dust material.

R.F. Amplifiers (68 to 174 Mc/s)

3V1 and 3V2 are grounded grid, low noise, r.f. amplifiers. The antenna circuit is connected via the contacts of the antenna changeover relay 1RLD and a low pass filter to the cathode of the first r.f. amplifier 3V1. Inductive interstage coupling between 3V1 and 3V2 is provided by the tuned circuits associated with 3L5 and 3L6. The amplified signal developed at the anode of 3V2 is inductively coupled by the tuned circuits associated with 3L10 and 3L11 to the cathode of the first mixer 3V3.

The r.f. coils used in these stages comprise silvered ceramic formers fitted with adjustable cores, the separate frequency bands being covered by using cores composed of different types of material.

Mixer and Oscillator (25 to 68 Mc/s)

The heterodyne voltage for the mixer 3V4 is obtained from the pentode 3V11, which functions as a crystal controlled overtone oscillator. Crystal trimming is effected by adjustment of 3L17 in single channel equipments, whilst for switched channel equipments, a separate trimming coil is switched into circuit with each crystal.

The anode circuit of 3V11, comprising 3L15, 3C86 and 3C93, is coupled to the signal grid of the mixer 3V4 via a tap on 3L15, 3C62 and the secondary of 3T1. The multiplying factor depends on the operating frequency, as quoted in Crystal Formulae on page 56, and is chosen to give a resultant i.f. of 2 Mc/s.

1st Mixer and Oscillator (68 to 174 Mc/s)

The first mixer employs a grounded-grid triode 3V3. The heterodyne voltage obtained from the triode-pentode 3V10, the pentode section of which functions as a cathode-coupled crystal controlled oscillator. Crystal trimming is effected by means of 3C76 on single channel equipments, whilst for switched channel equipments a separate trimming capacitor is switched into circuit with each crystal. A harmonic of the crystal frequency is selected by the transformer 3T10 in the anode circuit of the pentode section. The triode also serves as a multiplier and the selected harmonic of the crystal frequency, chosen to give a first i.f. of 10.7 Mc/s, is taken from a tapping point on 3L15 and injected into the input circuit of the first mixer 3V3. The resultant signal produced at the anode of 3V3 is the first i.f. of 10.7 Mc/s which is transformer-coupled by 3T1 to the grid of the second mixer 3V4a.

2nd Mixer and Oscillator (68 to 174 Mc/s)

The triode section of 3V4 functions as a crystal-controlled oscillator at a frequency of 12.7 Mc/s, except in the cases listed in Crystal Formulae on page 56.

Signal from the oscillator is fed, together with the first i.f. into the grid circuit of the pentode section of 3V4, which acts as the second mixer. The 2 Mc/s second i.f. component produced at the anode of 3V4a is transformer-coupled to the grid of the i.f. amplifier 3V5.

2 Mc/s I.F. Amplifier (25 to 174 Mc/s)

This section consists of three i.f. amplifiers which provide most of the gain and selectivity of the receiver. Three r.f. pentodes 3V5, 3V6 and 3V7 are employed, inductive interstage coupling being provided by high-Q i.f. transformers. In Type V receivers the anode circuit of 3V4a is coupled to the grid of 3V5 by a double i.f. transformer, 3T3 and 3T2. These transformers are coupled by the capacitor 3C73. The following stages, using 3V5, 3V6 and 3V7, are coupled in a similar manner, using 3T4, 3C74 and 3T5, and 3T6, 3C75 and 3T7 respectively.

In the Type N and Type W receivers, where a wider band-width is required, a single high-Q transformer is employed between each of these stages. The gain of the whole stage is made variable by the inclusion of the i.f. gain control RV3 (normally mounted on the main unit front panel) in the cathode circuit of 3V5.

Detection and A.G.C. (25 to 174 Mc/s)

The final i.f. transformer 3T8 is directly coupled to one diode of the double diode triode 3V8 for detection. The capacitor 3C51 feeds a small portion of the i.f. output to the second diode of 3V8; the resultant d.c. voltage developed across the load resistor 3R32 is fed as a.g.c. bias to the grid returns of 3V2, 3V4, 3V5 and 3V6. A.G.C. delay is provided by the voltage developed across the cathode resistor 3R49.

A.F. Amplifier (25 to 174 Mc/s)

The a.f. voltage developed across the diode load is fed, via the noise limiter, a.f. gain (VOLUME) control 4RV1 and the coupling capacitor 3C54 to the grid of the triode section of 3V8. After amplification the a.f. signal is coupled via 3C104 to the grid of 3V9, which is a beam tetrode a.f. amplifier capable of delivering over 1 watt of audio power into the 3Ω loudspeaker.

Noise Limiter (25 to 174 Mc/s)

The load circuit of the signal diode includes a silicon diode 3MR1 functioning as a series noise limiter. Under normal working conditions, a voltage proportional to the carrier level is developed across 3R48 and 3MR1. In the event of a sudden peak in signal, such as that caused by interference from a vehicle ignition system, the positive side of 3MR1 will be driven rapidly negative and 3MR1 will momentarily fail to conduct. The relatively large time constant of 3R47 and 3C71 prevents the negative side of 3MR1 from following a rapidly changing signal, whilst normal speech waveform remains unaffected.

The noise limiter forms part of the signal diode load, the input to the limiter being taken from the secondary winding of the final i.f. transformer 3T8 via the filter 3C68, 3R48 and 3C72. The output from the limiter is fed to the a.f. gain (VOLUME) control 4RV1 via tag 4 of 2TS1. The input to the squelch circuit, if fitted is taken from the secondary of 3T8 via tag 8 of 2TS1.

Squelch Circuit Fig.24

The components of the squelch circuit, if fitted, are mounted on the power supply unit chassis. The double-triode 2V1 is a two-stage d.c. amplifier with the squelch relay 2RLF in the anode circuit of the second section 2V1b.

Contacts 2RLF1 of the relay disconnect the loudspeaker and ground the secondary of the audio output transformer when the relay is in the de-energised condition.

Action of the Squelch Valve 2V1

Positive bias at the grid of 2V1a causes the valve to conduct, resulting in a voltage drop at the anode, and by direct coupling, a negative grid-to-cathode bias at the grid of 2V1b until insufficient current is drawn to operate 2 RLF. Negative bias at the grid of 2V1a cuts off the valve, resulting in a rise in anode volts and in a positive grid-to-cathode bias at the grid of 2V1b. 2V1b now conducts and the relay is energised.

Operation of the Squelch Circuit

Bias at the grid of 2V1a is determined by the following four squelch voltages:-

1. Positive voltage from the a.g.c. delay resistor 3R49.

2. Positive voltage from the high frequency components of any random noise at the signal diode. This is filtered from any a.f. component by 2C6, 2R6, 2C7 and rectified by 2MR3.

3. Negative voltage from the i f. or noise signals from the signal diode of 3V8.

4. Negative voltage from the negative resistor of 2V1a i.e. the SQUELCH control 4RV2.

The SQUELCH control is set to ensure that in the no-signal condition the sum of these voltages is positive. The relay is therefore de-energised and the loudspeaker silenced.

When a signal is received the negative voltage from the signal diode (voltage 3) rapidly increases and the positive bias from 2MR3 (voltage 2) is simultaneously reduced until the signal voltage exceeds the level determined by the setting of 4RV2. Bias at the grid of 2V1a is now negative, the relay is energised and the loudspeaker connected.

A feature of this circuit is the self-compensating action against the effect of external noise. An increase in negative bias from the signal diode (voltage 3) due to noise signals is offset by an increase in positive bias from 2MR3 (voltage 2).

CIRCUIT FEATURES (25 to 68 Mc/s)

This transmitter employs three valves in the r.f. section. The output from a pentode crystal oscillator is successively multiplied in each section of a double beam tetrode and coupled to the push-pull power amplifier stage, which also employs a double beam tetrode. The transmitter is connected to the antenna via the contacts of the changeover relay 1RLD.

Two valves are employed in the modulator section. The microphone input is amplified by both sections of a double triode acting in cascade. The output from the second section is fed to the output pentode, which provides anode and screen modulation of the power amplifier stage.

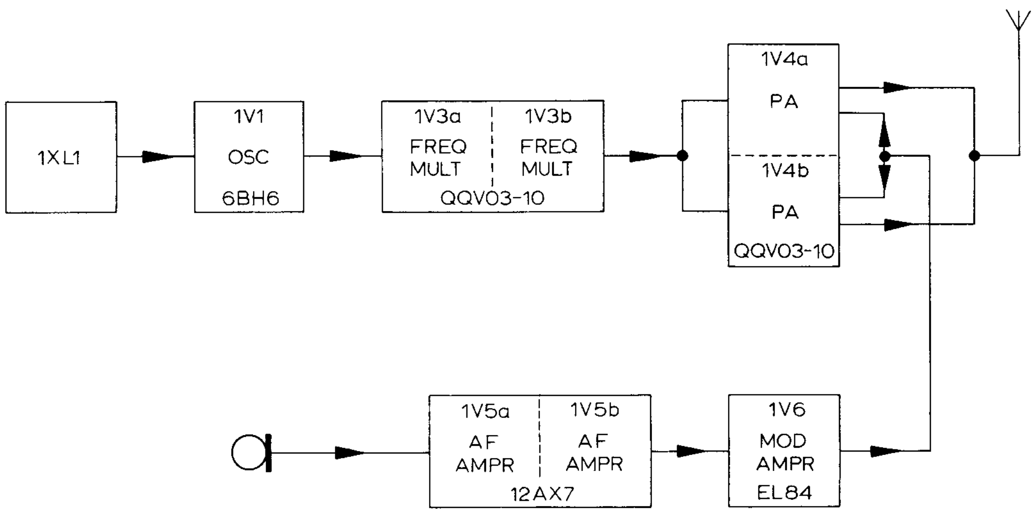


Fig.3 Transmitter Block Diagram - 25 to 68 Mc/s

DETAILED DESCRIPTION (25 to 68 Mc/s)

Fig.20

Oscillator

The pentode 1V1 functions as a crystal controlled oscillator at fundamental crystal frequency, crystal trimming being effected by adjustment of 1C1. On switched channel equipments a separate trimming capacitor is switched into circuit with each crystal. The anode circuit 1L1 and 1C14 is tuned to the fundamental crystal frequency and the r.f. voltage developed across it is fed to the grid of the first section of 1V3 via the capacitor 1C19. A test point 1TP is provided in the anode circuit of the oscillator to enable a suitable frequency measuring instrument to be connected.

Frequency Multiplication

The double beam tetrode 1V3 multiplies the crystal frequency to the required signal frequency. The anode circuit 1L2 and 1C60 of the first section (1V3a) is permeability tuned to the second or third harmonic of the crystal frequency, depending upon operating frequency. The r.f. voltage developed across this circuit is fed to the grid of the second section (1V3b) via the coupling capacitor 1C61.

The second section of 1V3 operates as a frequency doubler, its anode circuit, consisting of the split-stator tuning capacitor 1C35 and the primary of the multiplier transformer 1T3, being tuned to the operating frequency. The secondary of 1T3 is connected to the grids of the power amplifier 1V4.

Multiplication Factors

Band	1V3a	1V3b	Total Multiplication
25-32.5 Mc/s	x2	x2	x4
32.5-42 Mc/s	x2	x2	x4
42 - 54 Mc/s	x3	x2	x6
54 - 68 Mc/s	x3	x2	x6

Power Amplifier and Antenna Circuit

The power amplifier stage employs a double beam tetrode 1V4, the two sections operating in push-pull. Grid bias is developed across 1R14, which is connected between the centre-tap of the secondary winding of the multiplier transformer 1T3 and 1R15. 1R15 is included to enable the power amplifier grid current to be metered.

The output from the balanced anode circuit 1L6 and 1C44 is inductively coupled to 1L7 and link coupled via a co-axial feeder to a low impedance tap on 1L8 in the antenna tuned circuit; this arrangement minimises spurious subcarrier emissions. H.T. is applied to the centre tap of 1L6 via 1R19 and 1R30 in series, 1R30 acting as a meter shunt for metering the power amplifier anode current.

The antenna is connected via the co-axial plug 1PLA and the contacts of the relay 1RLD. This relay is energised only during transmission by the h.t. supply to the modulator and early r.f. stages.

NOTE: If required a low-pass filter 1FL1 may be added between the antenna plug 1PLA and the contacts of the antenna changeover relay 1RLD to reduce spurious emissions above carrier frequency.

1R29 is connected in series with the h.t. supply to the power amplifier screen grid and is normally shorted out by a link. When tuning, this link is removed and a reduced voltage is applied to the screen grid, thus preventing excessive anode dissipation under 'off tune' conditions.

CIRCUIT FEATURES (68 to 174 Mc/s)

This transmitter employs four valves in the r.f. section. The output from a pentode crystal oscillator is successively multiplied in a further pentode and each section of a double beam tetrode, the output from which is coupled to the push-pull power amplifier stage, also employing a double beam tetrode. The transmitter is connected to the antenna via the contacts of the changeover relay 1RLD.

The modulator circuit is identical with that used in 25 - 68 Mc/s equipments.

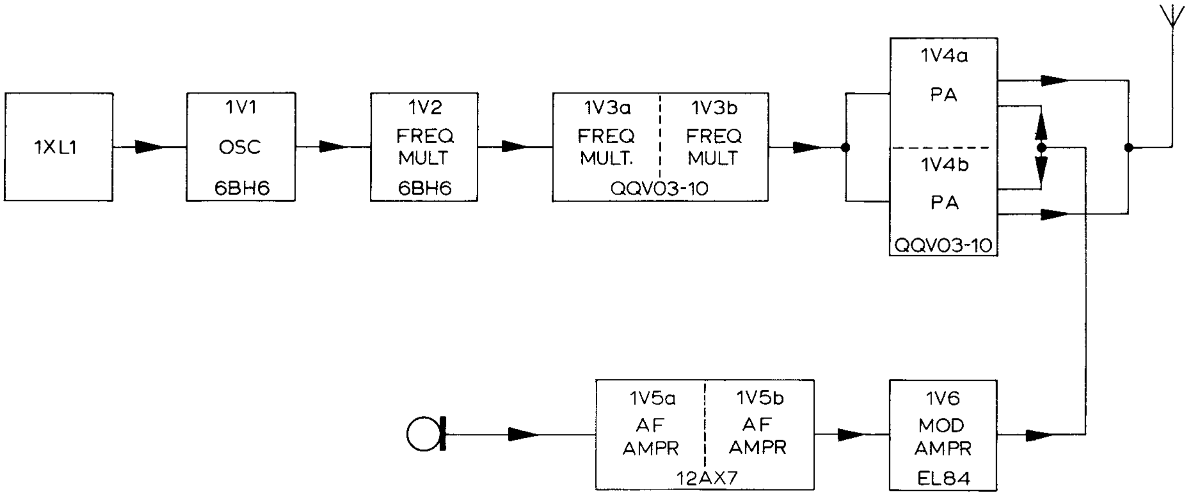


Fig.4 Transmitter Block Diagram - 68 to 174 Mc/s

DETAILED DESCRIPTION (68 to 174 Mc/s)

Fig.22

Oscillator

The pentode 1V1 functions as a crystal controlled oscillator at fundamental crystal frequency, crystal trimming being effected by adjustment of 1C1. On switched channel equipments a separate trimming capacitor is switched into circuit with each crystal. The anode circuit 1L1 and 1C14 is tuned to the fundamental crystal frequency and the r.f. voltage developed across it is fed to the grid of the pentode 1V2 via the capacitor 1C19. A test point 1TP is provided in the anode circuit of the oscillator to enable a suitable frequency measuring instrument to be connected.

Frequency Multiplication

In the anode circuit of the pentode 1V2, 1L2 and 1C21 are tuned to the second or third harmonic of the crystal frequency, depending upon the operating frequency. The r.f. voltage developed across this circuit is fed to the grid of the first section of the double beam tetrode 1V3 via the capacitor 1C25. The anode circuit of 1V3a , comprising 1C26 and 1T1, is tuned to the second or third harmonic of the output of 1V2, depending upon operating frequency. The secondary of 1T1 is directly connected to the grid of the second section (1V3b), which operates as a frequency doubler. Its anode circuit, consisting of the split stator tuning capacitor 1C35 and coil 1L4 is tuned to the carrier frequency. 1L4 and 1L5 couple the output of 1V3b to the grids of the power amplifier 1V4. Coupling between 1V3b and the grids of the power amplifier 1V4 is capacitive (1C58 and 1C59) on 68-132 Mc/s equipments and inductive (1L4 and 1L5) on 132-174 Mc/s equipments.

Multiplication Factors

Band	1V2	1V3a	1V3b	Total Multiplication
68 - 88 Mc/s	x2	x2	x2	x8
88 -108 Mc/s	x2	x3	x2	x12
108-132 Mc/s	x2	x3	x2	x12
132-156 Mc/s	x3	x3	x2	x18
148-174 Mc/s	x3	x3	x2	x18

Power Amplifier and Antenna Circuit

The power amplifier stage employs a double beam tetrode 1V4, the two sections operating in push-pull.

Grid bias is developed across 1R43 and 1R44 on 68-132 Mc/s equipments and across 1R14 on 132-156 Mc/s equipments. 1R15 is included to enable the power amplifier grid current to be metered.

The output from the balanced anode circuit 1L6 and 1C44 is inductively coupled to 1L7 and link coupled via a co-axial feeder to a low impedance tap on 1L8 in the antenna tuned circuit; this arrangement minimises spurious subcarrier emissions. H.T. is applied to the centre tap of 1L6 via 1R19 and 1R30 in series, 1R30 acting as meter shunt for metering the power amplifier anode current.

The antenna is connected via the co-axial plug 1PLA and the contacts of the relay 1RLD. This relay is energised only during transmission by the h.t. supply to the modulator and early r.f. stages.

NOTE: Transmitters for operation on the frequency bands 68-108 Mc/s and 148-174 Mc/s incorporates a low-pass filter 1FL1 between the antenna plug 1PLA and the contacts of the antenna changeover relay to reduce spurious emissions above carrier frequency. 1FL1 may be added to transmitters for operation on other frequency bands if required.

1R29 is connected in series with the h.t. supply to the power amplifier screen grid and is normally shorted out by a link. When tuning, this link is removed and a reduced voltage is supplied to the screen grid, thus preventing excessive anode dissipation under 'off tune' conditions.

Modulator Circuit (25 to 174 Mc/s)

An electro-magnetic microphone is used, the output from which is amplified in one section (1V5a) of a double triode. The output from 1V5a is capacity coupled by 1C48 to the grid of the second amplifier section 1V5b.

The output pentode modulator 1V6 is fed from 1V5b by 1C47. Modulation is applied to the anodes and screen of the power amplifier valve 1V4 by the modulation transformer 1T2.

The screen voltage of the power amplifier valve 1V4 is arranged to limit peak audio voltages and prevent over-modulation. A low-pass filter 1C49. 1L9 and 1C50 is inserted between the secondary of the modulation transformer and the power amplifier valve 1V4 to prevent excessive side band radiation under limiting conditions.

POWER SUPPLY Fig.24

The circuit consists of two power transistors 2VT1 and 2VT2 connected in a multivibrator configuration with the transformer 2T1 as a centre tapped load. Starting bias is applied to the circuit by means of 2RV4, 2R2 and 2C1. Feedback is provided by connecting out-of-phase windings on transformer 2T1 to the bases of transistors 2VT1 and 2VT2. These transistors are mounted on heat sinks on the rear panel of the main unit and the remainder of the converter components are located on the power supply unit chassis.

The frequency of operation of the transistor power supply unit is approximately 3.4 kc/s.

The output is rectified by two silicon diodes 2MR1 and 2MR2 with capacitors 2C2 and 2C3 in a voltage doubling circuit. Filtering is provided in the output line by resistors 2R3 and 2R4 (or the choke 2L1) and capacitor 2C4.

NOTE: A polarity changeover panel 2TS3 is mounted on the power supply unit and must be connected as shown in the circuit diagram to correspond with the positive or negative ground of the vehicle wiring system.

RELAY OPERATION Figs. 24 &26

2RLA H.T. changeover relay, energised in the transmit condition by the vehicle d.c. supply via pin 4 of 2TS2 and the microphone (or handset) switch. This switch is connected in parallel with the local transmit switch SB on the front panel of the main unit.

2RLA1 connects the voltage doubling capacitor 2C2 to tag 2 (low voltage tap) on the converter transformer 2T1 in the receive condition. When the relay is energised 2C2 is connected to tag 7 (high voltage tap) on 2T1, providing increased h.t. for the transmitter.

2RLA2 connects the smoothed h.t. output to the receiver via tag 11 of 2TS1. When the relay is energised the smoothed h.t. output is connected to the transmitter via tag 25 of 2TS1.

2RLB Start relay, energised by the vehicle d.c. supply when the OFF-RX-S/BY switch 4SA on the control unit is moved to the RX position.

2RLB1 connects the vehicle d.c. supply to the power supply unit and the receiver heaters.

RLC Ledex switch relay, fitted to switch channel equipments only. Energised by the vehicle d.c. supply via pin 2 of SKTB and the CHANNEL selector switch 4SC on the control unit.

RLC1 connects the vehicle d.c. supply to the Ledex motor when 4SC is operated, via tag''e' of TS6.

1RLD Antenna changeover relay, energised in the transmit condition by the h.t. supply to the modulator and early r.f. stages.

1RLD1 connects the antenna to the receiver when the relay is not energised and to the transmitter when energised.

RLE Standby relay, energised by the vehicle d.c. supply when 4SA is moved to the S/BY position.

RLE1 connects the vehicle d.c. supply to the transmitter heaters.

2RLF Squelch relay energised by the anode current of 2V1b when a signal is received.

2RLF1 disconnects the loudspeaker and grounds the secondary of the audio output transformer in the de-energised condition.

2RLF2 is not used

The functions of the controls provided on the control unit are as follows:-

4RV1 VOLUME control, connected in the grid circuit of the a.f. amplifier 3V8.

4RV2 SQUELCH control (if fitted), which varies the sensitivity of the squelch circuit.

4SA OFF-RX-S/BY switch, which operates the equipment by switching energising voltage to the coils of the appropriate control relays.

4SC CHANNEL selector switch (if fitted), which completes the energising circuit of RLC and, in conjunction with the Ledex motor, selects the required channel.

CHAPTER III

INSTALLATION AND OPERATION

INSTALLATION

MAIN UNIT

Fig. 5

Before commencing the installation remove the main unit from its covers, as described in Dismantling Procedure on page 25, and check that all valves and crystals are firmly seated in position and that no obvious damage has occurred during transit.

These equipments are normally despatched from the factory connected for operation from a POSITIVE GROUND battery supply. Before connecting to the supply it is essential to ensure that the equipment is adjusted to correspond with the positive or negative ground of the vehicle wiring system. The polarity changeover panel 2TS3 on the power supply unit chassis is provided to enable either system to be used. Connection details are shown on the power supply unit circuit diagram (Fig. 24).

In vehicles with a 'floating ground' system precautions must be taken to avoid grounding the equipment, and when installing the antenna, to avoid grounding the antenna base and feeder.

Replace the unit in the covers with the toggle catch on the required side, place the unit on the cradle and locate the assembly in position. It should be noted that the design of the covers allows the top half to be completely removed without removing the unit from the cradle and also permits access to the equipment when installed in situations with very limited headroom.

Three important points must be observed in determining the position of the main unit in the restricted space of a car trunk.

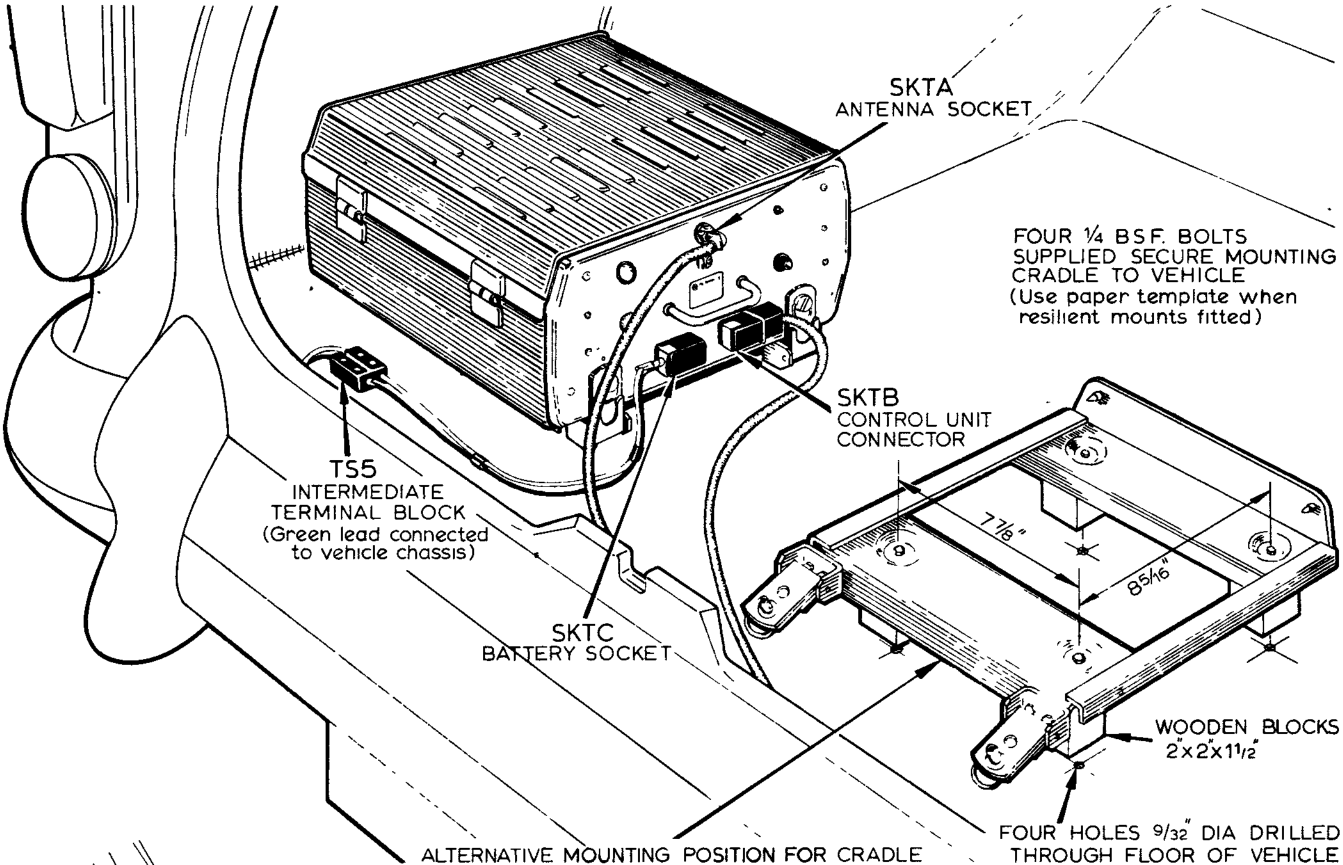
1. Sufficient space must be allowed round the equipment to ensure adequate ventilation, (The cradle is mounted on wooden blocks, or shock absorbing mountings, either of which ensure sufficient ventilation under the equipment).

2. The cradle must be mounted on a surface as flat as possible to minimise distortion.

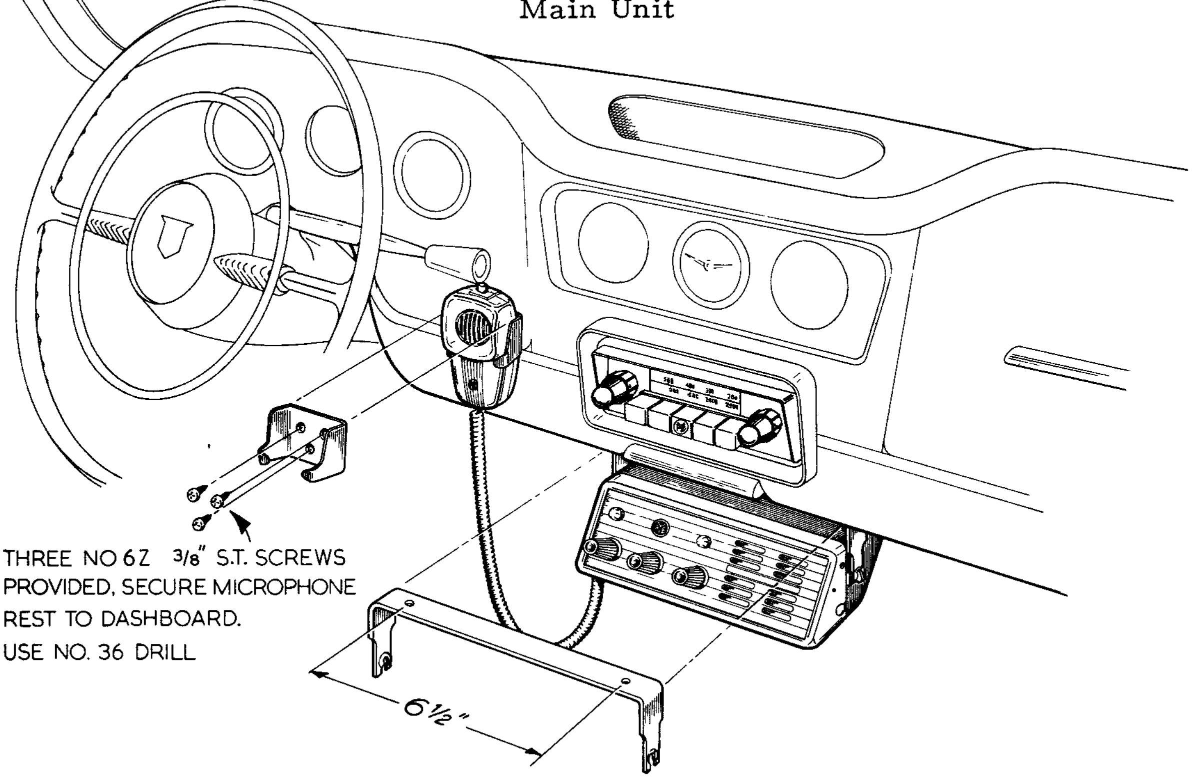
3. It must be positioned so as to permit easy access for maintenance purposes.

Remove the unit from the cradle and, using the cradle as a template, carefully mark the position of the fixing holes. Drill four 9/32" (7.14mm.) diameter holes through the floor of the vehicle, place one wooden block over each hole and bolt the cradle in position, using the four $\frac{1}{4}$ B.S.F. bolts supplied. The unit can then be secured to the cradle as shown in Fig. 5.

When shock absorbing mountings are fitted these are normally secured by the 1" x 2 B.A. bolts supplied with each set of mountings.



Main Unit



Control Unit

Fig. 5 Typical Installation

CONTROL UNIT

Fig.6

Remove the control unit from its fixing bracket and separate the two halves of the case, as described in Dismantling Procedure on page 25. Movement of the front section is restricted by the control cable, which is anchored to the rear section of the unit. Disconnect the control leads from the terminal panel 4TS4 in the front section of the unit and secure the fixing bracket in the desired position.

Feed the control cable through from the trunk and reconnect to 4TS4. Reassemble the control unit and mount it on the bracket. It should be noted that the control unit case is so designed that the external lead for the microphone may be brought out from whichever side is required.

Fit the microphone or telephone handset bracket in the required position, using three No.6Z (No.36 drill) x 3/8" self-tapping screws.

Plug the control unit connector plug into the 24-way socket on the main unit front panel.

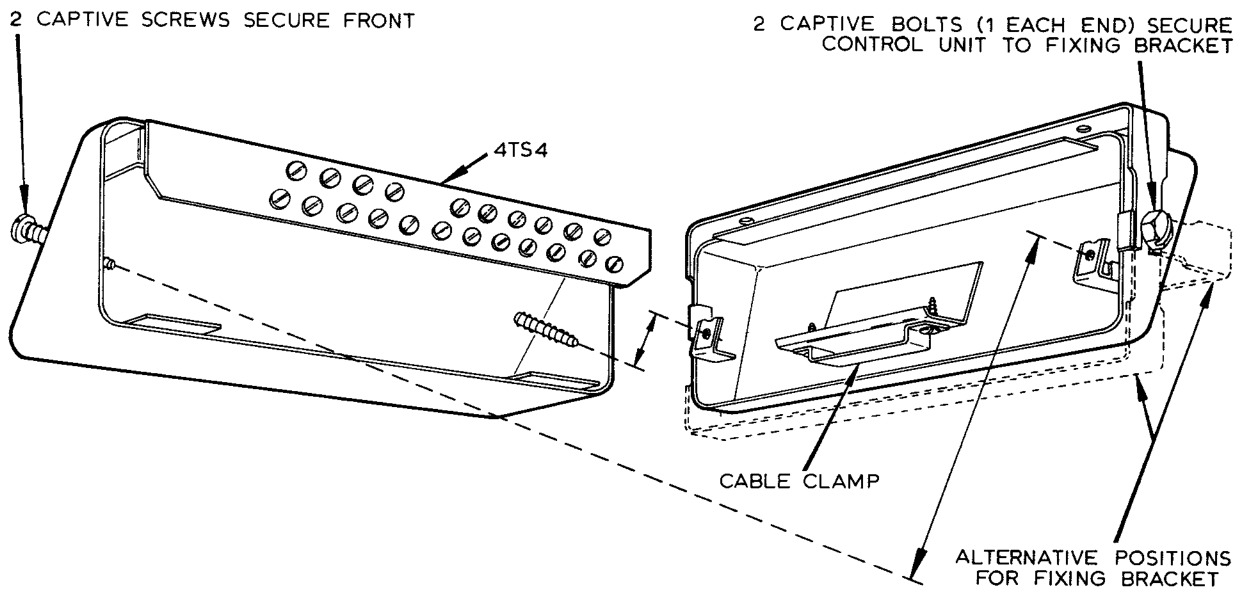


Fig.6 Control Unit Construction

POWER SUPPLY

Fig.5

The power leads are taken from the equipment, to which they are connected by a 6-way plug on the main unit front panel, via the terminal block to the battery. The terminal block should be mounted at a convenient point near the main unit. Ensure that the brown lead is connected to the live battery terminal and the green lead to the terminal connected to the vehicle chassis. Owing to the amount of current required, it is recommended that the equipment be connected directly to the battery and not via the ammeter or ignition switch. In those cases where a 'floating ground' supply is used great care must be taken to avoid grounding the equipment. The power and control cables must not be cleated together in their run from the main unit to the battery and control unit respectively but should be separated as far as possible.

It is imporant that the power leads should be of sufficiently heavy gauge to ensure that the voltage drop to the equipment is not excessive. The following table gives a guide to the size of lead required.

Distance of equipment from battery	Total length of lead	Gauge of conductor	Resistance per yard of cable
2 yards	4 yards	110/0.0076	0.0052Ω
4 yards	8 yards	162/0.0076	0.0035Ω

Standard Test Voltage

The standard test voltage for test and alignment purposes is 13.2 volts measured at the battery on load, the equipment being connected to the battery by a suitable length of the recommended lead as shown in the above table.

ERECTION OF ANTENNA

The vertical whip antenna normally supplied with this equipment must be mounted on a horizontal metallic surface or ground plane for the best results. The ground plane should preferably be of such a size that the distance from the antenna base to the nearest edge is not less than the length of whip antenna employed.

If the antenna base is to be mounted on a non-metallic surface where a solid plate is not possible, at least four radial conductors of metal strip should be used to simulate a ground plane. These conductors should be connected electrically to the outer braid of the co-axial transmission line.

