

COMMUNICATIONS RECEIVER
TYPE RA. 17

OPERATING AND MAINTENANCE
INSTRUCTIONS

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Front view of Receiver Type RA.17

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THE RACAL COMMUNICATIONS RECEIVER
TYPE R.A.17

PART 1
TECHNICAL DETAILS
AND
OPERATION

PART 1

TECHNICAL DETAILS AND OPERATION

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SECTION 1

DETAILS OF THE RECEIVER

1.1 ELECTRICAL DETAILS

Frequency Range

0.5 to 30 Mc/s covered in 30 bands 1 Mc/s wide. Frequencies below 1 Mc/s will be received with slight degradation of performance.

Tuning

An effective scale length of approximately 145 feet, with substantially constant frequency increments, provides excellent discrimination, *i.e.* 6 inches of scale corresponds to 100 kc/s, calibrated at 1 kc/s intervals.

Calibration

Scale checkpoints at 100 kc/s intervals

Aerial Input

75Ω unbalanced.

I.F. Output

100 kc/s :—

- (a) 75Ω approximately 180mV R.M.S.
- (b) High impedance.

Audio Outputs

	<i>Impedance</i>	<i>Level</i>	<i>Distortion</i>
(a) (i)	3Ω	50mW	5% max.
(ii)	600Ω	3mW	5% „
(iii)	600Ω	3mW	5% „
(iv)	600Ω	3mW	5% „
(b)	600Ω	10mW	5% „

The level of output (b) is not dependent on the setting of the audio gain control but may be separately adjusted.

Power Supplies

100–125 volts or 200–250 volts. 45–65 c/s.
Consumption—85 watts approximately.

1.2 MECHANICAL DETAILS

The receiver is designed for both table or rack mounting. The front panel, normally painted Light Admiralty Grey to British Standard Specification 381C colour 697, has been carefully designed to minimise operator fatigue and combines utility with pleasing appearance.

The dimensions of the $\frac{1}{8}$ -in. thick steel front panel conform with the requirements for mounting in a standard 19-in. rack.

For table mounting, the receiver is fitted in a robust steel cabinet which is slotted at the rear to enable the operator to gain easy access to the mains input socket and fuse, and the termination strips.

A dust cover is provided with both models, thereby keeping the dust intake to a minimum.

The chassis are of cast construction ensuring maximum rigidity and effective electrical screening.

1.3 DIMENSIONS AND WEIGHT

Rack Model

Width	19-in. (48.3 cm)
Height	10 $\frac{1}{2}$ -in. (26.7 cm)
Depth overall	20 $\frac{1}{8}$ -in. (51 cm)
Depth behind panel	18 $\frac{3}{8}$ -in. (47.6 cm)
Weight	67-lb. (30.5 kg)

Table Model

Width	20 $\frac{1}{2}$ -in. (52 cm)
Height	12-in. (30.5 cm)
Depth	21 $\frac{7}{8}$ -in. (55.6 cm)
Weight	97-lb. (44 kg)

SECTION 2

INSTALLATION

After carefully unpacking the receiver, remove the dust cover and make sure that all valves and screening cans are firmly in place and that no packing material remains within the tuning mechanism.

2.1 SUPPLY

Ascertain that the links are set to the appropriate A.C. voltage. Connect the supply to the three pin plug (PL10). Check that the terminals HT.1 and HT.2, situated on the main chassis, are linked when the L.F. Converter Type RA.37 is not used.

2.2 FUSE

Ensure that the rating of the supply fuse is correct, viz.: 2 amp.

2.3 AERIAL

The impedance at the coaxial aerial plug is designed to match into a 75Ω unbalanced transmission line. The connector socket, type Z549028, supplied with the receiver, is intended for use with UR70 or similar cable of nominal diameter $\frac{1}{2}$ -in.

2.4 AUDIO OUTPUTS

(a) The two headphone sockets, situated on the front panel, are connected across the 3Ω speaker.

(b) The following outputs are connected to the terminal strip situated at the rear of the receiver :—

Provision is made for three 600Ω outputs at 3mW.

3Ω at 50mW.

600Ω at 10mW. This output is controlled by the preset A.F. level control independent of the outputs previously described.

2.5 100 kc/s I.F. OUTPUT

Connection consists of two paralleled coaxial plugs. The total load should not be less than 70Ω (*e.g.* with one socket loaded by 75Ω , the other can be used as a high impedance source).

2.6 AUTOMATIC VOLUME CONTROL

The AVC line is brought out to the terminal strip for diversity applications.

SECTION 3

OPERATION

Reference to the controls in this section are in capitals and are in accordance with the engraving adjacent to them.

3.1 TUNING

Switch AE RANGE to the desired frequency band, AE ATTENUATOR to MIN. Set the MEGACYCLE dial to the required integer. (An increase in receiver noise will indicate the correct setting.) Set system switch to CAL, BANDWIDTH to 3 kc/s. Set AF GAIN to mid position and set the KILOCYCLE scale to zero beat at the 100 kc/s point nearest to the desired frequency. Adjust the milled cursor slide to coincide with this point. Switch BFO on and set system switch to CHECK BFO. Adjust BFO NOTE control to zero beat. Rotate system switch to MAN.

Set the KILOCYCLE scale to the required frequency and critically tune for zero beat, in order to centralise the signal within the I.F. pass band. Adjust AE TUNE for maximum signal (or noise). For optimum CW reception, 'off-tune' the BFO to produce an acceptable beat note. Set the AF GAIN to MAX and adjust the output level with the IF GAIN control. For MCW or RT reception, switch BFO off.

The station should now be received assuming that transmission conditions are suitable. Set system switch to AVC if required and set BANDWIDTH for optimum reception.

3.2 GENERAL NOTES

(a) Six bandwidths are provided :—

100 c/s, 3,000 c/s, 750 c/s (crystal),
1.2 kc/s, 3 kc/s and 8 kc/s.

(b) The BFO is arranged to be exactly central on the I.F. amplifier response when the BFO control is set to zero beat with the calibrator. The frequency of an incoming signal may be accurately measured by obtaining zero beat with the BFO control set precisely at 100 kc/s.

(c) AERIAL TUNING. If maximum sensitivity is not required, the aerial need not be tuned except when strong unwanted signals are present. The presence of very strong signals anywhere within the spectrum may cause cross-modulation unless the aerial is tuned. Under these conditions, CARE MUST BE TAKEN TO AVOID TUNING THE INPUT TO THE INTERFERING SIGNALS instead of the signal required. Familiarity with the tuning controls will obviate this.

(d) The AE ATTENUATOR control is intended to enable the operator to reduce the level of all incoming signals when very strong unwanted signals are present and cannot be rejected sufficiently by tuning the aerial, or if the required signal is causing overloading in the early stages of the receiver.

(e) SPURIOUS CHANNEL INTERFERENCE. Should high level unwanted signals cause interference with the desired signal, the spurious response may be eliminated by slight resetting of the MEGACYCLE control without disturbing the desired signal.

(f) The MEGACYCLE scale should be occasionally checked to ensure that its setting is fairly central with respect to the crystal controlled band in use. This is indicated by a 'falling off' of signal, or noise, each side of the correct setting.

(g) The calibration of the KILOCYCLES scale may be checked at 100 kc/s intervals by turning the system switch to the CAL position.

(h) METERING. With the METER switch in the RF level position, the meter reads the signal diode current. In the AF LEVEL position, the Audio Output to lines is monitored. A calibration mark is provided at 10mW.

SECTION 4

BRIEF TECHNICAL DESCRIPTION

This Section briefly describes, with the aid of the block diagram in Figure 1, the basic theory of operation. For a fully detailed explanation of the receiver, Section 5 (Detailed Circuit Description) should be read.

4.1 SIGNAL INPUT

The aerial loading is designed for optimum performance (with a 75Ω unbalanced feeder) when the input circuits are tuned. When the AE RANGE switch is set to WIDE BAND, the input impedance is high unless the AE ATTENUATOR is in use.

4.2 FIRST MIXER

An input signal between 0.98 and 30 Mc/s is fed via an R.F. Amplifier and a low pass filter to the first mixer (M1) where the signal is mixed with the output from a variable frequency oscillator (VFO1). This oscillator covers a frequency range of 40.5 to 69.5 Mc/s. When mixed with the input ranging from 0.98 to 30 Mc/s, an output, in the frequency band 39.5 to 40.5 Mc/s, is obtained from M1. This band of frequencies is acceptable to the first I.F. band pass filter.

4.3 HARMONIC GENERATOR AND MIXER

The output from a 1 Mc/s crystal oscillator is connected to a harmonic generator. The harmonics derived from this stage are passed through a 32 Mc/s low pass filter and mixed with the output from VFO1 in a mixer stage (M4). This mixer provides an output at 37.5 Mc/s which is amplified before being passed through a band pass filter tuned to 37.5 Mc/s with a band width of 300 kc/s.

4.4 SECOND MIXER

The first I.F. is mixed with the 37.5 Mc/s output in mixer (M2) to produce an output in the frequency range 2-3 Mc/s (second I.F.) which is acceptable to a conventional super-heterodyne receiver circuit for final interpolation.

To clarify this method of operation, some examples of dial setting and intermediate frequencies corresponding to various incoming signals are tabulated below :—

Dial Mc/s	Settings kc/s	Signal Freq. f_s Mc/s	VFO.1 f_o Mc/s	Xtal Harmonic nf_c Mc/s	1st I.F. $f_o - f_s$	Het. Freq. $f_o - nf_c$	2nd I.F. $nf_c - f_s$
4	1,000	5.0	44.5	7th	39.5	37.5	2.0
5	0	5.0	45.5	8th	40.5	37.5	3.0
18	500	18.5	58.5	21st	40.0	37.5	2.5

VFO1 drift, within the limits of the 37.5 Mc/s filter bandwidth does not affect the frequency stability of the receiver. A change in this oscillator frequency will alter the frequency within the first I.F. to the same extent and in the same sense as the nominal 37.5 Mc/s signal from M4. Therefore the difference frequency from M2 will remain constant.

4.5 THIRD MIXER

The 2-3 Mc/s receiver is preceded by a three stage, tuned, band pass filter ganged to the variable frequency oscillator (VFO2). This oscillator is temperature compensated and provides, when mixed with the 2-3 Mc/s output of the band pass filter, the third and final intermediate frequency of 100 kc/s.

4.6 THIRD I.F. STAGE

The final I.F. Amplifier stages are preceded by a crystal lattice filter and L/C filter network which provide six alternative bandwidths. Separate signal and AVC diodes are employed and alternative switched time constants give the optimum conditions for telegraphy and telephony reception. An additional I.F. amplifier is incorporated to give an independent output at 100 kc/s.

4.7 A.F. STAGES

Two independent audio frequency stages are provided, giving separate level control for line output and for headphone sockets and internal loud speaker.

4.8 CRYSTAL CALIBRATOR

A crystal calibrator unit is incorporated to enable the scale of VFO2 to be checked at 100 kc/s intervals. These check points are obtained from a regenerative divider controlled by the 1 Mc/s crystal oscillator.

SECTION 5

DETAILED CIRCUIT DESCRIPTION

Reference should be made to the theoretical circuit diagram at the end of this handbook.

5.1 AERIAL CIRCUIT

A 75Ω unbalanced aerial source is connected through a five position attenuator covering an attenuation range of 0 to 40 dB to the tuned R.F. amplifier. Switch S2 selects wideband operation or any one of the six aerial coils L4-9 for tuned operation. These aerial coils may be aligned by means of dust iron cores. The aerial is tuned by a capacitor C18 which is switched out of circuit in the wideband position.

5.2 R.F. AMPLIFIER

C28, the coupling capacitor, feeds the incoming signals through the grid stopper R25 to the control grid of the R.F. amplifier (V3) which employs a high gain low noise pentode so that sufficient gain is obtained over the whole frequency range. The capacitors C40, C41, C49 and C57 ensure that the cathode is adequately decoupled over the wide frequency range.

5.3 30 Mc/s LOW PASS FILTER

The amplified signal is passed to a 30 Mc/s low pass filter which has a substantially flat response over the frequency range. L27, C47 and R28 constitute the first 'L half-section' of the filter. The signal is then fed at low impedance (680Ω) through the coupling capacitor C74 and the grid stopper R45 to the control grid of V7, the first mixer stage. The input capacitance of V7 forms the capacitance to ground between L15 and L17, required to complete the filter network.

Note : This capacitance is not critical, therefore no adjustment will be necessary should V7 be changed.

5.4 FIRST VARIABLE FREQUENCY OSCILLATOR (VFO1)

This circuit comprises a cathode coupled Hartley oscillator stage (V5) that may be continuously varied over the frequency range of $40 \cdot 5 - 69 \cdot 5$ Mc/s. The frequency determining components are an inductance L36 and a variable capacitance C76. Alignment is accomplished by adjusting the aluminium core of L76 and the trimming capacitor C77. The variable capacitor C76 is coupled to the Mc/s dial which is calibrated from 0 to 29 Mc/s. The anode load consists of L20, a compensating inductance which is wound on a 470Ω resistor R18. The Oscillator is coupled via C85 to the signal grid of the first mixer stage V7 and also via C42 to the control grid of the harmonic mixer V4.

Note : The Mc/s dial calibration may be affected if V5 is changed. The necessary correction may be made by adjusting C77 with the Mc/s dial set to 29 Mc/s.