In general, it is essential to ensure that:-

1. The ground plane or radial conductors make good electrical contact with the outer braid of the co-axial transmission line via the contact plate.

2. The mounting surface is flat, so that the cork or rubber sealing washer can form an effective seal against the entry of water.

3. In cases where a 'floating ground' supply is employed, no metallic part of the antenna or feeder makes contact with the vehicle chassis. Antenna installation instructions are available as supplements to this Manual.

Complete the installation by connecting the antenna feeder socket to the co-axial plug on the main unit front panel.

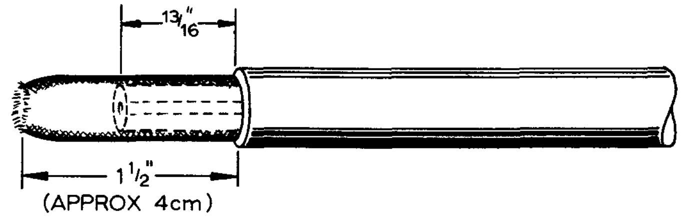
INITIAL ADJUSTMENTS

TEST SET

The Pye PTC 409 or 405A Test Set can be used with this equipment. An adaptor cable is supplied with the Test Set to connect its input to the test socket on the main unit front panel. Meter readings are given in the Test Readings on page 36.

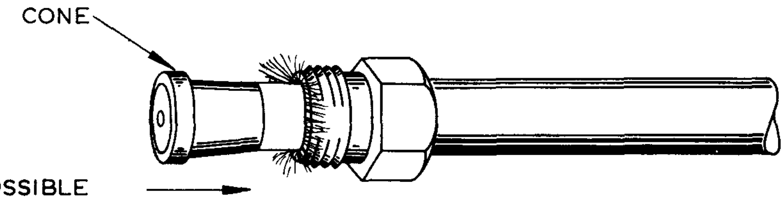
(1)

PREPARE THE COAXIAL FEEDER CABLE AS SHOWN



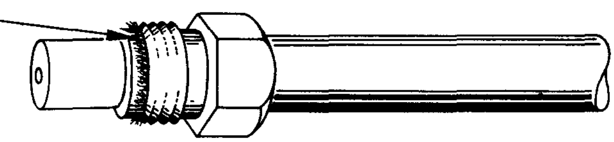
(2)

ASSEMBLE THE HEXAGONAL NUT AND THE BRAIDING CONE, COMBING AND CUTTING BRAIDING AS SHOWN.
PUSH CONE UNDER BRAIDING AS FAR AS POSSIBLE



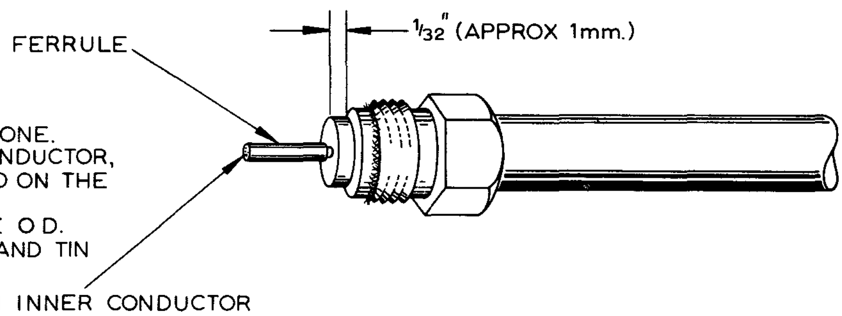
(3)

TEMPORARILY SCREW ELBOW IN POSITION TO FORCE BRAIDING CONE UNDER BRAIDING. TRIM OFF SUPLUS BRAIDING



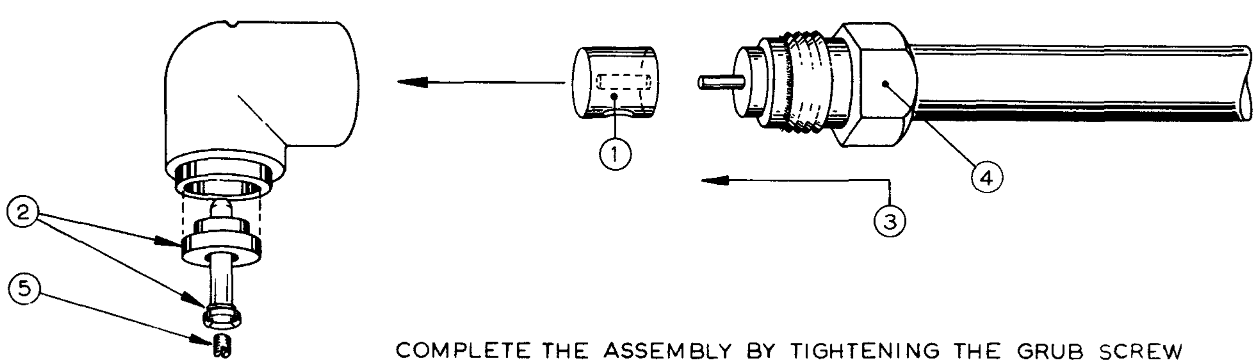
(4)

TRIM BACK DIELECTRIC TO WITHIN 1/32" OF CONE. SOLDER THE FERRULE TO THE INNER CONDUCTOR, ENSURING THAT NO SOLDER IS DEPOSITED ON THE OUTSIDE OF THE FERRULE (IF USED WITH MULTISTRAND INNER CONDUCTOR WHOSE O D. EQUALS FERRULE O D. DELETE FERRULE AND TIN INNER CONDUCTOR. REMOVE ALL FLUX)



(5)

ASSEMBLE THE PLUG IN THE ORDER INDICATED ENSURE FERRULE IS FREE TO TURN WITH CABLE AND TIGHTEN HEXAGONAL NUT BEFORE INSERTING GRUB SCREW.



COMPLETE THE ASSEMBLY BY TIGHTENING THE GRUB SCREW

Fig. 7 Assembly of Coaxial Connectors

PROCEDURE

1. Plug the Test Set into the test meter socket on the front panel of the main unit.

2. Turn the OFF-RX-S/BY switch on the control unit to S/BY.

3. After a period of about a minute receiver noise should be heard, except when squelch is fitted, in which case a noise burst will be heard.

4. Check that pressing the local transmit switch operates the relays 2RLA and 1RLD, the operation of which should be quite audible.

Transmitter

1. With the antenna connected, switch the Test Set to position 5 and press the local transmit switch on the main unit. Adjust the antenna trimming capacitor 1C45 for maximum meter reading, which must not exceed 270μA.

2. Disconnect the Test Set, switch it to position 6 and plug the Test Set antenna into its socket. Place the meter sufficiently close to the radiotelephone antenna to obtain a convenient deflection and readjust 1C45 for maximum meter reading. The meter reading should increase slightly with modulation.

Receiver

The only adjustment needed to equipments not fitted with the squelch facility is to the i.f. gain control to obtain the best balance between sensitivity and standing noise. Set the VOLUME control in the midway position and adjust the i.f. gain control RV3 under 'no signal' conditions until noise is barely audible.

On equipments fitted with the squelch facility, the SQUELCH sensitivity control 4RV2 must be set for maximum receiver sensitivity as follows:-

Under 'no signal' conditions, and with the VOLUME and i.f. gain controls set as above, slowly rotate 4RV2 until the squelch relay opens, silencing the receiver. Then back off the control slightly, taking care that the squelch relay does not close again. If required, a less sensitive setting of the control may be used to eliminate unwanted interfering signals of lower strength than the required signal.

OPERATION

Upon completion of the installation and initial adjustments the equipment should be given an operational test run under the supervision of the engineer in charge. At the same time operators should be instructed in the proper handling of the controls.

It is advisable to contact the base station from various locations in the area to be covered in order to determine the relative signal strengths to be expected

MICROPHONE TECHNIQUE

In order to obtain optimum results from the transmitter, proper use of the microphone is essential.

The operator should hold the microphone two or three inches from the lips and speak across its face at a normal level of speech. It this is done, high background noise will be much reduced and the call clearly received. It is to the operator's advantage to make practice calls and develop a microphone technique best suited to his or her speech characteristics.

It is important to appreciate that shouting into the microphone will result in speech clipping and transmission of a distorted signal.

FIELD TESTING PROCEDURE

NOTE: Before leaving the factory, both receiver and transmitter oscillators are accurately aligned against a frequency standard and it will not normally be necessary to readjust the frequency unless a valve, crystal or other component in the crystal circuit is changed.

> Under no circumstances should the settings of the transmitter or the receiver crystal trimmers be altered without reference to a frequency substandard or to the base station equipment as described below.

The Pye 2 Mc/s transistor oscillator PTC 422 is available for use in checking the operating frequency against that of the base station. When checking the operating frequency at least one hour should be allowed for the equipment to reach operating temperature.

RECEIVER

1. Arrange for the base station to radiate a carrier

2. Plug the output lead of the 2 Mc/s oscillator into pin 1 of the test meter socket on the main unit front panel (sufficient coupling to the i.f. amplifier may be obtained by holding the 2 Mc/s oscillator close to the i.f. strip).

3. If a high audio beat note is produced, i.e. in excess of 1000 c/s for Type V equipments and 2000 c/s for Type N and W equipments, the mobile receiver crystal trimmer 3L17 (25-68 Mc/s) or 3C76 (68-174 Mc/s) should be adjusted for zero beat.

4. Where channel switching is employed procedure 3 should be repeated on each channel.

TRANSMITTER

NOTE: The following procedure is applicable only when used in conjunction with base stations having a receiver with an accurate i.f. of 2 Mc/s, such as the Pye PTC 723/4 and Pye PTC 2710/2.

1. Arrange for the mobile transmitter to radiate a carrier.

2. Connect the output lead of the 2 Mc/s oscillator to the screen grid of the penultimate i.f. amplifier in the base station receiver (sufficient coupling to

the i.f. amplifier may be obtained by holding the 2 Mc/s oscillator close to the i.f. strip). The PTC 723/4 and PTC 2701/2 base stations have convenient connecting points at the rear of the cabinets as follows:-

PTC 723/4	TS4.b	(marked V6 Es on rear panel)
PTC 2701/2	TS3.F	

3. If a high audio beat note is produced, i.e. in excess of 1000 c/s for Type V equipments and 2000 c/s for Type N and W equipments, the mobile transmitter crystal trimmer 1C1 should be adjusted for zero beat as reported by the base station engineer. Adjustment must <u>not</u> be made to the base station receiver crystal trimmer without reference to a frequency standard.

4. Where channel switching is employed procedure 3 should be repeated on each channel.

Although unnecessary where wide channel spacing is employed, the field testing procedure becomes increasingly important as the carrier frequency increases and the channel spacing decreases.

CHAPTER IV

SERVICING

The performance figures given in the Bench Alignment Procedure on page 29 are for new equipment and equipment regularly maintained in accordance with the Routine Maintenance Procedure given on page 25.

In schemes in which equipments operate on marginal signals more maintenance will be required to keep sets at peak performance. However, in systems where signals of good strength can normally be expected, such a high performance may not be necessary.

The engineer in charge of the scheme should exercise discrimination as to the frequency with which full maintanance is required, making due allowance for gradual falling off in performance when regular maintenance is not carried out.

EQUIPMENT REQUIRED FOR ROUTINE MAINTENANCE PROCEDURE

NOTE: The equipment required to carry out the Routine Maintenance Procedure in full is as given below, but where such equipment is not readily obtainable the routine should be completed as far as possible, interpreting the figures given in the light of the limitations of the available test gear.

1. Signal generator. (See V.H.F. Signal Generator on page 29).
2. 0-50μA meter with a minimum resistance of 500Ω. (Avo Model 8 is suitable)
3. Diode probe. (A suitable circuit is shown in Fig. 8 on page 26).
4. Audio output meter with a scale reading up to 2 watts. (Most standard multi-range instruments are suitable).
5. Pye PTC 409 Test Set.
6. Multi-range d.c. voltmeter of 20,000Ω/volt sensitivity. (Avo Model 8 is suitable)
7. R.F. power output meter. (Bird Termaline Model 612 is suitable).

ADDITIONAL EQUIPMENT REQUIRED FOR BENCH ALIGNMENT PROCEDURE

1. A source of standard test voltage of 13.2 volts d.c. measured at the battery on load. (See Standard Test Voltage on page 19).

NOTE: It is important that a hum-free source of l.t. is applied to the equipment for most receiver tests. When the equipment is supplied from a battery to which a floating charge from a mains rectifier unit is applied, the hum level may be too great to enable the tests to be accurately performed. In these cases the rectifier unit should be switched off.

2. Crystal controlled i.f. signal generator accurate to 0.01%. If only a standard signal generator is available, a crystal controlled 2 Mc/s oscillator, such as the Pye PTC 422 transistor oscillator, must be provided for calibration purposes.
3. 10nF (0.01μF) capacitor.
4. Two small 2.2kΩ resistors with extremely short leads.

DISMANTLING PROCEDURE

MAIN UNIT

To remove the unit from the cradle, disconnect the power supply socket, the control cable plug and the co-axial antenna connector. Unlock the two quick release fasteners (see Fig. 5 on page 17) and pull the unit off the two locating pins at the rear of the cradle.

The covers can be removed after releasing the large toggle catch. The 'lift off' type hinges enable the two parts of the case to be separated and once the top half is removed the main unit can be lifted out of the bottom half of the cover.

Each chassis is bolted to two side plates, which are in turn secured to the front and rear panels of the unit. The heat sinks for the power supply unit transistors are mounted on the rear panel. Should the removal of the front panel or the separation of the individual chassis be required the appropriate leads should be unsoldered from 2TS1 before proceeding further.

On switched channel equipments the switch shaft must be removed before separating individual chassis. To remove the switch shaft, take off the rear panel of the main unit, remove the 6 B.A. screw and nut which secures the switch shaft to the coupling on the Ledex motor shaft and withdraw the switch shaft through the rear of the main unit. The switch wafers are each locked to the switch shaft by a rotor lock spring and upon re-assembly it must be ensured that these springs are replaced in their recesses in the switch shaft.

CONTROL UNIT

Access to the inside of the control unit can be gained by loosening the captive screw at each side of the escutcheon (see Fig. 6 on page 18) and carefully pulling off the front section. Movement of the front section is restricted by the control cable, which is anchored to the rear section of the unit.

The complete control unit can be removed from its fixing bracket by loosening the captive hexagon head bolt at each end of the unit and lifting the unit off the bracket.

Press-to-Transmit Switch

Access to the press-to-transmit switch in the microphone is gained by removing the four screws at the back of the microphone.

When a telephone handset is fitted access to the switch is gained by unscrewing the microphone cover and lifting out the assembly.

ROUTINE MAINTENANCE PROCEDURE

Nominal figures (in brackets) are given for guidance.

GENERAL

1. Disconnect the control, antenna and supply leads by removing the connectors from the main unit front panel.
2. Remove the top cover of the main unit and remove the equipment from the cradle. (see Dismantling Procedure above).

3. Clean out all dust,etc.

4. Check over the antenna installation, paying particular attention to the grub screws in Pye connectors.

5. Check the battery leads for wear and replace if necessary. Ensure that all connections are firmly tightened.

6. Check the battery voltage, (See Power Supply on page 18).

7. Reconnect the control, antenna and supply leads and check the operation of the OFF-RX-S/BY switch. Operate it several times.

8. Check that the indicator lamps are functioning and firmly secured in their holders (the transmitter must be operated to check the TX ON lamp).

9. Check that all valves and crystals are firmly seated and that there is no noise from intermittent contacts.

10. Check the operation of all the relays. Clean the contacts if necessary.

11. On switched channel equipments check the operation of the CHANNEL selector switch.

12. Check the receiver h.t. voltage (180 volts).

13. Check the transmitter h.t. voltage (280 volts).

RECEIVER PERFORMANCE CHECKS

14. Check the crystal oscillator stage as follows:-

Receivers operating between 25 and 68 Mc/s:- With an r.f. input of 2μV e.m.f. check the signal-to-noise ratio (11dB). A diode probe should be used in conjunction with the 0-50μA meter, to check the voltage on the grid (pin 2) of the mixer 3V4 (0.5 volts).

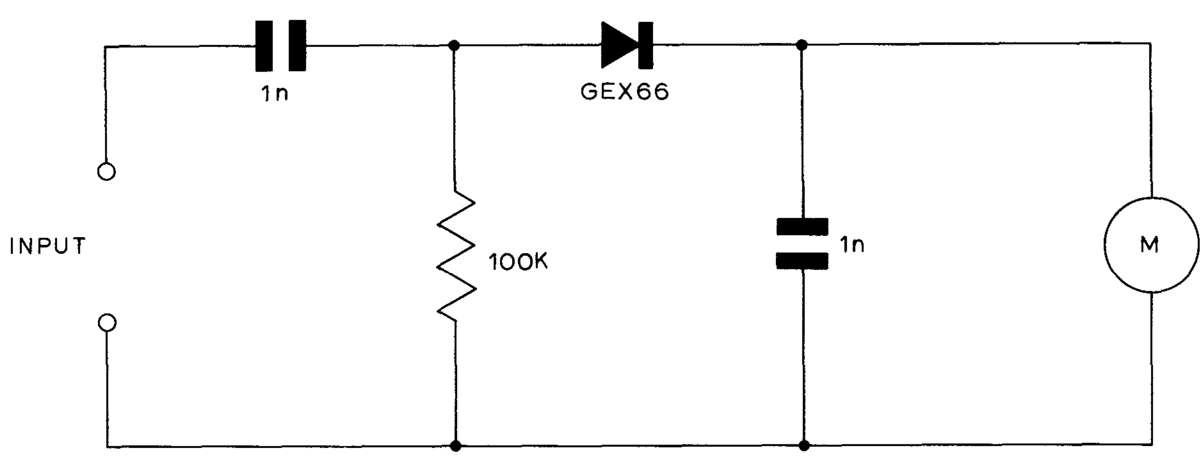


Fig.8 Diode Probe

Receivers operating between 68 and 174 Mc/s:- Connect the 20,000Ω/volt meter, switched to the 2.5 volt range, across 3R42 in the cathode circuit of the triode section of 3V10 and adjust both cores of 3T10 for maximum output (0.6 volts).

15. Check the overall sensitivity as follows:-

Set the output meter to high impedance input and connect between tag 4 of 3T9 (the a.f. output transformer) and the chassis. Connect the signal generator to the antenna plug and apply an r.f. signal of 2μV e.m.f. modulated 30% at 1000 c/s.

Check the output (Type V and N equipments 300mW; Type W equipments 200mW).

16. Check the signal-to-noise ratio as follows:-

With the signal generator and output meter connected as in 15 above and with the modulation switched on, note the reading on the dB scale of the output meter. Switch off the modulation and again note the reading on the dB scale.

Subtracting the latter reading from the former reading will give the approximate signal-to-noise ratio at this level (25 to 68 Mc/s 11dB; 68 to 156 Mc/s 9dB; 148 to 174 Mc/s 8dB).

17. Check the a.g.c. performance as follows:-

With the signal generator and output meter connected as in 15 above apply an input of 20mV and adjust the a.f. output to 100mW. Note the maximum change in output when the signal is reduced to 4μV e.m.f. (Type V and N equipments 8dB; Type W equipments 9dB).

18. In the event of the receiver performance being suspect, compare the voltages on the equipment with the typical voltages given on the receiver circuit diagrams (Figs.14, 16 & 18). The gain of the receiver can be checked stage-by-stage using the v.h.f. signal generator and the diode probe shown in Fig.8.

TRANSMITTER PERFORMANCE CHECKS

19. Check the grid current of the multiplier and driver stages as follows:-

Connect the PTC 409 Test Set to the test socket on the main unit front panel, and check the readings obtained. (For further details see Test Readings on page 36).

Switch Position		Meter Reading
2		*170μA
3		*170μA
4	(25 to 132 Mc/s)	120μA

Switch Position		Meter Reading
4	(132 to 174 Mc/s) adjust the coupling (see para. 7 on page 35) to give a reading between	120µA and 170µA
5		210µA - 270µA

* The actual values are relatively unimportant, providing that the readings for power amplifier drive (switch position 4) and power amplifier current (switch position 5) are correct.

20. Check the carrier for hum and noise as follows:-

With the PTC 409 Test Set disconnected from the equipment, switch to position 6, plug in the Test Set antenna and connect a pair of earphones to the jack socket. Operate the transmitter and ensure that there is no hum or noise on the carrier.

21. Check the modulation as follows:-

With the same arrangement as in 20 above speak into the microphone and ensure that the modulator is working satisfactorily.

22. Check the power output (5 watts).

23. In the event of the transmitter performance being suspect, compare the voltages on the equipment with the typical voltages given on the transmitter circuit diagrams (Figs. 20 & 22).

24. Align the transmitter to the antenna, using a thru-line or reflectometer where available. Otherwise use the procedure described in Initial Adjustments on page 19.

25. Refit the equipment, ensuring that all fastenings are tight and that all connectors are pressed home and secured.

26. Call up the base station for a final operational check, carrying out the Field Testing Procedure described on page 22 if necessary.

BENCH ALIGNMENT PROCEDURE

RECEIVER

V.H.F. SIGNAL GENERATORS

The high order of selectivity employed in this receiver necessitates the use of v.h.f. signal generators in which the degree of frequency modulation is of a very low order. Unless a signal generator of a sufficiently high standard is used accurate r.f. measurements of sensitivity, signal-to-noise ratio and a.g.c. cannot be obtained. The following signal generators are satisfactory:-

1.	Boonton Radio Corporation, Boonton, N.Jersey (r.f. alignment above 54 Mc/s only)	Type 202C
2.	Marconi Instruments	Type TF995A/1-5
3.	Hewlett Packard	Type 608A

Other signal generators not meeting the exacting requirements called for may be used for comparative tests only.

Where signal generators are used which have a resistance termination at the end of the output lead (such as Boonton Type 202C) this must be removed and the lead connected either directly to the receiver input or via a suitable matching pad. The attenuators of many signal generators are calibrated to read closed circuit microvolts, which is the voltage appearing across a load equal to the generator impedance (the Boonton Type 202C is in this category). The open circuit voltage of these generators is twice the attenuator reading.

I.F. ALIGNMENT

In normal service re-alignment is unnecessary. The design is such that the bandwidth and symmetry of the band-pass circuits are maintained even after changing valves. If re-alignment does become necessary use the following procedure:-

NOTES:

1. The primary cores of all i.f. transformers are adjustable from below the chassis and the secondary cores from above the chassis.

2. The lock nuts on adjustable cores should be tightened and the adjustment checked before disconnecting the signal generator and meter, in order to ensure that the circuits have not become detuned.

3. When carrying out the following adjustments the signal generator output should be adjusted as necessary to keep the microammeter slightly below mid scale.

4. The use of a 2 Mc/s signal generator input to the i.f. stages of receivers operating between 25 and 68 Mc/s is not recommended since, unless extreme care is taken, regeneration will occur, resulting in incorrect alignment.

Receivers operating between 25 and 68 Mc/s

1. Connect the a.g.c. line to chassis.

2. Connect the 0-50μA meter across pins 8 (positive) and 9 (negative) of the test meter socket on the main unit front panel. The meter will then read the detector diode current.

3. Connect the v.h.f. signal generator to the anode (pin 7) of 3V3 via the 10nF capacitor.

4. Set the signal generator (with modulation switched off) to the carrier frequency and adjust 3C86 and the secondary core of 3T1 for maximum diode current.

5. Connect the 2 Mc/s oscillator to pin 1 of the test meter socket on the main unit front panel. (Sufficient coupling may be obtained by placing the oscillator near the i.f. amplifier stages).

6. Adjust the signal generator to zero beat, switch off and disconnect the 2 Mc/s oscillator. The signal generator must be set for zero beat at frequent intervals to ensure that the signal generator remains accurately set to the carrier frequency.

Receivers operating between 68 and 174 Mc/s

1. Connect the a.g.c. line to chassis.

2. Connect the 0-50μA meter across pins 8 (positive) and 9 (negative) of the test meter socket on the main unit front panel. The meter will then read the detector diode current.

3. Connect the i.f. signal generator to the cathode (pin 5) of 3V3 via the 10nF capacitor.

4. Set the signal generator to 10.7 Mc/s with the modulation switched off.

5. If only a standard signal generator is available, connect the 2 Mc/s oscillator to pin 1 of the test meter socket on the main unit front panel (sufficient coupling may be obtained by placing the oscillator near the i.f. amplifier stages), adjust the signal generator to zero beat, switch off and remove the 2 Mc/s oscillator. This procedure must be repeated at frequent intervals throughout the alignment procedure to ensure that the signal generator remains accurately set to 10.7 Mc/s.

6. Adjust the primary and secondary cores of 3T1 for maximum diode current.

Receivers Type N and W (25-174 Mc/s)

7. Adjust the primary and secondary cores of 3T3 and 3T8 for maximum diode current.

8. Shunt the primary of 3T6 with a 2.2kΩ resistor and adjust the secondary core for maximum diode current.

9. Transfer the damping resistor to the secondary of 3T6 and adjust the primary core for maximum diode current.

10. Transfer the damping resistor to the primary of 3T4 and adjust the secondary core for maximum diode current.

11. Transfer the damping resistor to the secondary of 3T4 and adjust the primary core for maximum diode current. Remove the damping resistor.

12. Check the bandwidth and symmetry as described in paragraph 12 of the Type V receiver alignment procedure below.

Receiver Type V (25-174 Mc/s)

7. Adjust the primary and secondary cores of 3T8 for maximum diode current.

8. Shunt the primaries of 3T3 and 3T2 with 2.2kΩ resistors. Adjust the secondary core of 3T3 for maximum diode current. Adjust the secondary core of 3T2 for maximum diode current.

9. Transfer the damping resistors to the secondaries of 3T3 and 3T2. Adjust the primary core of 3T3 for maximum diode current. Adjust the primary core of 3T2 for maximum diode current.

10. Repeat instructions 8 and 9 above, reading 3T4 for 3T3 and 3T5 for 3T2.

11. Repeat instructions 8 and 9 above, reading 3T6 for 3T3 and 3T7 for 3T2. Remove the damping resistors.

12. Check the bandwidth and symmetry. This test may only be carried out with a signal generator having an accurately calibrated incremental frequency control such as the Marconi Instruments Ltd. Type TF995A/4 or 5. If the Marconi Instruments Ltd. I.F. Response Unit is used, the r.f. carrier level is automatically stepped to correspond with the mean i.f. response, e.g. at the ±11 kc/s points the r.f. carrier level is increased by 6dB for Type N receivers R.F. carrier level readings are therefore relative to this fixed stepping, high and low limits being obtained by subtracting the appropriate step from the figures given below.

(a) 25 - 68 Mc/s only - Disconnect the v.h.f. signal generator from the anode of 3V3 and connect the TF995A/4 or 5 to the signal grid (pin 2) of 3V4 via the 10nF capacitor. The unscreened section of the signal generator output lead must be kept as short as possible. Set the signal generator to 2 Mc/s.

68 -174 Mc/s only - Disconnect the i.f. signal generator from the cathode (pin 5) of 3V3 and connect the TF995A/4 or 5 in its place via the 10nF capacitor. Set the signal generator to 10.7 Mc/s.

(b) Adjust the signal generator output to obtain a convenient reading on the meter keeping the reading as low as possible to prevent blocking.

(c) Detune the signal generator on each side of 2 Mc/s (25-68 Mc/s receivers) or 10.7 Mc/s (68-174 Mc/s receivers) by the increments detailed below, adjust the signal generator output until the original meter reading is obtained and note the difference in generator output required to give the original meter reading. The following figures should be obtained.

	Frequency	Carrier Level High	Carrier Level Low
Type V	± 6 kc/s	+ 4dB	+8dB
	±22.5 kc/s	+88dB	+∞ dB
Type N	± 5 kc/s	- 3dB	+ 1dB
	±11 kc/s	+ 2dB	+ 9dB
	±40 kc/s	+87dB	+∞dB
Type W	±15 kc/s	- 4dB	+ 4dB
	±25 kc/s	+ 1dB	+12dB
	±90 kc/s	+82dB	+ ∞ dB

If the results obtained are widely different from the above, or are asymmetrical check that the i.f. alignment procedure has been carried out correctly.

Receivers Type V, N and W (25 -174 Mc/s)

13. 25 - 68 Mc/s only - Disconnect the TF995A/4 or 5 and connect the v.h.f. signal generator to the anode (pin 7) of 3V3 via the 10nF capacitor. Set the generator to the carrier frequency.

    68 -174 Mc/s only - Disconnect the TF955A/4 or 5 and connect the i.f. signal generator to the cathode (pin 5) of 3V3 via the 10nF capacitor. Set the generator to 10.7 Mc/s.

14. Remove the microammeter and short circuit from the a.g.c. line.

15. Disconnect the loudspeaker and connect the audio output meter in its place.

16. With the VOLUME control 4RV1 at maximum (fully clockwise) and the signal generator on centre frequency switch on the modulation, set at 1000 c/s, 30% modulation depth. With an r.f. input of 10μV e.m.f. Type V and N receivers should give an audio output of at least 200mW and Type W receivers at least 100mW. Signal-to-noise ratio with this input should be greater than 8dB (see Checking Signal-to-Noise Ratio on page 34).

17. Disconnect the signal generator.

R.F. ALIGNMENT

> Under no circumstances should the settings of the receiver crystal trimmers be altered without reference to a frequency substandard (a similar procedure to that described in Crystal Oscillator Alignment on page 34 may be adopted) or the carrier of the base station transmitter as described in Field Testing Procedure on page 22.

NOTE: Alignment of switched channel equipments should be carried out on the nearest channel to centre frequency. The performance of remaining channels should be checked after alignment. In the case of equipments using two widely-spaced channels it is necessary to effect a compromise tuning of the r.f. section in order to equalise the performance on each channel. Note that the frequency limitation is within ±0.2% of the centre carrier frequency.

Receiver operating between 25 and 68 Mc/s

1. Connect the v.h.f. signal generator to the antenna input.

2. Set the signal generator to the carrier frequency, as described in paragraphs 5 and 6 of the 25 to 68 Mc/s receiver i.f. alignment procedure on page 30, and modulate the signal 30% at 1000 c/s.

3. Adjust 3L1, 3C8, 3C9, 3C14, 3C15, 3C86 and both cores of 3T1 for maximum audio output. Note that the iron dust cores used in the r.f. coils should be left in their normal position at the centre of the coil windings, except when the frequency required is near the edge of the band. Under these conditions they may be adjusted, by the minimum amount necessary, to enable trimming to be effected by the capacity trimmers.

4. With an r.f. input of 2μV e.m.f. check that the signal-to-noise ratio is not less than 11dB (see Checking Signal-to-Noise Ratio on page 34.)

5. With an r.f. input of 2μV e.m.f. check that the audio output is not less than 200mW (Type W) or 300mW(Types V and N).

6. Disconnect the signal generator and audio output meter and reconnect the loudspeaker.

Receivers operating between 68 and 174 Mc/s

1. Connect the d.c. voltmeter across the 100Ω resistor 3R42 in the cathode circuit of 3V10b.

2. Adjust the primary and secondary cores of 3T10 for maximum reading on the voltmeter. A typical reading is 0.8V.

3. Disconnect the voltmeter and connect the v.h.f. signal generator to the antenna input.

4. Set the signal generator to the carrier frequency, as described in paragraphs 5 and 6 of the 25 to 68 Mc/s receiver i.f. alignment procedure on page 30, and modulate the signal 30% at 1000 c/s.

5. Adjust 3C2, 3C8, 3C9, 3C14, 3C15 and 3C86 for maximum audio output.

6. With an r.f. input of 2μV e.m.f. check that the signal-to-noise ratio is not less than 9dB (68-156 Mc/s) or 8dB (148-174 Mc/s) (see Checking Signal-to-Noise Ratio on page 34).

7. With an r.f. input of 2μV e.m.f. check that the audio output is not less than 200mW (Type W) or 300mW (Types V and N).

8. Disconnect the signal generator and audio output meter and reconnect the loudspeaker.

CHECKING SIGNAL-TO-NOISE RATIO

The following method should be adopted when checking signal-to-noise ratio:-

1. Feed in a signal of the appropriate strength from the signal generator (10µV e.m.f. for checking the i.f., 2µV e.m.f. for checking the r.f.) with the modulation set to 30% at 1000 c/s.

2. Note the audio signal level on the dB scale of the output meter.

3. Switch off the modulation.

4. Again note the audio signal level on the output meter.

Subtracting the reading 4 from the reading 2 will give the 'signal plus noise' to 'noise only' ratio. At the levels used this is very nearly equal to the signal-to-noise ratio and may be regarded as such for the purpose of this test.

H.T. VOLTAGE

Using the standard test input voltage of 13.2 volts d.c. the h.t. voltage developed is 180 volts ±10%, measured at the junction of 2R3/2R4 (or 2L1) and 2C4.

TRANSMITTER

CRYSTAL OSCILLATOR ALIGNMENT

> Under no circumstances should the settings of the crystal trimmers be adjusted without reference to a high accuracy narrow channel base station receiver (see Field Testing Procedure on page 22), or to a frequency substandard, as described below.

NOTE: The following section does not form part of the normal alignment procedure. The Field Testing Procedure is normally adequate for netting the transmitter to the base station receiver or re-aligning the crystal oscillator if a valve, crystal or other component in this stage is changed. However, if it is not desired to use the Field Testing Procedure the following method may be adopted.

Adjustment of the crystal trimmers (1C1 on single channel equipments and 1C1-1C6 on switched channel equipments) should be carried out with test equipment of a high standard only, the following instruments being typical of those found to be satisfactory.

1. Berkeley Counter Frequency Meter Model 5570 or 7370 (direct frequency indicating meters).

2. Schomandl Frequency Meter Type F.D.1 (zero beat indicating meter).

Detailed information on the operation of these instruments is supplied by the manufacturers, but the following points should be noted:-

(a) Measurement can be made either of the carrier frequency or of the crystal frequency.

(b) If measurement is made of the carrier frequency, the coupling between transmitter and frequency meter should be the minimum required to obtain a reading. In general there should be no direct coupling and it may be necessary to space the transmitter a few feet away from the meter.

(c) If measurement is made of the crystal frequency, connection to the meter should be by coaxial cable from the tag point 1TP provided on the transmitter chassis.

(d) If crystal ovens are fitted the effect of the oven heat cycling should be observed and the crystal trimmers adjusted as near as possible in the centre of the total excursion of the oven cycle.

(e) Upon completion of the crystal oscillator alignment it may be necessary to re-align the r.f. stages if the frequency has been changed outside the transmitter pass band.

MULTIPLIER ALIGNMENT

1. Remove the shorting link from 1R29, switch to S/BY and allow one minute to warm up.

2. Connect the Test Set to the test meter socket on the main unit front panel and depress the local transmit switch on the main unit front panel.

3. Switch the Test Set to position 2 and adjust 1L1 for maximum meter reading A typical reading is 200μA.

   68-174 Mc/s only - Adjust 1L2 for maximum meter reading (grid current of 1V2 and 1V3a). A typical reading is 200μA.

4. 25-68 Mc/s only - Switch the Test Set to position 3 and adjust 1L2 for maximum meter reading (grid current of 1V3b). A typical reading is 200μA.

   68-174 Mc/s only - Switch the Test Set to position 3 and adjust the primary and secondary cores of 1T1 together for maximum meter reading (grid current of 1V3b). Repeat this adjustment until no further increase can be obtained. A typical reading is 200μA.