5.5 FIRST MIXER (M1)

The outputs from the 30 Mc/s low pass filter and the variable frequency oscillator VFO1 are fed to the signal grid of the mixer stage (V7) which produces a signal at 40 Mc/s. The signal is then passed to a 40 Mc/s band pass filter which forms the anode load of this stage.

5.6 40 Mc/s BAND PASS FILTER

The 40 Mc/s band pass filter consists of eight over-coupled tuned circuits connected in cascade and is tuned by the trimming capacitors C21, C33, C43, C53, C61, C70, C79 and C88. This filter which has a pass band of $40 \text{ Mc/s} \pm 650 \text{ kc/s}$ ensures that only the required 1 Mc/s spectrum of signals is passed to the second mixer stage. This filter is deliberately set to a slightly wider pass band than is theoretically required, to allow for possible drift in VFO1.

5.7 1 Mc/s CRYSTAL OSCILLATOR

The frequency of the crystal oscillator (V1) (which is a cathode coupled Colpitts circuit) may be set precisely to 1 Mc/s by adjusting the trimming capacitor C2. The anode coil L2 which is adjusted to 1 Mc/s by means of a dust iron core is electron coupled to the oscillator. The fixed capacitors C9, C10 and C11 complete the tuned circuit. The output from this circuit is fed to the harmonic generator and also the coaxial plugs PL2 and PL3.

5.8 HARMONIC GENERATOR

The 1 Mc/s signal is fed through the coupling capacitor C8 to the control grid of the harmonic generator (V2). Megacycle harmonics are produced in this stage by operating the valve in a non-linear state. A suitable bias potential is produced due to the time constant of C8 and R13. The screening grid is not de-coupled.

5.9 32 Mc/s LOW PASS FILTER

The megacycle harmonics are fed through a 32 Mc/s low pass filter circuit to prevent harmonics other than those required from passing to the harmonic mixer (V4). Some control over the cut off frequency is provided by C7 which is adjusted to equalise the output from the filter at the harmonic frequencies corresponding to 28 and 29 Mc/s on the megacycle dial.

5.10 HARMONIC MIXER (M4)

The outputs from the 32 Mc/s low pass filter and VFO1 are mixed in the harmonic mixer (M4) by applying the filtered megacycle harmonics to the suppressor grid and the output from the VFO1 to the control grid. The 37.5 Mc/s output is selected by the tuned anode load, consisting of a fixed capacitor C50 and an inductance L28 which may be adjusted by means of a dust iron core, and coupled by C51 to V6. R36 is a grid stopper.

5.11 2 STAGE 37.5 Mc/s AMPLIFIER (1)

The anode load of V6 is a tuned circuit consisting of a fixed capacitor C67 and an inductance L33 which is tuned to 37.5 Mc/s. Frequency adjustment is by the dust iron core in L33. This stage feeds the amplified signal via C68 to the following stage V8. The 37.5 Mc/s signal is then passed to the 37.5 Mc/s band pass filter. The anode load of this stage is provided by this filter.

5.12 37.5 Mc/s BAND PASS FILTER

The 37.5 Mc/s band pass filter consists of eight under-coupled tuned circuits arranged in cascade. These filter sections may be tuned by C24, C35, C45, C55, C63, C72, C81 and C90 respectively. This filter which has a pass band of 300 kc/s allows for possible drift in VFO1. The narrow pass band and high rejection to frequencies outside the pass band prevent spurious signals from reaching the second mixer stage (V9).

5.13 37.5 Mc/s AMPLIFIER (2)

The filtered 37.5 Mc/s signal is further amplified by V10 before being passed to the second mixer stage (V9). To prevent interaction between the 40 Mc/s Band Pass Filter and the 37.5 Mc/s tuned circuit (L50 and C113) and to enable either circuit to be adjusted without affecting the other, a balancing circuit is included which is shown in a simplified form in Figure 2.

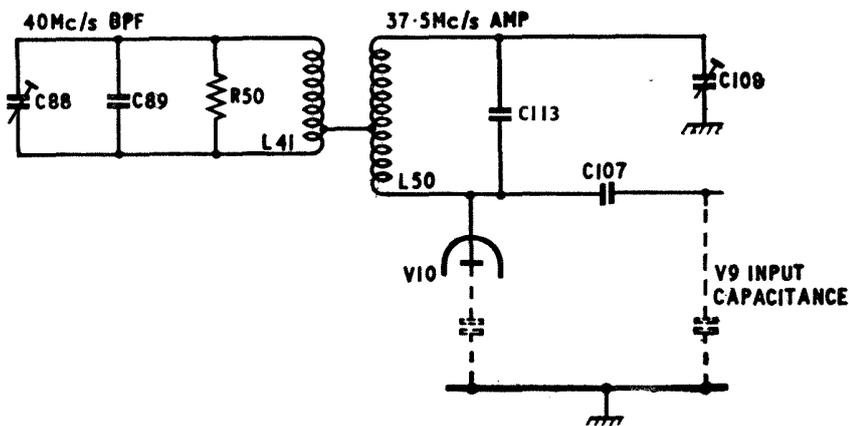


FIGURE 2

The 40 Mc/s signal is introduced into the 37.5 Mc/s tuned circuit at a point of zero R.F. potential since L50 is centre tapped and C108 is adjusted to be equal to the total of the capacitances of V10 anode to ground, C107 and the input capacitance of V9.

Notes : The anode load of V10 is adjusted to 37.5 Mc/s by adjusting the dust iron core in L50.
The balancing circuit will not be affected if V9 or V10 is changed.

5.14 SECOND MIXER (M2)

This mixer (V9) produces the second intermediate frequency of 2-3 Mc/s by mixing the 40 Mc/s I.F. and the 37.5 Mc/s signal, in V9. The anode choke L51 and the tuned circuit formed by C116 and L52 removes the 37.5 Mc/s frequency and other H.F. components, so that only the second I.F. is passed to the 2-3 Mc/s band pass filter preceding the third mixer stage. The series tuned circuit is tuned to 37.5 Mc/s by adjusting the dust iron core in L52.

5.15 2-3 Mc/s TUNED BAND PASS FILTER

This filter (which is ganged to the second Variable Frequency Oscillator) consists of three tuned band pass filter sections as follows :—

- An inductance L59 and a variable capacitor C129. A fixed capacitor C127 and a trimmer C128 complete this section. L59 is tapped to provide an input connection via the coaxial plug PL5 so that the 2-3 Mc/s low impedance output of the L.F. Converter Type RA.37 may be connected.
- A variable inductance L58 is connected in series with a coupling coil L60 and a variable capacitor C126. A fixed capacitor C124 and a trimmer C125 are connected in parallel with C126.
- An inductance L57 and a variable capacitor C123 in parallel with a fixed capacitor C121 and a trimmer C122 form the final section.

The correct bandwidth is obtained by adjusting the dust iron cores and the trimming capacitors C128, C125 and C122 respectively.

5.16 THIRD MIXER

The output from the 2-3 Mc/s band pass filter is directly coupled to the signal grid of a pentagrid valve V11 and second VFO output (2.1 to 3.1 Mc/s) is fed through the coupling capacitor C143 to the oscillator grid. The resistor R68 completes the D.C. path from this grid to earth. The 100 kc/s output, obtained from this mixer stage, is then fed via PL6, SK6 and a screened cable to the crystal filter unit.

Note : The resistors R67 and R72 are grid stoppers.

5.17 SECOND VFO

The second Variable Frequency Oscillator, covering a frequency range of 2.1 to 3.1 Mc/s, is an electron coupled Hartley circuit. The oscillation frequency is determined by an inductance L55 (which can be adjusted by means of an aluminium core), a fixed capacitor C137, a temperature compensating capacitor C138, a trimming capacitor C136 and a variable capacitor C139 which is ganged to the tuned Band Pass Filter. The kilocycles scale which is calibrated between 0 and 1,000 kc/s is coupled to this ganged capacitor. The output from VFO2 is resistance capacity coupled (R76 C143) to the third mixer stage (V11).

5.18 CRYSTAL FILTER

Six alternative switched I.F. bandwidths are available as follows :—

100 c/s	} Crystal.	1.2 kc/s	} L/C.
300 c/s		3.0 kc/s	
750 c/s		8.0 kc/s	

In the crystal positions the third mixer anode is connected to L48 in the crystal filter. L47 and L49 provide a balanced output which is tuned by capacitors C109 and C110. In the 100 c/s position, the balanced output is connected through the crystals XL2 and XL5 to the first tuned section of the 100 kc/s L/C filter. The differential trimmer C118 is the phasing control for this bandwidth. XL3, XL6, C119 and XL4, XL7, C120 form similar circuits for 300 c/s and 750 c/s respectively, but damping resistors (R64 and R63) are connected across the tuned circuits to obtain the required pass band.

In the three L/C bandwidth positions the crystal filter is by-passed and the anode of the third mixer valve (V11) is connected directly to the first tuned section of the 100 kc/s L/C filter.

5.19 100 kc/s L/C FILTER

(i) L/C Bandwidths

This filter consists of four tuned circuits arranged in cascade. In the L/C bandwidth positions, the signal is fed to the tuned circuit formed by L61 and the combination of the capacitors C145, C146, C146A and C147. The second section consists of L62 and L63 in series with C152, C152A and C153. The third section is identical to the preceding section and consists of L64 and L67 in series with C157, C157A and C158. The final section, consisting of L68 and L71 in series with C161 and C162, is damped by the series resistors R86, R87 or R88 according to the bandwidth. In the L/C positions the output is taken from a capacitive divider formed by C161 and C161A with C170, to equalise the gains in the L/C and crystal bandwidth positions.

The L/C bandwidths are obtained by varying the degree of coupling between each section of the filter in addition to the damping resistors in the final stage. The capacitor C175 is included to compensate for the effective reduction of the input capacitance of V14, appearing across the tuned circuit, when switching from crystal to L/C positions.

In early models (up to Serial No. 510) C146A, C152A, C157A and C161A are not fitted.

(ii) Crystal Bandwidths

To maintain the input capacitance of the L/C filter, in the crystal positions, a trimming capacitor C148 is switched into circuit. This trimmer is adjusted to be equal to the output capacitance of V11 and the screened cable.

In the crystal bandwidth positions, the L/C filter is operating in its narrow bandwidth position, *i.e.* 1.2 kc/s.

Note : The damping resistors R77 and R80 are disconnected except during filter alignment.

5.20 FIRST 100 kc/s I.F. AMPLIFIER

The output from the L/C filter is passed through a coupling capacitor C164 to the control grid of the pentode amplifier valve V14. This grid is returned via R96 to the AVC line which is filtered at this point by R102 and C173. The screen potential is derived from a potential divider formed by R93, R94 and R97. This stage is coupled to the second I.F. Amplifier and the I.F. output stage by a double tuned transformer having an 'over-coupled' characteristic.

5.21 SECOND 100 kc/s I.F. AMPLIFIER

The signal from the first I.F. transformer is fed through the grid stopper R114 to the control grid of the second I.F. Amplifier. The control grid of this valve is returned to the AVC line via L73 and L74. H.T. is supplied to the screen via the dropping resistor R113 and is de-coupled by C181. The anode load is a tuned circuit consisting of L77, C192 and C191. This circuit is heavily damped by R112. The secondary winding L78 and L79 is tuned by C195A and C195B with R120A as a damping resistor. The output is fed to the diode detector anode. In early models (up to Serial No. 510), the secondary winding of this I.F. transformer is not tuned.

5.22 DIODE DETECTOR

The low potential end of L79 is connected through the R.F. filter (C209, R128, C210, R129 and C211) to the diode load R130. With the meter switched to R.F. level the meter indicates the detector diode current. The resistor R131 is included to complete the diode detector circuit when the meter is switched out of circuit.

5.23 NOISE LIMITER

The noise limiter diode (pins 2 and 5 of V21) is connected in a series circuit to operate at approximately 30 per cent. modulation. Its operation is explained with reference to Figure 3.

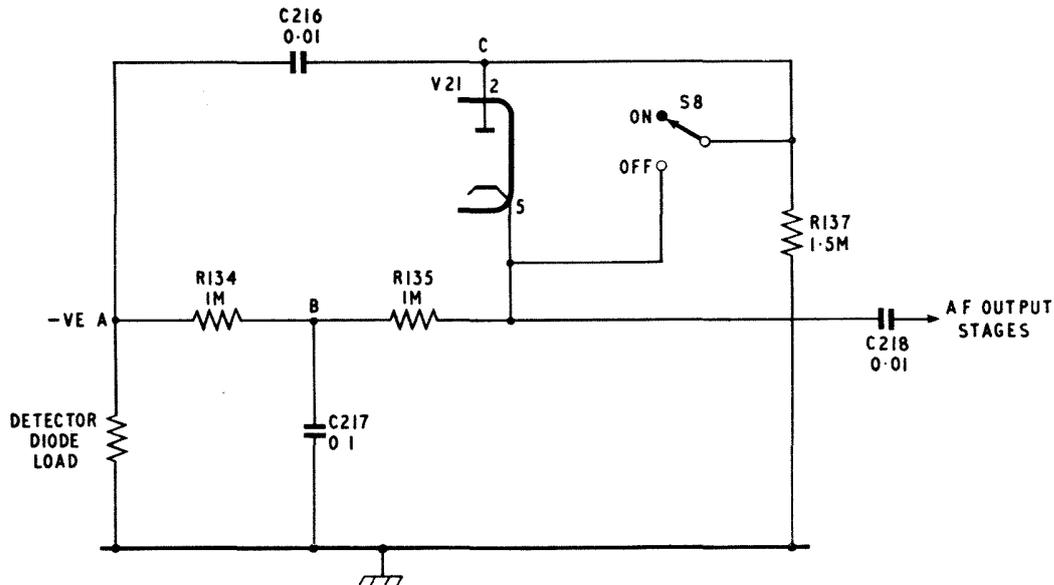


FIGURE 3

The D.C. path from point A is through R134, R135, the diode and R137. The A.F. signal path from the detector diode load is through C216, the diode and C218 when S8 is open. In the presence of a signal, a negative potential varying with the depth of modulation, will be developed at point A thus causing the diode to conduct. The negative potential at B, will be lower than that at A and will be maintained at a constant level due to the long time constant of R134 and C217. R135 allows the cathode potential to vary in sympathy with the modulation provided the modulation depth does not exceed 30 per cent. The potential appearing at the cathode of the Noise Limiter diode therefore consists of a steady negative potential with the modulation superimposed. When noise impulses corresponding to high modulation peaks appear at point A and via C216 at point C, the voltage across the diode changes sign thereby causing the diode to stop conducting and open circuit the A.F. signal path. S8 renders the limiter inoperative.