5. Switch the Test Set to position 4 and adjust 1C35 for maximum meter reading (grid current 1V4). A typical reading is 150μA.

6. Adjust 1C36, whilst keeping 1C35 on tune, until no further increase in meter reading can be obtained.

7. Equipments with operating frequencies above 132 Mc/s - Vary the coupling between 1L4 and 1L5 by bending 1L4 towards or away from 1L5, retuning 1C35 as necessary, to give a maximum reading which is not greater than 170μA (1.7mA actual). A typical reading is 150μA.

POWER AMPLIFIER ALIGNMENT

1. Switch the Test Set to position 5 and adjust 1C44 for greatest dip in the meter reading (anode current of 1V4), resetting 1C45 if necessary.

2. Connect the r.f. power output meter to the antenna socket and replace the shorting link across 1R29. Recheck 1C44 for greatest dip in the meter reading.

3. Adjust 1C45 for maximum power output.

4. Switch the Test Set to position 4 and check the setting of 1C35.
5. If the meter reading on position 5 is other than 210µA-270µA (42mA-54mA actual) manual re-adjustment of the coupling between 1L6 and 1L7 is necessary. In this case the whole tuning procedure for the power amplifier stage must be repeated.
6. Disconnect the Test Set.

TEST READINGS

Minimum figures to be expected with the PTC 409 Test Set are:-

Switch Position	Meter Reading
2 - total grid current of 1V2 and 1V3a (68-174 Mc/s) or grid current of 1V3a (25-68 Mc/s)	*170µA
3 - grid current of 1V3b	*170µA
4 - grid current of 1V4 (25-132 Mc/s)	120µA
4 - grid current of 1V4 (132-174 Mc/s) Adjust the coupling (see para.7 on page 35) to give a reading between	120µA and 170µA
5 - anode current of 1V4	210µA (270µA max)

* These figures are given for guidance only. The actual values are relatively unimportant, providing that the readings for power amplifier drive (switch position 4) and power amplifier current (switch position 5) are correct.

Power Output 5 watts minimum

H.T. Voltage

Using the standard test input voltage of 13.2 volts d.c. the h.t. voltage developed is 280 volts ±10% measured at the junction of 2R3/2R4 (or 2L1) and 2C4.

TRANSISTORS

TRANSISTOR CIRCUITS

1. When soldering, complete the soldering operation as quickly as possible and protect the transistor by using a heat shunt on the lead, e.g. grip the wire between the transistor and the joint with a pair of pliers.
2. Always observe the correct polarity when connecting up transistor circuits.
3. Transistors are extremely robust when operated under the correct conditions but they have a very low resistance and may be destroyed by the inadvertent application of quite low potentials. It should be noted that such potentials may exist between the terminals of a test meter or other pieces of test equipment or between a soldering iron and ground.

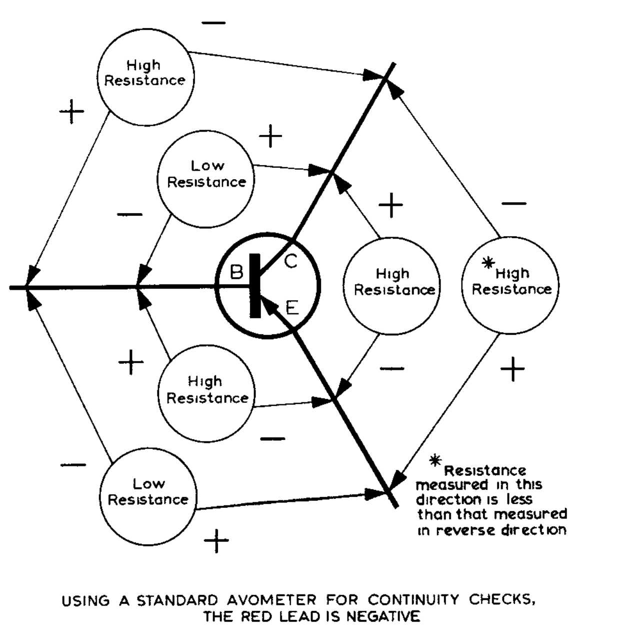


Fig.9 Transistor Servicing Diagram

4. The metal cases of the power transistors are at collector potential insulated from the heat sink by porcelain washers, which are coated in silicon compound to ensure efficient thermal contact. This thermal contact and electrical insulation must be maintained.

5. If transistor damage is suspected, continuity checks should be carried out as shown in Fig. 9. The ohmmeter should have an internal or external resistance of approximately 1kΩ in circuit. If these results are not obtained, a replacement transistor should be fitted after rectification of the fault.

TRANSISTOR REPLACEMENT

Remove the transistor cover plate, which is retained by two 4 B.A. screws and Nyloc nuts which secure the transistor to the heat sink. Remove the transistor and insulating washers and replace with the new transistor, ensuring that the insulating washers are correctly positioned and observing the precautions given above.

TRANSISTOR FEEDBACK ADJUSTMENT CONTROL

After replacement of a transistor, the feedback adjustment control 2RV4 must be re-set. The optimum position is determined under the least favourable conditions, using an input supply of 15.8 volts d.c., and is indicated when:-

1. The full h.t. voltage is present on the transmitter h.t. line when the equipment is switched from receive to transmit.

2. The frequency of oscillation is maintained under load.

3. The spikes which appear on the oscillator waveform are at minimum amplitude consistent with 1 and 2 above.

Equipment Required

1. Source of standard test voltage (13.2 volts d.c.)
2. Source of l.t. input voltage of 15.8 volts d.c. on load.
3. Oscilloscope
4. 0-500V d.c. meter. (Avo Model 8 is suitable)
5. 0.05Ω resistor. ($\frac{3}{4}$" of No. 20 gauge Eureka wire).

Procedure

1. Insert the 0.05Ω resistor in the lead from one transistor collector to transformer 2T1 (i.e. collector of 2VT1 to tag 4, or 2VT2 to tag 6).
2. Connect the oscilloscope across the ends of the 0.05Ω resistor. Both connections must be isolated from ground.
3. Place the feedback adjustment control slider in the position of minimum resistance in the circuit.
4. Connect the standard test voltage to the equipment, observing polarity
5. Switch to RX.
6. Observe the oscillator waveform, noting the amplitude of the spikes on the square waveform displayed.

7. Set the feedback adjustment control to give a minimum spike amplitude. This must not be adjusted beyond the point at which the oscillator frequency falls.

8. Switch off and connect the 15.8 volts supply in place of the standard test voltage, again observing polarity.

9. Connect the 0-500V d.c. meter to the transmitter h.t. line (tag 25 of 2TS1).

10. Switch to S/BY and depress the local transmit switch. Check that the oscillator starts without hesitation and that the rated voltage (280V) is present on the h.t. line.

11. If the oscillator is sluggish in starting and a delay in reaching rated h.t. voltage is apparent, switch off, re-set the feedback adjustment control by increasing its resistance in the circuit, and make a further check.

12. Repeat the adjustment until satisfactory operation (see 10 above) is obtained.

NOTE: In normal working, a reduction in transmitter output due to low h.t. voltage, which can be partially remedied by a reduction in supply voltage, indicates failure of one transistor.

PRINTED CIRCUITRY

The techniques employed in the servicing of printed circuitry are basically similar to those used with conventional equipment. However, the following points should be noted:-

1. The circuitry is covered with a protective layer of polystrene and, to avoid damage, it is preferable wherever possible to take meter readings from the end wires of the components on the upper side of the board.

2. When it is necessary to take readings on the circuitry side of the board needle point test probes should be used.

3. Care should be taken when soldering to avoid application of excess heat, which will result in softening of the thermoplastic adhesive under the copper foil. Best results are obtained by using a hot iron and applying it for minimum time.

4. It is advisable to use as little force as possible in order to remove faulty components. Wires which are bent over against the copper foil should be gently levered up. If care is not taken, the copper foil may lift away from the board before the solder is molten.

5. The leads of replacement components should be carefully cleaned before they are inserted through the holes in the board. They should then be cut to length, bent over against the copper foil sufficiently to hold them in position and soldered as rapidly as possible. 60/40 resin-cored solder is recommended.

6. Excess deposits of solder should be avoided, particularly in the more congested areas of circuitry.

7. It will not normally be necessary to clean the circuitry before soldering, but, should the necessity arise, a small glass-fibre brush should be used. After soldering the exposed copper foil should be recoated with a preservative to

keep out moisture. Durofix or polystyrene dope is recommended. Any particles of solder should be removed from the protective surface.

8. Damaged circuitry can be bridged with tinned copper wire or, in the case of microscopic cracks, a solder bridge is often satisfactory.

D.C. RESISTANCE OF INDUCTORS

POWER SUPPLY UNIT		Tag Nos.	Resistance
2RLA	H.T. changeover relay		200Ω
2RLF	Squelch relay		14kΩ
2T1	Transformer	1 - 8	2.1Ω
		4 - 5	0.08Ω
		5 - 6	0.08Ω
		10 - 12	0.15Ω
2L1	Filter choke		25Ω

RECEIVER UNIT			
3T9	Output transformer	1 - 2	180Ω
		3 - 4	0.5Ω

TRANSMITTER UNIT			
1T2	Modulation transformer	1 - 2	95Ω
		3 - 4	89Ω
1L3	Cathode choke		7.6Ω
1L9	Filter choke		186Ω
1RLD	Antenna changeover relay		80Ω

FRONT PANEL			
RLB	Start relay		60Ω
RLC	Ledex switch relay		170Ω
RLE	Standby relay		170Ω

CHAPTER V

V.H.F. INTERFERENCE SUPPRESSION

This chapter contains information designed to enable an installation engineer to locate and correct various forms of electrical interference. However, this can only be considered as a guide and does not deal exhaustively with the problem of interference to mobile radiotelephone equipment. Throughout this chapter it is assumed that all necessary electrical and mechanical safety precautions will be observed by the engineer.

INTRODUCTION

Electromagnetic fields resulting from sudden variations or interruptions in the current taken by electrical apparatus of the vehicle are the main causes of interference in all radio reception. The most likely source of such fields in petrol engined vehicles is the ignition system. The interference field from this source increases to a maximum in the region of 40-50 Mc/s, and this maximum value of the field may be maintained up to a frequency of 600 Mc/s.

Other items of electrical equipment responsible for causing appreciable interference fields are the generators, the windscreen wiper and fan motors, the vibrating contacts of current and voltage regulators and petrol pumps. A further source of interference is the discharge of electrostatic energy built up on the wheels of the vehicle.

The degree of interference caused depends on the following factors:-

1. The installation layout of the electrical apparatus concerned and the length and routing of the associated wiring.

2. The screening properties inherent in the construction of the vehicle which, in turn, depends on the quality of contact between the various body panels.

3. The position of the antenna on the vehicle.

   NOTE: The amount of interference picked up on the antenna can be determined by removing the feeder from the antenna base if this is accessible. When the feeder is only accessible at the equipment end, it may be detached at this point. However, this will not differentiate between the interference picked up by the feeder and that picked up by the antenna itself.

The magnitude of the interference from any, or all, of the above sources may not cause much serious trouble in areas of high signal strength but may assume considerable nuisance value in areas of low signal strength, i.e. at extreme range or in heavily screened areas.

The following notes, which give the sources of interference, their diagnosis and treatment, while covering in general all radio frequency reception, lay special emphasis on v.h.f. equipment.

IGNITION INTERFERENCE

Diagnosis

Regular pulsating noise whilst the engine is running and synchronised with the engine speed.

This is normally the easiest form to eliminate. In modern British cars an interference suppression resistor is built into the distributor lead, but when no such resistor is fitted a cut lead suppressor or similar device should be fitted into the h.t. lead from the coil to the distributor as close to the centre terminal of the distributor as possible. To obtain highly effective suppression of the ignition h.t. system, metal shrouded plugs, cables, distributor and ignition coil should replace those existing. Further, the l.t. supply may be fitted with a suitable radio frequency filter (a one or two capacitor - choke combination housed in a grounded metal case) connected between the ignition switch and the coil, the cable from the coil to the filter being screened.

Additional Treatment

1. Ensure that the h.t. and l.t. leads are well separated.
2. Fit individual plug suppressors.
3. Bond the bonnet to the main bodywork with a short length of heavy grounding braid. Also bond the engine to the main bodywork, using just sufficient length of grounding braid to allow for normal engine vibration relative to the bodywork.

DYNAMO INTERFERENCE

Diagnosis

A continuous whine, varying in pitch with the speed of the engine and occurring at all times when the engine is running.

Due to the radiation of r.f. from even very short leads it is recommended that the suppression capacitor be fitted close to the brushes under the brush cover of the dynamo, as shown in Fig.10.

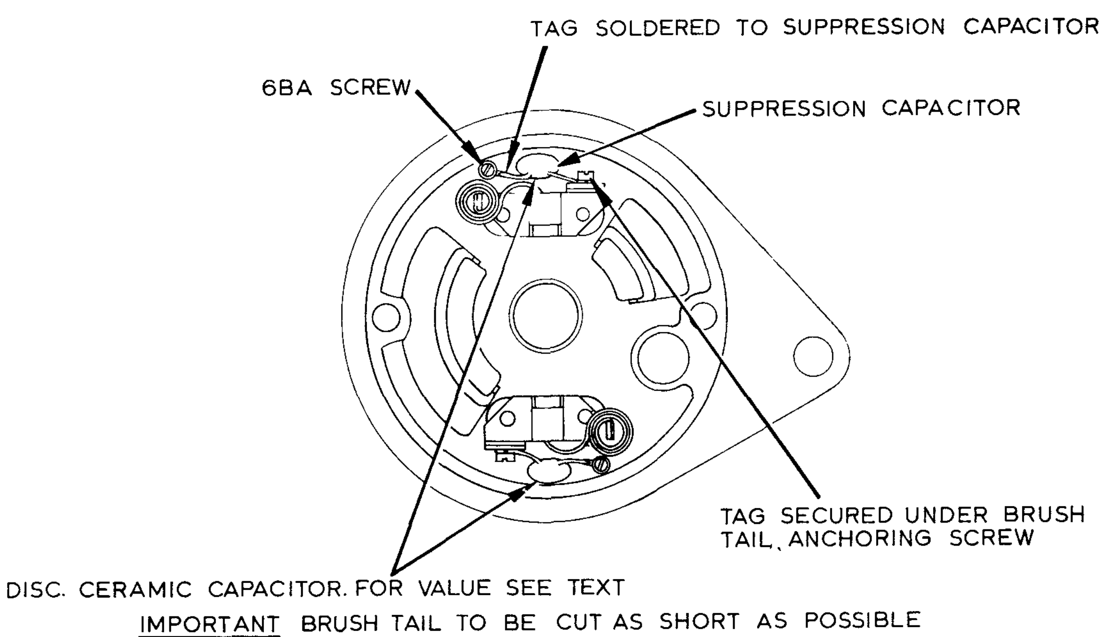


Fig.10 Dynamo End Plate

Treatment

Two 1000pF disc ceramic capacitors should be fitted to equipments operating below 68 Mc/s (bands F, G, H and J) and two 470pF disc ceramic capacitors should be fitted to equipments operating above 68 Mc/s (bands A, B, C, D and E).

Fitting Procedure

1. Remove the dynamo from the vehicle.

2. Remove the dust band, brushes and end plate.

3. Drill and tap a hole for a 6 B.A. screw close to each brush holder, as shown in Fig.10.

4. Solder a 6 B.A. tag to one end wire on each suppression capacitor (leaving about $\frac{1}{4}$" of lead at each end) and a suitable tag to the other end wire on each suppression capacitor.

5. Secure the 6 B.A. tag on each capacitor under the appropriate 6 B.A. screw as shown in Fig.10 and secure the other tag under the corresponding brush tail anchoring screw on the end plate.

6. Clean and check the commutator and brushes.

7. Replace and secure the end plate and refit the brushes, shortening any brush tails that are longer than necessary for free movement of the brushes.

8. Refit the dustband and replace the dynamo on the vehicle.

AUXILIARY EQUIPMENT

Diagnosis

Interference occurring only when a particular electrical device, such as the windscreen wiper motor, is switched on.

While the radio equipment is in operation switch on each electrical device singly and check its effect on reception.

Treatment

Fit a capacitor (1000pF for frequencies below 68 Mc/s and 470pF for frequencies above 68 Mc/s) between the live side of the device and the chassis. Use the shortest possible leads, well grounded, to the frame of the device. When resilient mounts are used, fit a heavy copper braid from the frame of the device to the main bodywork, keeping the length as short as possible.

TYRE AND BRAKE STATIC

The rotation of the vehicle wheels on the road surface, especially when it is dry, generates electrostatic energy in the tyres. This energy, normally called 'tyre static', gives rise to microampere level currents tending to flow from the tyres to the body of the vehicle. In the case of rear wheels, free and continuous passage for the current to the body exists through the gearing at many points independently of the bearings. In front wheels, however, the passage of current must lie solely through the bearings. Normally, oil or grease film in the bearings provides complete insulation at this point. It is when this insulation breaks down intermittently, resulting in a series of make-and-break contacts, that interference to the radio equipment is generated.

Application of brakes creates the same type of electrostatic energy and presents the same problem of interference to radio reception under conditions of intermittent insulation at the bearings.

Diagnosis

A continuous hissing sound when the vehicle is in motion, even though the engine is switched off, or a hissing sound which occurs whenever the brakes are applied. This type of interference is more prevalent in dry weather or in dry climates.

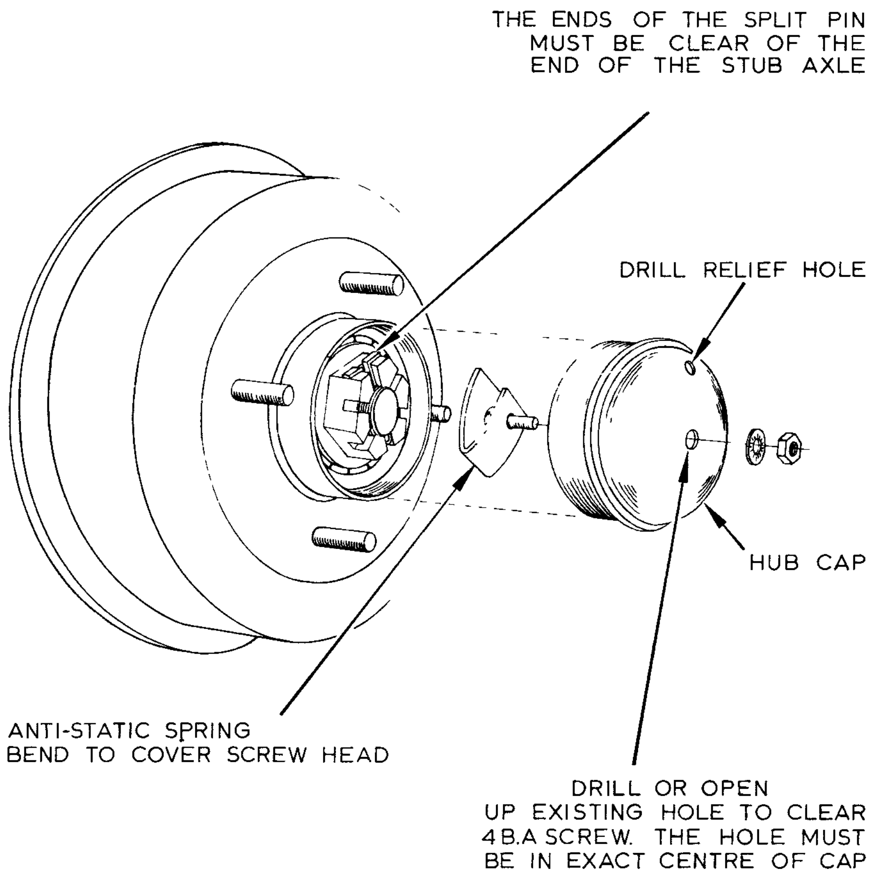


Fig. 11 Fitting an Anti-Static Spring to the Hub Cap

Treatment

1. Anti-static springs can be obtained for fitting to the wheel hubs of most British cars. When these are not available, a pick-up spring should be fitted as shown in Fig. 11. This spring provides a passage for the current from the wheel to the body by by-passing the bearings.

2. Inject anti-static powder, or a little water into the tyre.

3. Paint the tyre with lamp-black or graphite (black lead).

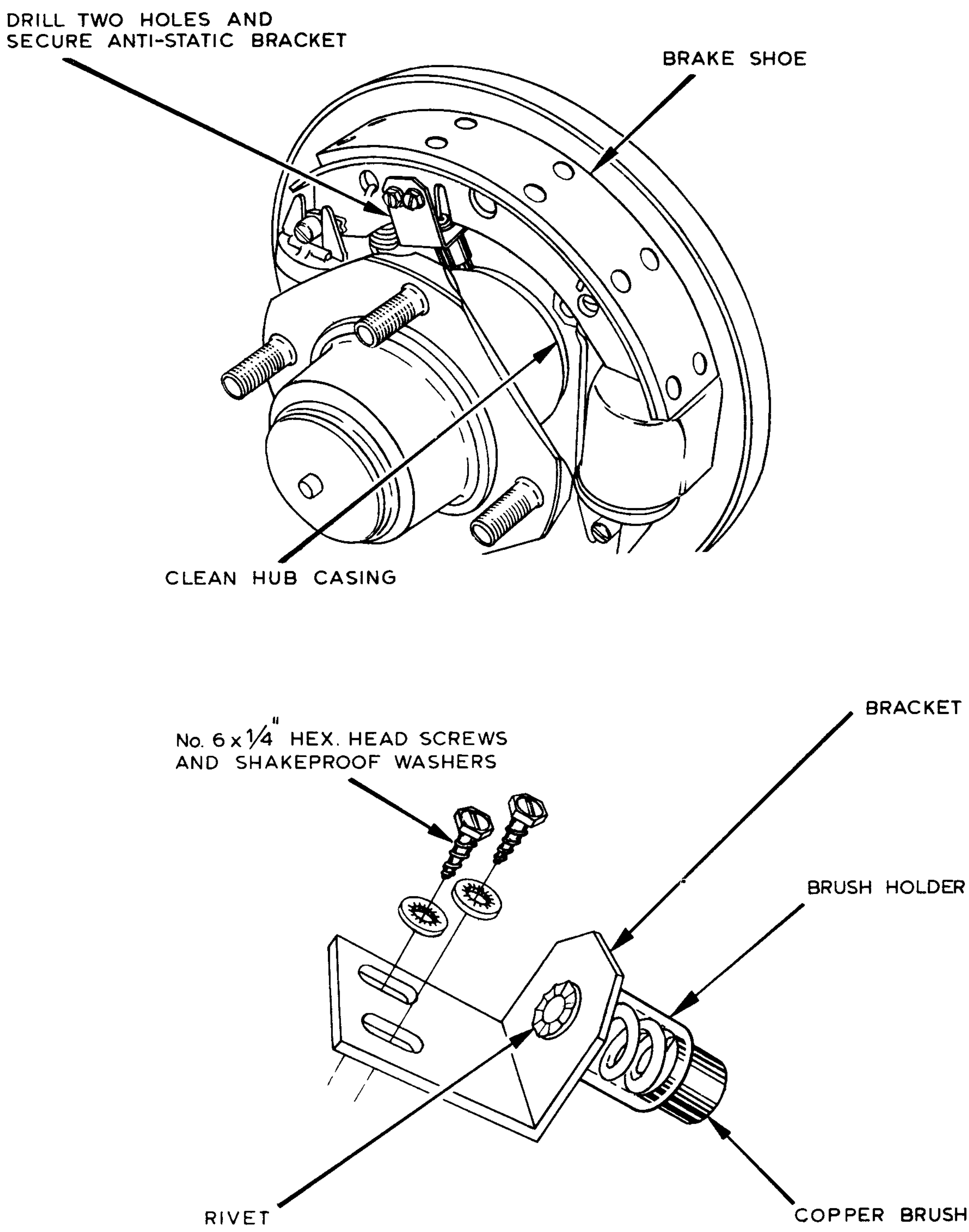


Fig. 12 Fitting an Anti-Static Bracket to the Brake Shoes

4. Pump graphited grease into the front wheel bearings to increase conductivity.

5. Ground the suspension and rear axle with a heavy grounding braid.

6. Fit anti-static brackets to the brake shoes, as shown in Fig. 12, in order to establish conducting paths between the brake shoes and the axle .

OTHER POSSIBLE SOURCES OF INTERFERENCE

Any interference not eliminated by the above operations may be due to bad electrical contact between adjacent parts of the bodywork, giving rise to irregular noises, especially on uneven road surfaces.

The usual points at which such troubles originate are:-

(a) Exhaust system to bodywork.

(b) Engine block to bodywork.

(c) Wings to bodywork.

(d) Rear axle assembly to bodywork (see paragraph 6 of Tyre and Brake Static above).

Treatment

1. With the vehicle stationary, rotate the SQUELCH control (if fitted) until receiver noise is heard, run the engine at varying speeds and check for vibrating oil gauge pipes, throttle cables and for other parts of the system which may be badly grounded. If the cause is found, secure and/or bond the vibrating item to the engine block, using the shortest possible length of heavy grounding braid.

2. If the noise does not appear to be associated with engine vibration but only with road shocks, a careful check of the entire vehicle should be made, paying particular attention to electrical connections and ensuring that all body member and accessories are securely fixed in position.

PARTS LISTS

AND

DIAGRAMS

ORDERING OF SPARE PARTS

To avoid delays and possible errors in the supply of spare parts the reference numbers shown in these parts lists should be quoted in all orders.

RECEIVER - 25 to 68 Mc/s

Code		CAPACITORS				Part No
C1	33pF	Feedthrough				266032
*C2	47pF	Ceramic	(25-32.5 Mc/s)		±10%	650739
	33pF	Ceramic	(32.5-42 Mc/s)		±10%	650746
	22pF	Ceramic	(42 - 54 Mc/s)		±10%	650738
	15pF	Ceramic	(54 - 68 Mc/s)		±10%	650744
C3		Glass seal				963566
C4	1nF	Disc ceramic				660433
C5	1nF	Disc ceramic				660433
C6		Glass seal				963566
C7	1nF	Feedthrough				266034
*C8	1-10pF	Trimmer				280019
*C9	1-10pF	Trimmer				280019
C10	47pF	Feedthrough				266033
C11	1nF	Disc ceramic				660433
C12	470pF	Disc ceramic			±20%	266244
C13		Glass seal				963566
*C14	1-10pF	Trimmer				280019
*C15	1-10pF	Trimmer				280019
C16	1nF	Feedthrough				266034
C17		Not used				
C18	47pF	Feedthrough				266033
C19	1nF	Disc ceramic				660433
C20	470pF	Disc ceramic			±20%	266244
C21	10nF	Disc ceramic				660006
C22	1nF	Disc ceramic				660433
C23	10nF	Disc ceramic				660006
C24	10nF	Disc ceramic				660006
C25	10nF	Disc ceramic				660006
C26	10nF	Disc ceramic				660006
C27	1.7pF	Ceramic	(Types V and N)		±0.1pF	266036
	3.3pF	Ceramic	(Type W)		±0.1pF	622650
C28	0.1µF	Ceramic		200V	±10%	266246
C29 to C32		Not used				
C33	10nF	Disc ceramic				660006
C34		Not used				
C35	10nF	Disc ceramic				660006
C36	10nF	Disc ceramic				660006
C37	2pF	Ceramic	(Types V and N)		±0.1pF	266025
	5.6pF	Ceramic	(Type W)		±0.1pF	652652
C38	0.1µF	Ceramic	(Types N and W only)		±10%	266246
C39	10nF	Disc ceramic				660006
C40	10nF	Disc ceramic				660006
C41	0.1µF	Ceramic		200V	±10%	266246
C42	10nF	Disc ceramic				660006
C43	2pF	Ceramic	(Types V and N)		±0.1pF	266025
	5.6pF	Ceramic	(Type W)		±0.1pF	652652
C44	10nF	Disc ceramic				660006
C45	10nF	Disc ceramic				660006
C46	10nF	Disc ceramic				660006
C47	0.1µF	Ceramic		200V	±10%	266246
C48	10nF	Disc ceramic				660006
C49	10nF	Disc ceramic				660006
C50	0.1µF	Ceramic		200V	±10%	266246
C51	22pF	Ceramic			±10%	650738
C52	10µF	Electrolytic		50V		266383
C53	47pF	Ceramic			±10%	650739
C54	3nF	Disc ceramic				660439
C55	10µF	Electrolytic		50V		266383
C56	10nF	Disc ceramic		100V		660040
C57		Not used				
C58	8.2pF	Ceramic			±10%	652660
C59 to C61		Not used				
C62	3.3pF	Ceramic				652650
C63		Not used				
C64		Glass seal				963566
C65	1nF	Feedthrough				266034
C66		Glass seal				963566
C67		Not used				
C68	100pF	Ceramic			±10%	650740
*C69	1nF	Tubular				669479
*C70	10nF	Disc ceramic		500V		669101
*C71	0.1µF	Ceramic		200V	±10%	266246
*C72	100pF	Ceramic			±10%	650740
C73	1.7pF	Ceramic	(Type V only)		±0.1pF	266036
C74	1.7pF	Ceramic	(Type V only)		±0.1pF	266036
C75	1.7pF	Ceramic	(Type V only)		±0.1pF	266036
C76 to C82		Not used				
C83	47pF	Ceramic	(25-32.5 Mc/s)		±10%	650739
	22pF	Ceramic	(32.5-42 Mc/s)		±10%	650738
		Not used	(42 - 68 Mc/s)			
C84		Not used				
*C85	12pF	Ceramic	(25-32.5 Mc/s)		±10%	650755
		Not used	(32.5-68 Mc/s)			
*C86	1-10pF	Trimmer				280019

Code		CAPACITORS (cont.)				Part No.
*C87	12pF	Ceramic	(25-32.5 Mc/s)		±10%	650755
	6.8pF	Ceramic	(32.5-42 Mc/s)		±10%	650742
		Not used	(42 - 68 Mc/s)			
*C88	12pF	Ceramic	(25-32.5 Mc/s)		±10%	650755
		Not used	(32.5-68 Mc/s)			
*C89	12pF	Ceramic	(25-32.5 Mc/s)		±10%	650755
	6.8pF	Ceramic	(32.5-42 Mc/s)		±10%	650742
		Not used	(42 - 68 Mc/s)			
C90 to C92		Not used				
*C93	6.8pF	Ceramic	(25-32.5 Mc/s)		±10%	650742
		Not used	(32.5-68 Mc/s)			
C94	10nF	Disc ceramic	(Types N and W)			660006
	0.1µF	Ceramic	(Type V)	200V		266246
C95	68pF	Ceramic	(25-32.5 Mc/s)		± 2%	652599
	39pF	Ceramic	(32.5-42 Mc/s)		±1pF	652598
	12pF	Ceramic	(42 - 54 Mc/s)		±10%	650755
		Not used	(54 - 68 Mc/s)			
C96	82pF	Ceramic	(25-32.5 Mc/s)		± 2%	652787
	39pF	Ceramic	(32.5-42 Mc/s)		±1pF	652598
	12pF	Ceramic	(42 - 54 Mc/s)		±10%	650755
		Not used	(54 - 68 Mc/s)			
C97	220pF	Silver mica				660883
C98	12pF	Ceramic			±10%	650755
C99		Not used				
C100	1nF	Disc ceramic				660433
C101	3.3pF	Ceramic	(Type W only)			622650
C102	100pF	Ceramic			±10%	650740
C103	0.1µF	Ceramic		200V		266246
C104	560pF	Silver mica			±10%	665369
C105	10nF	Disc ceramic		1400V		660040

NOTE: 1nF = 1000pF = 0.001µF

Code		RESISTORS			Part No.
R1	1.5kΩ		¼W	±10%	671508
R2	100Ω		¼W	±10%	671494
R3	1kΩ		¼W	±10%	671506
R4	150Ω		¼W	±10%	671496
R5	1kΩ		¼W	±10%	671506
R6	1MΩ		¼W	±10%	671542
R7	4.7kΩ		¼W	±10%	671514
R8	1kΩ		¼W	±10%	671506
R9	1.2MΩ		¼W	±10%	671543
R10	100kΩ		¼W	±10%	671530
R11	47kΩ		¼W	±10%	671526
R12	1kΩ		¼W	±10%	671506
R13	180kΩ	(Types V and N)	¼W	±10%	671533
	27kΩ	(Type W)	¼W	±10%	671523
R14	2.2kΩ		¼W	±10%	671510
R15		Not used			
R16		Not used			
R17	180kΩ	(Types V and N)	¼W	±10%	671533
	27kΩ	(Type W)	¼W	±10%	671523
R18	100kΩ		¼W	±10%	671530
R19	120kΩ	(Type N)	¼W	±10%	671531
	47kΩ	(Types V and W)	¼W	±10%	671526
R20	120Ω	(Type V)	¼W	±10%	671495
	1kΩ	(Type N)	¼W	±10%	671506
	330Ω	(Type W)	¼W	±10%	671500
R21	2.2kΩ		¼W	±10%	671510
R22	1MΩ		¼W	±10%	671542
R23	470kΩ		¼W	±10%	671538
R24	120kΩ	(Type N)	¼W	±10%	671531
	47kΩ	(Types V and W)	¼W	±10%	671526
R25	1.2kΩ	(Type V)	¼W	±10%	671507
	2.7kΩ	(Type N)	¼W	±10%	671511
	220Ω	(Type V)	¼W	±10%	671498
R26	2.2kΩ		¼W	±10%	671510
R27	150Ω	(2 x 300Ω in parallel)	¼W	±10%	671500
R28	120kΩ	(Type N)	¼W	±10%	671531
	15kΩ	(Types V and W)	¼W	±10%	671520
R29	1.2kΩ	(Type N)	¼W	±10%	671507
	150Ω	(Types V and W)	¼W	±10%	671496
R30	2.2kΩ		¼W	±10%	671510
R31	1MΩ		¼W	±10%	671542
R32	470kΩ		¼W	±10%	671538
R33	100kΩ		¼W	±10%	671530
R34	10kΩ		¼W	±10%	671518
R35	4.7MΩ		¼W	±10%	671550
R36	270Ω		¼W	±10%	671499
R37 to R39		Not used			
R40	1kΩ		¼W	±10%	671506

Code	RESISTORS (cont.)				Part No.
R41 to R43		Not used			
R44	39Ω		½W	±10%	670425
R45		Not used			
*R46	470kΩ		¼W	±10%	671538
*R47	470kΩ		¼W	±10%	671538
*R48	180kΩ		¼W	±10%	671533
*R49	22kΩ		¼W	±10%	671522
*R50	100kΩ		¼W	±10%	671530
*R51	2.2kΩ		¼W	±10%	671510
R52		Not used			
R53		Not used			
R54	680Ω		¼W	±10%	671504
R55	680Ω	(6 channel only)	¼W	±10%	671504
R56	680Ω	(6 channel only)	¼W	±10%	671504
R57	680Ω	(6 channel only)	¼W	±10%	671504
R58	680Ω	(6 channel only)	¼W	±10%	671504
R59	680Ω	(6 channel only)	¼W	±10%	671504
R60	10kΩ		¼W	±10%	671518
R61	470Ω		¼W	±10%	671502
R62	22kΩ		¼W	±10%	671522
R63		Not used			
R64	27kΩ	(Type W only)	¼W	±10%	671523
R65	27kΩ	(Type W only)	¼W	±10%	671523
R66	56kΩ	(Type W only)	¼W	±10%	671527
R67	56kΩ	(Type W only)	¼W	±10%	671527
R68	56kΩ	(Type W only)	¼W	±10%	671527
R69	56kΩ	(Type W only)	¼W	±10%	671527
R70	47kΩ		¼W	±10%	671526
R71	470kΩ		¼W	±10%	671538

Code	TRANSFORMERS			Part No.
*T1		R.F.		277105/1
*T2	2 Mc/s	I.F.	(Type V only)	277097
*T3	2 Mc/s	I.F.		277097
*T4	2 Mc/s	I.F.		277097
*T5	2 Mc/s	I.F.	(Type V only)	277097
*T6	2 Mc/s	I.F.		277097
*T7	2 Mc/s	I.F.	(Type V only)	277097
*T8	2 Mc/s	I.F.		277097
T9		Output		277866

Code	VALVES British	American	Part No.
V1	EC91	6AQ4	860160
V2	EC91	6AQ4	860160
V3	EC91	6AQ4	860160
V4	ECF80	6BL8	860324
V5	6BJ6	6BJ6	860397
V6	6BJ6	6BJ6	860397
V7	6CB6	6CB6	860095
V8	EBC90	6AT6	860236
V9	EL90	6AQ5	860112
V10	Not used		
V11	6BH6	6BH6	860099

Code	COILS & CHOKES	Part No.	COIL CORES 25-32.5 Mc/s	32.5-42 Mc/s	42-54 Mc/s	54-68 Mc/s
*L1	Antenna coil	278407	272746	272744	272744	272744
L2	Cathode choke	279052	-	-	-	-
L3	Heater choke	279052	-	-	-	-
L4	Heater choke	279052	-	-	-	-
*L5	V1 anode coil	278405	274804	27 804	272742	Not used
*L6	V2 cathode coil	278406	274804	272743	272746	Not used
L7	Cathode choke	279052	-	-	-	-
L8	Heater choke	279052	-	-	-	-
L9	Heater choke	279052	-	-	-	-
*L10	V2 anode coil	278405	274804	274804	272742	Not used
*L11	V3 cathode coil	278406	274804	272743	272746	Not used
L12	Cathode choke	279052	-	-	-	-
L13	Heater choke	279052	-	-	-	-
L14	Not used		-	-	-	-
*L15	Oscillator anode coil	278505/11	274804	272746	272744	Not used
L16	Cathode choke	278052	-	-	-	-
L17	Oscillator coil (25-32.5 Mc/s) (single channel only)	278508/3	-	-	-	-
	Oscillator coil (32.5-42 Mc/s) (single channel only)	278471/2	-	-	-	-
	Oscillator coil (42 - 54 Mc/s) (single channel only)	278508/7	-	-	-	-
	Oscillator coil (54 - 68 Mc/s) (single channel only)	278508/3	-	-	-	-
L17 to L22	Oscillator coil (25-32.5 Mc/s) (six channel only)	278508/9	274823/1	274823/1	274823/1	274823/1
	Oscillator coil (32.5-42 Mc/s) (six channel only)	278471/4	274823/1	274823/1	274823/1	274823/1
	Oscillator coil (42 - 54 Mc/s) (six channel only)	278508/11	274823/1	274823/1	274823/1	274823/1
	Oscillator coil (54 - 68 Mc/s) (six channel only)	278508/9	274823/1	274823/1	274823/1	274823/1

Code	MISCELLANEOUS		Part No.
*MR1	Diode	OA200	621601
SC	Wafer switch (6 channel only)		283197
	Noise limiter assembly		275607
	Crystal oven		271502
XL1	Crystal		
XL2	Crystal	(6 channel only)	
XL3	Crystal	(6 channel only)	
XL4	Crystal	(6 channel only)	
XL5	Crystal	(6 channel only)	
XL6	Crystal	(6 channel only)	

When ordering crystals, please state frequency and type required (see CRYSTAL FORMULAE at end of the PARTS LISTS).