5.24 AVC AND TC DIODE

The signal appearing at the anode of V16 is passed through the coupling capacitor C193 to the anode of the AVC diode. The diode load is formed by R116. A positive potential derived from R120, R121 and R122, supplies the required AVC delay voltage to the cathode of this diode. When the AVC switch is in the SHORT position and the System switch set to a position in which the AVC is operative, *i.e.* AVC, CAL, or check BFO, the anode of the AVC diode is connected to the AVC line via L81 and R127. The choke L81 is tuned by C203 to a frequency slightly below 100 kc/s so that it presents a small capacitance at 100 kc/s, thus R127 is prevented from shunting the diode load. When the AVC switch is in the LONG position the AVC de-coupling capacitors C182 and C173 are charged through R127, the Time Constant diode and R119. When the signal level falls, the capacitors C182 and C173 discharge through R119, R118, R127 and L81 into the diode load resistor R116. The AVC potential is brought out via R123 to the tag strip at the rear of the receiver for external use if required. With the system switch set to the manual position, the AVC line is connected to the I.F. gain control RV1, thus the gain of the 100 kc/s amplifiers may be varied by adjusting the negative potential applied to the AVC line.

In early models (up to Serial No. 510), the I.F. gain control is out of circuit when the AVC is operative.

5.25 AUDIO OUTPUT

Audio frequencies are applied to the control grid of V22 via RV2, audio gain control. The output transformer (T2) provides four separate outputs as follows : 50mW 3 Ω , and three windings supplying 3mW. at 600 Ω .

The headphone jacks JK1 and JK2 and the internal loudspeaker (which may be switched out of circuit by operating S11) are connected across the 3 Ω winding.

5.26 A.F. LINE OUTPUT

The audio frequencies are also applied to the grid of V23 via RV3, the A.F. level control ; this control presets the level from the output transformer T3. The transformer provides a 10mW. output at 600Ω which is suitable for direct connection to landlines. A bridge rectifier MR3 is connected across the output via R142 and R143. The meter may be switched across the rectifier circuit so that the operator can monitor the A.F. output.

Note : The red line on the meter scale corresponds to 10mW. output into 600Ω.

5.27 BEAT FREQUENCY OSCILLATOR

The Beat Frequency Oscillator (V19) employs an electron coupled Hartley circuit. The oscillation frequency is determined by a fixed inductance L82 and a variable capacitor C200 in parallel with C202 and C201. The trimming capacitor C201 is adjusted to produce an output frequency of precisely 100 kc/s when the Beat Frequency Oscillator frequency control is set to zero. Bias is applied to this valve by C199 and R125.

The BFO output is coupled to the diode detector anode via C215. The BFO is supplied with H.T. via S7 except when the System switch is in the CAL or STAND-BY positions.

5.28 100 kc/s I.F. OUTPUT

The control grid of V17 is connected to the secondary of the first 100 kc/s I.F. transformer which feeds the stage with the AVC potential as well as the 100 kc/s signal. The screen resistor R108 and the cathode bias resistor R115 are of the same values as used in the second 100 kc/s I.F. Amplifier, hence the AVC characteristic of this stage is similar to that of the main receiver. The anode load resistor R109 feeds the auto transformer L76 via the blocking capacitor C189. This transformer provides an 70Ω output at PL8 and PL9 for external applications.

Note : PL8 and PL9 are connected in parallel, therefore only one 100 kc/s output is available at 75Ω, and to avoid a mis-match the other connection should be made at high impedance.

5.29 CRYSTAL CALIBRATOR

The crystal calibrator, controlled by the 1 Mc/s crystal, feeds signals at 100 kc/s intervals to the signal grid of the third mixer stage to provide calibration check points.

The 1 Mc/s signal, fed through PL2, is connected through SK2 and the grid stopper R83 to the first grid of the mixer valve V13. The anode load consists of a 100 kc/s tuned circuit (L70 C167) and is coupled to the control grid of V15 through the capacitor C168. The anode load of V15 (L75 C177) is tuned to 900 kc/s and is coupled via C178 to the third grid of V13. V15 is heavily biased so that it functions as a frequency multiplier.

An output of 900 kc/s, appearing across the tuned circuit (L75 C177) is coupled to Grid 3 of V13 thereby producing a difference frequency of 100 kc/s relative to the 1 Mc/s input. The 100 kc/s output appears across the anode tuned circuit (L70 C167) and is fed to the control grid of V15. The ninth harmonic is selected in turn by the anode tuned circuit (L75 C177) of V15 and fed back to the third grid of V13 to provide the beat frequency of 100 kc/s with the 1 Mc/s input. This crystal-controlled regenerative circuit is thus self-maintaining. The 100 kc/s output is obtained from the coil L69 which is mutually coupled to L70 and fed via the octal plug (PL7) to the third mixer V11.

5.30 POWER SUPPLIES

The conventional bi-phase half wave rectifier circuit, employing a capacitive input filter, provides 240 volts H.T. supply. A 165Ω resistor R124 is connected between the negative line of the power supply and earth, thus providing a 25V negative D.C. supply for gain control purposes. The resistor R136 has been included to limit the peak current of V20 to a safe value. To remove mains-borne interference the capacitors C224 and C225 are included. All valve heaters and the scale illuminating lamp are supplied from the 6.3V 7A winding. The mains transformer T1 has input taps at 0, -5, -10, 110, 125, 210, 230 and 250 volts and is connected to the supply via F1 (2A), S10 and a three-pin Mk. IV plug and socket (PL10, SK10).

5.31 SYSTEM SWITCH

The following conditions exist for each setting of the System Switch. The link on the H.T. Adaptor terminals is assumed to be in position.

- (a) **STAND BY** S5A disconnects the H.T. from all stages and connects R119A across the H.T. as a compensating load. In early models (up to Serial No. 660) R119A is not fitted.
- (b) **MANUAL**
 - (i) The H.T. is passed through S5A, S5B and S5C to all stages except the calibrator unit.
 - (ii) S5F connects H.T. to the BFO when S7 is switched on.
 - (iii) The AVC line is disconnected from the AVC diode by S5D and connected to the I.F. gain control (RV1) by S5E.
- (c) **AVC**
 - (i) (b) (i) and (b) (ii) applicable.
 - (ii) S5E renders the I.F. gain control inoperative.
 - (iii) S5D connects the AVC line to the AVC diode.

- (d) **CAL** (i) H.T. is applied via S5A, S5B and S5F to all stages except :—
The R.F. Amplifier (V3)
The First VFO (V5)
The First Mixer (V7)
The Second Mixer (V9)
The Final 37·5 Mc/s Amplifier (V10)
The BFO.
(ii) (c) (ii) and (c) (iii) applicable.
- (e) **CHECK BFO** (i) (d) (i) applicable except that H.T. is also applied to the BFO.
(ii) (c) (ii) and (c) (iii) applicable.

PART 2
MAINTENANCE

PART 2

MAINTENANCE

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WARNING

The Receiver will, under normal conditions, remain in alignment over an extremely long period of time, consequently **ALL POSSIBILITY OF OTHER CAUSES OF LOW SENSITIVITY SHOULD BE ELIMINATED BEFORE RE-ALIGNMENT IS CONSIDERED**, and should then only be undertaken by order of the Engineer responsible for the maintenance of the equipment.

Should it become necessary to re-align any part of the receiver only a very small angular adjustment of the trimmers should be necessary unless units have been changed.

TEST EQUIPMENT REQUIRED FOR MAINTENANCE

The following items of test gear are required to carry out the maintenance described in this part of the handbook :—

- (a) Valve Voltmeter reading up to 5·0V at frequencies up to 70 Mc/s
- (b) Signal Generator capable of operating on fundamental frequencies up to 40 Mc/s
- (c) Digital Frequency Meter measuring frequencies at least up to 100 kc/s
- (d) Multi-Meter measuring A.C. and D.C. voltages up to 500V with resistance of 20,000 Ω per volt
- (e) Heterodyne Wavemeter measuring 40–70 Mc/s
- (f) Coupling Aids : viz. 0·1 μ F capacitor, 4·7k Ω resistor and 12pF trimmer capacitor.

Note : Major users of the RA.17 Receiver are advised to obtain factory-type test jigs for alignment of the various units. Details of these jigs and specially designed test gear will be supplied on request. A supplement to Section 6 (Alignment Procedures) describing the employment of this test gear can be made available to such users.

SECTION 1

SPURIOUS RESPONSES

1.1 ORIGINS OF SPURIOUS RESPONSES

In a highly sensitive Receiver, precautions against internally generated spurious responses are essential. To this end, the various sections of the Receiver have been carefully screened and the power supplies filtered.

Any reduction in the screening efficiency or the failure of any filtering component may result in spurious signals being generated. It is therefore essential to ensure that the bonding surfaces are clean and that all securing screws are tight. Spurious responses in the Receiver may occur from the following main causes :—

- (a) 37·5 Mc/s break-through from the second mixer V9 to the third mixer V11
- (b) Break-through of 1 Mc/s harmonics
- (c) Break-through of BFO harmonics
- (d) Responses at 2·550 and 3·050 Mc/s due to second VFO break-through.

1.2 CHECKS FOR SPURIOUS RESPONSES

Spurious responses are measured relative to receiver noise in the following manner :—

When a response is located, the Receiver is de-tuned from it just sufficiently to render the beat note inaudible. The I.F. gain is then adjusted to provide a convenient noise reference output (1mW) and the Receiver re-tuned to the spurious signal for maximum output. The dB rise in audio output is a measure of the spurious signal level relative to Receiver noise.

Standard conditions of test :

- No connection to aerial socket
- System switch to MAN
- IF GAIN at MAX
- BFO on
- 3 kc/s bandwidth
- AERIAL ATTENUATOR at MIN.

(a) 37·5 Mc/s Break-through to Third Mixer

Switch AE RANGE to WIDEBAND.

This response will be indicated as a beat note which varies rapidly in frequency with respect to the Kilocycles scale, *i.e.* a change of 1 kc/s on the scale results in a much larger change in the note. It will also move along the Kilocycles scale if the Megacycles dial is adjusted slightly. This response may be eliminated by adjusting the 37·5 Mc/s trap (L52 at second mixer anode).

(b) 1 Mc/s Harmonic Break-through

Switch AE RANGE to WIDEBAND.

1 Mc/s break-through responses appear at 0 and 1,000 on the Kilocycles scale at each setting of the Megacycles dial and are generally more prominent with wideband input. If the response is dependent upon the setting of the Megacycles dial, the 1 Mc/s spectrum is probably breaking through to the first mixer stage. If the response is independent of the Megacycles dial setting, it is due either to break-through of the second and/or third harmonic to the second or third mixer stage. Remove second mixer valve to eliminate this stage and so determine in which stage the break-through occurs.

(c) First VFO Harmonics

Spurious responses may occur at 4·5, 5·5 and/or 17·5 Mc/s, if C42A and/or C194A are open-circuit. These responses are caused by the harmonics of the first VFO breaking through to the Second Mixer stage and beating with the harmonics of the 37·5 Mc/s heterodyne voltage.

(d) BFO Harmonics

These responses may be detected at 100 kc/s intervals between 1 and 1·5 Mc/s when the BFO is set to 100 kc/s and the Receiver aerial input is tuned.

(e) Second VFO Break-through

Responses may occur at 2·550 and 3·050 Mc/s, with tuned aerial input.

Ascertain that the first and second VFO are not in contact, that the VFO chassis are well bonded to the main chassis and the fixing screws are tight.

Notes : A failure in any one of the following capacitors C66, C92, C96, C97, C98, C103 or C104 may result in increased 'end of band' responses. These responses will disappear when the Megacycle dial is de-tuned.

The failure of C117, C154, C155, C207, C208 or C214 can result in increased 'end of band' responses, or BFO Harmonic break-through. De-tuning the Megacycles dial will have no effect.

SECTION 2 VALVE DATA

Details of valves used in the Receiver are shown below. A key to the valve base connections is provided in Figure 4. The location of valves in the Receiver is shown in Figure 5.