* Components mounted in cans.

Chassis Assembly Complete Part No. 288274/1-6

When ordering complete chassis assemblies, please state operating frequency.

RECEIVER - 68 to 174 Mc/s

Code		CAPACITORS				Part No.
C1	33pF	Feedthrough				266032
*C2	1-10pF	Trimmer				280019
C3		Glass seal				963566
C4	1nF	Disc ceramic				660433
C5	1nF	Disc ceramic				660433
C6		Glass seal				963566
C7	1nF	Feedthrough				266034
*C8	1-10pF	Trimmer				280019
*C9	1-10pF	Trimmer				280019
C10	47pF	Feedthrough				266033
C11	1nF	Disc ceramic				660433
C12	470pF	Disc ceramic			± 2%	266244
C13		Glass seal				963566
*C14	1-10pF	Trimmer				280019
*C15	1-10pF	Trimmer				280019
C16	1nF	Feedthrough				266034
C17		Glass seal				963566
C18	47pF	Feedthrough				266033
C19	1nF	Disc ceramic				660433
C20	470pF	Disc ceramic			±20%	266244
C21	10nF	Disc ceramic				660006
C22	1nF	Disc ceramic				660433
C23	10nF	Disc ceramic				660006
C24	10nF	Disc ceramic				660006
C25	10nF	Disc ceramic				660006
C26	10nF	Disc ceramic				660006
C27	1.7pF	Ceramic	(Types V and N)		±0.1pF	266036
	3.3pF	Ceramic	(Type W)		±0.5pF	652650
C28	0.1μF	Ceramic		200V	±10%	266246
C29	4.7pF	Ceramic			±10%	650737
C30	6.8pF	Ceramic			±10%	650742
C31	47pF	Ceramic			±10%	650739
C32	10nF	Disc ceramic				660006
C33	10nF	Disc ceramic				660006
C34	15pF	Ceramic			±10%	650744
C35	10nF	Disc ceramic				660006
C36	10nF	Disc ceramic				660006
C37	2pF	Ceramic	(Types V and N)		±0.1pF	266025
	5.6pF	Ceramic	(Type W)		±0.5pF	652652
C38	0.1μF	Ceramic	(Types N and W only)	200V	±10%	266246
C39	10nF	Disc ceramic				660006
C40	10nF	Disc ceramic				660006
C41	0.1μF	Ceramic		200V	±10%	266246
C42	10nF	Disc ceramic				660006
C43	2pF	Ceramic	(TypesV and N)		±0.1pF	266025
	5.6pF	Ceramic	(Type W)		±0.5pF	652652
C44	10nF	Disc ceramic				660006
C45	10nF	Disc ceramic				660006
C46	10nF	Disc ceramic				660006
C47	0.1μF	Ceramic		200V	±10%	266246
C48	10nF	Disc ceramic				660006
C49	10nF	Disc ceramic				660006
C50	0.1μF	Ceramic		200V	±10%	266246
C51	22pF	Ceramic			±10%	650738
C52	10μF	Electrolytic		50V		266383
C53	47pF	Ceramic			±10%	650739
C54	3nF	Disc ceramic				660439
C55	10μF	Electrolytic		50V		266383
C56	10nF	Disc ceramic		100V		660040
C57	10nF	Disc ceramic				660006
C58	8.2pF	Ceramic			±10%	652660
C59	100pF	Ceramic			±10%	650740
C60	1nF	Disc ceramic				660433
C61	1nF	Disc ceramic				660433
C62	3.3pF	Ceramic			±0.5pF	652650
C63	1nF	Disc ceramic				660433
C64		Glass seal				963566
C65	1nF	Feedthrough				266034
C66		Glass seal				963566
C67	47pF	Silver mica		350V	±1pF	660848
C68	100pF	Ceramic			±10%	650740
*C69	1nF	Tubular				669479
*C70	10nF	Disc ceramic		500V		669101
*C71	0.1μF	Ceramic		200V	±10%	266246
*C72	100pF	Ceramic			±10%	650740
C73	1.7pF	Ceramic	(Type V only)		±0.1pF	266036
C74	1.7pF	Ceramic	(Type V only)		±0.1pF	266036
C75	1.7pF	Ceramic	(Type V only)		±0.1pF	266036
C76	1-12pF	Trimmer				280057
C77	1-12pF	Trimmer	(6 channel only)			280057
C78	1-12pF	Trimmer	(6 channel only)			280057
C79	1-12pF	Trimmer	(6 channel only)			280057
C80	1-12pF	Trimmer	(6 channel only)			280057
C81	1-12pF	Trimmer	(6 channel only)			280057
C82	4.7pF	Ceramic	(single channel only)		±10%	650737

Code		CAPACITORS (cont.)				Part No.
C83	22pF	Ceramic	(68 - 88 Mc/s)		±10%	650738
	15pF	Ceramic	(88 -108 Mc/s)		±10%	650744
	6.8pF	Ceramic	(108-132 Mc/s)		±10%	650472
*C84		Not used	(132-174 Mc/s)			
	4.7pF	Ceramic	(68 -132 Mc/s)		±10%	650737
		Not used	(132-174 Mc/s)			
C85		Not used				
*C86	1-10pF	Trimmer				280019
*C87	10pF	Ceramic	(68 - 88 Mc/s)		±10%	650751
	4.7pF	Ceramic	(88 -132 Mc/s)		±10%	650737
		Not used	(132-174 Mc/s)			
C88		Not used				
*C89	10pF	Ceramic	(68 - 88 Mc/s)		±10%	650751
	4.7pF	Ceramic	(68 -132 Mc/s)		±10%	650737
		Not used	(132-174 Mc/s)			
C90	15pF	Silver mica	(68 - 88 Mc/s)	350V	±1pF	660844
	5.6pF	Silver mica	(79 -101 Mc/s) (Home Office only)		±0.5pF	660840
	4.7pF	Silver mica	(88 -132 Mc/s)	350V	±0.5pF	660868
		Not used	(132-174 Mc/s)			
C91	15pF	Silver mica	(68 - 88 Mc/s)	350V	±1pF	660844
	5.6pF	Silver mica	(79 -101 Mc/s) (Home Office only)		±0.5pF	660840
	4.7pF	Silver mica	(88 -132 Mc/s)	350V	±0.5pF	660868
		Not used	(132-174 Mc/s)			
C92	6.8pF	Silver mica	(68 - 88 Mc/s)			660841
	4.7pF	Silver mica	(88 -108 Mc/s)	350V	±0.5pF	660868
		Not used	(108-174 Mc/s)			
C93		Not used				
C94	10nF	Disc ceramic	(Types N and W)			660006
	0.1μF	Ceramic	(Type V)	200V		266246
C95 to C100		Not used				
C101	3.3pF	Ceramic	(Type W only)		±0.5pF	652650
C102	100pF	Ceramic			±10%	650740
C103	0.1μF	Ceramic		200V		266246
C104	560pF	Silver mica			±10%	665369
C105	10nF	Disc ceramic		1400V		660040

NOTE: 1nF = 1000pF = 0.001μF

Code		RESISTORS			Part No
R1	1.5kΩ		¼W	±10%	671508
R2	100Ω		¼W	±10%	671494
R3	1kΩ		¼W	±10%	671506
R4	150Ω		¼W	±10%	671496
R5	1kΩ		¼W	±10%	671506
R6	1MΩ		¼W	±10%	671542
R7	1kΩ		¼W	±10%	671506
R8	1kΩ		¼W	±10%	671506
R9	1.2MΩ		¼W	±10%	671543
R10	100kΩ		¼W	±10%	671530
R11	47kΩ		¼W	±10%	671526
R12	560Ω		¼W	±10%	671503
R13	180kΩ	(TypesV and N)	¼W	±10%	671533
	27kΩ	(Type W)	¼W	±10%	671523
R14	2.2kΩ		¼W	±10%	671510
R15	39kΩ		¼W	±10%	671525
R16	15kΩ		¼W	±10%	671520
R17	180kΩ	(Types V and N)	¼W	±10%	671533
	27kΩ	(Type W)	¼W	±10%	671523
R18	100kΩ		¼W	±10%	671530
R19	120kΩ	(Type N)	¼W	±10%	671531
	47kΩ	(Types V and W)	¼W	±10%	671526
R20	120Ω	(Type V)	¼W	±10%	671495
	1kΩ		¼W	±10%	671506
	330Ω	(Type W)	¼W	±10%	671500
R21	2.2kΩ		¼W	±10%	671510
R22	1MΩ		¼W	±10%	671542
R23	470kΩ		¼W	±10%	671538
R24	120kΩ	(Type N)	¼W	±10%	671531
	47kΩ	(TypesV and W)	¼W	±10%	671526
R25	120Ω	(Type V)	¼W	±10%	671495
	470Ω	(Type N)	¼W	±10%	671502
	220Ω	(Type W)	¼W	±10%	671498
R26	2.2kΩ		¼W	±10%	671510
R27	150Ω	(2 x 330Ω in parallel)	¼W	±10%	671500
R28	120kΩ	(Type N)	¼W	±10%	671531
	15kΩ	(Types V and W)	¼W	±10%	671520
R29	1.2kΩ	(Type N)	¼W	±10%	671507
	150Ω	(Types V and W)	¼W	±10%	671496
R30	2.2kΩ		¼W	±10%	671510
R31	1MΩ		¼W	±10%	671542
R32	470kΩ		¼W	±10%	671538

Code	RESISTORS (cont.)				Part No.
R33	100kΩ		¼W	±10%	671530
R34	10kΩ		¼W	±10%	671518
R35	4.7MΩ		¼W	±10%	671550
R36	270Ω		¼W	±10%	671499
R37	39kΩ		¼W	±10%	671525
R38	1kΩ		¼W	±10%	671506
R39	2.2kΩ		¼W	±10%	671510
R40	1kΩ		¼W	±10%	671506
R41	1kΩ		¼W	±10%	671506
R42	100Ω		¼W	±10%	671494
R43	100kΩ		¼W	±10%	671530
R44	47Ω		½W	±10%	670426
R45	Not used				
*R46	470kΩ		¼W	±10%	671538
*R47	470kΩ		¼W	±10%	671538
*R48	180kΩ		¼W	±10%	671533
*R49	22kΩ		¼W	±10%	671522
*R50	100kΩ		¼W	±10%	671530
*R51	2.2kΩ		¼W	±10%	671510
R52	47kΩ		¼W	±10%	671526
R53 to R63	Not used				
R64	27kΩ	(Type W only)	¼W	±10%	671523
R65	27kΩ	(Type W only)	¼W	±10%	671523
R66	56kΩ	(Type W only)	¼W	±10%	671527
R67	56kΩ	(Type W only)	¼W	±10%	671527
R68	56kΩ	(Type W only)	¼W	±10%	671527
R69	56kΩ	(Type W only)	¼W	±10%	671527
R70	47kΩ		¼W	±10%	671526
R71	470kΩ		¼W	±10%	671538

Code	VALVES British	American	Part No.
V1	EC91	6AQ4	860160
V2	EC91	6AQ4	860160
V3	EC91	6AQ4	860160
V4	ECF80	6BL8	860324
V5	6BJ6	6BJ6	860397
V6	6BJ6	6BJ6	860397
V7	6CB6	6CB6	860095
V8	EBC90	6AT6	860236
V9	EL90	6AQ5	860112
V10	ECF80	6BL8	860324

Code		TRANSFORMERS		Part No.
*T1	10.7 Mc/s	I.F.		277113
*T2	2 Mc/s	I.F.	(Type V only)	277097
*T3	2 Mc/s	I.F.		277097
*T4	2 Mc/s	I.F.		277097
*T5	2 Mc/s	I.F.	(Type V only)	277097
*T6	2 Mc/s	I.F.		277097
*T7	2 Mc/s	I.F.	(Type V only)	277097
*T8	2 Mc/s	I.F.		277097
T9		Output		277866
*T10		R.F.		277095

COILS & CHOKES — COIL CORES

Code		Part No.	68-88 Mc/s	88-108 Mc/s	108-132 Mc/s	132-156 Mc/s	148-174 Mc/s	Home Office 79-101 Mc/s
*L1	Antenna coil	278351	272743	272742	272744	272740	Not used	272743
L2	Cathode choke	279052	-	-	-	-	-	-
L3	Heater choke	279050	-	-	-	-	-	-
L4	Heater choke	279050	-	-	-	-	-	-
*L5	V1 anode coil	278352	272746	272744	Not used	Not used	**Not used**	272742
*L6	V2 cathode coil	278352	272743	272746	272742	272740	**Not used**	272743
L7	Cathode choke	279052	-	-	-	-	-	
L8	Heater choke	279050	-	-	-	-	-	-
L9	Heater choke	279050	-	-	-	-	-	-
*L10	V2 anode coil	278352	272746	272744	Not used	Not used	Not used	272742
*L11	Cathode choke	278352	272743	272746	272742	272740	Not used	272742
L12	Cathode choke	279052	-	-	-	-	-	-
L13	Heater choke	279050	-	-	-	-	-	-
L14	Cathode choke	279051	-	-	-	-	-	-
*L15	Multiplier coil	278353	272743	272744	272741	Not used	Not used	272742
L16	Cathode choke	279051	-	-	-	-	-	

Code	MISCELLANEOUS	Part No.
*MR1	Diode OA200	621601
SC	Wafer switch (6 channel only)	283197
	Noise limiter assembly	275607
	Crystal oven	271502
XL1	Crystal	
XL2	Crystal (6 channel only)	
XL3	Crystal (6 channel only)	
XL4	Crystal (6 channel only)	
XL5	Crystal (6 channel only)	
XL6	Crystal (6 channel only)	
XL7	Crystal	

When ordering crystals please state frequency and type required (see CRYSTAL FORMULAE at the end of the PARTS LISTS)

* Components mounted in cans

Chassis Assembly Complete Part No. 288273/7-12

When ordering complete chassis assemblies, please state operating frequency.

Code		CAPACITORS				Part No.
C1	1-10pF	Trimmer				280019
C2	1-10pF	Trimmer	(6 channel only)			280019
C3	1-10pF	Trimmer	(6 channel only)			280019
C4	1-10pF	Trimmer	(6 channel only)			280019
C5	1-10pF	Trimmer	(6 channel only)			280019
C6	1-10pF	Trimmer	(6 channel only)			280019
C7		Not used				
C8	5.6pF	Ceramic			±0.5pF	652652
C9	2nF	Disc ceramic				660002
C10	0.75pF	Gimmicon			±0.1pF	266031
C11	10pF	Ceramic			±10%	650751
C12	47pF	Ceramic			±1pF	653102
C13	2nF	Disc ceramic				660002
C14	47pF	Ceramic	(25-32.5 Mc/s)		±1pF	653102
	15pF	Ceramic	(32.5-42 Mc/s)		±1pF	652597
	33pF	Ceramic	(42 - 54 Mc/s)		±1pF	653657
	15pF	Ceramic	(54 - 68 Mc/s)		±1pF	652595
	27pF	Ceramic	(88 -108 Mc/s)		±1pF	652597
	15pF	Ceramic	(108-132 Mc/s)		±1pF	652595
	27pF	Ceramic	(132-174 Mc/s)		±1pF	652597
C15	2nF	Disc ceramic				660002
C16	2nF	Disc ceramic				660002
C17		Not used	(25 - 68 Mc/s)			
	2nF	Disc ceramic	(68 -174 Mc/s)			660002
C18	2nF	Disc ceramic				660002
C19	220pF	Ceramic Hi K			±20%	666648
C20		Not used	(25 - 68 Mc/s)			
	2nF	Disc ceramic	(68 -174 Mc/s)			660002
C21		Not used	(25 - 68 Mc/s)			
	47pF	Ceramic	(68 - 88 Mc/s)		±1pF	653102
	68pF	Ceramic	(88 -108 Mc/s)		± 2%	652599
	47pF	Ceramic	(108-132 Mc/s)		±1pF	653102
	18pF	Ceramic	(132-174 Mc/s)		±1pF	652596
C22		Not used	(25 - 68 Mc/s)			
	2nF	Disc ceramic	(68 -174 Mc/s)			660002
C23	1nF	Disc ceramic				660433
C24		Not used	(25 - 68 Mc/s)			
	2nF	Disc ceramic	(68 -174 Mc/s)			660002
C25		Not used	(25 - 68 Mc/s)			
	220pF	Ceramic	(68 -174 Mc/s)		±20%	666648
C26		Not used	(25 - 68 Mc/s)			
	12pF	Ceramic	(68 - 88 Mc/s)		±10%	650755
	5.6pF	Ceramic	(88 -108 Mc/s)		±0.5pF	652652
		Not used	(108-132 Mc/s)			
	3.9pF	Ceramic	(132-148 Mc/s)		±0.5pF	652651
	2pF	Ceramic	(148-156 Mc/s)		±0.5pF	652659
		Not used	(156-174 Mc/s)			
C27	1nF	Disc ceramic				660433
C28	1nF	Disc ceramic				660433
C29		Not used	(25 - 68 Mc/s)			
	2pF	Ceramic	(68 - 88 Mc/s)		±0.5pF	652659
		Not used	(88 -179 Mc/s)			
C30	1nF	Disc ceramic				660433
C31		Not used	(25 - 68 Mc/s)			
	22pF	Ceramic	(68 - 88 Mc/s)		±1pF	653103
	6.8pF	Ceramic	(88 -108 Mc/s)		±0.5pF	652653
		Not used	(108-132 Mc/s)			
	6.8pF	Ceramic	(132-148 Mc/s)		±0.5pF	652653
	3.3pF	Ceramic	(148-156 Mc/s)		±0.5pF	652650
		Not used	(156-174 Mc/s)			
C32	1nF	Disc ceramic				660433
C33		Not used	(25 - 68 Mc/s)			
	1nF	Disc ceramic	(68 -174 Mc/s)			660433
C34	1nF	Disc ceramic				660433
C35	2-20pF	Split stator trimmer				280021
C36	6.8pF	Ceramic			±10%	650742
C37	10nF	Disc ceramic				660006
C38	2nF	Disc ceramic				660002
C39	1nF	Disc ceramic	(25 - 68 Mc/s and 132-174 Mc/s only)			660433
C40	1nF	Disc ceramic				660433
C41	1nF	Disc ceramic				660433
C42	1nF	Disc ceramic				660433
C43	10nF	Disc ceramic				660006
C44	2-20pF	Split stator trimmer				280021
C45	2-20pF	Variable capacitor				800155
C46	4µF	Electrolytic		350V		266387
C47	2nF	Tubular		500V		669102
C48	2nF	Tubular		500V		669102
C49	20nF	Tubular		750V		668872
C50	20nF	Tubular		750V		668872
C51 to C57		Not used				
C58		Not used	(25 - 68 Mc/s)			
	10pF	Ceramic	(68 -132 Mc/s)		±10%	650751
		Not used	(132-174 Mc/s)			
	10pF	Ceramic	(68 -132 Mc/s)		±10%	650751
		Not used	(132-174 Mc/s)			

Code		CAPACITORS (cont.)				Part No.
C60	120pF	Ceramic	(25.5-32.5 Mc/s)		± 2%	653656
	56pF	Ceramic	(32.5-42 Mc/s)		± 2%	653655
	27pF	Ceramic	(42 - 54 Mc/s)		±1pF	652597
	8.2pF	Ceramic	(54 - 68 Mc/s)		±0.5pF	652650
		Not used	(68 -174 Mc/s)			
C61	220pF	Ceramic	(25 - 68 Mc/s)		±20%	666648
		Not used	(68 -174 Mc/s)			
*C62	76pF	Lemco 1106R	(25-32.5 Mc/s)	350V	± 2%	660880
	58pF	Lemco 1106R	(32.5-42 Mc/s)	350V	± 2%	660854
	36pF	Lemco 1106R	(42 - 54 Mc/s)	350V	±1pF	660836
	39pF	Lemco 1106R	(54 - 68 Mc/s)	350V	±1pF	660864
	27pF	Lemco 1106R	(68 - 88 Mc/s)	350V	±1pF	660846
	22pF	Lemco 1106R	(88 -108 Mc/s)	350V	±1pF	660845
	18pF	Lemco 1106R	(108-148 Mc/s)	350V	±1pF	660835
	15pF	Lemco 1106R	(148-174 Mc/s)	350V	±1pF	660844
C63	47pF	Ceramic			±1pF	653102
C64	1nF	Ceramic				660433

NOTE: 1nF = 1000pF = 0.001µF

Code		RESISTORS				Part No.
R1	10kΩ			¼W	±10%	671518
R2	330Ω			¼W	±10%	671500
R3	150kΩ			¼W	±10%	671532
R4	100kΩ			¼W	±10%	671530
R5	100Ω		(25 - 68 Mc/s)	¼W	±10%	671494
	47Ω		(68 -174 Mc/s)	¼W	±10%	671490
R6		Not used	(25 - 68 Mc/s)			
	15kΩ		(68 -174 Mc/s)	¼W	±10%	671520
R7		Not used	(25 - 68 Mc/s)			
	56kΩ		(68 -174 Mc/s)	¼W	±10%	671527
R8		Not used	(25 - 68 Mc/s)			
	100kΩ		(68 -174 Mc/s)	¼W	±10%	671530
R9	330Ω			¼W	±10%	671500
R10	100kΩ			¼W	±10%	671530
R11	82kΩ			¼W	±10%	671529
R12	47Ω			¼W	±10%	671490
R13	330Ω			¼W	±10%	671500
R14	22kΩ		(25 - 68 Mc/s)	¼W	±10%	671522
	39kΩ		(68 -174 Mc/s)	¼W	±10%	671525
R15	1kΩ			¼W	±10%	671506
R16	18kΩ			¼W	±10%	671521
R17	15kΩ			¼W	±10%	671520
R18	27kΩ			½W	±10%	670459
R19	100Ω			¼W	±10%	671494
R20	47kΩ			¼W	±10%	671526
R21	4.7kΩ			¼W	±10%	671514
R22	220kΩ			¼W	±10%	671534
R23	220kΩ			¼W	±10%	671534
R24	4.7kΩ			¼W	±10%	671514
R25	100kΩ			¼W	±10%	671530
R26	680kΩ			¼W	±10%	671540
R27	470kΩ			¼W	±10%	671538
R28	120Ω			½W	±10%	670431
R29	68kΩ			¼W	±10%	671528
R30	10Ω			¼W	±10%	671482
R31	39Ω			½W	±10%	670425
R32	39Ω		(25 - 68 Mc/s)	½W	±10%	670425
		Not used	(68 -174 Mc/s)			
R33 to R42		Not used				
R43		Not used	(25 - 68 Mc/s)			
	82kΩ		(68 -174 Mc/s)	¼W	±10%	674572
		Not used	(132-174 Mc/s)			
R44		Not used	(25 - 68 Mc/s)			
	82kΩ		(68 -132 Mc/s)	¼W	±10%	674572
		Not used	(132-174 Mc/s)			
R45	100Ω		(6 channel only)	¼W	±10%	671494

Code	TRANSFORMERS		Part No.
*T1	Not used	(25 - 68 Mc/s)	
	Multiplier	(68 -132 Mc/s)	278359
	Multiplier	(132-174 Mc/s)	278412
T2	Modulation		277867
T3	2nd multiplier	(25-32.5 Mc/s)	277099/J
	2nd multiplier	(32.5-42 Mc/s)	277099/H
	2nd multiplier	(42 - 54 Mc/s)	277099/G
	2nd multiplier	(54 - 68 Mc/s)	277099/F
	Not used	(68 -174 Mc/s)	

Code	COILS & CHOKES		Part No.
*L1	Oscillator anode assembly		278356
*L2	Multiplier coil		278357
L3	Cathode choke		279051
L4	Not used	(25 - 68 Mc/s)	
	Multiplier coil	(68 - 88 Mc/s)	278384
	Multiplier coil	(88 -108 Mc/s)	278383
	Multiplier coil	(108-132 Mc/s)	278361/C
	Multiplier coil	(132-156 Mc/s)	278361/B
	Multiplier coil	(148-174 Mc/s)	278361/A
L5	Not used	(25 -132 Mc/s)	
	P.A.grid coil	(132-156 Mc/s)	278368/B
	P.A.grid coil	(148-174 Mc/s)	278368/A
L6	P.A.anode coil	(25-32.5 Mc/s)	278402/J
	P.A.anode coil	(32.5-42 Mc/s)	278402/H
	P.A.anode coil	(42 - 54 Mc/s)	278402/G
	P.A.anode coil	(54 - 68 Mc/s)	278402/F
	P.A.anode coil	(68 - 88 Mc/s)	278436
	P.A.anode coil	(88 -108 Mc/s)	278385
	P.A.anode coil	(108-132 Mc/s)	278369/C
	P.A.anode coil	(132-156 Mc/s)	278369/B
	P.A.anode coil	(148-174 Mc/s)	278369/A
L7	Antenna coupling coil	(25 - 68 Mc/s)	278403
	Antenna coupling coil	(68 - 88 Mc/s)	278362/E
	Antenna coupling coil	(88 -108 Mc/s)	278362/D
	Antenna coupling coil	(108-132 Mc/s)	278362/C
	Antenna coupling coil	(132-156 Mc/s)	278362/B
	Antenna coupling coil	(148-174 Mc/s)	278362/A
L8	Antenna coil	(25-32.5 Mc/s)	278404/J
	Antenna coil	(32.5-42 Mc/s)	278404/H
	Antenna coil	(42 - 54 Mc/s)	278404/G
	Antenna coil	(54 - 68 Mc/s)	278404/F
	Antenna coil	(68 - 88 Mc/s)	278363/E
	Antenna coil	(88 -108 Mc/s)	278363/D
	Antenna coil	(108-132 Mc/s)	278363/C
	Antenna coil	(132-156 Mc/s)	278363/B
	Antenna coil	(148-174 Mc/s)	278363/A
L9	Filter choke		279054
L10	Filter coil assembly	(25-32.5 Mc/s)	278573/1
	Filter coil assembly	(32.5-42 Mc/s)	278573
	Filter coil	(54 - 68 Mc/s)	278595/6
	Filter coil	(68 - 88 Mc/s)	278595/3
	Filter coil	(88 -108 Mc/s)	278595/2
	Filter coil	(108-132 Mc/s)	278595/4
	Filter coil	(132-148 Mc/s)	278595/5
	Filter coil	(148-156 Mc/s)	278595/1
	Filter coil	(156-174 Mc/s)	278595

Code	VALVES British	American		Part No.
V1	6BH6	6BH6		860099
V2	Not used		(25 - 68 Mc/s)	
	6BH6	6BH6	(68 -174 Mc/s)	860099
V3	QQV03-10	6360		860395
V4	QQV03-10	6360		860395
V5	ECC83	12AX7		860246
V6	EL84			860327

Code	MISCELLANEOUS		Part No.
*FL1	Filter assembly	(25-32.5 Mc/s)	276199/9
	Filter assembly	(32.5-42 Mc/s)	276199/8
	Filter assembly	(42 - 54 Mc/s)	276199/7
	Filter assembly	(54 - 68 Mc/s)	276199/6
	Filter assembly	(68 - 88 Mc/s)	276199/5
	Filter assembly	(88 -108 Mc/s)	276199/4
	Filter assembly	(108-132 Mc/s)	276199/3
	Filter assembly	(132-148 Mc/s)	276199/2
	Filter assembly	(148-156 Mc/s)	276199/1
	Filter assembly	(156-174 Mc/s)	276199
RLD	Antenna changeover relay		283070
PLA	Antenna plug		730318
SC	Wafer switch (6 channel only)		283178
SKTD	Test meter socket		272341
	Crystal oven		271502
XL1	Crystal		
XL2	Crystal (6 channel only)		
XL3	Crystal (6 channel only)		
XL4	Crystal (6 channel only)		
XL5	Crystal (6 channel only)		
XL6	Crystal (6 channel only)		

When ordering crystals, please state frequency and type required (see CRYSTAL FORMULAE at the end of the PARTS LISTS).

* Components mounted in cans

Chassis Assembly Complete Part No.288282/1-4

When ordering complete chassis assemblies, please state operating frequency.

SQUELCH & POWER SUPPLY UNIT

Code		CAPACITORS			Part No.
C1	12μF	Electrolytic	50V		680136
C2	50μF	Electrolytic	200V		266632
C3	20μF	Electrolytic	400V		266631
C4	20μF				
C5	75μF	Reversible electrolytic	50V		266372
†C6	680pF	Ceramic		±20%	666663
†C7	680pF	Ceramic		±20%	666663
†C8	0.25μF	Tubular	250V		669373
†C9	8μF	Electrolytic	250V		680025
C10	4μF	Electrolytic	350V		266387
C11	3nF	Tubular	350V		669199

NOTE: 1nF = 1000pF = 0.001μF

Code		RESISTORS			Part No.
R1		Not used			
R2	560Ω		$\frac{1}{4}$W	±10%	671503
R3	68Ω		$\frac{1}{4}$W	±10%	671492
R4	68Ω		$\frac{1}{4}$W	±10%	671492
R5	2.2kΩ		$\frac{1}{4}$W	±10%	671510
†R6	150kΩ		$\frac{1}{4}$W	±10%	671532
†R7	2.2MΩ		$\frac{1}{4}$W	±10%	671546
†R8	1MΩ		$\frac{1}{4}$W	±10%	671542
†R9	120kΩ		$\frac{1}{4}$W	±10%	671531
†R10	2.2kΩ		$\frac{1}{4}$W	±10%	671510
†R11	1MΩ		$\frac{1}{4}$W	±10%	671542
†R12	100kΩ		$\frac{1}{4}$W	±10%	671530
†R13	6.8kΩ		$\frac{1}{4}$W	±10%	671516
†R14	100kΩ		$\frac{1}{4}$W	±10%	671530
R15	330kΩ		$\frac{1}{4}$W	±10%	671536
RV3	25kΩ	Potentiometer			281133
RV4	15Ω	Potentiometer	1W		281099

MISCELLANEOUS

FS1		Fuse 10A	271539
T1		Transformer	277812
MR1		Rectifier OA214 or 60 AS or 50 AS	709090
MR2		Rectifier OA214 or 60 AS or 50 AS	709090
†MR3		Rectifier WX6	704494
RLA	200Ω	Relay	283272
†RLF	14kΩ	Relay	703736
V1		Valve ECC81 (12AT7)	860180
TS1		3 nine-way tag strips	204996
TS2		8-way tag strip	204930
TS3		4-way tag board	275067
L1		Filter choke	279827
VT1		Transistor OC35 } Matched pair	286050
VT2		Transistor OC35	
or			
VT1		Transistor NKT 404 } Matched pair	286071
VT2		Transistor NKT 404	

Chassis Assembly Complete Part No. 288296/2 & 3

† Squelch circuit components

When ordering complete chassis assemblies, please state whether squelch circuit is required.