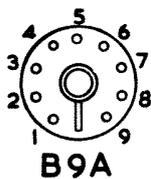
2.1 VALVE CONNECTIONS

Pin No	CV138	CV140	CV378	CV453	CV454	CV2209	CV3998
	EF91	EB91	GZ33	EK90	EF93	6F33	E180F
1	Grid 1	Cathode 1	N.C.	Grid 1	Grid 1	Grid 1	Cathode
2	Cathode	Anode 2	Heater	Cathode Grid 5	Grid 3	Cathode	Grid 1
3	Heater	Heater	Omitted	Heater	Heater	Heater	Cathode
4	Heater	Heater	Anode	Heater	Heater	Heater	Heater
5	Anode	Cathode 2	Omitted	Anode	Anode	Anode	Heater
6	Grid 3 Screen	Screen	Anode	Grid 2 Grid 4	Grid 2	Grid 3 Diode	I.C.
7	Grid 2	Anode 1	Omitted	Grid 3	Cathode	Grid 2	Anode
8			Heater				Grid 3 Screen Grid 2
9							Grid 2 B9A
Base	B7G	B7G	Int. Octal	B7G	B7G	B7G	

2.2 VALVE COMPLEMENT AND TYPICAL D.C. VOLTAGES

<i>Cct</i>		<i>CV</i>					<i>Cct</i>
<i>Ref.</i>	<i>Function</i>	<i>No.</i>	<i>Equivalent</i>	<i>Anode</i>	<i>Screen</i>	<i>Cathode</i>	<i>Ref.</i>
V1	Crystal Oscillator	138	EF91	190 (5)	190 (7)	41 (2)	V1
V2	Harmonic Generator	138	EF91	210 (5)	80 (7)	—	V2
V3	R.F. Amplifier	3998	E180F	190 (7)	150 (9)	1·0 (1)	V3
V4	Harmonic Mixer	2209	6F33	220 (5)	160 (7)	2·5 (2)	V4
V5	First VFO	138	EF91	210 (5)	210 (7)	—	V5
V6	37·5 Mc/s Amplifier	138	EF91	220 (5)	150 (7)	1·5 (2)	V6
V7	First Mixer	3998	E180F	210 (7)	210 (9)	1·0 (1)	V7
V8	37·5 Mc/s Amplifier	138	EF91	220 (5)	200 (7)	1·8 (2)	V8
V9	Second Mixer	3998	E180F	200 (7)	150 (9)	1·0 (1)	V9
V10	37·5 Mc/s Amplifier	138	EF91	220 (5)	220 (7)	2·0 (2)	V10
V11	Third Mixer	453	EK90	210 (5)	80 (6)	1·3 (2)	V11
V12	Second VFO	138	EF91	60 (5)	170 (7)	—	V12
V13	Calibrator	453	EK90	210 (5)	80 (6)	2·0 (2)	V13
V14	First I.F. Amplifier	454	EF93	200 (5)	65 (6)	0·7 (7)	V14
V15	Calibrator	454	EF93	210 (5)	120 (6)	6·0 (7)	V15
V16	Second I.F. Amplifier	454	EF93	200 (5)	100 (6)	1·6 (7)	V16
V17	I.F. Output	454	EF93	160 (5)	110 (6)	1·6 (7)	V17
V18	AVC and TC	140	EB91	—	—	27 (1)	V18
V19	BFO	138	EF91	180 (5)	210 (7)	—	V19
V20	Power Rectifier	378	GZ33	240 (4)	—	250 (8)	V20
V21	Detector and Noise Limiter	140	EB91	—	—	—	V21
V22	Audio Output	138	EF91	220 (5)	230 (7)	2·5 (2)	V22
V23	A.F. Output	138	EF91	220 (5)	230 (7)	2·0 (2)	V23

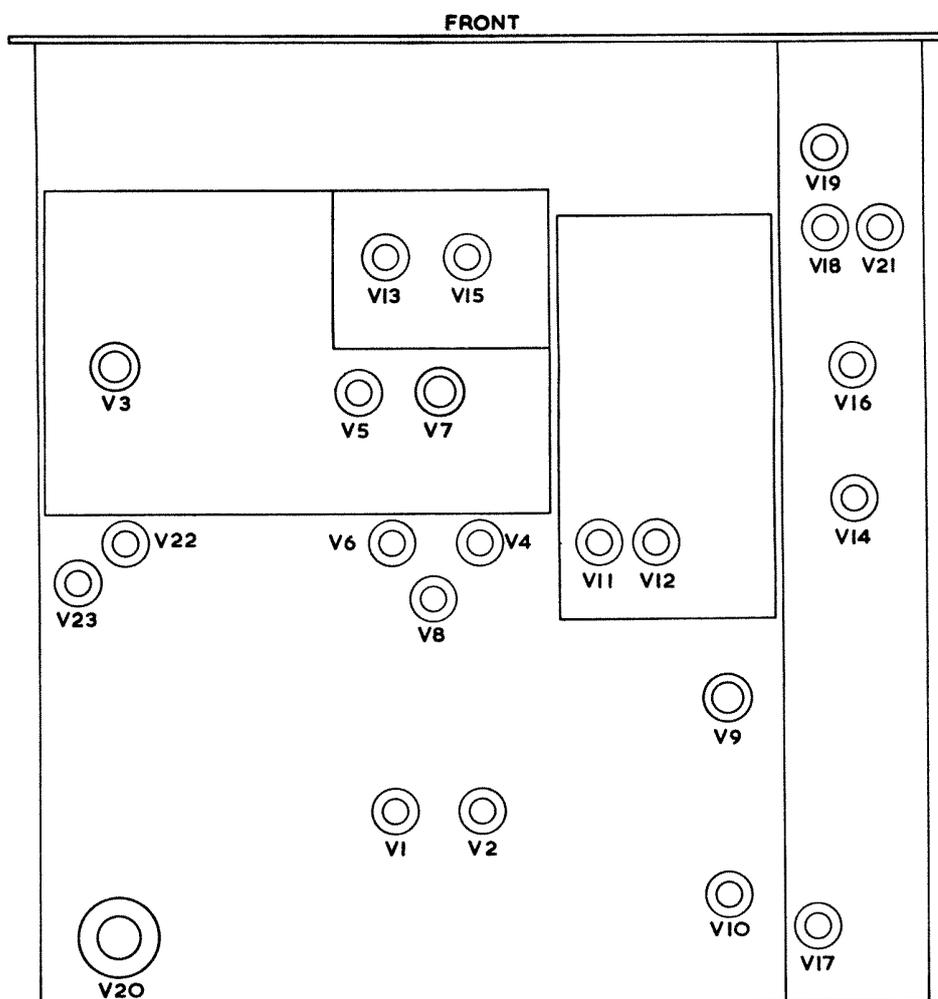
The above voltage to chassis measurements are approximate and are measured with a 20,000 Ω /Volt voltmeter, the Receiver being in the quiescent state. Valve pin connections are indicated in the brackets.



VALVE BASE CONNECTIONS

(ALL VALVE HOLDERS VIEWED FROM UNDERSIDE)

FIGURE 4



RA 17 VALVE LOCATION DIAGRAM

(VIEW FROM ABOVE)

FIGURE 5

SECTION 3

TYPICAL PERFORMANCE

3.1 STABILITY

Overall drift, less than 1,500 c/s during a three hour period from switching on. Thereafter, less than 150 c/s at all frequencies under normal operating conditions.

3.2 SENSITIVITY

For 20dB signal to noise ratio. Bandwidth set at 3 kc/s.

A 1.—1 μ V input.

A 2.—3·5 μ V input (Modulated 30 per cent.).

3.3 SELECTIVITY

	6dB	66dB
Position 1	100 c/s	1·2 kc/s
„ 2	300 c/s	1·7 kc/s
„ 3	750 c/s	2·1 kc/s
„ 4	1·2 kc/s	8 kc/s
„ 5	3 kc/s	15 kc/s
„ 6	8 kc/s	30 kc/s

The centre frequency on crystal bandwidths, does not change by more than 50 c/s when the bandwidth is changed. Typical selectivity curves are shown in Figure 6.

3.4 CROSS MODULATION

Conditions : Aerial Attenuator at MIN.

Bandwidth set at 3 kc/s.

Aerial tuned to wanted signal.

Wanted signal level : 1mV.

Unwanted signal (30% modulated) : 30dB above and 10 kc/s from wanted signal.

Resulting cross modulation : equivalent to 1% modulation.

3.5 IMAGE AND SPURIOUS RESPONSE

Rejection greater than 60dB with tuned input. Internally generated spurious responses not greater than 1dB above noise.

3.6 A.V.C.

An increase of 60dB above A.V.C. threshold increases audio output not more than 6dB.

3.7 NOISE FACTOR

1·5 Mc/s : less than 8dB.

3, 6, 12 and 24 Mc/s : less than 6dB.

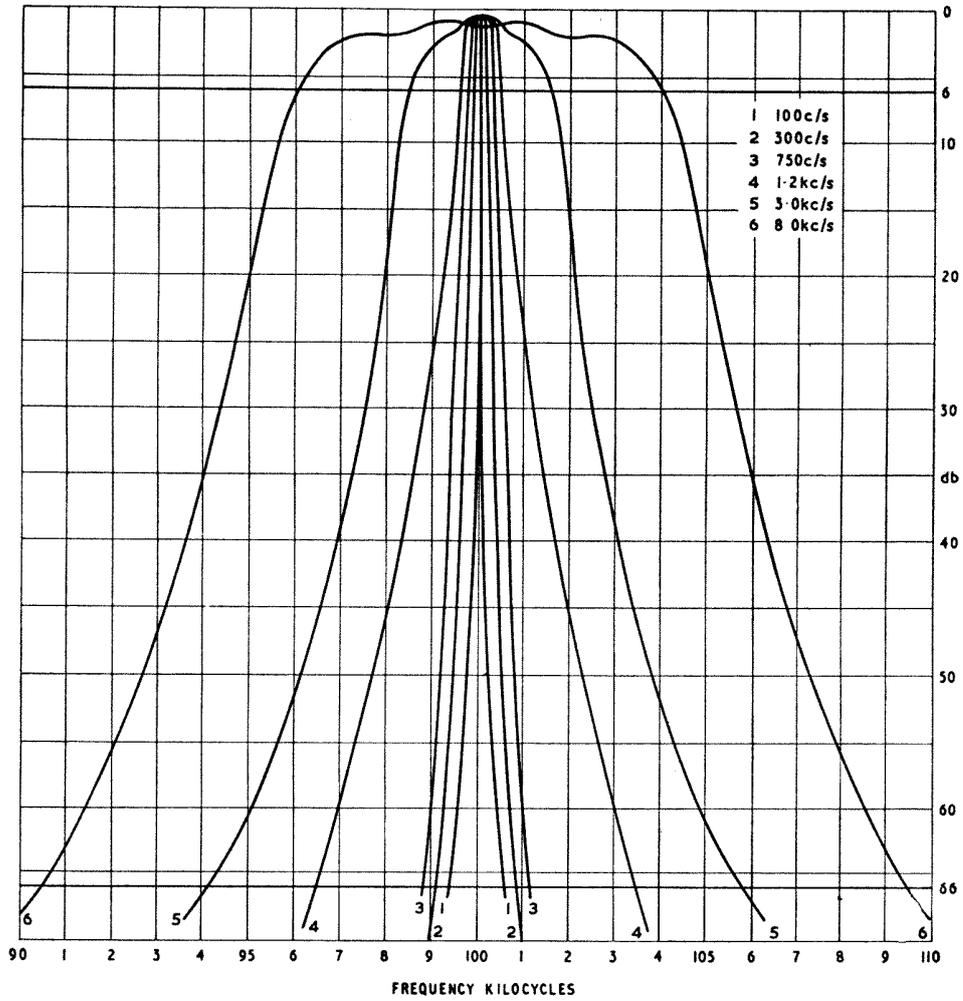


FIGURE 6 TYPICAL SELECTIVITY CURVES

SECTION 4

FAULT LOCATION

4.1 PROCEDURE FOR FAULT LOCATION

The following simple checks enable the faulty section of the receiver to be determined with the minimum of delay. After the initial determination, detailed location of the fault can be carried out by use of the representative test data in Section 5 and examination of voltages at valve electrodes in Section 2.2.

4.2 2-3 Mc/s INTERPOLATION RECEIVER

With the I.F. and audio gain controls at maximum and the I.F. bandwidth set to 8 kc/s, the first circuit noise of the 2-3 Mc/s interpolation receiver should be audible. Absence of noise indicates a fault in this section, which may be located by the usual techniques.

4.3 SECOND/THIRD MIXER STAGES

The internal noise should rise as each point on the megacycle dial is tuned through. Should this not occur, trouble at the second mixer stage or misalignment of the ganged circuits between the second and third mixer may be suspected.

4.4 37.5 Mc/s DRIVE

A fault appearing at the second mixer stage may be due either to the mixer circuits or lack of 37.5 Mc/s drive. The latter may be checked by removing the second mixer valve (V9) and connecting a suitable valve voltmeter to the test point TP3. At each setting of the Megacycles scale, several volts at 37.5 Mc/s should be measured. The absence of this voltage will indicate a fault in the harmonic generator and amplifier circuits, harmonic filter, or possibly in the first variable frequency oscillator stage.

4.5 AERIAL TO FIRST I.F. FILTER

Should the noise rise satisfactorily on each Megacycle band, the fault must be in the first I.F. filter, first Mixer or in the R.F. stage.

4.6 FIRST MIXER

The removal of the first mixer valve (V7), should result in a drop in noise output.

Note : Care must be taken during this check to 're-peak' the Megacycles scale as the oscillator frequency is slightly affected.

4.7 FIRST VARIABLE FREQUENCY OSCILLATOR

The output voltage from the first variable frequency oscillator may be checked by removing the valve from the first mixer stage and connecting a suitable valve voltmeter to test point TP2. Several volts should appear at this point, throughout the range of the Megacycles scale.

4.8 NOISE

The Receiver may be checked overall by ascertaining that the noise rises as the aerial circuits are 'peaked up' at the correct frequency, with the aerial disconnected. With the Receiver set on Manual Gain the rise in noise should be approximately 10-20dB at the lower frequencies and 6-12dB at the higher frequencies.

SECTION 5

REPRESENTATIVE TEST DATA

<i>Signal Input to :</i>	<i>Frequency</i>	<i>Input</i>	<i>Output</i>	<i>Remarks</i>
(a) Grid V22	1,000 c/s	0.3V	50mW in 3Ω	} AUDIO GAIN MAX. AUDIO LEVEL MAX. IF GAIN MIN. BFO OFF LIMITER OFF
Grid V23	1,000 c/s	0.35V	10mW in 600Ω (Output to line)	
(b) Grid V16	100 kc/s CW	360mV	100μA R.F. level	} BFO OFF. System Switch MAN. IF GAIN MAX. 1 Mc/s crystal removed. Mc/s scale set to 20. Bandwidth 3 kc/s.
Grid V14	100 kc/s CW	850μV	100μA R.F. level	
Anode Connection of V12 via 0.1μF with valve removed	100 kc/s CW	100μV	100μA R.F. level	
(c) Grid of second mixer (TP3)	2.2 Mc/s CW 2.5 Mc/s CW 2.9 Mc/s CW	5μV 5.8μV 5μV	100μA R.F. level 100μA R.F. level 100μA R.F. level	} Image response (<i>i.e.</i> receiver frequency plus 200 kc/s) should be at least 60dB down.
(d) Aerial input (Wideband)	3.5 Mc/s CW	120mV	0.5V at TP2	} WIDEBAND INPUT. AE ATTENUATOR MIN. V5 and V7 removed. Valve voltmeter input shunt- ed to 12μμF.
(e) Aerial Input (Wideband)	3.5 Mc/s CW	100mV	0.5V at TP3	} WIDEBAND INPUT. AE ATTENUATOR MIN. Replace V5 and V7. V18 and 1 Mc/s crystal re- moved. Valve voltmeter input shunt- ed to 12μμF. Megacycles scale 3.
(f) Grid V10 Grid V8 TP1	37.5 Mc/s CW	40mV 25mV 2.8mV	1V at TP3	} V9 and V5 and 1 Mc/s crystal removed. Valve voltmeter input shunt- ed to 12μμF.

(g) With the 1 Mc/s crystal in place, the output at plugs PL2 and PL3 should be approximately 2 volts.

(h) The level of the 37.5 Mc/s drive at TP3 should be between 2 and 10 volts at any Megacycle setting.

SECTION 6

ALIGNMENT PROCEDURES

6.1 GENERAL

The receiver will, under normal conditions, maintain the factory alignment over an extremely long period of time. Consequently ALL POSSIBILITY OF OTHER CAUSES OF TROUBLE SHOULD BE ELIMINATED BEFORE RE-ALIGNMENT IS CONSIDERED.

If it becomes necessary to re-align any part of the receiver, only a very small angular adjustment of any trimmer should be necessary. The signal generator must have a high degree of frequency resetting accuracy and be very stable.

Unless otherwise stated, the panel-mounted R.F. Level meter is used as the output indicator.

6.2 100 kc/s I.F. STRIP

(a) First and Second I.F. Amplifier

Remove the second VFO valve V12. Set the system switch to MAN, the IF GAIN to MAX and the meter switch to RF LEVEL. Connect the signal generator (100 kc/s CW) via a $0.1\mu\text{F}$ capacitor to the grid of V16 (Pin 1). Adjust C191 to obtain maximum indication on the meter. The output from the generator required to produce $100\mu\text{A}$ deflection on the meter should be approximately 320mV. Connect the signal generator via a $0.1\mu\text{F}$ capacitor to the grid of V14 (Pin 1) and connect a $4.7\text{k}\Omega$ damping resistor across L72. Adjust C179 to give maximum indication.

Remove the $4.7\text{k}\Omega$ resistor from L72 and connect it across L73. Adjust C171 for maximum indication. Remove the $4.7\text{k}\Omega$ resistor. The signal generator output required to produce a $100\mu\text{A}$ deflection should be approximately 800 μV . Tune the signal generator through the pass band and note the 'double peak' response. The peak separation should be approximately 5-5.6 kc/s and be symmetrical about 100 kc/s. If the peak amplitudes differ, slight re-adjustment of C191 will compensate for this. The 6dB bandwidth should be approximately 9.5 kc/s.

(b) 100 kc/s (L/C) Filter

Remove the second VFO valve V12 and set controls as in (a) above. Connect the signal generator (100 kc/s) via a $0.1\mu\text{F}$ capacitor to the anode connection on V12 holder (Pin 5). Remove the L/C filter can. Link R77 to C153 and R80 to C158, and replace filter can. Set bandwidth to 1.2 kc/s. Increase the signal generator output until the meter shows a deflection and tune the signal generator to give maximum indication.

The frequency at this setting should be within ± 100 c/s of 100 kc/s. Adjust C162, C158, C153 and C147 in this order several times until maximum output is obtained. Remove the links. The sensitivity should be approximately 300 μV for $100\mu\text{A}$ deflection of the meter. Check that the 8, 3 and 1.2 kc/s bandwidths agree approximately with the typical performance figures in Section 3.

(c) Crystal Filter

Remove the second VFO valve V12 and set the controls as in (a) above. Switch the bandwidth to 750 c/s. Connect the signal generator via a $0.1\mu\text{F}$ capacitor to pin 5 on V12 valve base. Tune the signal generator slowly through the pass band and observe the crystal responses (F1 and F2). Care must be taken since these are very sharp.

Re-tune the signal generator to the mean of F1 and F2, and adjust C110 and C148 for maximum output. Tune the generator through the pass band and ensure that 'the peak to trough' ratio does not exceed 3dB and that the peaks are approximately equal in amplitude. Reset the signal generator frequency to 100 kc/s and adjust the output to produce a reading of $100\mu\text{A}$. Set the generator frequency to 101, 250 c/s, increase the output by 66dB and adjust the phasing control C118 to obtain minimum output (*i.e.* the point of rejection occurs). Increase the generator frequency slowly and ascertain that the meter reading does not exceed $100\mu\text{A}$. Slowly decrease the signal frequency until $100\mu\text{A}$ reading is obtained and check that the frequency is not greater than 101, 125 c/s.

Tune through the pass band, adjusting the generator output as necessary to avoid meter damage. Note the highest frequency at which a signal generator output equal to that used at 101, 250 c/s gives an output of $100\mu\text{A}$. This frequency should not be greater than 98, 875 c/s.

Slowly decrease the signal frequency and ensure that the output does not rise above $100\mu\text{A}$. Decrease the generator output by 66dB and re-check the frequency response within the pass band, re-adjusting C110 and C148 if necessary. Set the signal generator frequency to 100 kc/s and adjust the output for $100\mu\text{A}$ level. Increase the signal generator output by 6dB and check the bandwidth for $100\mu\text{A}$ output. The bandwidth should be between 700 and 800 c/s and the mid position should not deviate from 100 kc/s by more than 25 c/s. The input required for $100\mu\text{A}$ level should be approximately 500 μV .

Switch the bandwidth to 300 c/s. Repeat the procedure with signal generator frequency settings of 101, 025 c/s, 100, 900 c/s and 99, 100 c/s respectively. Adjust phasing capacitor C119 only. The 6dB points should be between 270 and 330 c/s apart and the deviation of the mean from 100 kc/s should not exceed 25 c/s. The sensitivity should be approximately 280 μV for $100\mu\text{A}$ deflection.

Switch the bandwidth to 100 c/s. Proceed as before with frequency settings of 100, 925 c/s, 100, 800 c/s and 99, 200 c/s. Adjust the phasing capacitor C120. The 6dB bandwidth should be between 80 and 120 c/s and the deviation from the mean less than 25 c/s. For $100\mu\text{A}$ output, the input should be approximately 270 μV . Replace V12.

(d) Use of Digital Frequency Meter

The alignment of the I.F. strip and in particular the crystal filter involves the measurement of frequencies to far greater accuracies than those normally obtainable from signal generators. A digital frequency meter should therefore be employed. The equipment should be connected to SK8 or SK9. The exact frequency passing through the circuit will be displayed on the indicator panel. Should the level of output at any time during the alignment procedure be insufficient to drive the frequency meter, the signal generator output can be increased to obtain the frequency check but must be restored to the lower value for level measurements. When such increases are made, the meter on the receiver panel should be switched to A.F. to avoid damage.

6.3 SECOND VFO

(a) Minor Corrections

The variable capacitor has been carefully adjusted and should not be re-adjusted unless absolutely necessary. Minor corrections can be made as follows :—

Set the system switch to CAL.

Feed a $1 \text{ Mc/s} \pm 50 \text{ c/s}$ signal into the crystal calibrator input socket SK2 (1 volt).

Set the KILOCYCLES cursor in line with the MEGACYCLES cursor (*i.e.* central).

Remove V16.

Connect a valve voltmeter to the 100 kc/s output lead.

Set the system switch to MAN.

Ensure the BFO is switched off.

Rotate the IF GAIN to MAX.

Set the BANDWIDTH to 3 kc/s.

Set the KILOCYCLES scale to zero and adjust C136 for maximum indication.

Set the KILOCYCLES scale to 1000 and adjust L55 for maximum indication.

Approximately 0.5 volts indication should be obtained for the following CW inputs :— 2.2 Mc/s , $430\mu\text{V}$; 2.5 Mc/s , $580\mu\text{V}$; 2.9 Mc/s , $640\mu\text{V}$.

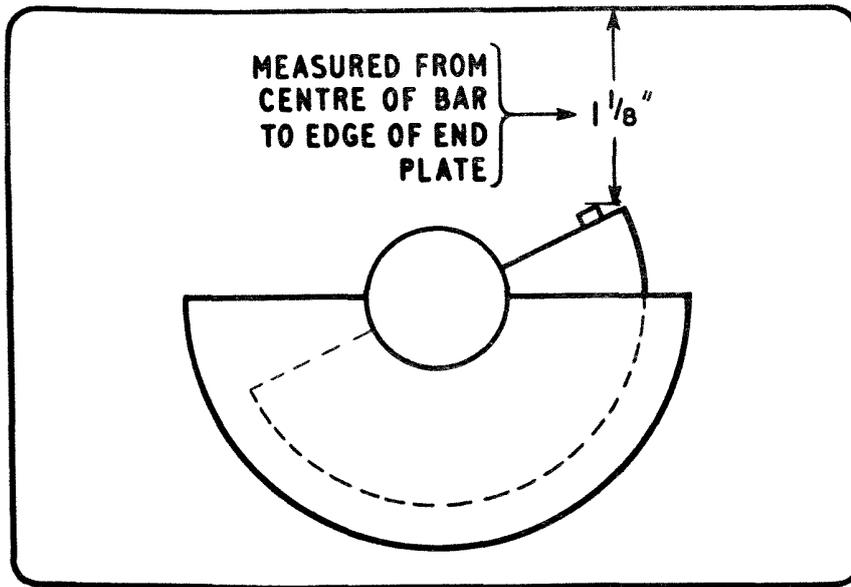


FIGURE 6

(b) Replacement of Ganged Capacitor

The procedure described below should not normally be carried out unless the ganged capacitor is being replaced. Before electrical adjustment the following mechanical points should be verified :—

- (i) Set the Kilocycles scale against the mechanical end stop at the 1,000 kc/s end and check that the ganged capacitor is set as shown in Figure 6.

- (ii) Check that the distance from the cursor to the extreme end of the scale, adjacent to the 1,000 kc/s point is approximately $\frac{1}{2}$ -in. Should this distance vary appreciably from $\frac{1}{2}$ -in., carefully lift the scale from the drive and move the scale round to the required position.
- (iii) Whenever the film scale is replaced, endeavour to re-align by adjusting the film to the correct position before trimming.

The procedure for electrical adjustment is carried out as follows :—

The built-in crystal calibrator will supply 100 kc/s calibration points throughout the range provided care is exercised to ensure that the correct harmonic is used. Electrical backlash should not exceed 500 c/s when checked against any calibration point. Set the Kilocycles scale to 1000 kc/s and adjust L55 for zero beat using the headphones. Set the Kilocycles scale to 0 kc/s and adjust C137 for zero beat. Repeat adjustments until calibration is correct at both settings. Check the calibration of the VFO at 100 kc/s intervals. If the error exceeds 1 kc/s, carefully adjust the plates of the oscillator section of the ganged capacitor to correct the calibration.

Note : The oscillator capacitor C139 is situated at the rear section of the gang capacitor.

6.4 BFO

Set the system switch to the CHECK BFO position. Switch the meter switch to RF LEVEL. Switch the BFO on and set the BFO frequency control knob to zero. Adjust C201 as necessary to obtain zero beat. Observe that the meter reads approximately half F.S.D.

If the BFO frequency control knob has been removed, adjust the frequency control capacitor for zero beat with the identification mark on the shaft uppermost. Replace the knob so that the pointer indicates zero.

6.5 SECOND I.F. CIRCUIT

Set the system switch to MAN. Remove the 1 Mc/s crystal. Set the IF GAIN to MAX. Set the meter switch to RF LEVEL. Connect the signal generator (CW output) to T.P.3. Alignment frequencies are 2.2 and 2.9 Mc/s which correspond to 800 and 100 kc/s respectively on the Kilocycles dial. Adjust C122, C125 and C128 at 100 kc/s and L57, L58 and L59 at 800 kc/s. Repeat as necessary until alignment is correct at both ends of the band. The input required for 100 μ A meter deflection should be between 5 and 10 μ V.