INTERCONNECTIONS

Code		COMPONENT			Part No.
C1	0.5μF	Tubular capacitor (6 channel only)	250V		669384
R1	2.2kΩ	Resistor	$\frac{1}{4}$W	±10%	671510
RV1	100kΩ	Potentiometer			281131
RV2	10kΩ	Potentiometer			281139
RV3	25kΩ	Potentiometer			281133
SA		OFF-RX-S/BY switch			283401
SB		Local transmit switch			283242
SC		CHANNEL switch (6 channel only)			283399
RLB	60Ω	Start relay			720126
RLC	170Ω	Ledex relay			283074
RLE	170Ω	Stand by relay			283377
LS		Loudspeaker			285026
MIC		Microphone and lead assembly or			274849
		Handset and lead assembly			275229

Code		COMPONENT (cont.)		Part No.
FS3	12A	Fuse and		271533
		Fuse box		271530
ILP1	12-14V	Set on lamp	0.75W	272232
ILP2	12-14V	TX on lamp	0.75W	272232
PLA		Antenna coaxial plug		730318
PLB		24-way plug		705776
PLC		6-way plug		700591
PLD		9-way plug		272344
SKTB		24-way socket		705768
SKTC		6-way socket		707914
SKTF		9-way socket		203959
TS4		22-way tag strip		272909
TS5		2-way terminal block		271569
TS6		7-way tag strip (6 channel only)		271868
		Ledex assembly (6 channel only)		274880/2
			or	274880/1

MECHANICAL ITEMS

RECEIVER	Part No.
Chassis	242059
B7G valveholder - without skirt	271524
B7G valveholder - ceramic with skirt	271518
B7G valveholder - with skirt for B9A screening cans	708995
B9A valveholder - with skirt	271523
Capacitor retaining clip for $\frac{3}{8}$" diameter capacitor	700651
Capacitor retaining clip for $\frac{3}{4}$" diameter capacitor	700654
Coil can $2\frac{1}{4}$" high	248127
Coil can 2" high	248129
Screen (in can 248129)	242013
Crystal trimmer bracket	244126/B
Insulating wrapper (in can 248127)	242062
Nyloc nut for crystal trimmer	320254
Terminal	270842
Insulator for terminal 270842	712622
Crystal holder (single channel)	271498
Crystal holder (switched channel)	274676/C&D
Crystal retaining clip (single channel)	271357
Crystal retaining clip (switched channel)	271885
Coil can retaining clip	271230
Spire nut to secure chassis to side plates	271222
Valve retaining spring	271911
B7G valve screening can and spring	706312
B9A valve screening can and spring	706315
Rubber grommet - $\frac{3}{8}$" bore	271200
3-way tag strip (e. d. e.)	204920
3-way tag strip (2e. d.) d=angled tag	204923
4-way tag strip (2e. d. e.) e=flat tag	204921
4-way tag strip (d. 3e.)	204922
7-way tag strip	272208
Crystal oven holder	271501
Crystal oven retaining clip	271503
Insulating bead	202613

TRANSMITTER	
Chassis	242051
B7G valveholder - without skirt	271524
B7G valveholder - ceramic with skirt	271518
B9A valveholder - without skirt	271519
B9A valveholder - nylon without skirt	705995
Capacitor retaining clip for $\frac{1}{2}$" diameter capacitor	700652
Meter socket bracket assembly	274430
Power amplifier coil screen assembly	274651
Lid for 274651	242786
Bakelite washer for trimmer	410181
Insulating plate for trimmer	411013
Cable clip	410259
Nyloc nut for crystal trimmer	320254
Terminal	270842
Insulator for terminal 270842	712622
Rubber grommet	706175
Valve retaining spring - $1\frac{1}{2}$" long	271910
Valve retaining spring - $2\frac{1}{4}$" long	271370
B7G valve screening can and spring	706312
Spire nut to secure chassis to side plates	271222
Coil can retaining clip	271230
2-way tag strip	272917
Insulating bead	202613
Coil clamp	400038
Crystal holder (single channel)	271498
Crystal holder (switched channel)	274676/C&D
Crystal retaining clip (single channel)	271357
Crystal retaining clip (switched channel)	271885
Crystal trimmer bracket	242195
Switch stop (switched channel)	242821

SQUELCH AND POWER SUPPLY UNIT	
Chassis	275604/A
Capacitor retaining clip for $\frac{3}{4}$" diameter capacitor	700654
Cableform clamp (free)	242642
Cableform clamp (fixed)	243216
Spacer for polarity changeover panel	310180
Relay cover	248132
Relay base	248134
Fuse holder	710632
Spire nut to secure chassis to side plates	271222
Rubber grommet	271201
8-way tag strip	204930
9-way tag strip	204996
Squelch circuit assembly	276020
Squelch mounting plate (part of 276020)	243814/A
B9A valveholder (part of 276020)	271523
B9A valve screening can and spring (part of 276020)	706315
Capacitor retaining clip (part of 276020)	410254
10-way tag strip (part of 276020)	204935

MAIN UNIT	Part No.
Metering plug and lead assembly	275751
Front panel assembly	274909/1
Rear panel	243383
Battery plug and lead assembly	275260/7
Transistor cover assembly	276186
Transistor heat sink	244130
Relay mounting bracket	244125
Spire speed tool (for coil screening cans)	242029
Retaining clip for 242029	271373
Left hand side plate	243318
Right hand side plate	243319
Retaining clip for battery plug	405736
Screw to secure front and rear panels to side plates	238480/B
Spire nut for 238480/B	271231
Screw securing side plates to chassis	238742/A
Cable clip	271248
Hexagon wrench	271947
Retaining clip for 271947	271759
Handle	270622
Washer for 270622	230357
Rubber grommet - $\frac{3}{8}$" bore	271200
Rubber stopper for $\frac{3}{8}$" hole in front panel	271610
Rubber stopper for $\frac{1}{2}$" hole in front panel	271623
Rubber stopper for hole in rear panel	271621
24-way plug retaining spring	270568
Bracket for 270568	270566
Battery socket and lead assembly	274878/1
Top cover assembly	274892/4
Bottom cover assembly	274893/4
Toggle catch assembly	274895
Grooved shaft for 274895	230767
Toggle catch retainer	271940
Microphone bracket	242367
Telephone handset bracket	208128
Rubber stopper on bottom cover	271608
Potentiometer spindle lock	208141
Cover for 208141	208142
Label (single channel)	203042
Label (switched channel)	202933
Resilient mounting	272479
Ledex switch shaft	272937
Coupling for 272937	242194
Spring rotor lock for 272937	272407
Cradle assembly	274872/2
Quick release fastener assembly	274890
Locating pin	230896
Wooden spacing block	208131

CONTROL UNIT	
Rear section of case	274884/1
Front section of case	274948/1
Knob	272059
Grub screw for 272059	238117
Control unit mounting bracket	242314
Screw for 242314	238046
Cable clamp	242363
Terminal strip mounting bracket	242364
Loudspeaker gasket	242365
Switch locating plate	242366
Potentiometer locating washer	242404
Screw securing terminal strip to bracket	238469/A
Screw securing control unit to mounting bracket	238469/C
Screw securing cable clamp	238488/A
Screw securing front of case to rear	238485/C
Retaining sleeve for 238485/C	271664
Crinkle washer for switch	272675
Spire nut for 238469/A and 238469/C	271222
Spire nut for 238485/C	271223
Spire nut for 238488/A	271231
Rubber grommet for control cable	271693
Rubber grommet for microphone lead	271694
Rubber stopper in side of case	271610
Loudspeaker fabric	271938
Red lampholder	272244
Green lampholder	272245
Control lead assembly (single channel)	275487/5
Control lead assembly (switched channel)	275487/6
Escutcheon (single channel)	271953
Escutcheon (switched channel)	248075
Pye medallion	711789
Switch stop	242821
Microphone cable cleat	704790
Telephone handset and lead assembly	275229
Telephone handset cable cleat	704791

CRYSTAL INFORMATION

RECEIVER

MULTIPLICATION FACTORS

	Carrier Frequency	3V10a	3V10b	3V11	Total Multiplication
Band J	25-32.5 Mc/s	-	-	x1	x1
Band H	32.5-42 Mc/s	-	-	x1	x1
Band G	42 - 54 Mc/s	-	-	x2	x2
Band F	54 - 68 Mc/s	-	-	x2	x2
Band E	68 - 88 Mc/s	x3	x4	-	x12
Band D	88 -108 Mc/s	x3	x4	-	x12
Band C	108-132 Mc/s	x3	x4	-	x12
Band B	132-156 Mc/s	x3	x4	-	x12
Band A	148-174 Mc/s	x3	x4	-	x12

CRYSTAL FORMULAE

Local Oscillator (25 - 68 Mc/s)

Carrier frequency (fc)	Crystal frequency (fx)	Specification No. Types N & W	Type V
25-32.5 Mc/s	fx = fc + 2 Mc/s	P28	P28
32.5-42 Mc/s	fx = fc + 2 Mc/s	P28	P28
42 - 54 Mc/s	$fx = \frac{fc + 2}{2}$ Mc/s	P28	P28
54 - 68 Mc/s	$fx = \frac{fc + 2}{2}$ Mc/s	P28	P28

1st Local Oscillator (68 - 174 Mc/s)

Carrier frequency (fc)	Crystal frequency (fx)	Types N & W	Type V
68 - 88 Mc/s	$fx = \frac{fc + 10.7}{12}$ Mc/s	P19	P19
88 -108 Mc/s	$fx = \frac{fc + 10.7}{12}$ Mc/s	P19	P18
108-132 Mc/s	$fx = \frac{fc - 10.7}{12}$ Mc/s	P19	P18
132-156 Mc/s	$fx = \frac{fc + 10.7}{12}$ Mc/s	P19	P18
148-174 Mc/s	$fx = \frac{fc - 10.7}{12}$ Mc/s	P19	P18

2nd Local Oscillator (68 - 174 Mc/s)

Crystal Specification No. P16

Crystal frequency = 12.7 Mc/s, except when the assigned frequency is within 100 kc/s of the following, in which case the crystal frequency is 8.7 Mc/s.

76.2 Mc/s	127.0 Mc/s
88.9 Mc/s	139.7 Mc/s
101.6 Mc/s	152.4 Mc/s
114.3 Mc/s	165.1 Mc/s

Additional frequencies at which 8.7 Mc/s crystals are used may be included.

Switched Channel Receivers

To avoid heterodynes on some switched channel receivers, the frequency of the second local oscillator may lie within the following limits:-

8.7 Mc/s ±3 kc/s   12.7 Mc/s ±3 kc/s

Should it become necessary to order a replacement crystal it is essential to quote the actual frequency of the original crystal. Use of a crystal of any other frequency will result in heterodynes on one or more channels.

TRANSMITTER

MULTIPLICATION FACTORS

	Carrier Frequency	1V2	1V3a	1V3b	Total Multiplication
Band J	25-32.5 Mc/s	-	x2	x2	x4
Band H	32.5-42 Mc/s	-	x2	x2	x4
Band G	42 - 54 Mc/s	-	x3	x2	x6
Band F	54 - 68 Mc/s	-	x3	x2	x6
Band E	68 - 88 Mc/s	x2	x2	x2	x8
Band D	88 -108 Mc/s	x2	x3	x2	x12
Band C	108-132 Mc/s	x2	x3	x2	x12
Band B	132-156 Mc/s	x3	x3	x2	x18
Band A	148-174 Mc/s	x3	x3	x2	x18

CRYSTAL FORMULAE

Carrier frequency (fc)	Crystal frequency (fx)	Specification No. Types N & W	Type V
25-32.5 Mc/s 32.5-42 Mc/s	$fx = \frac{fc}{4}$ Mc/s	P19	P19
42 - 54 Mc/s 54 - 68 Mc/s	$fx = \frac{fc}{6}$ Mc/s	P19	P19
68 - 88 Mc/s	$fx = \frac{fc}{8}$ Mc/s	P19	P19
88 -108 Mc/s 108-132 Mc/s	$fx = \frac{fc}{12}$ Mc/s	P19	P18
132-156 Mc/s 148-174 Mc/s	$fx = \frac{fc}{18}$ Mc/s	P19	P18

AMENDMENTS

AMENDMENT No. 1

To eliminate unwanted sideband radiations, which cause adjacent channel interference on 25 kc/s spaced schemes, the following change has been made to the transmitter.

TRANSMITTER CIRCUIT DIAGRAMS (C288282/1 - 4)

Add: C65 a 4μF electrolytic capacitor between the screen grid (pin 9) of 1V6 and chassis, with the negative terminal connected to chassis.

TRANSMITTER PARTS LISTS

Add:	C65 4μF	Electrolytic	350V	Part No. 266387

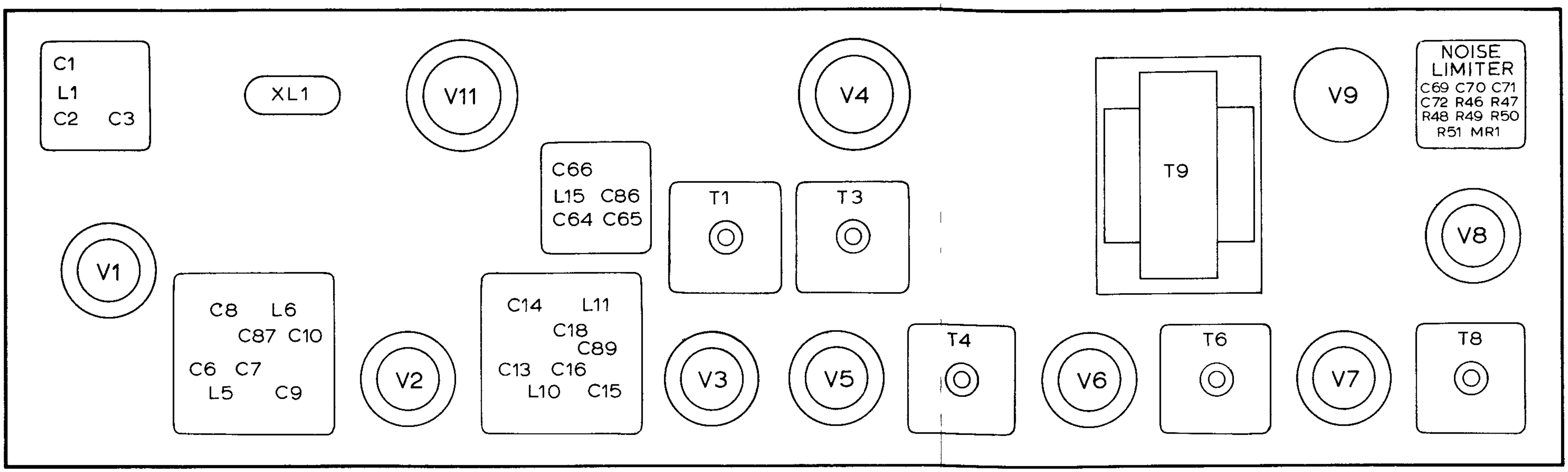
MECHANICAL ITEMS

Add:	1 Terry clip	Part No. 700652

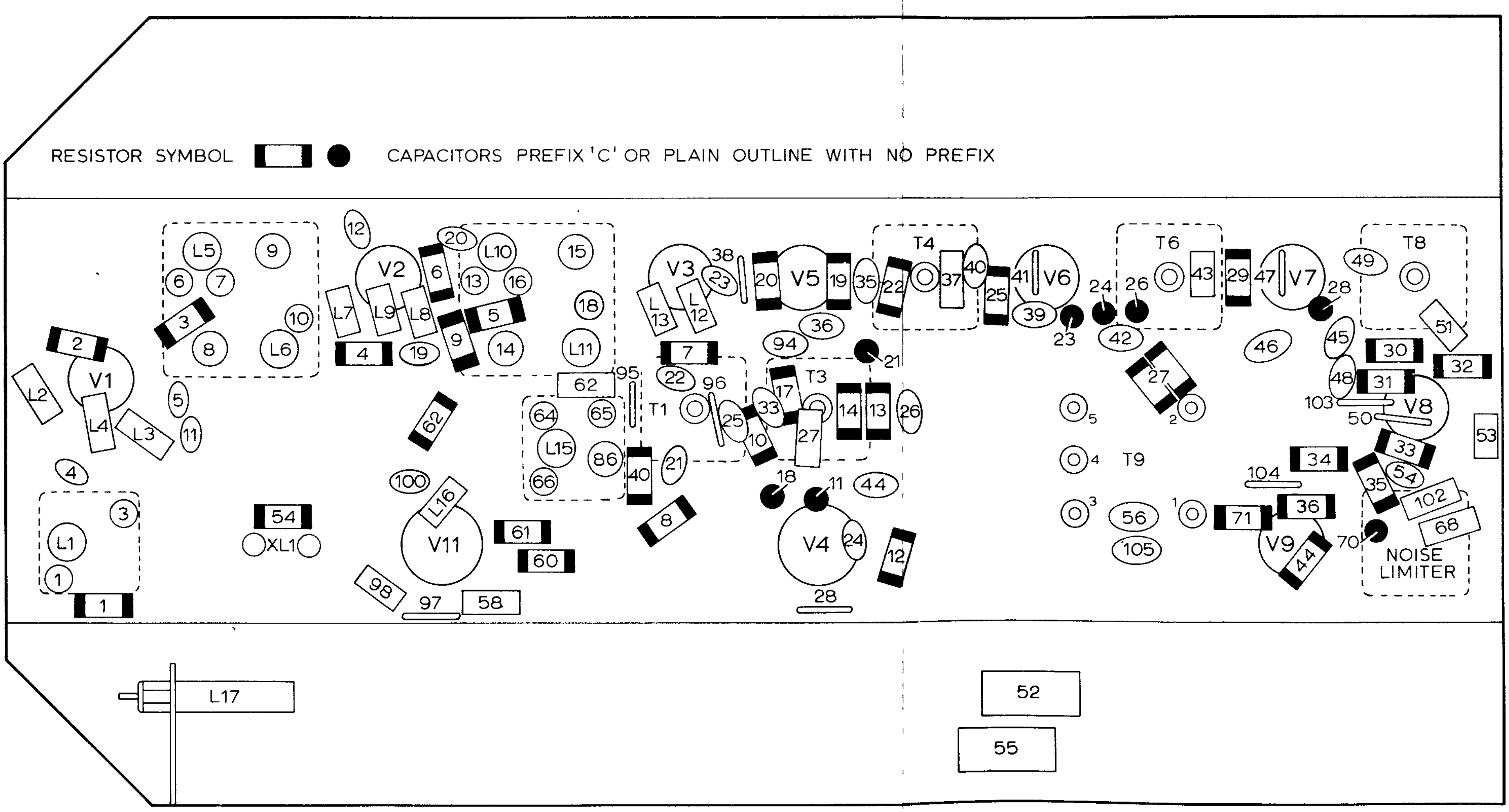
INSTALLATION

Fit the Terry clip underneath the chassis near the base of 1V6 and secure in position with an 8 B.A. nut and bolt; an existing hole is available in the chassis side-flange.

Insert the capacitor in the Terry clip and connect as described above.



TOP CHASSIS VIEW



UNDERSIDE CHASSIS VIEW

Fig. 13 RECEIVER LAYOUT DIAGRAM - 25 to 68 Mc/s
(PTC 2107 Ranger)

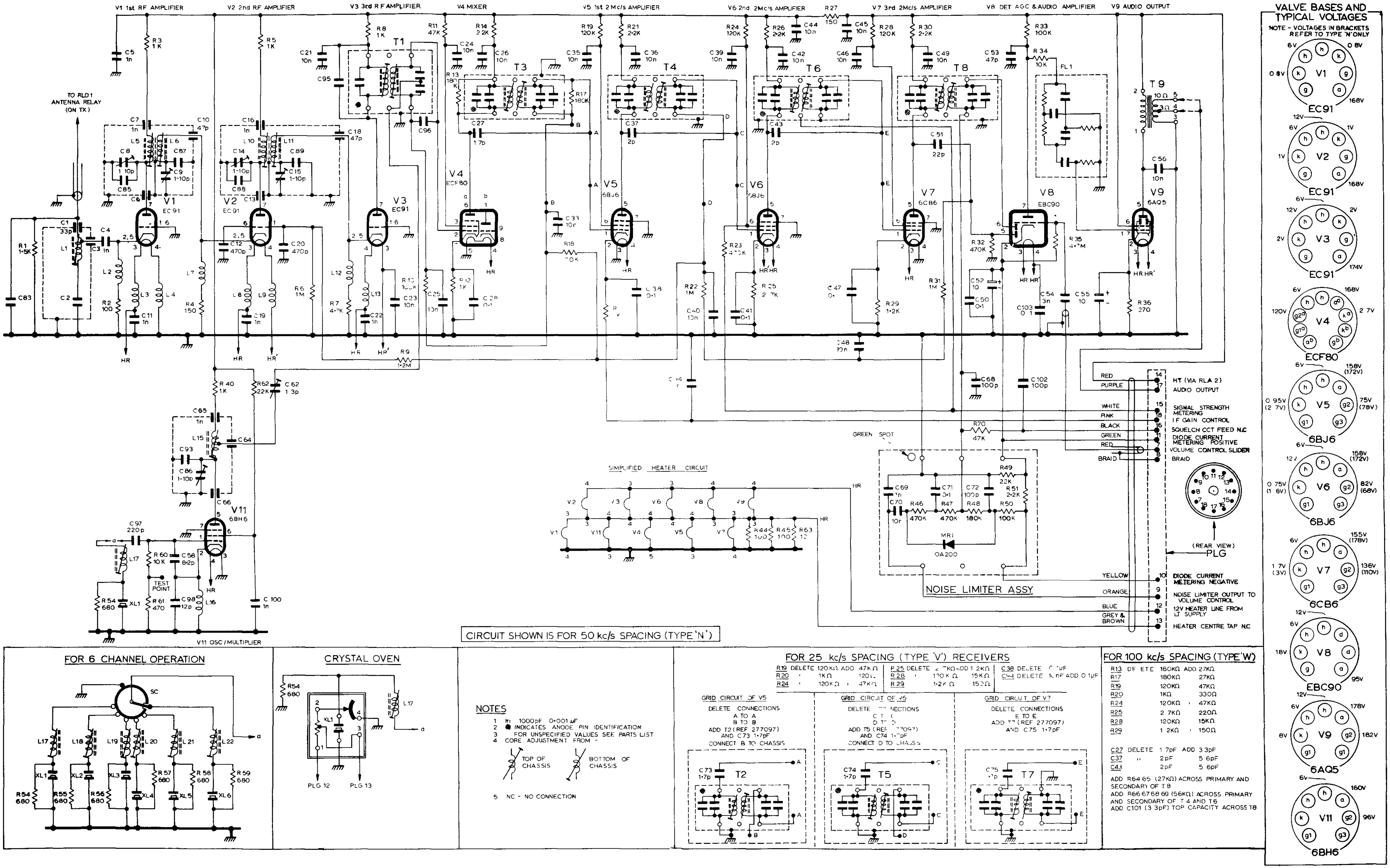
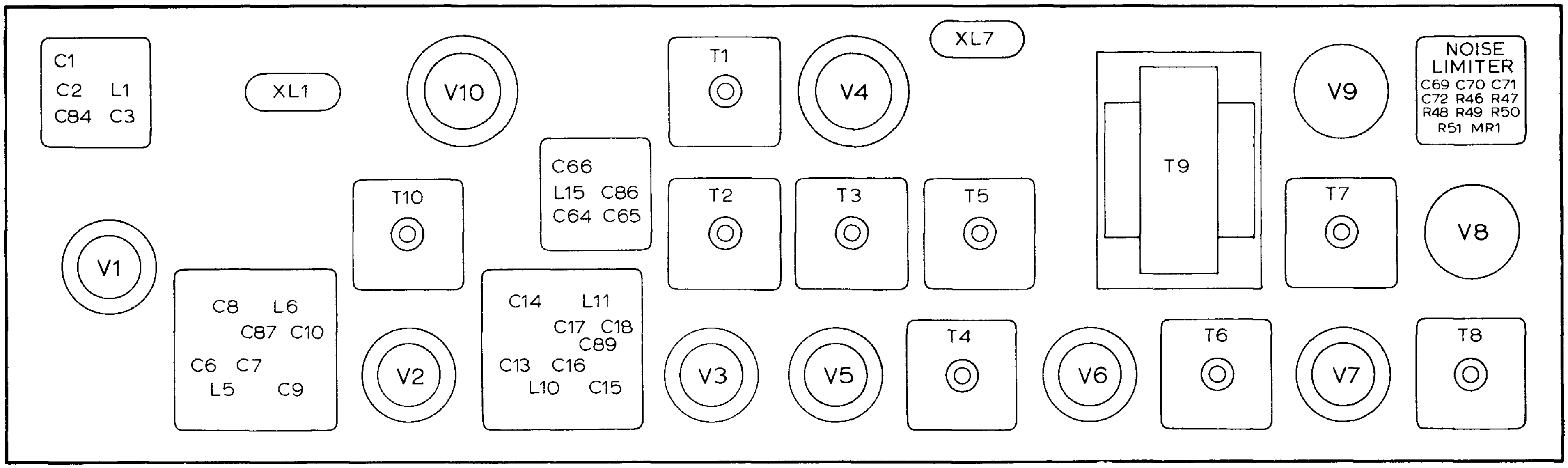
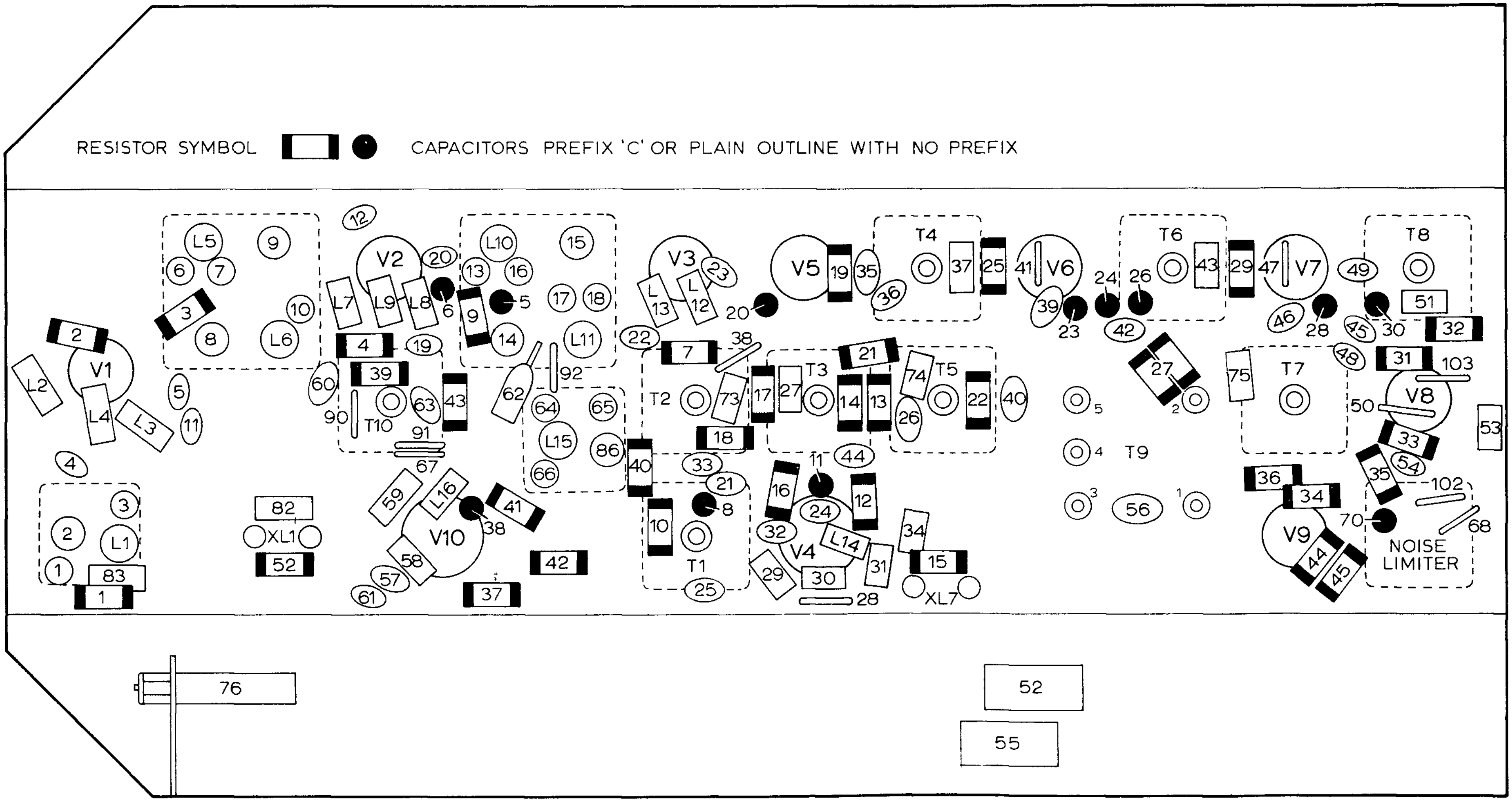


Fig. 14 RECEIVER CIRCUIT DIAGRAM - 25 to 68 Mc/s (PTC 2107 Ranger)

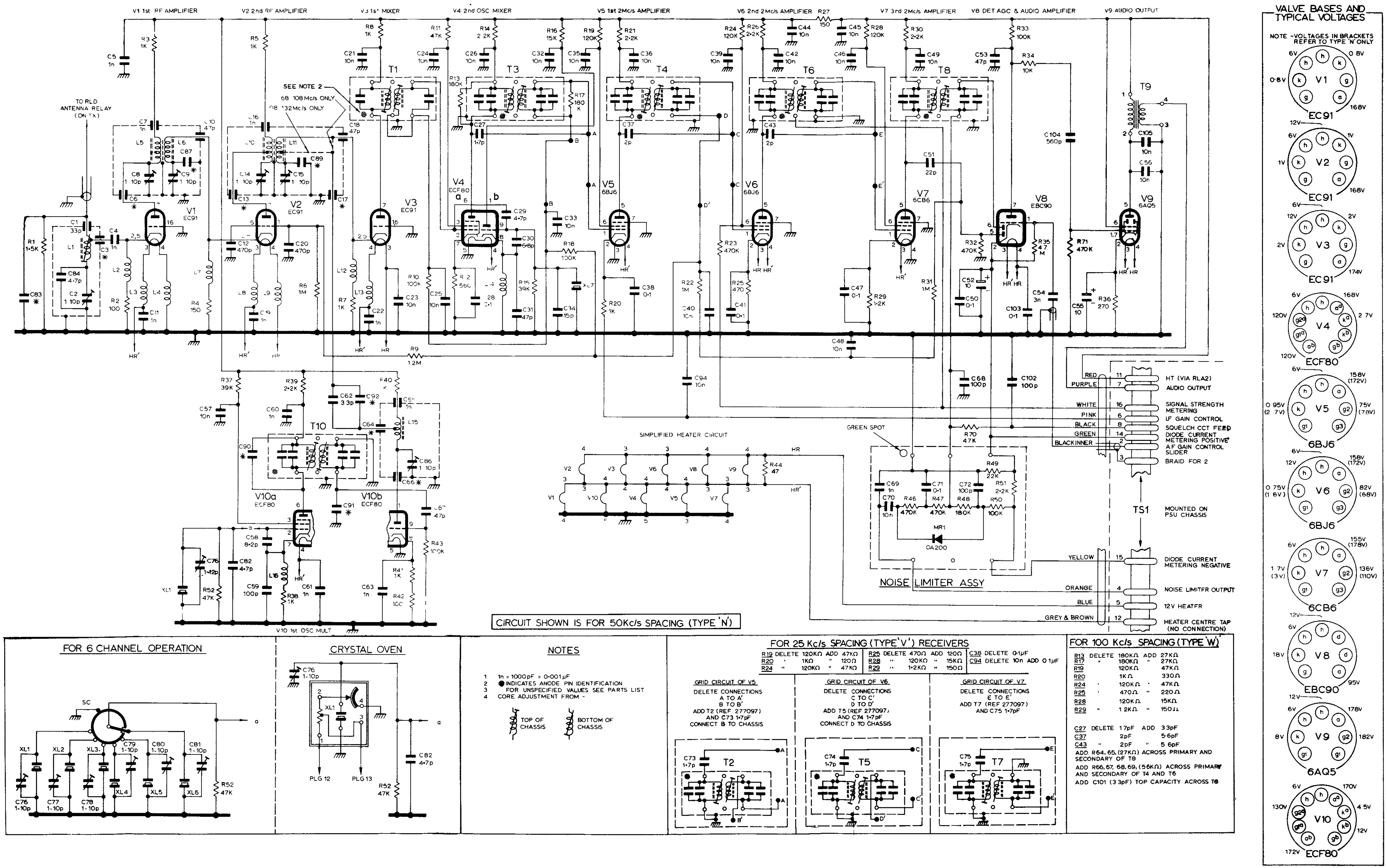


TOP CHASSIS VIEW



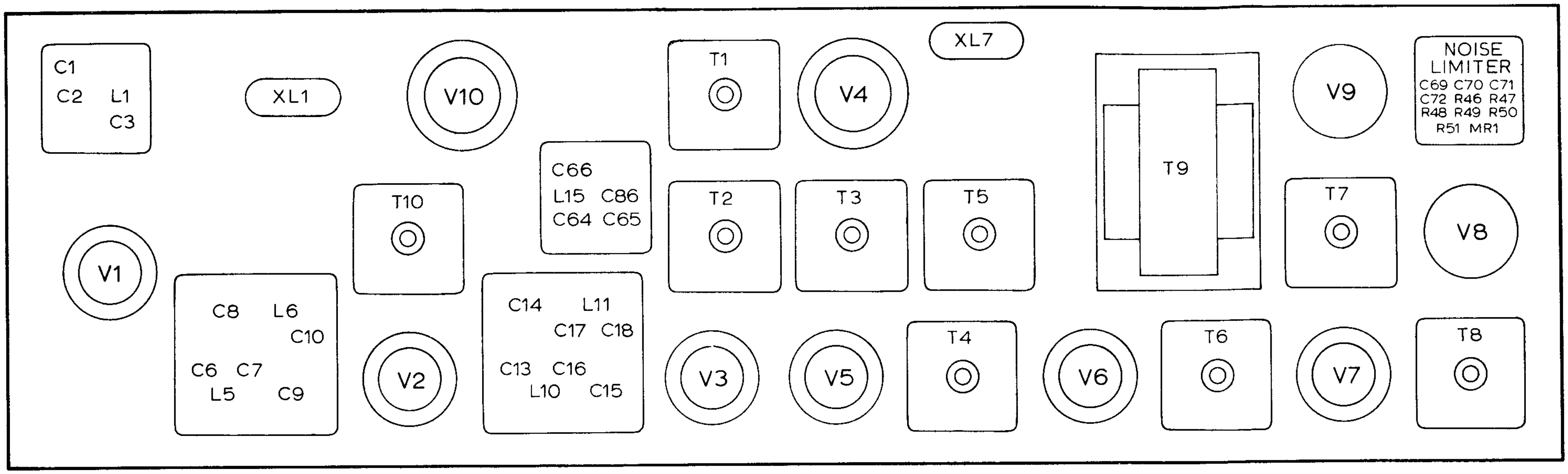
UNDERSIDE CHASSIS VIEW

Fig. 15 RECEIVER LAYOUT DIAGRAM - 68 to 132 Mc/s
(PTC 2107 Ranger)