6.6 37.5 Mc/s FILTER AND AMPLIFIER

Remove the 1 Mc/s crystal, second mixer valve V9 and the first VFO valve V5. Check that all the screening covers are in place. Connect a suitable valve voltmeter, shunted to 12 μ F to T.P.3. Inject an accurate 37.5 Mc/s signal at T.P.1. Ensure the valve voltmeter and signal generator leads are short to avoid regeneration. Adjust L50, C90, C81, C72, C63, C55, C45, C35, C24, L28 and L33 in that order, several times, to obtain maximum output. The input required to produce 1V should be approximately 2.5mV. The 6dB bandwidth of the 37.5 Mc/s chain should lie between 229–300 kc/s. The bandwidth at 40dB should not exceed 750 kc/s. The mean of the frequencies corresponding to the 6dB points should not deviate from 37.5 Mc/s by more than 20 kc/s and by more than 25 kc/s at 40dB bandwidth.

C108 is adjusted to avoid inter-action between the 37.5 and 40 Mc/s filters and should not normally require further adjustment. Replace the 1 Mc/s crystal, the second mixer and the first VFO valve.

6.7 1 Mc/s CRYSTAL OSCILLATOR

Connect the valve voltmeter to the 1 Mc/s output plug PL2 and adjust L2 for maximum output (2–3V). C2 may be adjusted to 'pull' the crystal to the correct frequency. Adjustment of the crystal frequency should not be attempted unless a standard of accuracy better than one part in 10^7 is available.

6.8 SECOND MIXER DRIVE LEVEL

Remove the second mixer valve V9. Connect the valve voltmeter, shunted to 12 μ F to T.P.3. Tune through each Megacycle calibration point and check that the level of each output lies between 2 and 10V. To equalise the drive at 28 and 29 Mc/s carefully adjust C7.

6.9 FIRST VFO CALIBRATION

Slacken off the mechanical end-stop until it is inoperative. Set C76 to maximum capacity and ensure that the calibration mark at the zero end of the Megacycles dial coincides with the cursor. Tighten end-stop after moving the scale free from the stop. Check that the mechanical stops operate before the capacitor end-stops become effective at both ends of the band.

To readjust the first VFO calibration, a heterodyne wavemeter should be employed. This is coupled very loosely to V7 by placing its input lead in the vicinity of the valve base. The 1 Mc/s crystal and V12 should be removed.

Set the wavemeter to 40.5 Mc/s and the Megacycles dial to zero. Adjust L36 for zero beat. Change the wavemeter setting to 69.5 Mc/s and the Megacycles dial to 29. Adjust C77 for zero beat. Repeat adjustment as necessary. Check the frequency calibration at 1 Mc/s intervals and ensure that the Megacycle positions are reasonably central on the scale markings. Remove the first mixer valve V7 and connect the valve voltmeter, shunted to 12 μ F between T.P.2 and the chassis. Check that the valve voltmeter indicates at least 1.5V over the range. Replace the 1 Mc/s crystal V12 and V7.

6.10 AERIAL CIRCUIT

The cores of the aerial coils L4 to L9 should be set so that the correct frequency ranges (plus a small overlap) are available when C18 is tuned.

6.11 CRYSTAL CALIBRATOR

Should no output be obtained from this unit, when the system switch is in the CAL position and the Kilocycles scale set at a 100 kc/s check point, or if spurious responses are obtained over the Kilocycles range, proceed as follows :—

Set the Kilocycles scale to a 100 kc/s point and check the tuning of L70 by carefully rotating the core a half-turn either side of the setting. If the signal does not appear, restore the core to its original setting and repeat the check with L75. If the signal is heard, the cores of L70 and L75 should be set to the centre of the range of adjustment over which a clean signal is produced.

Should a major fault be suspected, or if L70 or L75 have been inadvertently misaligned, it will be necessary to remove the unit and make up an extension cable so that the unit may be operated outside the receiver. The crystal calibrator may be aligned as follows :—

Remove V13 and connect the valve voltmeter probe to grid 3 (Pin 7). Inject a 900 kc/s CW signal from the signal generator, at the grid of V15 (Pin 1) and adjust L75 for maximum output. Disconnect the valve voltmeter and the signal generator, replace V13 and remove V15. Connect the signal generator to grid 1 (Pin 1) of V13 and the valve voltmeter to the grid 1 connection (Pin 1) of V15. Set the signal generator to 100 kc/s CW and adjust L70 for maximum indication on the valve voltmeter. Disconnect the valve voltmeter and the generator. Replace V15. Connect the coaxial connector to SK2 on the receiver.

The output should be approximately 0.2V measured between Pin 6 of the octal plug and earth.

6.12 40 Mc/s FILTER

This filter is over-coupled and cannot be readily aligned without a 40 Mc/s swept oscillator. Readjustment therefore should not be attempted unless the specially designed test equipment and factory-type alignment jigs are available.

SECTION 7

DISMANTLING PROCEDURE

7.1 UNIT BREAKDOWN

The receiver may be rapidly dismantled to five sub-units comprising as follows :—

- (a) **Main Chassis**
 - (i) Aerial Attenuator.
 - (ii) Crystal Oscillator (V1).
 - (iii) Harmonic Generator (V2).
 - (iv) 30 and 32 Mc/s Low Pass Filters.
 - (v) 37·5 and 40 Mc/s Band Pass Filters.
 - (vi) Harmonic Mixer (V4).
 - (vii) The 37·5 Mc/s Amplifier (V6), (V8) and (V10).
 - (viii) Second Mixer (V9).
 - (ix) A.F. Output Stages (V22) and (V23).
 - (x) Power Supplies (V20).
- (b) **First Variable Frequency Oscillator**
 - (i) R.F. Amplifier.
 - (ii) First VFO (V5).
 - (iii) First Mixer (V7).
- (c) **Crystal Calibrator**
- (d) **Second Variable Frequency Oscillator**
 - (i) 2-3 Mc/s Band Pass Filter.
 - (ii) Second VFO (V12).
 - (iii) Third Mixer (V11).
- (e) **100 kc/s I.F. Strip**
 - (i) Beat Frequency Oscillator (V19).
 - (ii) Crystal Filter.
 - (iii) L/C Filter.
 - (iv) First and Second I.F. Amplifier (V14) and (V16).
 - (v) AVC and TC Stages (V18).
 - (vi) Detector and Noise Limiter (V21).
 - (vii) 100 kc/s Output (V17).

7.2 DISMANTLING INSTRUCTIONS

- (a) **Front Panel**

Remove the control knobs.
Unscrew the eight panel fixing screws.
Note : The two at the bottom of the front panel are secured with nuts.
Carefully withdraw the front panel and unsolder the connections to the meter and speaker switches. The panel may now be completely removed.
Note : When replacing the BFO control knob, ensure that the identification mark on the shaft is uppermost and that the pointer indicates zero when zero beat is obtained.
- (b) **Second VFO**

Remove the bottom cover.
Unsolder the three connections on the 4 way tag strip adjacent to the terminal strip, situated in compartment 6. (See Illustration 1 : Key to underchassis layout.)
Remove the front panel. (See (a) above.)
Withdraw the crystal calibrator unit by slackening the knurled nut, disconnecting the coaxial cable and unplugging the unit.
Unbolt the cable cleat securing the dial light cable.
Unclip the lampholder.
Disconnect the coaxial cables.
Unscrew the screws securing the Megacycles dial to the boss and remove the dial.
Note : Do not unscrew the boss from the shaft.
Unscrew the second VFO cover and the two unit retaining screws. (Indicated in illustration 5.)
The unit may now be withdrawn vertically.

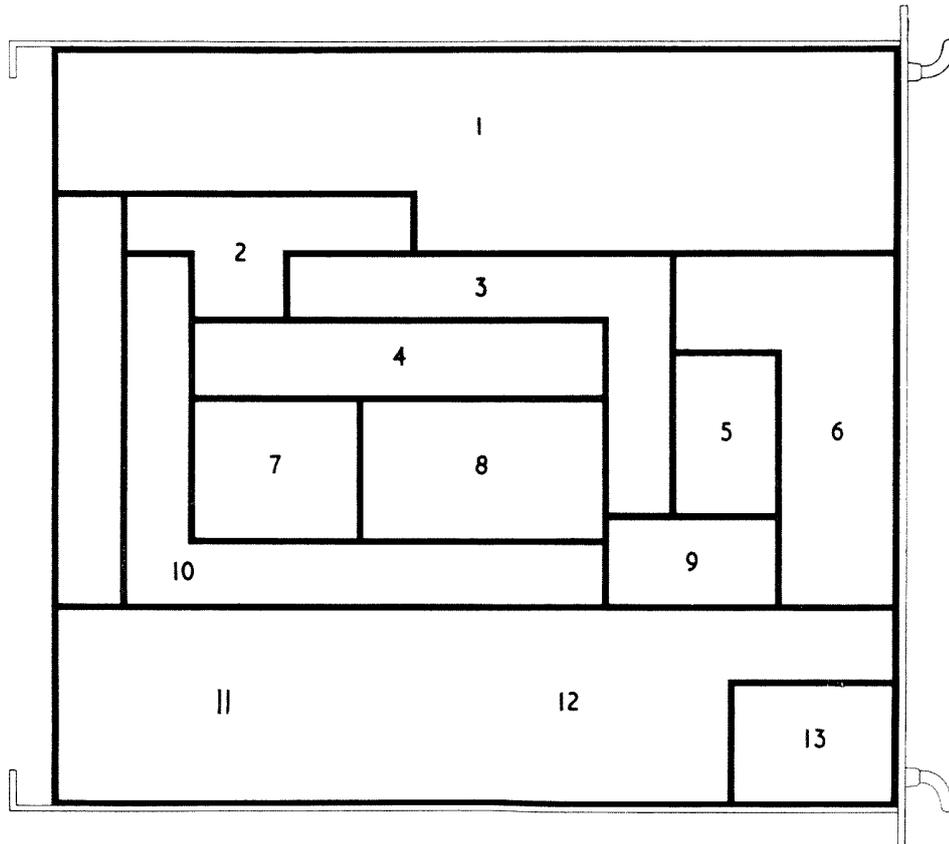
- (c) Ganged Capacitor**
 Remove the second VFO.
 Remove the KILOCYCLES scale. (See (d) below.)
 Unscrew the remaining cover plate and the under chassis screen.
 Unsolder the capacitor connections.
 Remove the drive gear and the collet.
 Unscrew the three fixing screws, retaining the capacitor to the bracket.
 Read the Second VFO Alignment notes carefully before attempting to replace the ganged capacitor.
 Ensure that the anti-backlash gears are loaded.
- (d) Kilocycles Scale**
 Rotate the Kilocycles dial to the 1000 kc/s end stop.
 Remove the front panel.
 Firmly hold the two gears, situated above the film bobbins, and slacken the screws retaining the idler gear.
 Allow the gears to unwind slowly.
 Unwind the film.
 To fit a new film :—
 Pass the 1000 kc/s end round the drive sprocket and insert the end into the slot of the inner bobbin.
 Rotate this bobbin until most of the film is wound.
 Insert the other end of the film into the other bobbin and rotate the bobbin anti-clockwise until the film is taut.
 Wind the gears in opposite directions approximately a half-turn.
 Re-engage the idler gear and tighten the two fixing screws.
 See Second VFO Alignment instructions.
- (e) First VFO**
 Remove the front panel, the bottom cover, and the screens from compartments 3, 8 and 13. (See Illustration 1 : Key to underchassis layout.)
 Unsolder the connecting wires from the two turret lugs, situated in compartment 3, the leads to the turret lug in compartment 8, the pin connections in compartment 5, and the screened cable in compartment 13.
 Unscrew the three fixing screws on the top of the unit.
- (f) I.F. Strip**
 Unsolder the leads to the 4 and 12 way tag strips and the 100 kc/s I.F. output plugs.
 Remove the front panel.
 Disconnect the coaxial lead to the second VFO.
 Unscrew the side plate adjacent to the I.F. Strip.
 Remove the six screws securing this unit to the main chassis.
- (g) BFO**
 Remove the I.F. Strip.
 Release the cleating from the BFO leads to the tag strip.
 Unsolder the black lead from the I.F. Gain potentiometer at the earthing tag.
 Remove the four fixing screws situated beneath this unit.

SECTION 8

ILLUSTRATIONS

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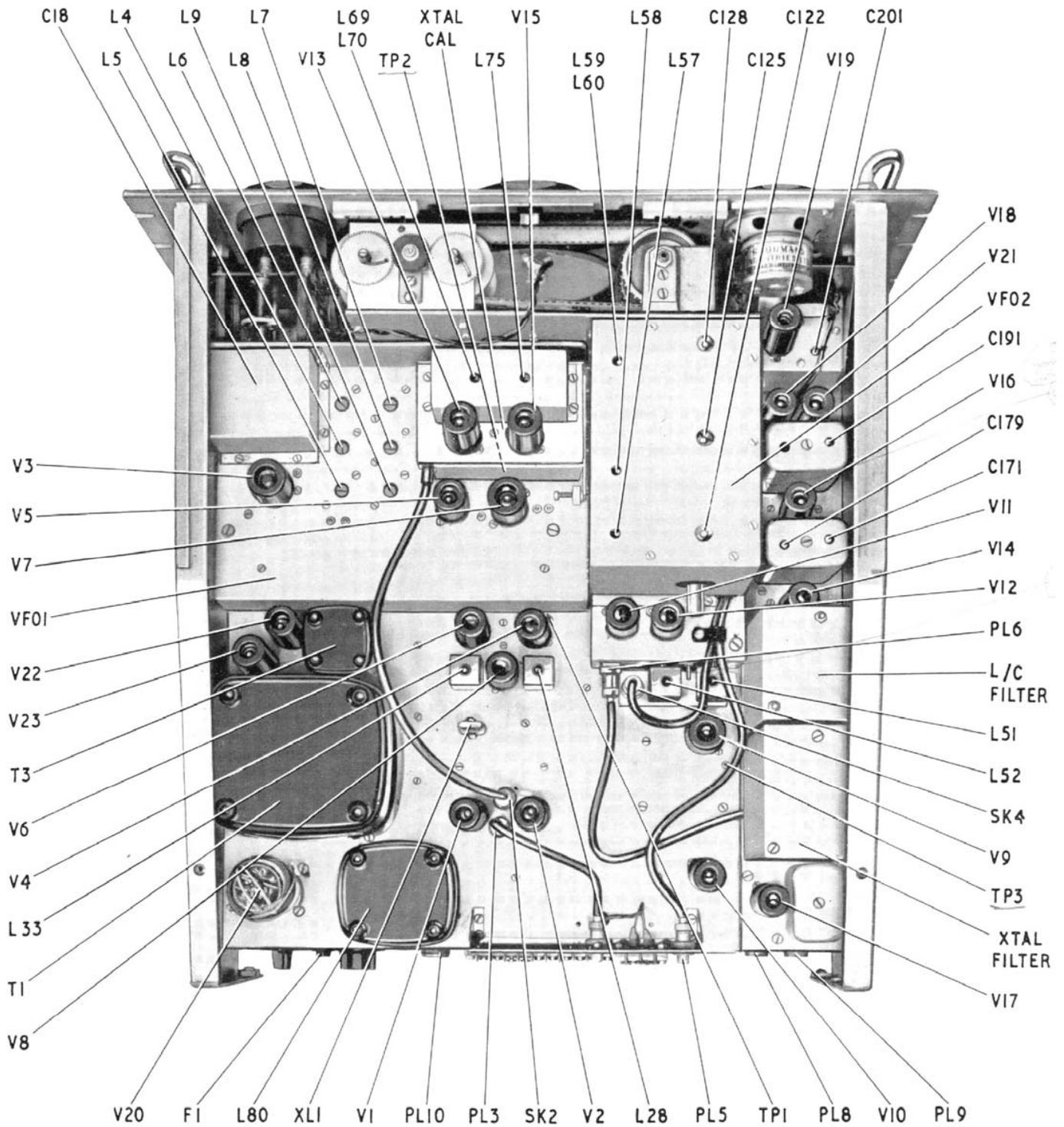
ILLUSTRATION 1



- 1 100kc/s IF
- 2 SECOND MIXER
- 3 40Mc/s. IF
- 4 HARMONIC FILTER
- 5 FIRST VFO SUPPLY FILTER
- 6 SYSTEM COMPARTMENT
- 7 CRYSTAL OSCILLATOR AND HARMONIC GENERATOR
- 8 HARMONIC MIXER AND 37.5Mc/s. AMPLIFIER
- 9 SUPPLY FILTER FOR 7 & 8
- 10 37.5Mc/s BAND PASS FILTER
- 11 POWER SUPPLIES
- 12 AUDIO STAGES
- 13 AERIAL ATTENUATOR

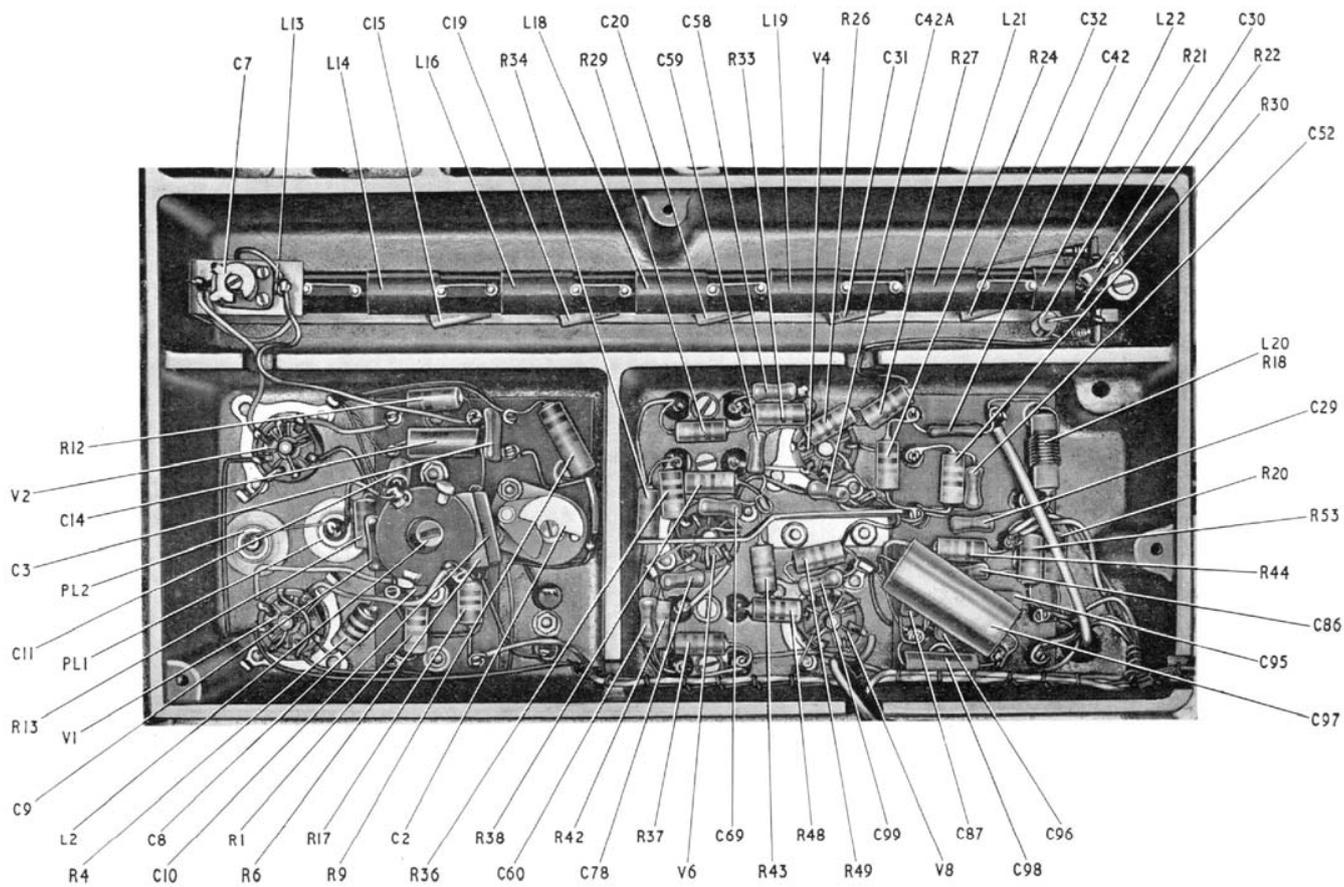
KEY TO UNDER-CHASSIS LAYOUT

ILLUSTRATION 2



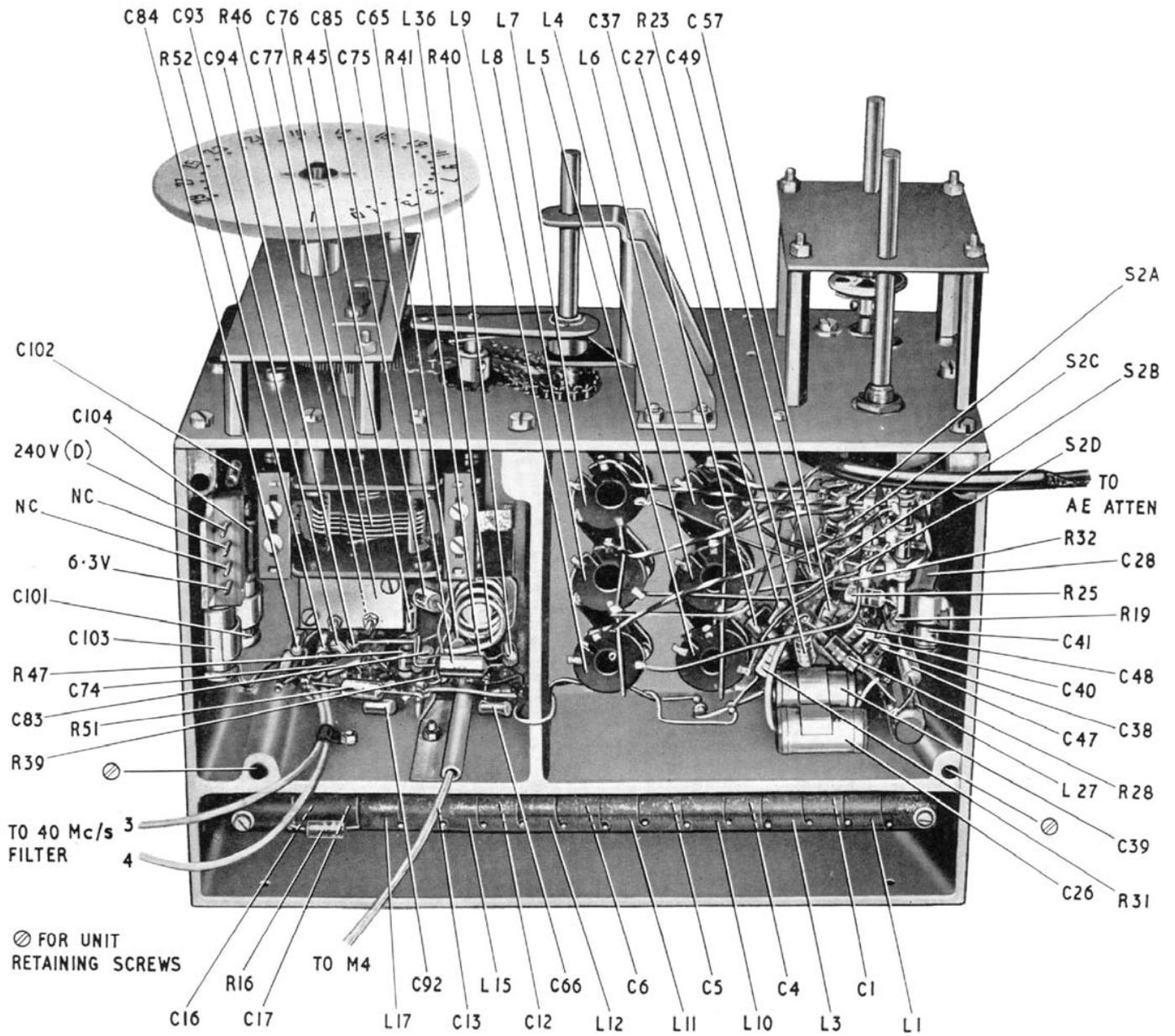
CHASSIS ASSEMBLY (TOP)

ILLUSTRATION 4



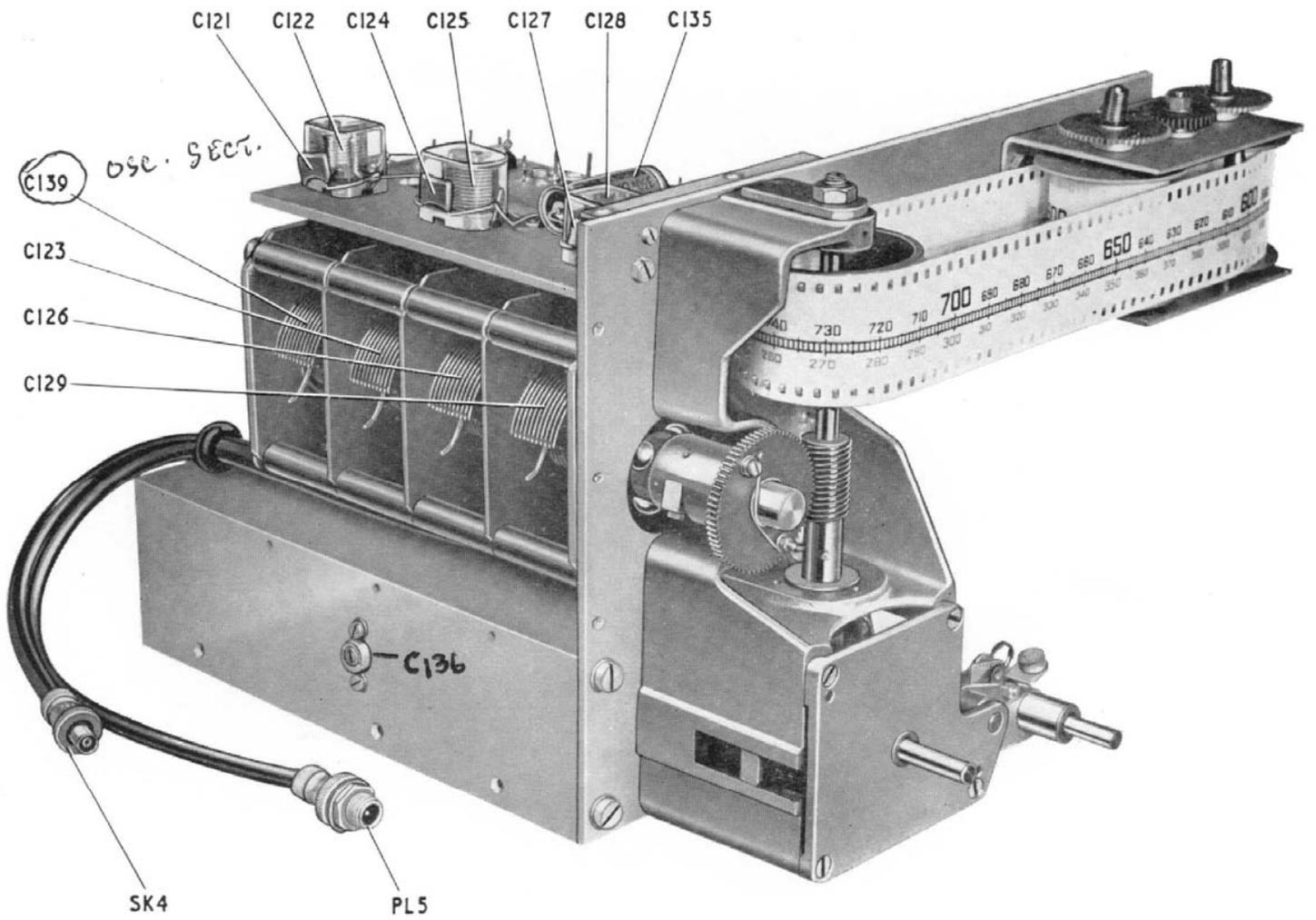
CRYSTAL OSCILLATOR AND HARMONIC FILTER SYSTEM (UNDERSIDE)