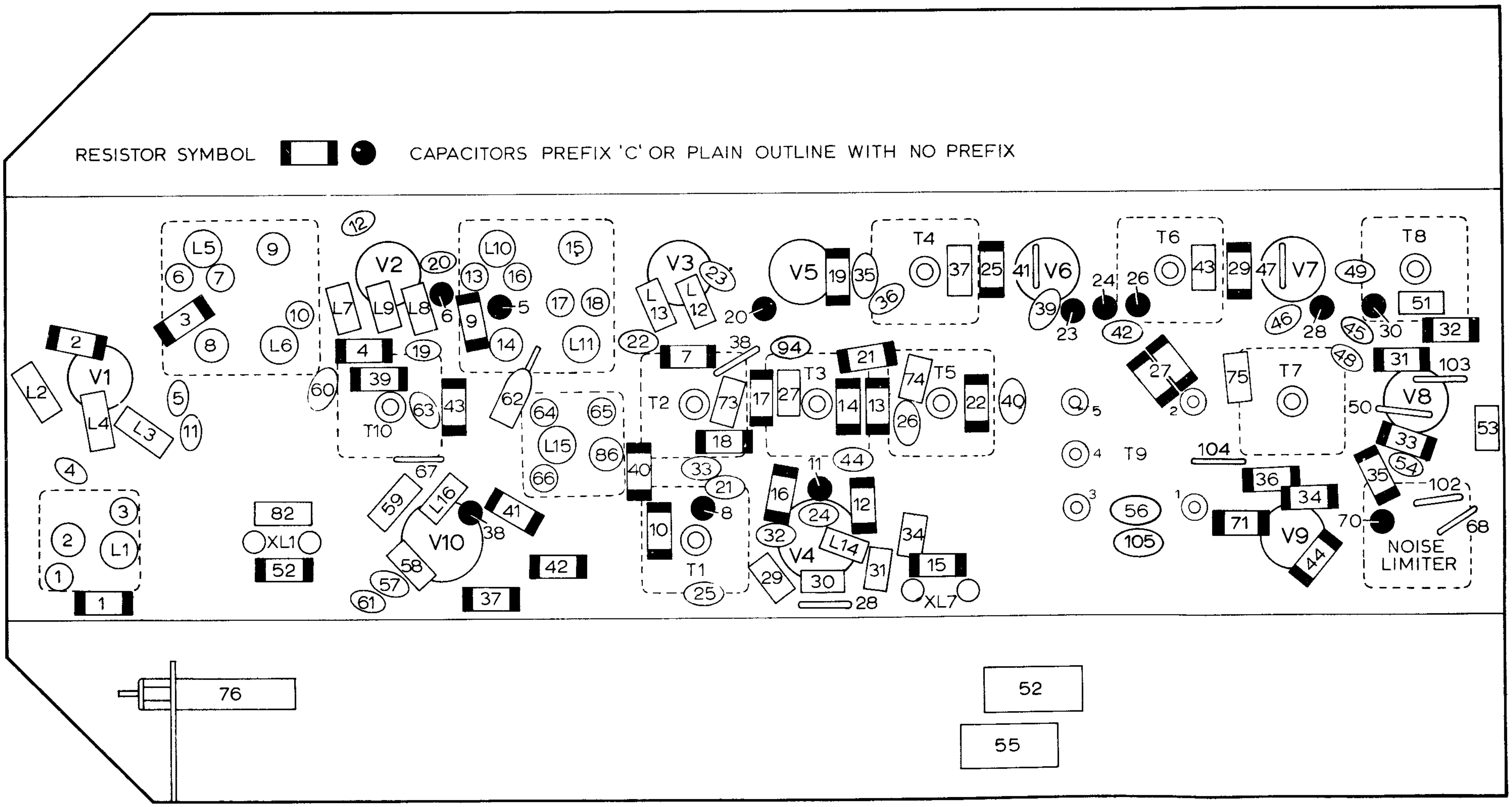


C288273/7-12 C, D & E

Fig. 16 RECEIVER CIRCUIT DIAGRAM - 68 to 132 Mc/s (PTC 2107 Ranger)

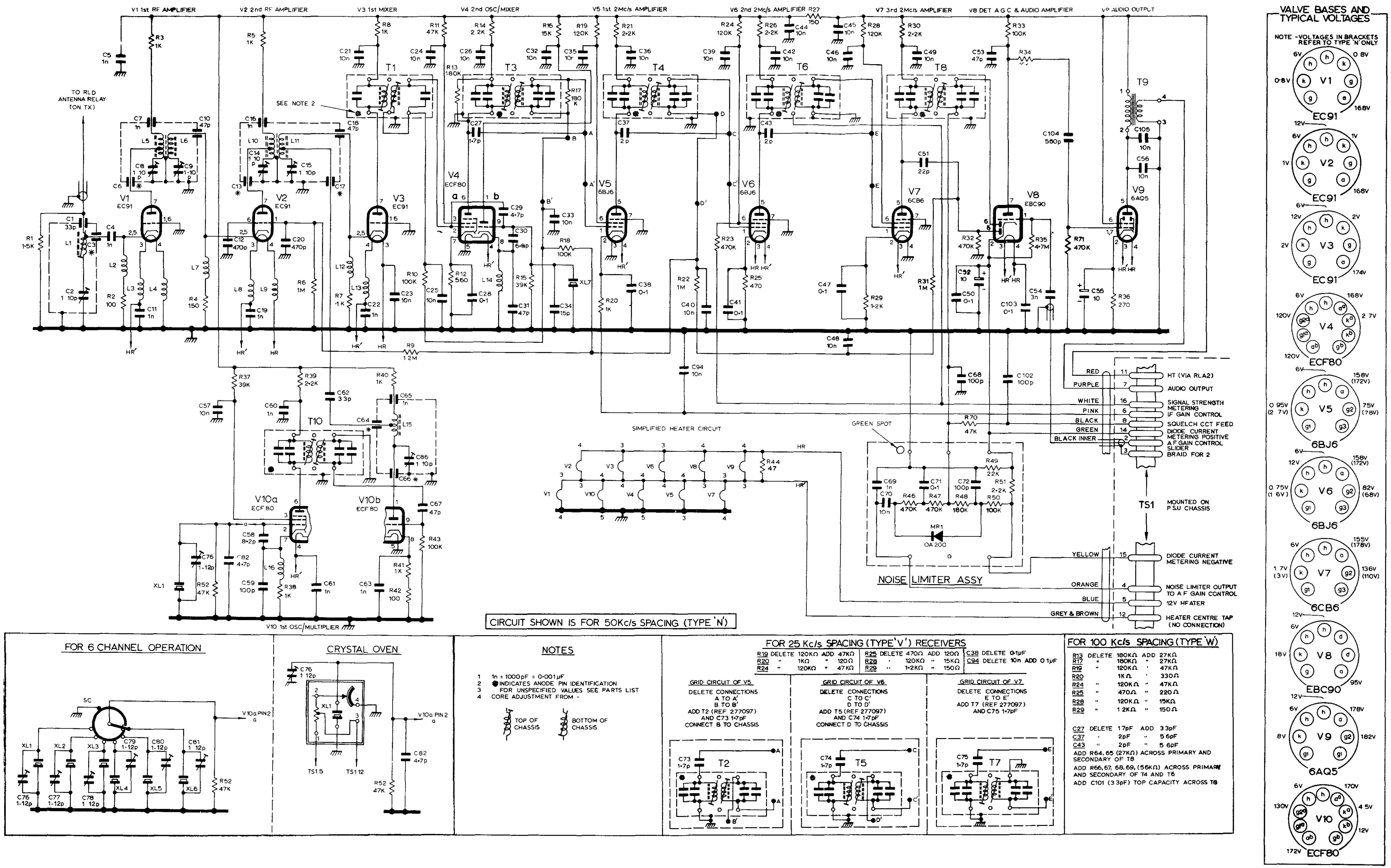


TOP CHASSIS VIEW



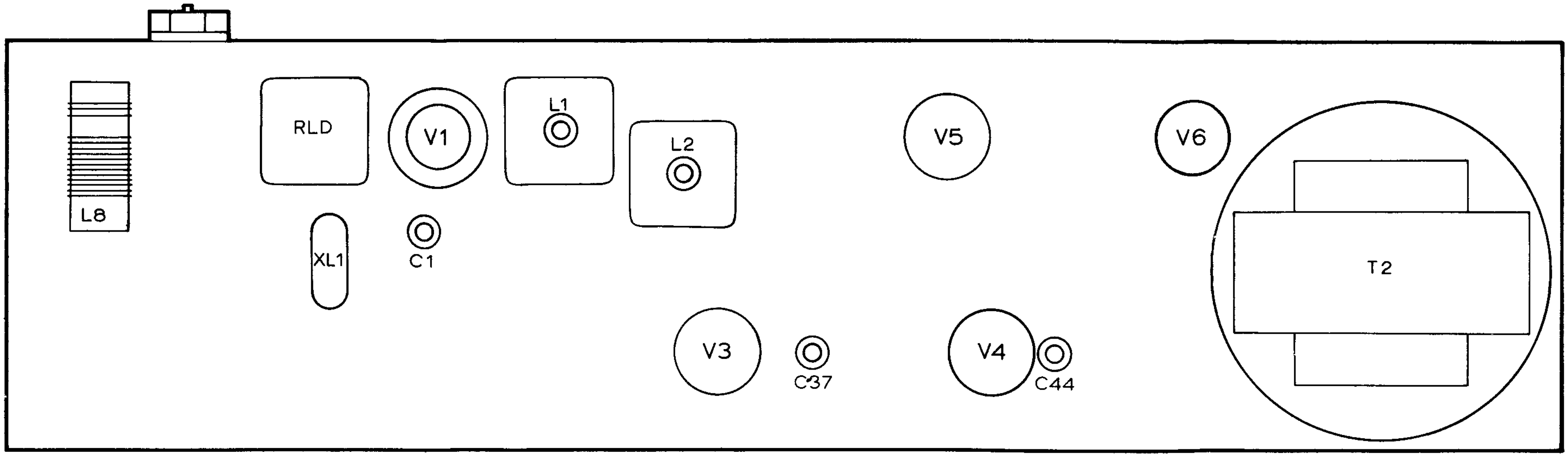
UNDERSIDE CHASSIS VIEW

Fig. 17 RECEIVER LAYOUT DIAGRAM - 132 to 174 Mc/s
(PTC 2107 Ranger)



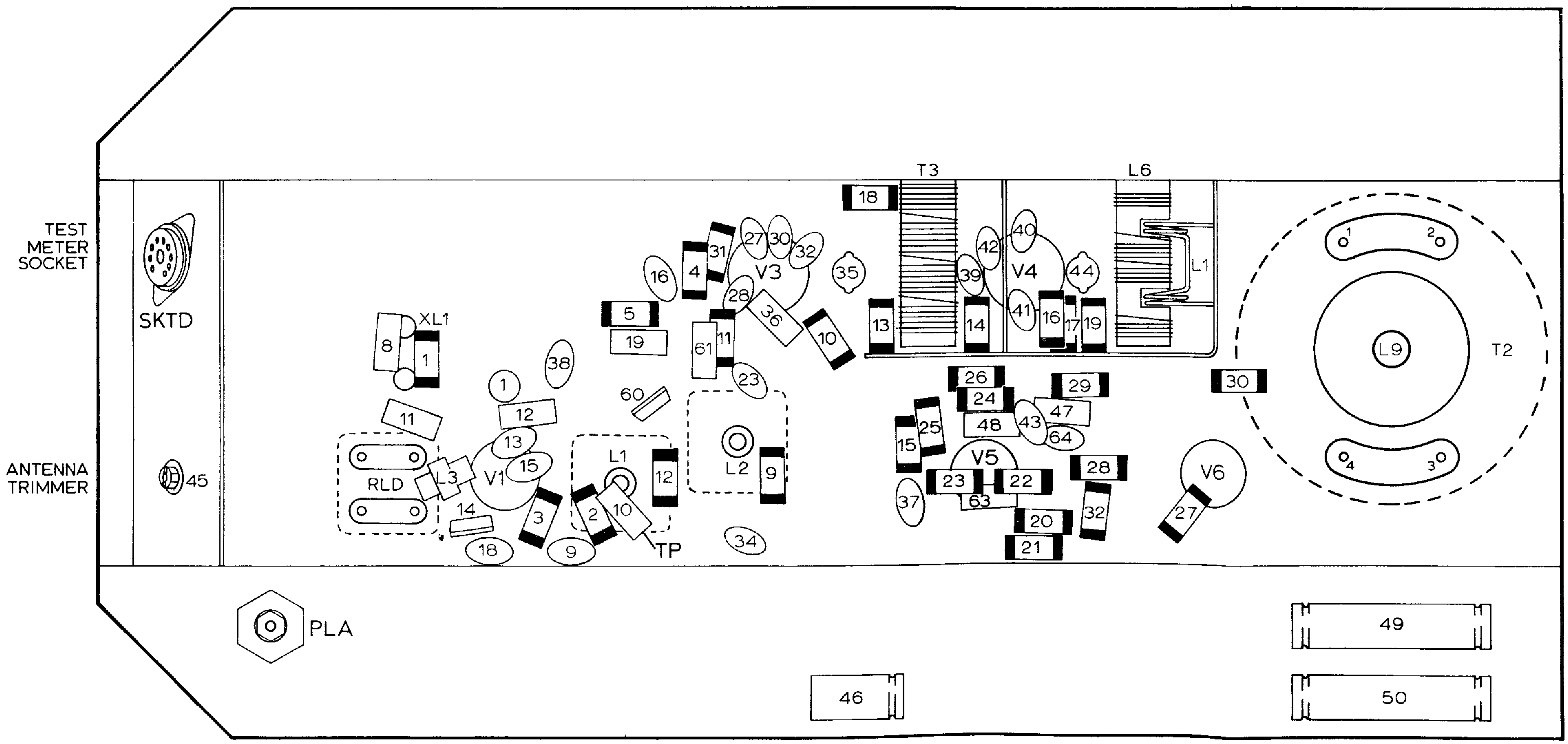
C288273/7-12 A & B

Fig.18 RECEIVER CIRCUIT DIAGRAM - 132 to 174 Mc/s (PTC 2107 Ranger)



TOP CHASSIS VIEW

RESISTOR SYMBOL ▭ CAPACITORS PREFIX 'C' OR PLAIN OUTLINE WITH NO PREFIX



UNDERSIDE CHASSIS VIEW

Fig.19 TRANSMITTER LAYOUT DIAGRAM - 25 to 68 Mc/s
(PTC 2107 Ranger)

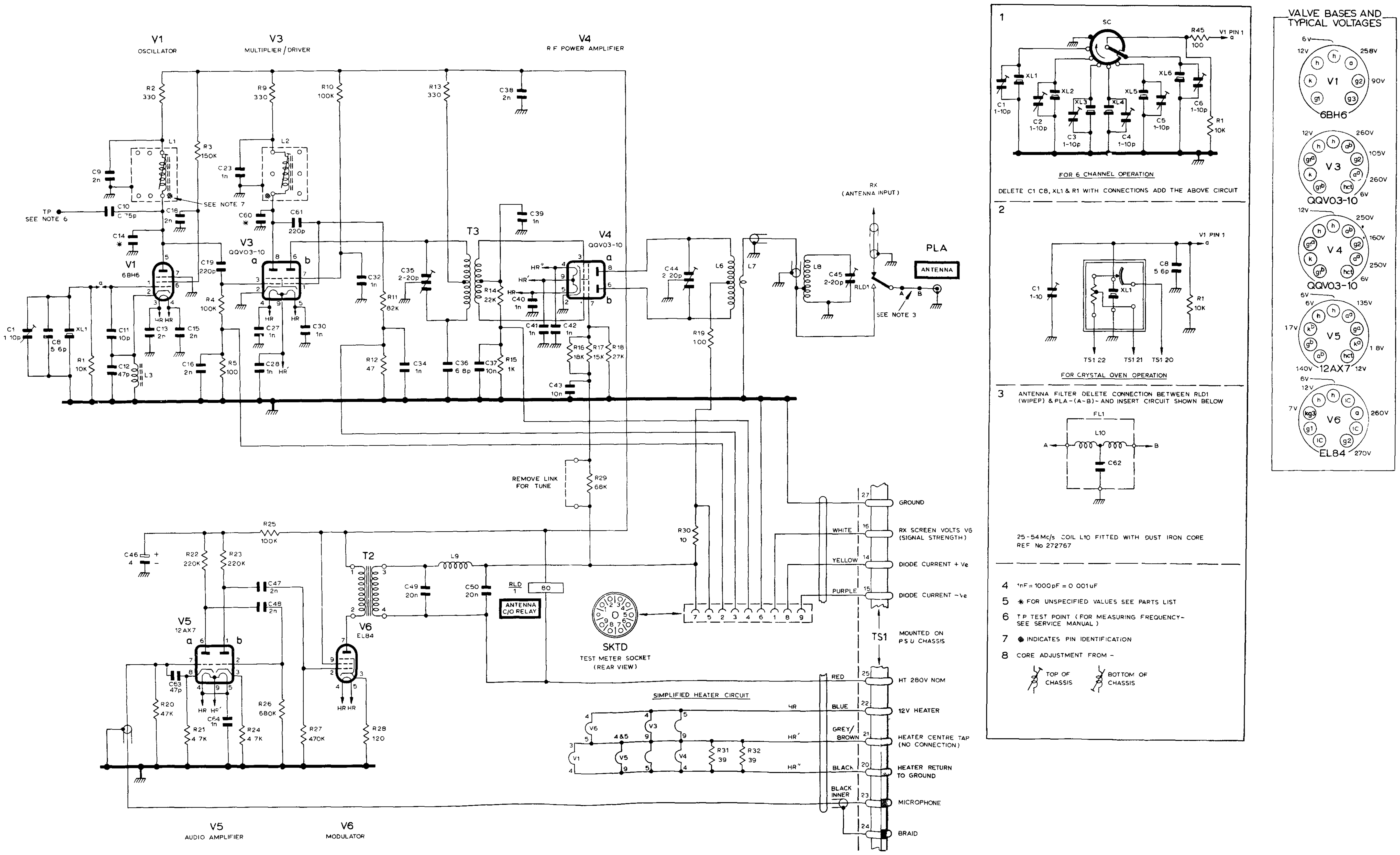
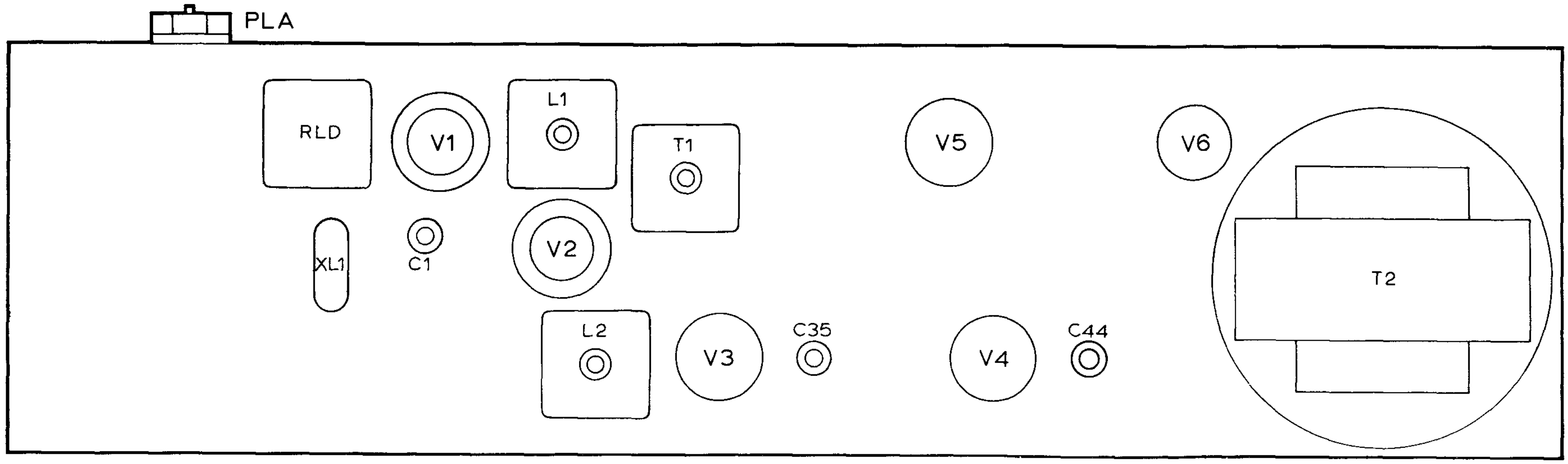
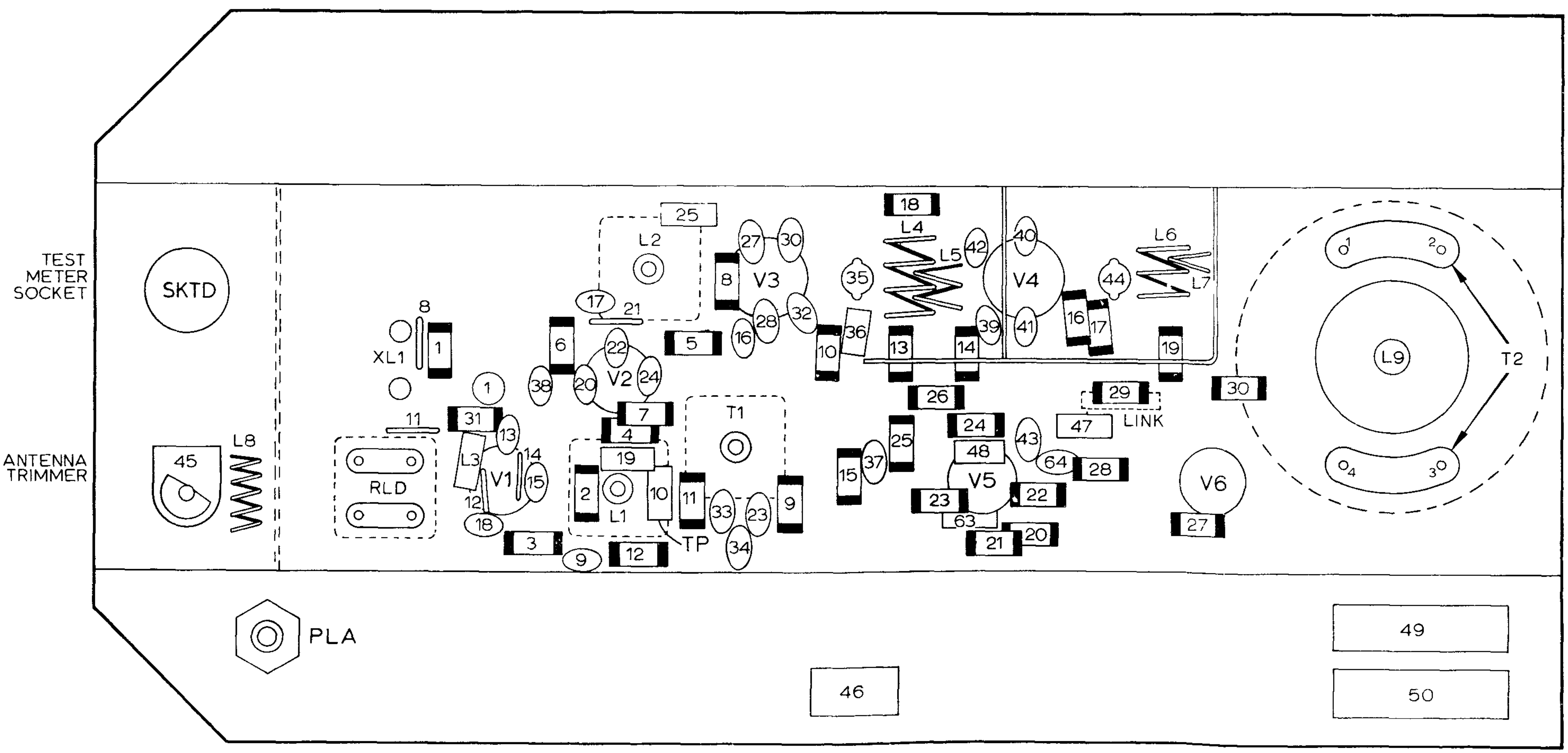


Fig.20 TRANSMITTER CIRCUIT DIAGRAM - 25 to 68 Mc/s
(PTC 2107 Ranger)



TOP CHASSIS VIEW

RESISTOR SYMBOL   CAPACITORS PREFIX 'C' OR PLAIN OUTLINE WITH NO PREFIX



UNDERSIDE CHASSIS VIEW

Fig. 21 TRANSMITTER LAYOUT DIAGRAM - 68 to 174 Mc/s
(PTC 2107 Ranger)

PREFIX USED THROUGHOUT TEXT TO IDENTIFY COMPONENTS IN THIS CIRCUIT (1)

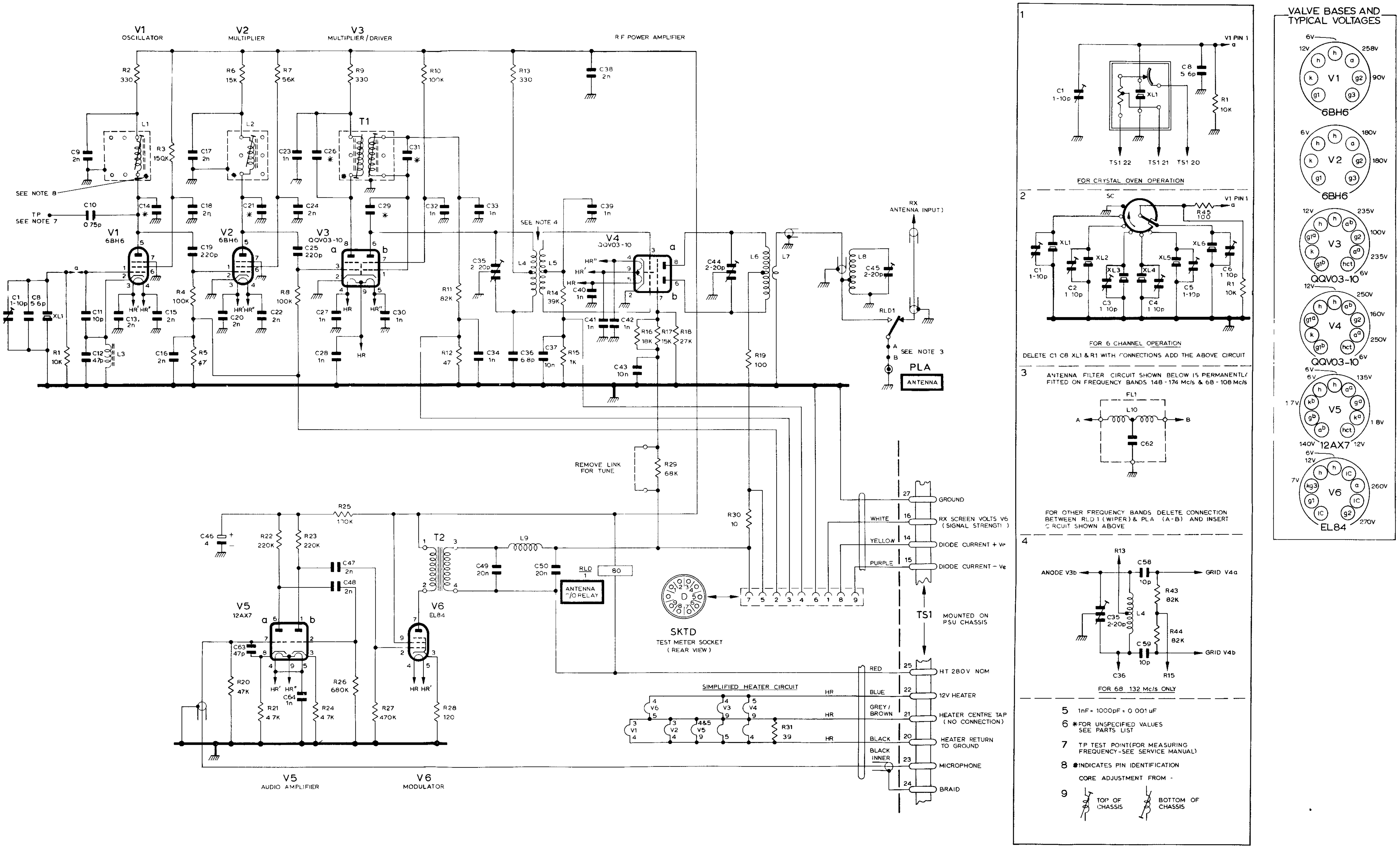
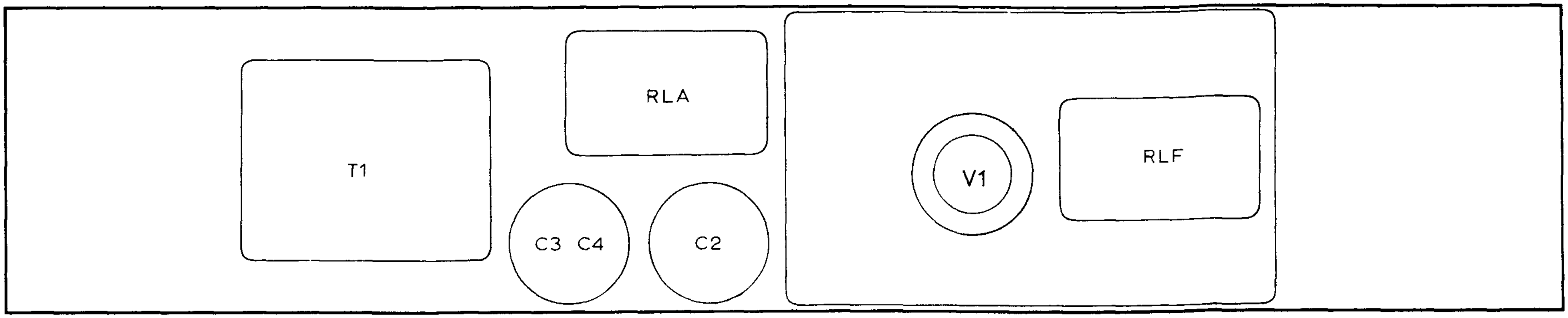
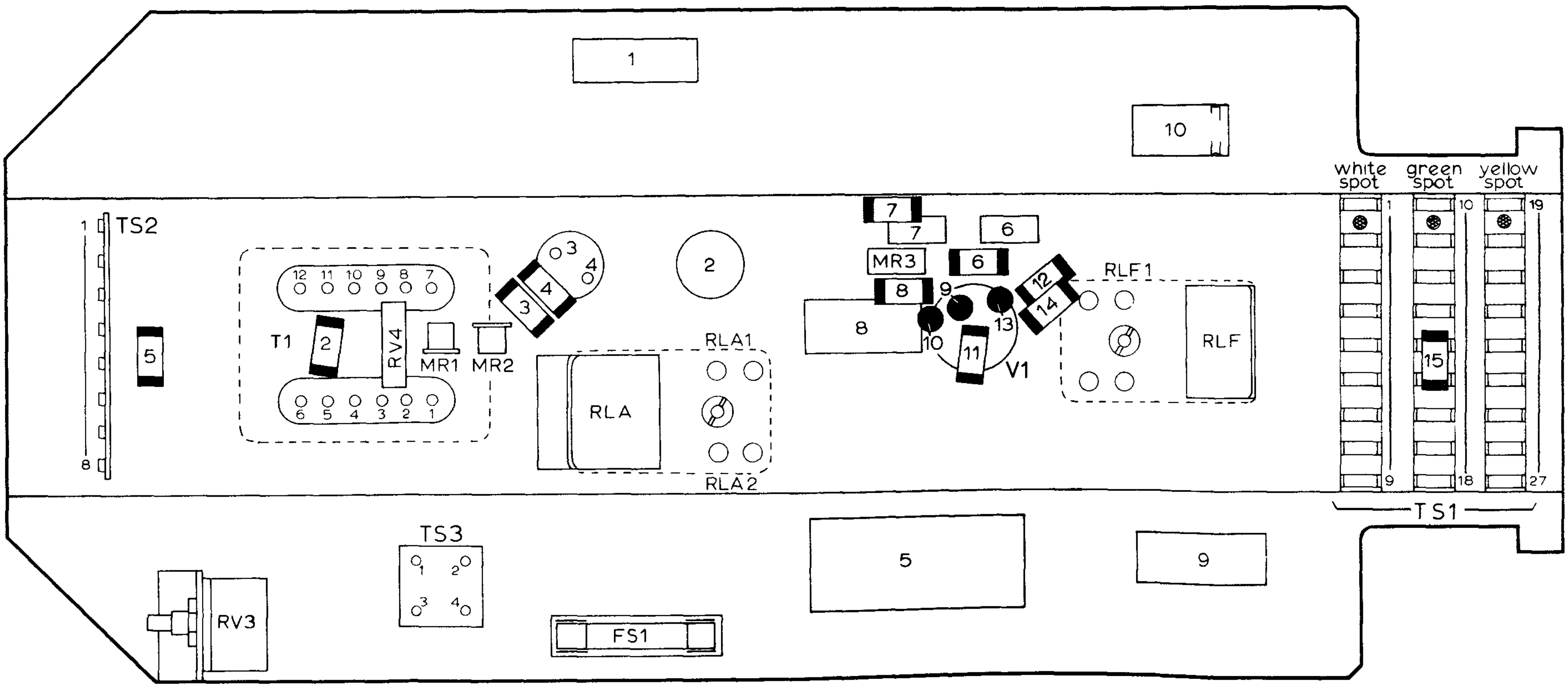


Fig.22 TRANSMITTER CIRCUIT DIAGRAM - 68 to 174 Mc/s (PTC 2107 Ranger)



TOP CHASSIS VIEW

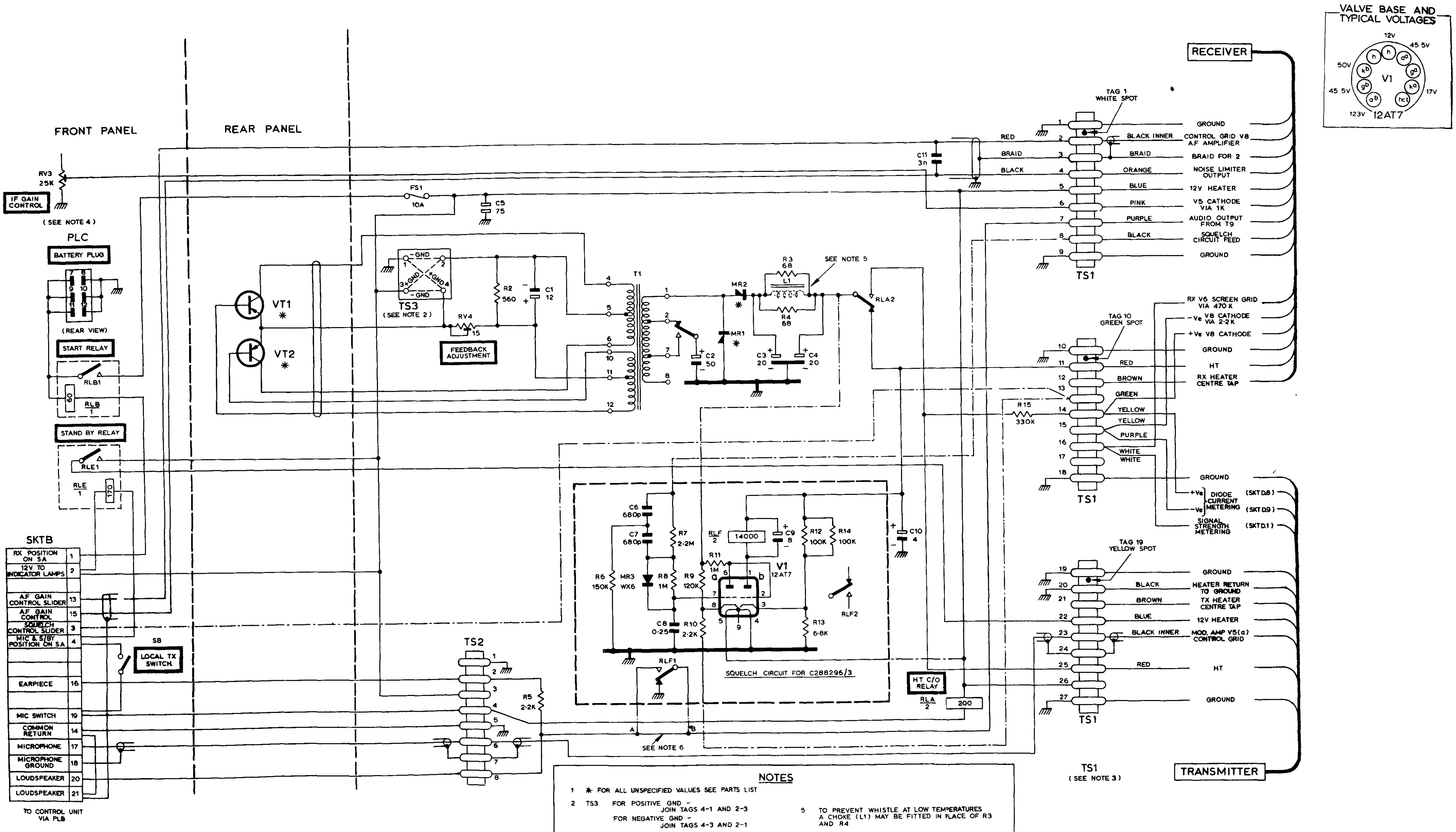
RESISTOR SYMBOL ▭ ● CAPACITORS PREFIX 'C' OR PLAIN OUTLINE WITH NO PREFIX



UNDERSIDE CHASSIS VIEW

Fig.23 SQUELCH & POWER SUPPLY UNIT LAYOUT DIAGRAM (PTC 2107 Ranger)

PREFIX USED THROUGHOUT TEXT TO IDENTIFY COMPONENTS IN THIS CIRCUIT ②



NOTES

1. ✱ FOR ALL UNSPECIFIED VALUES SEE PARTS LIST
2. TS3 FOR POSITIVE GND - JOIN TAGS 4-1 AND 2-3
   FOR NEGATIVE GND - JOIN TAGS 4-3 AND 2-1
3. TS1 - TAG 1 IS IDENTIFIED WITH A WHITE SPOT
   TAG 10 IS IDENTIFIED WITH A GREEN SPOT
   TAG 19 IS IDENTIFIED WITH A YELLOW SPOT
4. RV2 SQUELCH CONTROL (CONTROL UNIT) MAY BE FITTED IF REQUIRED, ON FRONT PANEL IN PLACE OF RV3, IF GAIN CONTROL, WHICH IS THEN TO BE MOUNTED IN PSU
5. TO PREVENT WHISTLE AT LOW TEMPERATURES A CHOKE (L1) MAY BE FITTED IN PLACE OF R3 AND R4
6. WHEN SQUELCH CIRCUIT FITTED CONNECTION A-B IS TO BE DELETED
   BROKEN LINE ——·——·—— DENOTES WIRING REQUIRED FOR SQUELCH

C288296/2 & 3

Fig.24 SQUELCH & POWER SUPPLY UNIT CIRCUIT DIAGRAM (PTC 2107 Ranger)

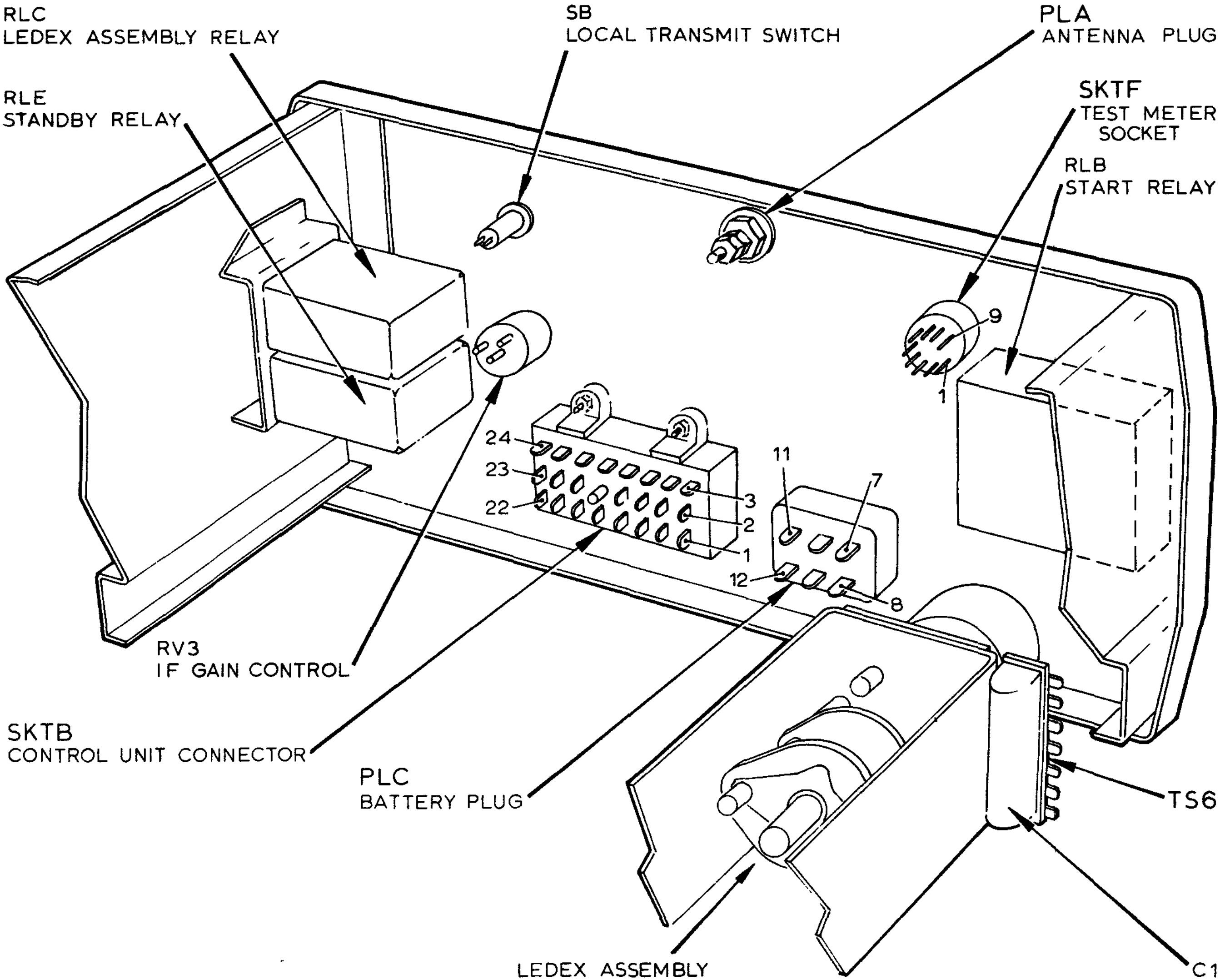
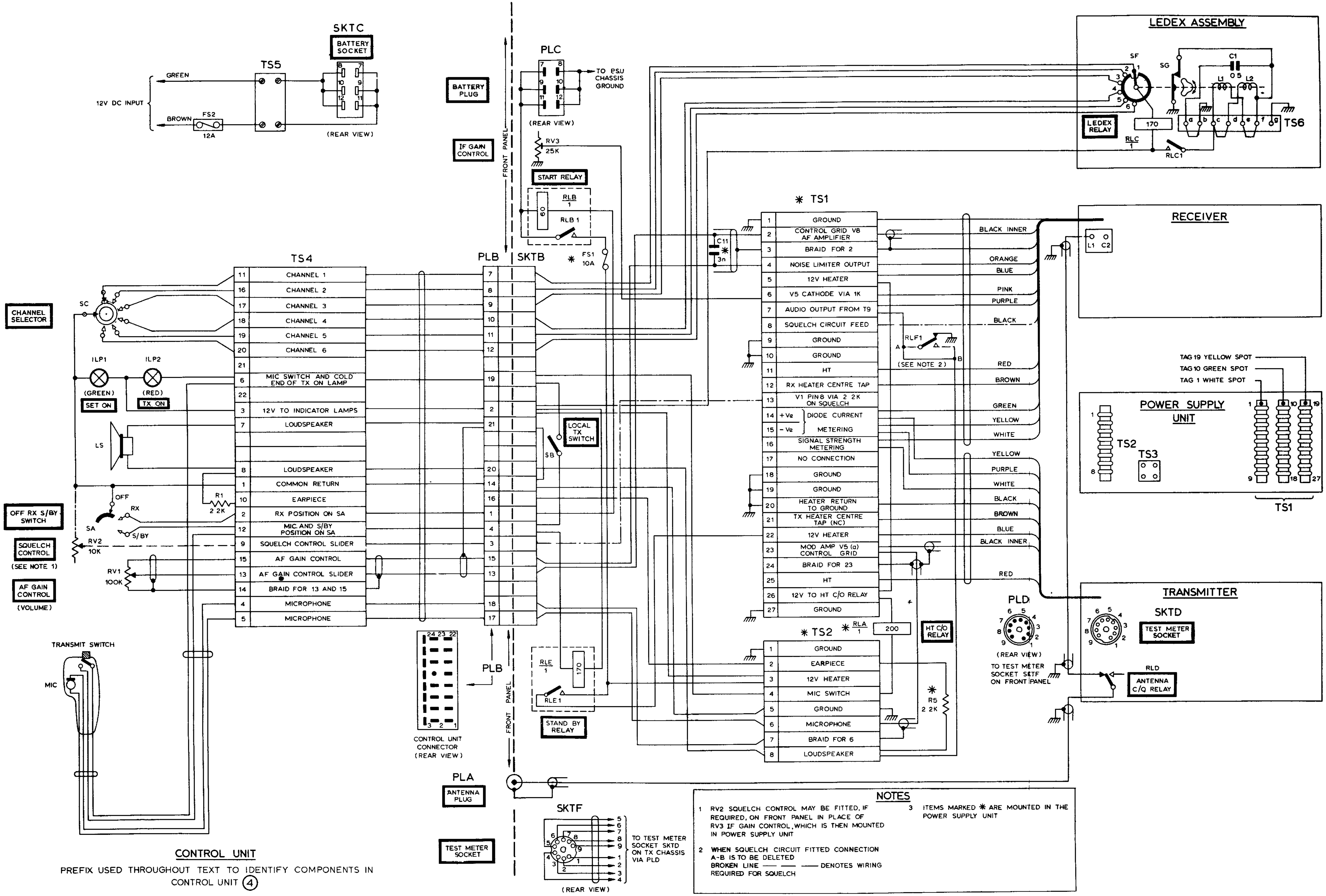


Fig.25 MAIN UNIT FRONT PANEL LAYOUT DIAGRAM
(PTC 2107 Ranger)



C294634/1-36

Fig.26 INTERCONNECTION DIAGRAM (PTC 2107)

(A.P. 113, Sect. 6B)

SUPPLEMENT

TO

AIR PUBLICATION

4809E

VOLUME I

AUGUST, 1962

MGRI. 26001

5 WATT V.H.F. RADIO TELEPHONE

(PYE PTC 6/2107V)

PTC 6/2107V EQUIPMENT FOR AIR MINISTRY

This supplement should be read in conjunction with the PTC 2107 Service Manual. Issue 3.

INTRODUCTION

The equipment is intended for operation in the frequency band 68-88 Mc/s, it employs 25 kc/s channel spacing and provides six switch-selected channels.

It is suitable for either 12 volt or 24 volt operation, voltage selection being achieved by means of a plug and socket arrangement in the power supply unit.

Receiver (Part No. 288357/1 5820-99-933-1341)

The receiver circuit description and servicing procedure, together with a parts list and circuit diagram are contained in this supplement.

Transmitter (Part No. 288356 5820-99-933-1284)

The transmitter circuit description and servicing procedure are contained in the PTC 2107 Service Manual. Issue 3. The parts list and circuit diagram are located at the rear of this supplement.

Power Supply Unit (Part No. 288358 6130-99-933-1287)

The power supply circuit description and servicing procedure, together with a parts list and circuit diagram are contained in this supplement.

SUMMARY OF DATA

Frequency band	68 - 88 Mc/s		
Channel spacing	Type V (very narrow) 20, 25 and 30 kc/s		
	Note: The equipment referred to in this supplement employs 25 kc/s channel spacing.		
Power supply	12 volts or 24 volts d.c. nominal, positive or negative ground		
Power consumption		Standby	Transmit
	12 volt	5.3A	9.3A
	24 volt	2.7A	5.0A

Standard Test Voltage

Nominal	Standard test voltage measured at battery (on load)
12V	13.2V
24V	26.4V

The equipment is connected to the battery by a suitable length of the recommended cable. (See INSTALLATION, page 6).

Notes:

1. A telephone handset is used in place of the fist microphone.
2. A 'receive only' facility is not fitted. The equipment employs a two-position OFF/ON (standby) switch in the control unit.
3. Amend the control unit dimensions to read:-

   9 in wide x 4 1/8 in deep x $3\frac{1}{4}$ in high
   (22.8 cm x 10.5 cm x 8.2 cm)

TECHNICAL DESCRIPTION

RECEIVER

CIRCUIT FEATURES

The receiver employs nine valves in a double superheterodyne circuit. A cascode r.f. amplifier is followed by two mixer stages employing crystal-controlled oscillators; the first i.f. is 10.7 Mc/s and the second i.f. is 2 Mc/s.

The second i.f. signal is passed through a three-stage i.f. amplifier before demodulation and a.f. amplification. Interposed between the demodulator and the first a.f. amplifier is a series noise limiter designed to suppress pulse type interference such as that caused by vehicle ignition systems. The audio signal from the first a.f. amplifier is coupled to an output pentode valve for final amplification.

DETAILED CIRCUIT DESCRIPTION

R.F. Stage

Two sections of the double triode 3V1 are employed in a cascode r.f. amplifier stage. The antenna circuit is connected via contacts 1RLD1 of the antenna changeover relay to the tuned grid circuit of 3V1a comprising 3L1 - 3C1. Neutralising is effected by 3L2 with associated capacitor 3C3. The anode of 3V1a is coupled by inductance 3L4 to the cathode of the grounded grid amplifier 3V1b. The amplified signal at the anode of 3V1b is fed via three band-pass filters comprising 3L3-3C4, 3L5-3C11 and 3L6-3C13 to the grid of the first mixer 3V2.

1st Mixer and Oscillator

The first mixer stage employs a triode 3V2. The heterodyne voltage is obtained from the double-triode 3V9, the first half of which functions as a crystal-controlled Pierce oscillator and multiplier. Crystal trimming is effected by the separate capacitors 3C58-3C63.

The third harmonic of the crystal frequency is selected by transformer 3T10 in the anode circuit of 3V9a and coupled to the grid of 3V9b via 3C76. 3V9b also serves as a multiplier and the twelfth harmonic of the crystal frequency, chosen to provided a first i.f. of 10.7 Mc/s, is injected into the cathode of the first mixer 3V2 via 3C15-3R5, from a loop coupled to inductance 3L9. The resultant signal produced at the anode of 3V2 is transformer coupled by 3T1 to the grid of the 2nd mixer 3V3a.

2nd Mixer and Oscillator

The triode section of 3V3 functions as a crystal-controlled oscillator at a frequency of 12.7 Mc/s except in the cases listed in the CRYSTAL FORMULAE at the end of the Parts List in the manual.

Output from the oscillator 3V3b, and the 10.7 Mc/s i.f. input from 3V2 are mixed in the pentode section 3V3a of the second mixer.

The 2 Mc/s second i.f. component produced at the anode of 3V3a is transformer coupled to the grid of the i.f. amplifier 3V4.

I.F. Amplifier

This section consists of three stages of i.f. amplification which provide most of the gain and selectivity of the receiver. Three r.f. pentodes, 3V4-3V5-3V6 are employed, inductive interstage coupling being provided by high-Q transformers.

The anode circuit of 3V3a is coupled to the grid of 3V4 by a pair of i.f. transformers, 3T2-3T3. These transformers are coupled by capacitor 3C82. The following stages using 3V4-3V5-3V6 are coupled in a similar manner by 3T4-3T5 and 3T6-3T7 respectively.

The i.f. gain control RV3 is in the cathode circuit of the first i.f. amplifier 3V4.

Demodulation and A.G.C.

The final i.f. transformer 3T8 is directly coupled to one diode of the double-diode triode 3V7 for demodulation. The capacitor 3C46 feeds a small portion of the i.f. output to the second diode of 3V7; the resultant d.c. voltage developed across the load resistor 3R29 is fed as a.g.c. bias to the grid returns of 3V3-3V4-3V5. A.G.C. delay is provided by the voltage developed across the cathode resistor 3R48.

A. F. Amplifier

The a.f. voltage developed across the diode load is fed via the noise limiter, capacitor 3C79, the VOLUME (audio gain) control 4RV1 and the coupling capacitor 3C53, to the grid of the triode section of 3V7. After amplification the a.f. signal is coupled via 3C54 to the grid of 3V8, a pentode a.f. amplifier capable of delivering approximately 1 watt into the 3Ω loudspeaker.

Noise Limiter

The load circuit of the signal diode includes a silicon diode 3MR1 functioning as a series noise limiter. Under normal working conditions a voltage proportional to the carrier level is developed across 3R46 and 3MR1. In the event of a sudden peak in signal, such as that caused by interference from a vehicle ignition system, the positive side of 3MR1 will be driven rapidly negative and 3MR1 will momentarily fail to conduct. The relatively large time constant of 3R45-3C80 prevents the negative side of 3MR1 from following a rapidly changing signal, whilst normal speech waveform remains unaffected.

The limiter forms part of the signal diode load, the input to the limiter being taken from the secondary winding of the final i.f. transformer 3T8 via the filter 3C48-3R46-3C81.

The output from the limiter is fed to the VOLUME control 4RV1 via tag 4 on 2TS1.

POWER SUPPLY UNIT

A matched pair of power transistors VT1-VT2 is connected in a multivibrator circuit with transformer 2T1 as the centre-tapped load.

Bias is applied to the circuit by means of the potential divider 2R1-2R2 and the series resistors 2R16-2R17-2R18-2RV4.

The switching action of the converter is controlled by feedback developed in antiphase windings on 2T1 and applied to the bases of VT1 and VT2.

The frequency of operation of the converter is approximately 3000 c/s.

The output from 2T1 is rectified by a half-wave voltage doubler system, 2C2-2C3a-2MR1-2MR2 and fed to a filter circuit 2L1-2C3b. Capacitor 2C10 provides additional smoothing in the receiver h.t. line.

The socket 2SKTS is incorporated to make the power supply unit common to both 24 volt and 12 volt equipment, the only difference being a change of connections in the plugs PLS.

Connecting to the Supply

The following section should be read in conjunction with POWER SUPPLY on page 18 in the Manual.

IMPORTANT

Ensure that the correct plug PLS is fitted in the power supply unit to correspond with the available l.t. supply voltage. The two plugs are marked 12V and 24V respectively; the plug not in use is mounted immediately behind the main unit front panel. In addition, a reversible plate fitted on the face of the panel is set to indicate the supply for which the equipment is intended.

The battery plug PLC located on the main unit front panel is wired to accept either a 12 volt or 24 volt l.t. input as follows:-

12 volt Operation (see Fig. 1)

The power leads are taken from the equipment, where they are terminated by the socket SKTC, via an intermediate terminal block and a fuse to the battery.

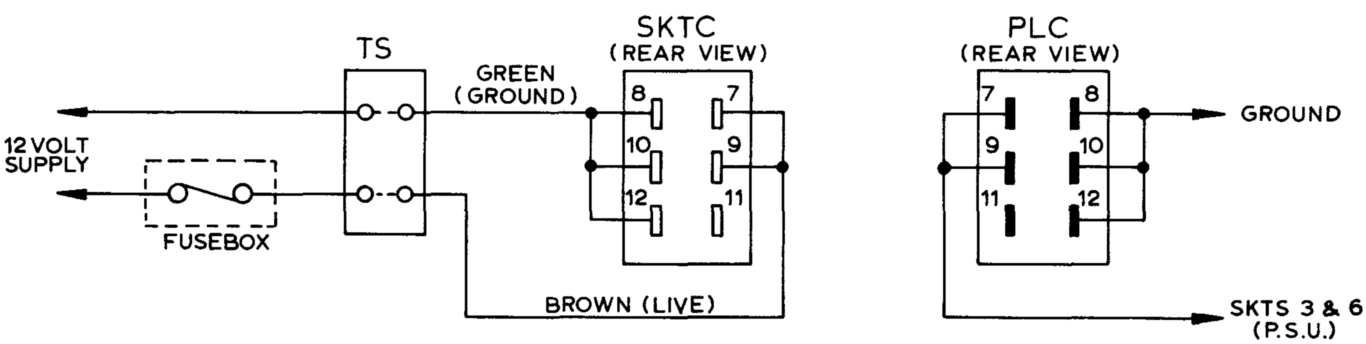


Fig. 1

24 volt Operation (see Fig. 2)

The power leads are taken from the equipment, where they are terminated by the socket SKTC, via an intermediate terminal block and a fuse and ballast unit to the battery.

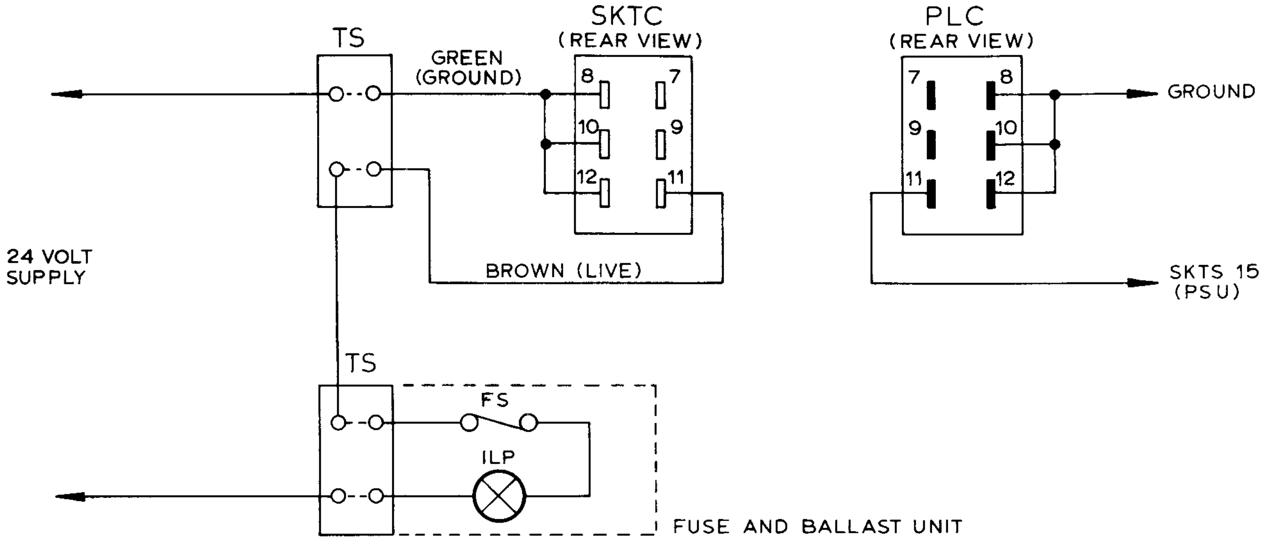


Fig. 2

The table on page 19 of the manual gives a guide to the size of cable required for 12 volt operation. Quadruple the figures given in the total length of lead and distance from equipment columns for 24 volt operation.

SERVICING

Equipment Required for Receiver Alignment Procedure

1. Signal Generator Type 9208B
2. Avometer Model 8
3. Diode Probe (a suitable circuit is shown in Fig. 3, page 9)
4. Wattmeter Absorption Audio Frequency 6625-99-914-9811
5. 10nF capacitor
6. Two small 2.2kΩ resistors with extremely short leads
7. Calibrator Frequency 6625-99-933-0967 (2 Mc/s marker oscillator)

   Note: This item is required for calibration purposes only if the specified signal generator is not available

8. A source of standard test voltage of 13.2 volts d.c. (12 volt equipment) or 26.4 volts d.c. (24 volt equipment), measured at the battery on load

RECEIVER PERFORMANCE CHECKS

Nominal figures (in brackets) are given for guidance when checking the equipment with Standard Test Voltage applied.

1. Check the overall sensitivity as follows:-

   Connect the output meter set to high impedance input across tag 4 on 3T9 (the audio output transformer) and chassis. Set the VOLUME control 4RV1 and the i.f. gain control RV3 at maximum: the former is located on the control unit, the latter on the main unit front panel. Connect the signal generator to the antenna plug and apply an r.f. signal of 2μV e.m.f. modulated to a depth of 30% at 1000 c/s (1 watt).

2. Check the signal-to-noise ratio as follows -

   With the i.f. gain control at maximum, the signal generator and output meter connected as in 1 above and the modulation switched on, adjust the a.f. output to approximately 100mW and note the reading on the dB scale of the output meter. Switch off the modulation and again note the reading on the dB scale. Subtracting the latter reading from the former reading will give the approximate signal-to-noise ratio at this level (14dB).

3. Check the a.g.c. performance as follows:-

   With the i.f. gain control at maximum and the signal generator and output meter connected as in 1 above, apply an r.f. input of 20mV e.m.f. and adjust the a.f. output to read 100mW. Note the change in output when the signal is reduced to 4μV e.m.f. (8dB).

RECEIVER ALIGNMENT PROCEDURE

I.F. ALIGNMENT

In normal service re-alignment is unnecessary. The design is such that the bandwidth and symmetry of the bandpass circuits are maintained even after changing valves. If re-alignment does become necessary use the following procedure:-

Notes:

1. The primary cores of all i.f. transformers are adjustable from below the chassis and the secondary cores from above the chassis.

2. The lock nuts on adjustable cores should be tightened and the adjustment checked before disconnecting the signal generator and meter, in order to ensure that the circuits have not become detuned.

3. When carrying out the following adjustments the signal generator output should be adjusted as necessary to keep the microammeter reading slightly below mid-scale.

1. Connect the a.g.c. line to chassis. A suitable point is between the junction 3R28 - 3C44 and chassis.

2. Connect a 50μA meter across pins 8 (positive) and 9 (negative) of the test meter socket 1SKTD. The meter will read diode current.

3. Remove 3V2 and connect the signal generator to the anode connection (pin 7) of the valveholder via the 10nF capacitor.

4. Set the signal generator to 10.7 Mc/s with modulation off.

5. Unless the signal generator specified is available, switch on and place the 2 Mc/s calibrator near the i.f. amplifier stages. Adjust the signal generator for zero beat, switch off and remove the calibrator.

6. Set the i.f. gain control fully clockwise.

7. Set the primary core of 3T1 to approximately a mid-way position and tune the secondary for maximum diode current.

8. Tune the primary and secondary of 3T8 for maximum diode current.

9. Shunt the primary of 3T6 and the primary of 3T7 with the 2.2kΩ resistors. Tune the secondary of 3T6 for maximum diode current. Tune the secondary of 3T7 for maximum diode current.

10. Shunt the secondary of 3T6 and the secondary of 3T7 with the 2.2kΩ resistors. Tune the primary of 3T6 for maximum diode current. Tune the primary of 3T7 for maximum diode current.

11. Repeat instructions 9 and 10 above, reading 3T5 for 3T7 and 3T4 for 3T6.

12. Repeat instructions 9 and 10 above, reading 3T3 for 3T7 and 3T2 for 3T6. Remove the damping resistors.

13. Check the bandwidth and symmetry using the signal generator specified.

    (a) With the signal generator still set to 10.7 Mc/s adjust the output to obtain a convenient reading of diode current; note this reading.

    (b) Detune the generator on each side of 10.7 Mc/s by the increments detailed below and increase the carrier level until the original meter reading is obtained. Note the difference in carrier level required to give the original meter reading; the following figures should be obtained.

Frequency	Carrier Level	
	High	Low
± 6 kc/s	+ 4dB	+ 8dB
±22.5 kc/s	+88dB	+∞dB

Should the symmetry be inadequate a very slight re-adjustment of 3T8 secondary can be made. However, if the results obtained differ widely from the figures given above, check that the i.f. alignment has been correctly carried out.

14. Re-set the generator to 10.7 Mc/s

15. Remove the microammeter and the a.g.c. short circuit connection.

16. Connect the audio output meter set to high impedance input across 3T9 tag 4 and chassis.

17. With the VOLUME and i.f. gain controls at maximum (fully clockwise), switch on the modulation set at 1000 c/s 30% modulation depth.

18. Adjust the generator output level to obtain a receiver output as detailed below:-

Carrier Level (max)	Audio Output
125μV	500mW

19. Disconnect the signal generator and replace 3V2.

R.F. ALIGNMENT

Under no circumstances should the settings of the receiver crystal trimmers be altered without reference to a frequency substandard or to the carrier of the base station transmitter.

Notes:

1. Alignment should be carried out on the channel nearest to the mean frequency of the channels in use and the performance of the remaining channels checked after alignment. Note that the specification figures relate to channels within ±0.2% of the mean frequency.

2. The 1pF capacitor 3C3 (connected across inductance 3L2) may be removed from receivers intended for operation at the high frequency end of the band to facilitate neutralising of the r.f. amplifier stage.

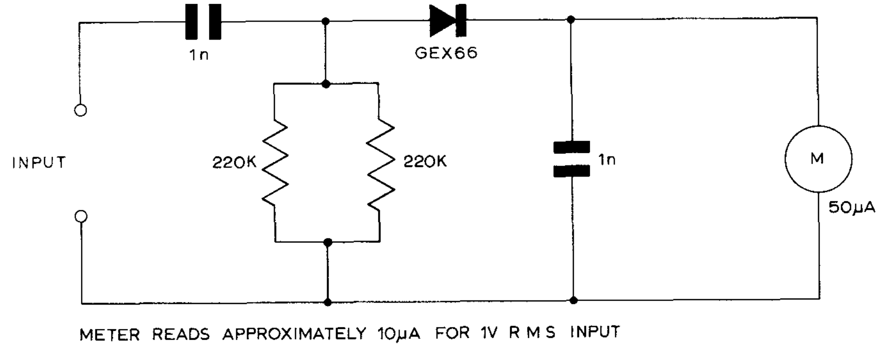


Fig. 3 Diode Probe Unit

1. Connect the 2.5V d.c. voltmeter across the cathode resistor 3R42 of 3V9b.

2. Tune the primary and secondary windings of 3T10 for maximum reading on the voltmeter. Repeat this adjustment, as detuning of the primary may occur when the secondary is tuned (typical reading 2.0V).

3. Disconnect the voltmeter and set the cores of 3L1-3L2-3L3-3L5-3L6 and 3L9 to the h.f. end of their travel, with as little of the core adjuster visible as possible.

4. Connect a diode probe, constructed as shown in Fig. 3 above, between the cathode (pin 2) of 3V2 and chassis. Adjust the core of 3L9 for maximum injection.

5. Disconnect the diode probe and connect the signal generator to the antenna plug PLA.

6. Accurately tune the signal generator to the channel nearest to the mean frequency of the channels in use and modulate the signal to a depth of 30% at 1000 c/s.

7. Set the VOLUME and i.f. gain controls at maximum (fully clockwise) and, throughout section 8, adjust the signal generator output so that the audio output reading does not exceed 500mW.

8. Adjust the cores of 3L1-3L3-3L4-3L5-3L6 and the primary winding of 3T1 for maximum audio output.

9. Disconnect the short lead which connects 3L4 to the cathode (pin 3) of 3V1b and connect the two 12kΩ resistors and 1000pF capacitor as shown in Fig. 4 below:-

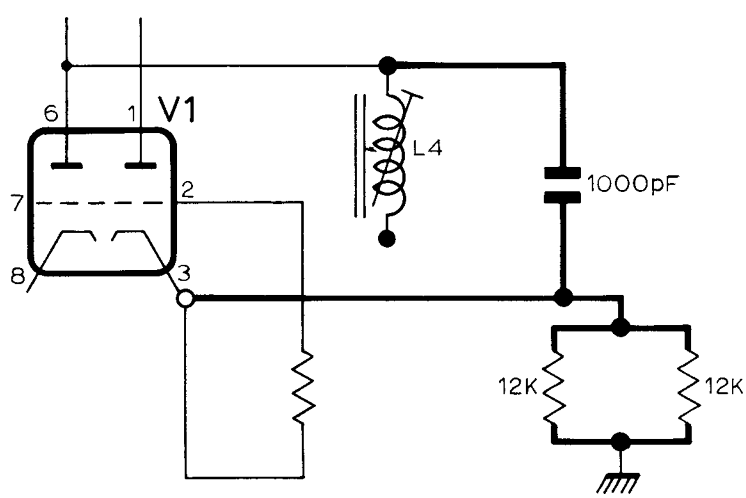


Fig. 4

10. Adjust the signal generator to obtain a convenient reading on the output meter and tune 3L2 for minimum meter reading.

11. Remove the 12kΩ resistors and 1000pF capacitor and solder the short lead connection between 3L4 and pin 3 of 3V1b.

12. Retune 3L1 and 3L3 for maximum audio output.

13. With an r.f. input of 2μV e.m.f. and the i.f. gain control set fully clockwise check that the signal-to-noise ratio is not less than 14dB (see Checking Signal-to-Noise Ratio).

14. With an r.f. input of 2μV e.m.f. and the VOLUME and i.f. gain controls set fully clockwise, check that the audio output is not less than 1 watt.

15. Disconnect the signal generator and audio output meter.

CHECKING SIGNAL-TO-NOISE RATIO

The following method should be adopted when checking signal-to-noise ratio:-

1. Feed in a signal of 2μV e.m.f. from the signal generator with modulation on. Set to 30% at 1000 c/s.

2. Adjust the a.f. output to approximately 100mW and note the reading on the dB scale of the output meter.

3. Switch off the modulation and again note the output meter reading.

4. Subtracting the reading of 3 from the reading of 2 will give the "signal plus noise" to "noise only" ratio. At the levels used this is very nearly equal to the signal-to-noise ratio and may be regarded as such for the purpose of this test.

Transistor Feedback Adjustment Control

After replacement of a transistor, the feedback adjustment control must be re-set. The optimum position is determined as detailed in the following sections, under the least favourable conditions using an input supply of 15.8 volts d.c. (12 volt operation) or 31.6 volts d.c. (24 volt operation) and is indicated when:-

1. The full h.t. voltage is present on the transmitter h.t. line when the equipment is switched from receive to transmit,

2. the frequency of oscillation is maintained under load, and

3. the mark-space ratio of the collector current waveform is 1 : 1.

Equipment Required

1. Source of standard test voltages (see page 2).

2. Source of l.t. input voltage of 15.8 volts on load

3. Source of l.t. input voltage of 31.6 volts on load

4. Oscilloscope (the Telequipment 'Serviscope' S32 is suitable)

5. 0-500V d.c. meter (the Avometer Model 8 is suitable)

6. 0.05Ω resistor ($\frac{3}{4}$ in of No. 20 gauge Eureka wire)

7. R.F. Power Output Meter - Wattmeter CT419

Procedure

1. Insert the 0.05Ω resistor in series with the lead from one transistor collector to transformer 2T1 i.e. collector of VT1 to 2T1 tag 10 (12 volt) or 2T1 tag 9 (24 volt).

2. Connect the oscilloscope across the ends of the 0.05Ω resistor. Both oscilloscope connections must be isolated from ground.

3. Connect the r.f. power output meter (or dummy load) to the antenna plug.

12 volt operation

4. Set the feedback adjustment control slider in the position of maximum resistance in circuit.

5. Connect the standard test voltage to the equipment, observing polarity, and switch ON.

6. Operate the transmit test switch and adjust the feedback adjustment control 2RV4 until a meter reading of 293 volts is obtained.

7. Observe the oscillator collector current waveform; the mark-space ratio should be 1 : 1.

8. Switch OFF and connect the 15.8 volt l.t. supply, observing polarity.

9. Switch ON and operate the transmit test switch. Check that the oscillator starts without hesitation and that the rated 270-315 volts is present on the h.t. line.

10. If the oscillator is sluggish in starting and a delay in reaching the rated h.t. voltage is apparent, switch OFF, re-set the feedback adjustment control and make a further check.

11. Repeat the adjustment until satisfactory operation is obtained.

24 volt operation

12. Connect resistors 2R16-2R17-2R18 in circuit by open circuiting the links on 2TS4.

13. Connect the standard test voltage to the equipment, observing polarity, and switch ON.

14. Operate the transmit test switch and select the required combination of 2R16-2R17-2R18 by adjustment of the links on 2TS4 to give a meter reading of 293 volts.

Note: It may be necessary to make a slight re-adjustment to the setting of the feedback control in order to obtain the correct meter reading.

15. Observe the oscillator collector current waveform; the mark-space ratio should be 1 : 1.

16. Switch OFF and connect the 31.6 volt l.t. supply, observing polarity.

17. Switch ON and operate the transmit test switch. Check that the oscillator starts without hesitation and that the rated 270-315 volts is present on the h.t. line.

18. If the oscillator is sluggish in starting and a delay in reaching the rated h.t. voltage is apparent, switch OFF, re-set the feedback adjustment control decreasing the resistance in circuit and make a further check.

19. Repeat the adjustment until satisfactory operation is obtained.

Note: If re-adjustment of the feedback control has proved necessary, re-check the setting for 12 volt operation. The feedback control should be finally set so that an h.t. supply of approximately 293 volts is produced with both 13.2 volts and 26.4 volts l.t. inputs.

PARTS LISTS

AND

DIAGRAMS

RECEIVER - 68 to 88 Mc/s

Code		CAPACITORS			Part No.
C1	27pF	Silver mica		±1pF	660846
C2	1nF	Disc ceramic			660433
C3	1pF	Ceramic		±0.1pF	266548
C4	22pF	Ceramic		±2.5%	266557
C5	2nF	Disc ceramic			660439
C6	1nF	Feedthrough			266241
C7		Ceramic feedthrough			202638
C8	1nF	Disc ceramic			660433
C9		Ceramic feedthrough			202638
C10	1nF	Disc ceramic			660433
C11	33pF	Silver mica		±1pF	660847
C12		Ceramic feedthrough			202638
C13	22pF	Ceramic		±2.5%	266557
C14		Ceramic feedthrough			202638
C15	1nF	Disc ceramic			660433
C16		Ceramic feedthrough			202638
C17	10nF	Disc ceramic			660006
C18	1nF	Disc ceramic			660433
C19	10nF	Disc ceramic			660006
C20	10nF	Disc ceramic			660006
C21	10nF	Disc ceramic			660006
C22	1.7pF	Ceramic		±0.1pF	266036
C23	0.1μF	Ceramic	200V	±10%	266246
C24	4.7pF	Ceramic		±10%	650737
C25	6.8pF	Ceramic		±10%	650742
C26	47pF	Ceramic		±10%	650739
C27	10nF	Disc ceramic			660006
C28	10nF	Disc ceramic			660006
C29	15pF	Ceramic		±10%	650744
C30	10nF	Disc ceramic			660006
C31	2pF	Ceramic		±0.1pF	266025
C32	10nF	Disc ceramic			660006
C33		Not used			
C34	0.1μF	Ceramic	200V	±10%	266246
C35	10nF	Disc ceramic			660006
C36	10nF	Disc ceramic			660006
C37	0.1μF	Ceramic	200V	±10%	266246
C38	2pF	Ceramic		±0.1pF	266025
C39	10nF	Disc ceramic			660006
C40	10nF	Disc ceramic			660006
C41	10nF	Disc ceramic			660006
C42	10nF	Disc ceramic			660006
C43	0.1μF	Ceramic	200V	±10%	266246
C44	10nF	Disc ceramic			660006
C45	10nF	Disc ceramic			660006
C46	22pF	Ceramic		±10%	650738
C47	0.1μF	Ceramic	200V	±10%	266246
C48	100pF	Ceramic		±10%	650740
C49	10μF	Electrolytic	50V		266383
C50	2nF	Tubular	350V		669102
C51	100pF	Ceramic		±10%	650740
C52	0.1μF	Ceramic	200V		266246
C53	3nF	Disc ceramic			660439
C54	560pF	Silver mica	350V	±10%	665369
C55	8μF	Electrolytic	250V		680025
C56	10nF	Tubular	400V		669208
C57	10nF	Tubular	400V		669208
C58	1-12pF	Trimmer			280057
C59	1-12pF	Trimmer			280057
C60	1-12pF	Trimmer			280057
C61	1-12pF	Trimmer			280057
C62	1-12pF	Trimmer			280057
C63	1-12pF	Trimmer			280057
C64		Not used			
C65	15pF	Silver mica		±1pF	660844
C66	6.8pF	Ceramic		±10%	650742
C67	150pF	Silver mica		±10%	660875
C68	1nF	Disc ceramic			660433
C69	1.7pF	Ceramic		±0.1pF	266036
C70	3nF	Disc ceramic			660439
C71	15pF	Silver mica		±1pF	660844
C72	3nF	Disc ceramic			660439
C73	1nF	Feedthrough			266241
C74		Ceramic feedthrough			202638
C75	22pF	Ceramic		±2.5%	266557
C76	82pF	Ceramic		±10%	652831
C77		Ceramic feedthrough			202638
C78	1nF	Tubular			669101
C79	10nF	Disc ceramic			660006
C80	0.1μF	Ceramic	200V	±10%	266246
C81	100pF	Ceramic		±10%	650740
C82	1.7pF	Ceramic		±0.1pF	266036
C83	1.7pF	Ceramic		±0.1pF	266036
C84	1.7pF	Ceramic		±0.1pF	266036
C85 to C102		Not used			
C103	1pF	Ceramic		±0.1pF	266548
C104	1pF	Ceramic		±0.1pF	266548

Code		RESISTORS			Part No.
R1	82Ω		¼W	±10%	671493
R2	1kΩ		¼W	±10%	671506
R3	10Ω		¼W	±10%	671482
R4	470kΩ		¼W	±10%	671538
R5	390Ω		¼W	±10%	671501
R6	1kΩ		¼W	±10%	671506
R7	100kΩ		¼W	±10%	671530
R8	47kΩ		¼W	±10%	671526
R9	180kΩ		¼W	±10%	671533
R10	560Ω		¼W	±10%	671503
R11	2.2kΩ		¼W	±10%	671510
R12	39kΩ		¼W	±10%	671525
R13	15kΩ		¼W	±10%	671520
R14	180kΩ		¼W	±10%	671533
R15	100kΩ		¼W	±10%	671530
R16	47kΩ		¼W	±10%	671526
R17	120Ω		¼W	±10%	o71495
R18	2.2kΩ		¼W	±10%	671510
R19	1MΩ		¼W	±10%	671542
R20	470kΩ		¼W	±10%	671538
R21	47kΩ		¼W	±10%	671526
R22	120Ω		¼W	±10%	671495
R23	2.2kΩ		¼W	±10%	671510
R24	Nom. 150Ω	(2 x 330Ω in parallel)			671500
R25	15kΩ		¼W	±10%	671520
R26	150Ω		¼W	±10%	671496
R27	2.2kΩ		¼W	±10%	671510
R28	1MΩ		¼W	±10%	671542
R29	470kΩ		¼W	±10%	671538
R30	100kΩ		¼W	±10%	671530
R31	10kΩ		¼W	±10%	671518
R32	4.7MΩ		¼W	±10%	671550
R33	470kΩ		¼W	±10%	671538
R34	470Ω		¼W	±10%	671502
R35	100Ω		¼W	±10%	671494
R36	470Ω		¼W	±10%	671502
R37	47kΩ		¼W	±10%	671526
R38	1kΩ		¼W	±10%	671506
R39	18kΩ		¼W	±10%	671521
R40	4.7kΩ		¼W	±10%	671514
R41	1.5kΩ		¼W	±10%	671508
R42	270Ω		¼W	±10%	671499
R43	100kΩ		¼W	±10%	671530
R44	470kΩ		¼W	±10%	671538
R45	470kΩ		¼W	±10%	671538
R46	180kΩ		¼W	±10%	671533
R47	47kΩ		¼W	±10%	671526
R48	56kΩ		¼W	±10%	671527
R49	100kΩ		¼W	±10%	671530
R50	2.2kΩ		¼W	±10%	671510
R51 to R69		Not used			
R70	220Ω		¼W	±10%	671498

	COIL & CHOKES	Core Part No.	Assembly Part No.
L1	Antenna coil	274822	278497/9
L2	Neutralising coil	272769	278576/6
L3	R.F. coil No.1	274822	278497/11
L4	Intervalve coupling coil	272776	278580/3
L5	R.F. coil No.2	274822	278497/8
L6	R.F. coil No.3	274822	278497/10
L7	Cathode choke	-	279051
L8	Cathode choke	-	279051
L9	Multiplier coil	274822	278579/1

	TRANSFORMERS		
T1	I.F. transformer	10.7 Mc/s	277113
T2	I.F. transformer	2 Mc/s	277097
T3	I.F. transformer	2 Mc/s	277097
T4	I.F. transformer	2 Mc/s	277097
T5	I.F. transformer	2 Mc/s	277097
T6	I.F. transformer	2 Mc/s	277097
T7	I.F. transformer	2 Mc/s	277097
T8	I.F. transformer	2 Mc/s	277091
T9	Output transformer		277891
T10	R.F. transformer		277094

RECEIVER - 68 to 88 Mc/s (Cont.)

Code	VALVES & SEMICONDUCTORS	Part No.
V1	ECC88	860474
V2	EC91	860160
V3	ECF80	860324
V4	6BJ6	860397
V5	6BJ6	860397
V6	6CB6	860095
V7	EBC90	860236
V8	EL84	860327
V9	ECC88	860474
MR1	OA200	721601

MISCELLANEOUS

SC	Switch wafer	283179

Chassis Assembly Complete Part No. 288357/1 (5820-99-933-1341

TRANSMITTER - 68 to 88 Mc/s

Code		CAPACITORS			Part No.
C1	1-10pF	Trimmer			280019
C2	1-10pF	Trimmer			280019
C3	1-10pF	Trimmer			280019
C4	1-10pF	Trimmer			280019
C5	1-10pF	Trimmer			280019
C6	1-10pF	Trimmer			280019
C7		Not used			
C8		Not used			
C9	2nF	Disc ceramic			660002
C10	0.75pF	Gimmicon		±0.1pF	266031
C11	10pF	Ceramic		±10%	650751
C12	47pF	Ceramic		±1pF	653102
C13	2nF	Disc ceramic			660002
C14	15pF	Ceramic		±1pF	652595
C15	2nF	Disc ceramic			660002
C16	2nF	Disc ceramic			660002
C17	2nF	Disc ceramic			660002
C18	2nF	Disc ceramic			660002
C19	220pF	Ceramic		±20%	666648
C20	2nF	Disc ceramic			660002
C21	47pF	Ceramic		±1pF	653102
C22	2nF	Disc ceramic			660002
C23	1nF	Disc ceramic			660433
C24	2nF	Disc ceramic			660002
C25	220pF	Ceramic		±20%	666648
C26	12pF	Ceramic		±10%	650755
C27	1nF	Disc ceramic			660433
C28	1nF	Disc ceramic			660433
C29	2pF	Ceramic		±0.5pF	652659
C30	1nF	Disc ceramic			660433
C31	22pF	Ceramic		±1pF	653103
C32	1nF	Disc ceramic			660433
C33	1nF	Disc ceramic			660433
C34	1nF	Disc ceramic			660433
C35	2-20pF	Trimmer			280021
C36	6.8pF	Ceramic		±10%	650742
C37	10nF	Disc ceramic			660006
C38	2nF	Disc ceramic			660002
C39		Not used			
C40	1nF	Disc ceramic			660433
C41	1nF	Disc ceramic			660433
C42	1nF	Disc ceramic			660433
C43	10nF	Disc ceramic			660006
C44	2-20pF	Trimmer			280021
C45	2-20pF	Trimmer			800155
C46	4µF	Electrolytic	350V		266387
C47	2nF	Tubular	350V		669102
C48	2nF	Tubular	350V		669102
C49	20nF	Tubular	750V		668872
C50	20nF	Tubular	750V		668872
C51 to C57		Not used			
C58	10pF	Ceramic		±10%	650751
C59	10pF	Ceramic		±10%	650751
C60		Not used			
C61		Not used			
C62	27pF	Silver mica	350V	±1pF	660846
C63	47pF	Ceramic		±1pF	653102
C64	1nF	Disc ceramic			660433
C65	4µF	Electrolytic	350V		266387

RESISTORS

Code				Part No.
R1	10kΩ	¼W	±10%	671518
R2	330Ω	¼W	±10%	671500
R3	150kΩ	¼W	±10%	671532
R4	100kΩ	¼W	±10%	671530
R5	47Ω	¼W	±10%	671490
R6	15kΩ	¼W	±10%	671520
R7	56kΩ	¼W	±10%	671527
R8	100kΩ	¼W	±10%	671530
R9	330Ω	¼W	±10%	671500
R10	100kΩ	¼W	±10%	671530
R11	82kΩ	¼W	±10%	671529
R12	47kΩ	¼W	±10%	671490
R13	330Ω	¼W	±10%	671500

Code		RESISTORS(contd.)			Part No.
R14		Not used			
R15	1kΩ		¼W	±10%	671506
R16	18kΩ		¼W	±10%	671521
R17	15kΩ		¼W	±10%	671520
R18	27kΩ		½W	±10%	670459
R19	100Ω		¼W	±10%	671494
R20	47kΩ		¼W	±10%	671526
R21	4.7kΩ		¼W	±10%	671514
R22	220kΩ		¼W	±10%	671534
R23	220kΩ		¼W	±10%	671534
R24	4.7kΩ		¼W	±10%	671514
R25	100kΩ		¼W	±10%	671530
R26	680kΩ		¼W	±10%	671540
R27	470kΩ		¼W	±10%	671538
R28	120Ω		½W	±10%	670431
R29	68kΩ		¼W	±10%	671528
R30	10kΩ		¼W	±10%	671482
R31	39Ω		½W	±10%	671425
R32 to R42		Not used			
R43	82kΩ		¼W	± 5%	674572
R44	82kΩ		¼W	± 5%	674572
R45	100Ω		¼W	±10%	671494

TRANSFORMERS, COILS & CHOKES

T1	Multiplier transformer	278359
T2	Modulation transformer	277867
L1	Oscillator anode coil	278356
L2	Multiplier coil	278357
L3	Cathode choke	279051
L4	Multiplier coil	278384
L5	Not used	
L6	P.A. anode coil	278386
L7	Antenna coupling coil	278362/E
L8	Antenna coil	278363/E
L9	Filter choke	279054
L10	Filter coil	278595/3

VALVES

V1	6BH6	860099
V2	6BH6	860099
V3	QQV03-10	860395
V4	QQV03-10	860395
V5	12AX7	860246
V6	EL84	860327

MISCELLANEOUS

FL1		Filter assembly complete		276199/5
RLD	80Ω	Relay 1 changeover		283070
SC		Switch wafer	6-way	283184
SKTD		Socket	9-way	272341

Chassis Assembly Complete Part No.288356 (5820-99-933-1284)

POWER SUPPLY UNIT

Code		CAPACITORS		Part No.
C1		Not used		
C2	50µF	Electrolytic	200V	266632
C3	20 + 20 µF	Electrolytic	400V	266631
C4		Not used		
C5	75µF	Reversible electrolytic	50V	266372
C6 to C9		Not used		
C10	4µF	Electrolytic	350V	266387
C11	3nF	Tubular	350V	669199

		RESISTORS		
R1	300Ω		4W ± 5%	267064
R2	22Ω		$\frac{1}{4}$W ±10%	671486
R3	180Ω		$\frac{1}{2}$W ±10%	670433
R4		Not used		
R5	2.2kΩ		$\frac{1}{4}$W ±10%	671510
R6 to R15		Not used		
R16	47Ω		$\frac{1}{4}$W ±10%	671490
R17	47Ω		$\frac{1}{4}$W ±10%	671490
R18	27Ω		$\frac{1}{4}$W ±10%	671487
R19	180Ω		$\frac{1}{4}$W ±10%	670433

Code		RESISTORS (Contd.)		Part No.
R20		Not used		
R21	60Ω		4W ± 5%	267113
RV1 to RV3		Not used		
RV4	50Ω	Variable resistor		281104

		MISCELLANEOUS		
PLS		Plug assembly	(12 volt)	274943
		Plug assembly	(24 volt)	274944
SKTS		Socket	33-way	705769
RLA	200Ω	Relay	2 changeover	283272
MR1		OA214		709090
MR2		OA214		709090
T1		Transformer		277874
FS1	10A	Fuse		271539
L1		Choke		279827
TS1		Tag strip	9-way	204996
		Tag strip	9-way	204996
		Tag strip	9-way	204996
TS2		Tag strip	8-way	204930
TS3		Tag board	4-way	275067
TS4		Tag strip	9-way	204996
TS7		Tag strip	2-way	272917

INTERCONNECTION DIAGRAM (Fig. 8)

CONTROL UNIT

Code				Part No.
R1	2.2kΩ		$\frac{1}{4}$W ±10%	671510
RV1	100kΩ	Potentiometer		281131
SA		Switch	3 - way (shorting)	283183
SC		Switch	1p 6w	283399
LS		Loudspeaker		285026
ILP1	24V	Indicator lamp		272236
ILP2	24V	Indicator lamp		272236
TS7		Tagstrip	22-way	272909
PLB		Control unit connector	24-way	705776
		Cover for above		270569
		Handset & lead assembly		275229

FUSE & BALLAST UNIT (Fig. 2)

This unit comprises:-

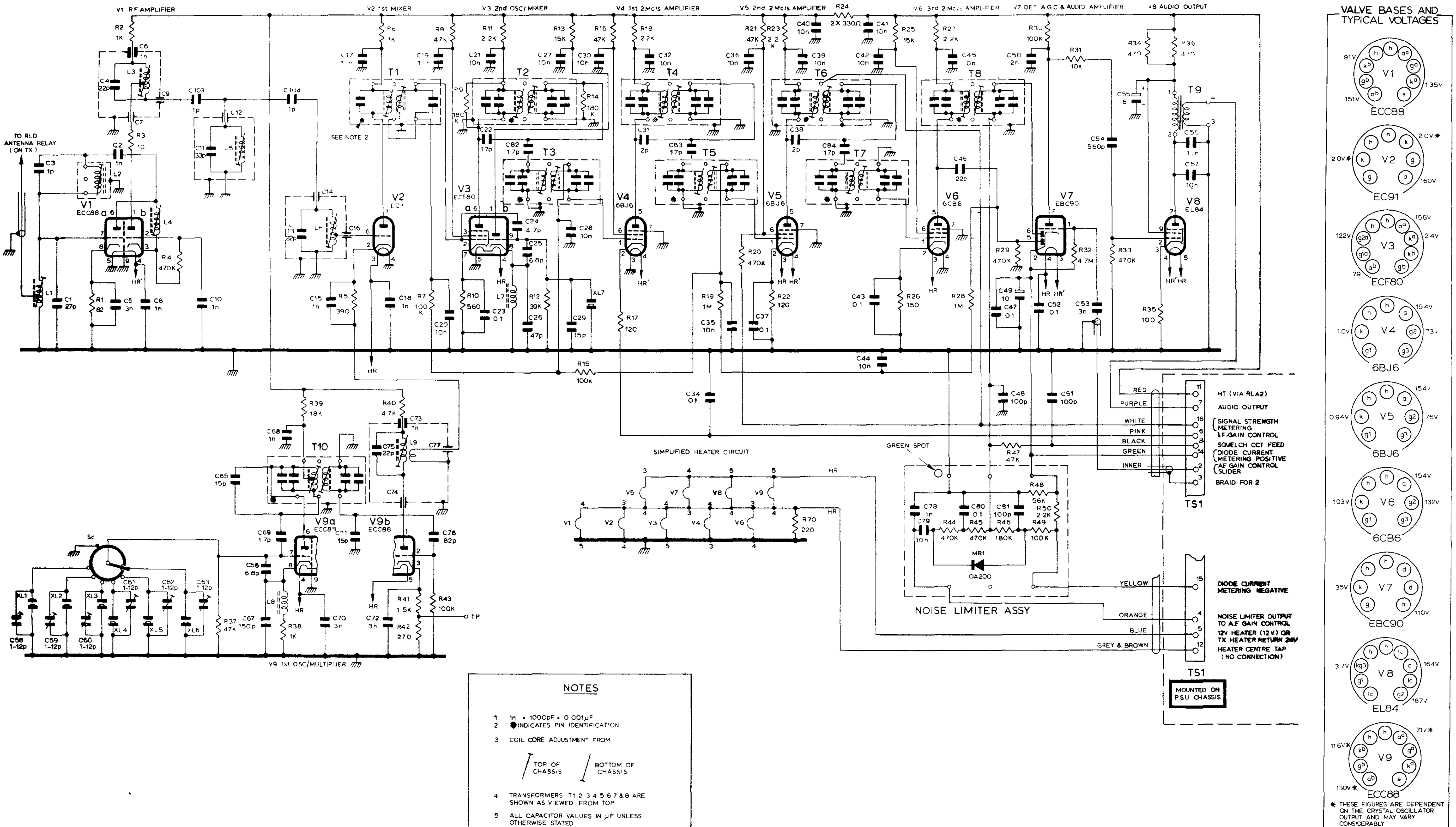
Code		COMPONENT	Part No.
TS		Terminal strip	701714
FS	10A	Fuse	271539
ILP		Lamp (painted black)	248219
		Lamp holder	272263
		Fuse holder	710168

Fuse & Ballast Unit complete 276173

Code		MAIN UNIT		Part No.
RLB	60Ω	Relay 1 make		720126
RV3	25kΩ	Potentiometer		281133
SB		Switch (biased off)		283242
PLA		Co-axial plug		730318
PLC		Plug	6-way	700591
PLD		Plug	9-way	272344
		Cover for above		272345
SKTB		Socket	24-way	705768
SKTC		Socket	6-way	707914
SKTF		Socket	9-way	203959
†VT1		2G210		286069
†VT2		2G210		
		Ledex assembly comprising:-		
L1) L2) SC)		Ledex switch assembly		283198
C1	0.5µF	Tubular	250V	669384
TS6		Tag strip	7-way	271868
RLC	170Ω	Relay 1 make		283074

Ledex Assembly Complete **274880/4**

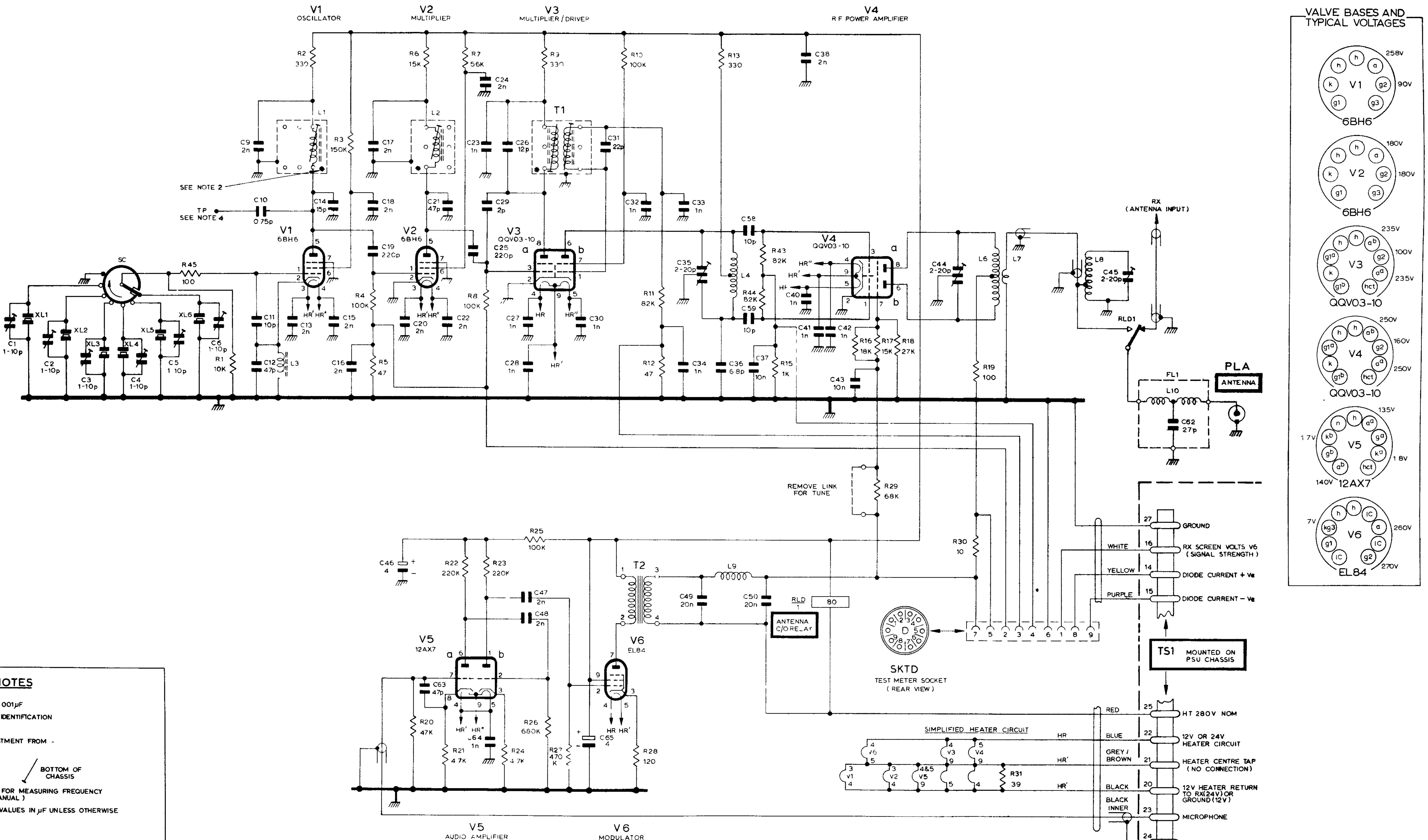
† **denotes matched pair**



NOTES

1. 1n = 1000pF = 0.001μF
2. ● INDICATES PIN IDENTIFICATION
3. COIL CORE ADJUSTMENT FROM TOP OF CHASSIS / BOTTOM OF CHASSIS
4. TRANSFORMERS T1 2 3 4 5 6 7 & 8 ARE SHOWN AS VIEWED FROM TOP
5. ALL CAPACITOR VALUES IN μF UNLESS OTHERWISE STATED

Fig. 5 RECEIVER CIRCUIT DIAGRAM



NOTES

1. 1n = 1000pF = 0.001μF
2. ● INDICATES PIN IDENTIFICATION
3. COIL CORE ADJUSTMENT FROM - TOP OF CHASSIS / BOTTOM OF CHASSIS
4. T.P TEST POINT (FOR MEASURING FREQUENCY SEE SERVICE MANUAL)
5. ALL CAPACITOR VALUES IN μF UNLESS OTHERWISE STATED

5820-99-933-1284
288356

Fig. 6 TRANSMITTER CIRCUIT DIAGRAM

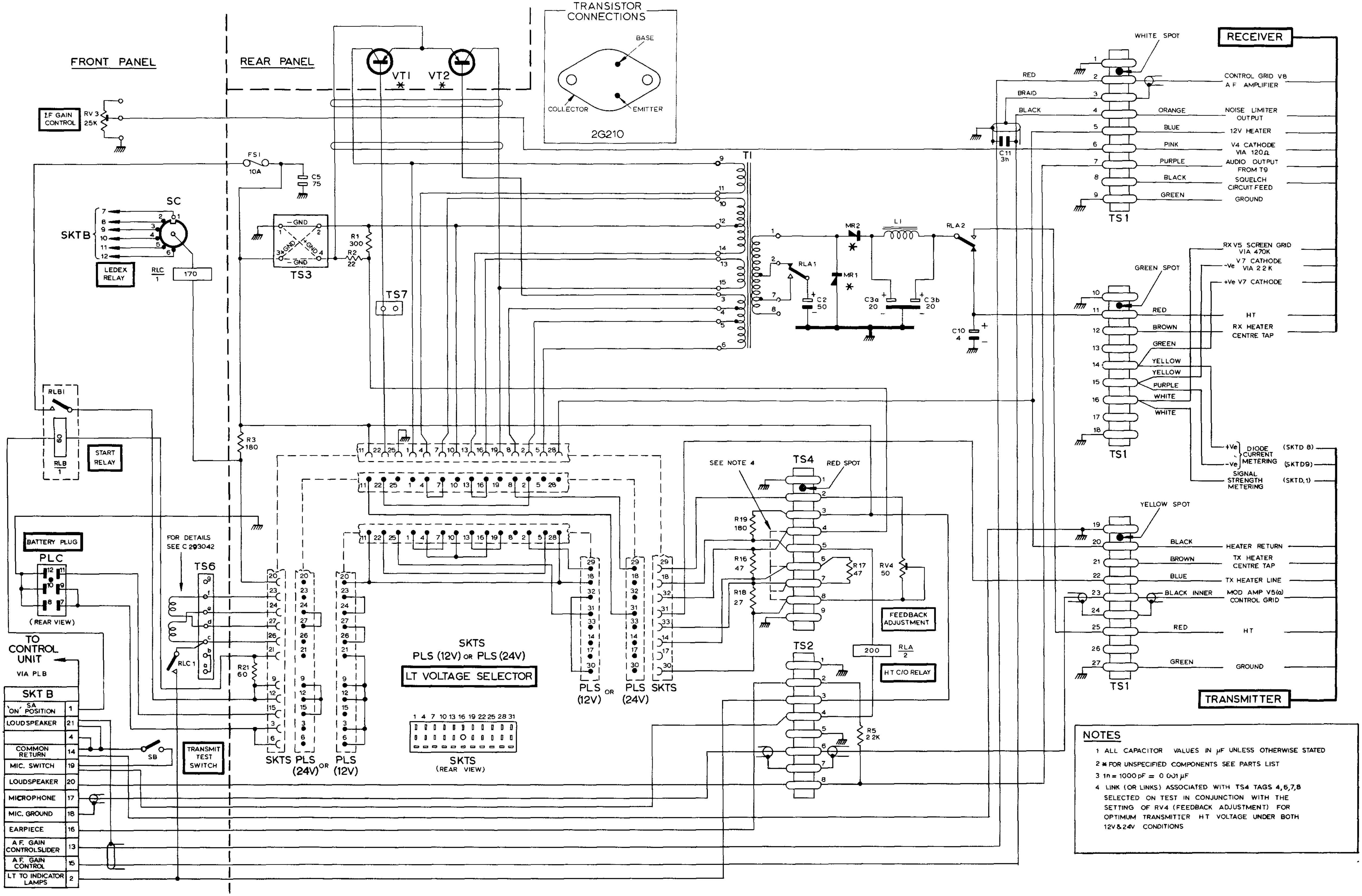
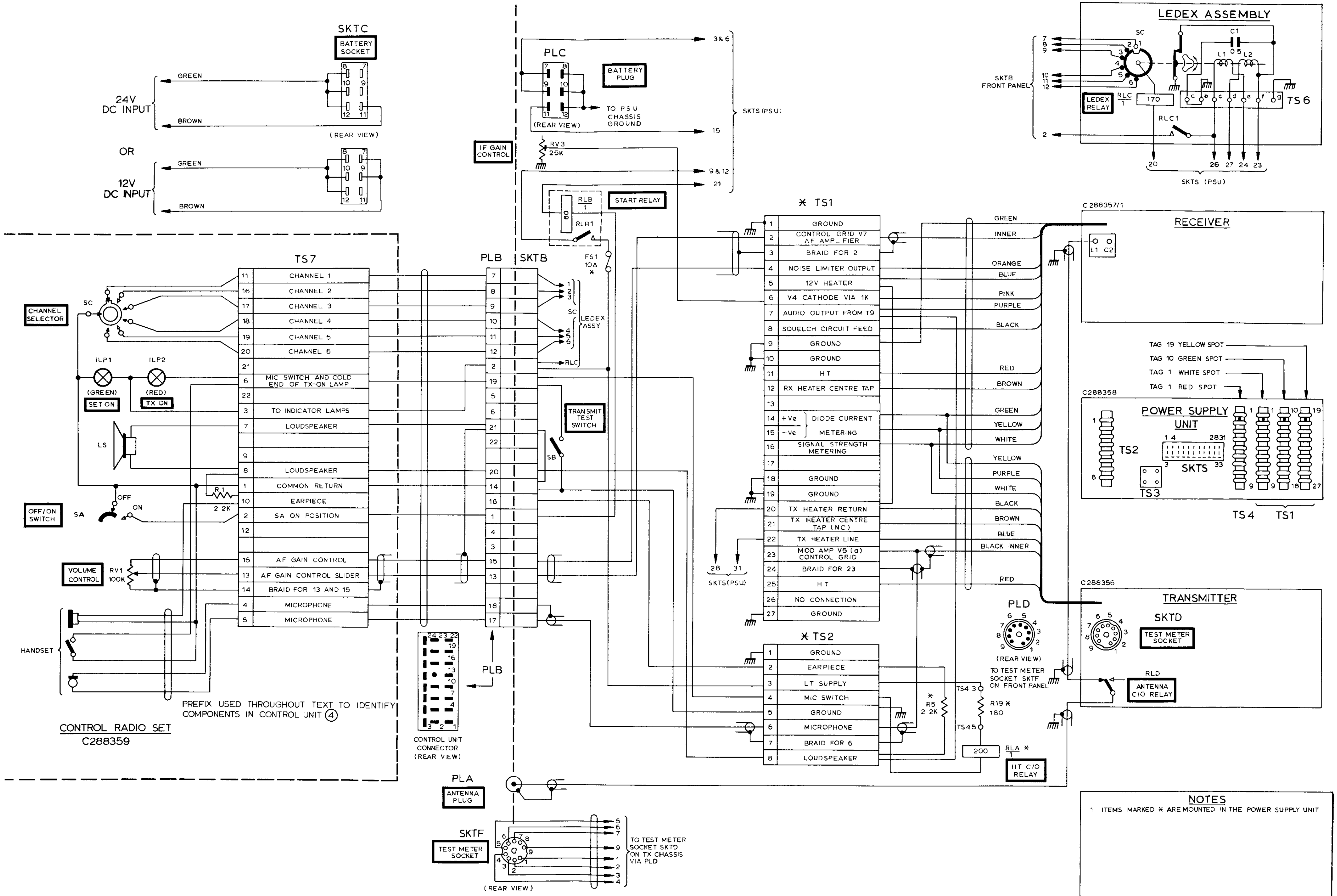


Fig. 7 POWER SUPPLY UNIT CIRCUIT DIAGRAM



10D/23975
293042

Fig. 8 INTERCONNECTION DIAGRAM