ILLUSTRATION 5



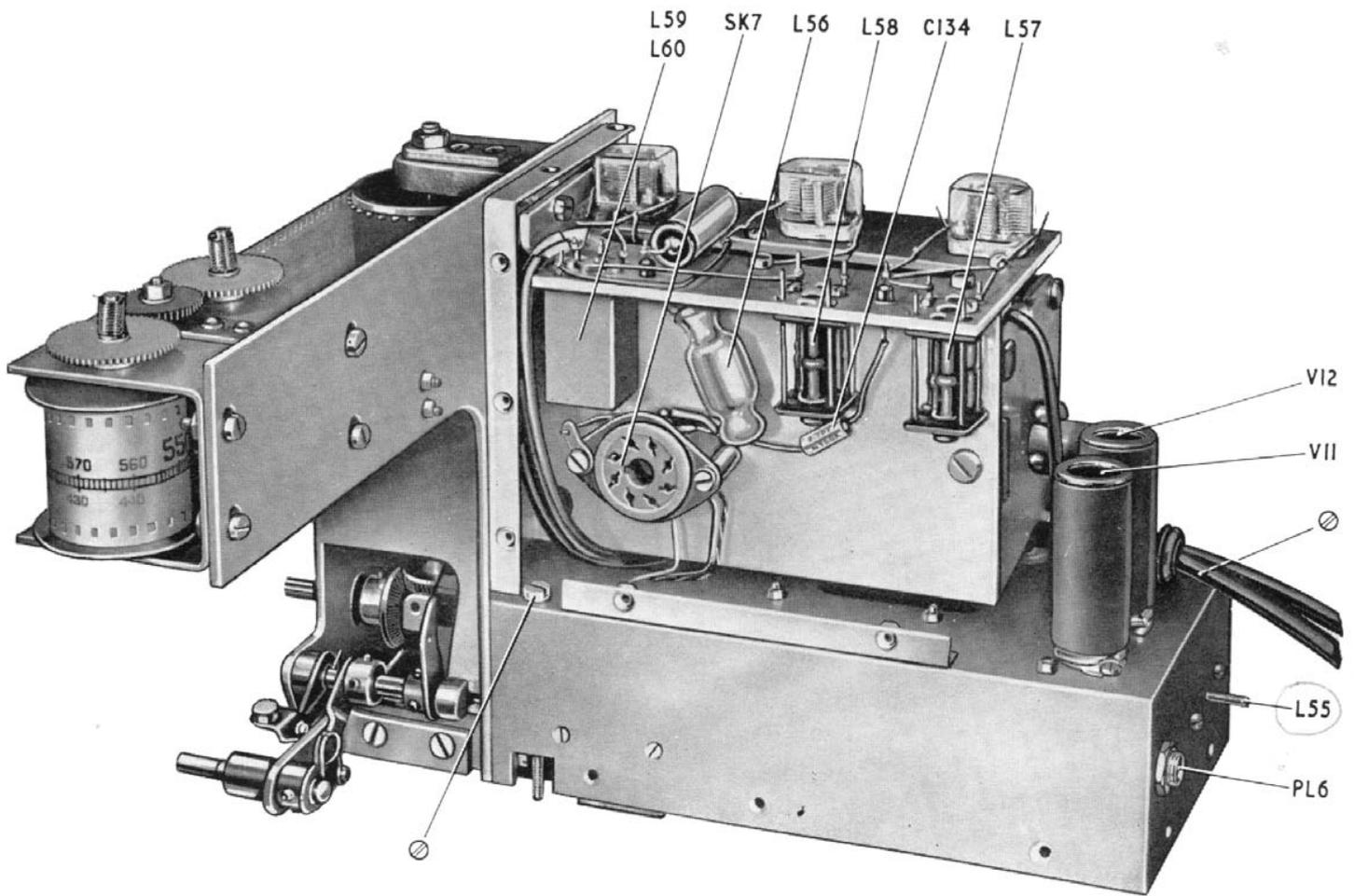
FIRST VFO UNIT (UNDERSIDE)

ILLUSTRATION 6



SECOND VFO UNIT (FRONT)

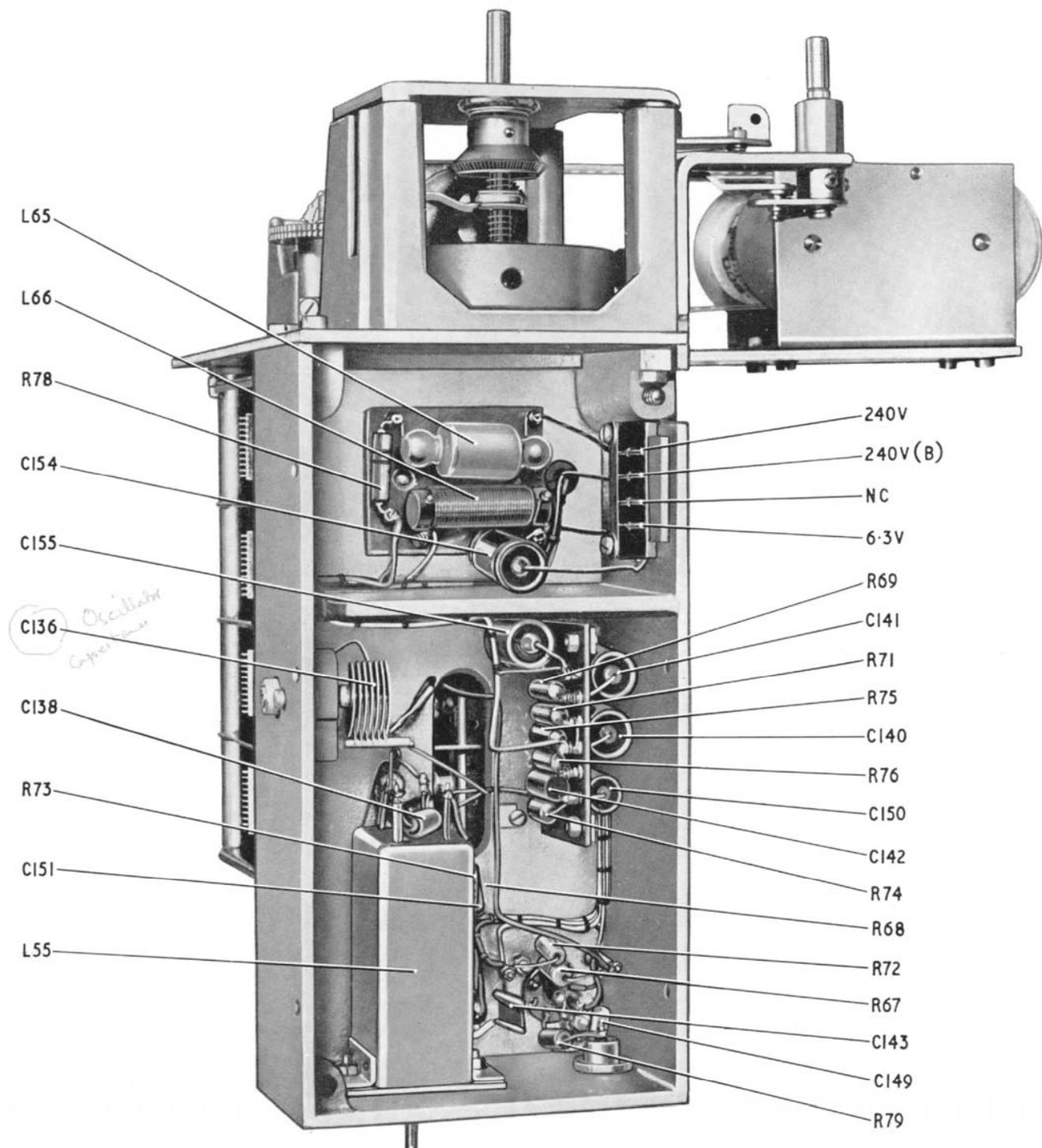
ILLUSTRATION 7



⊘ UNIT RETAINING SCREWS

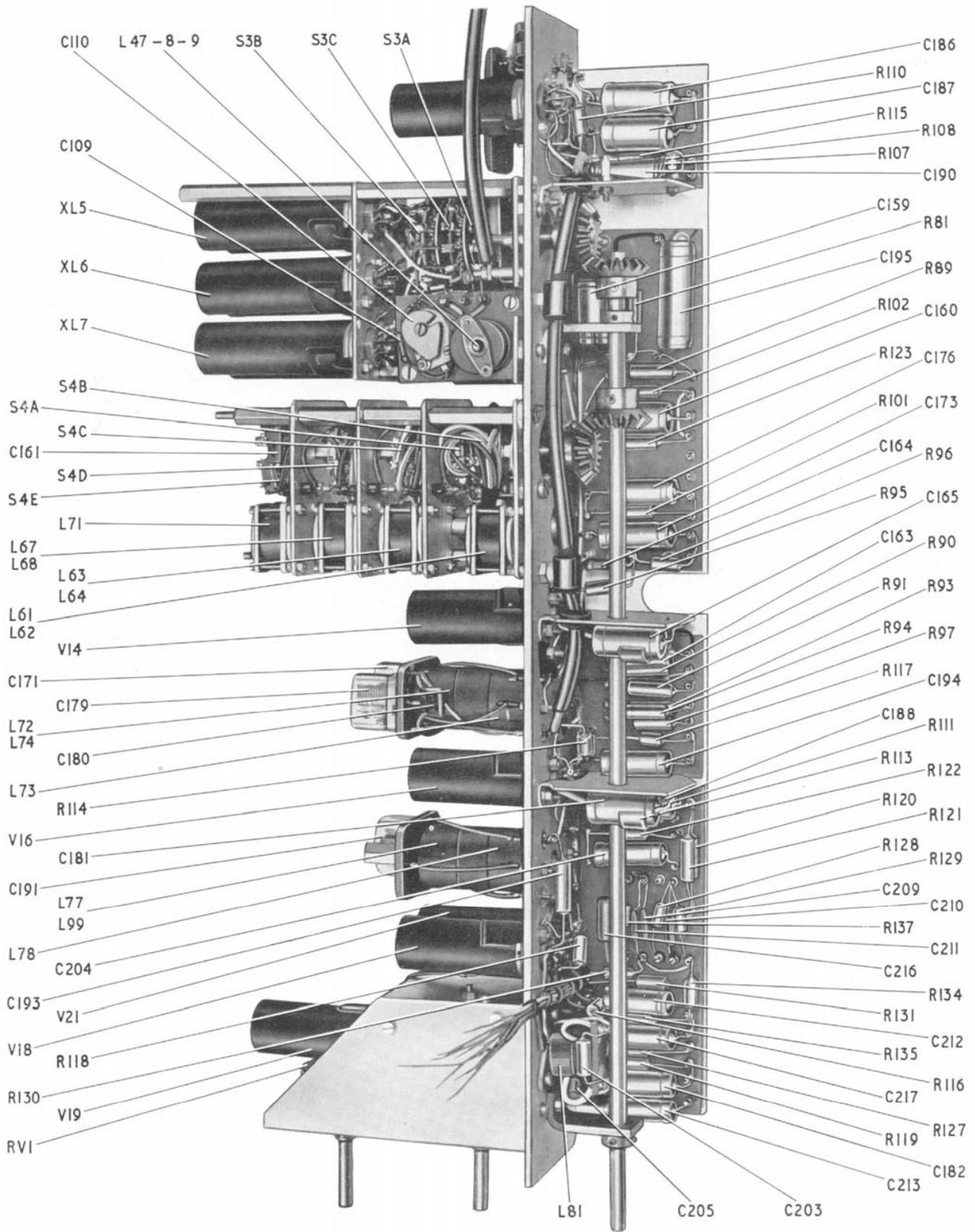
SECOND VFO UNIT (REAR)

ILLUSTRATION 8



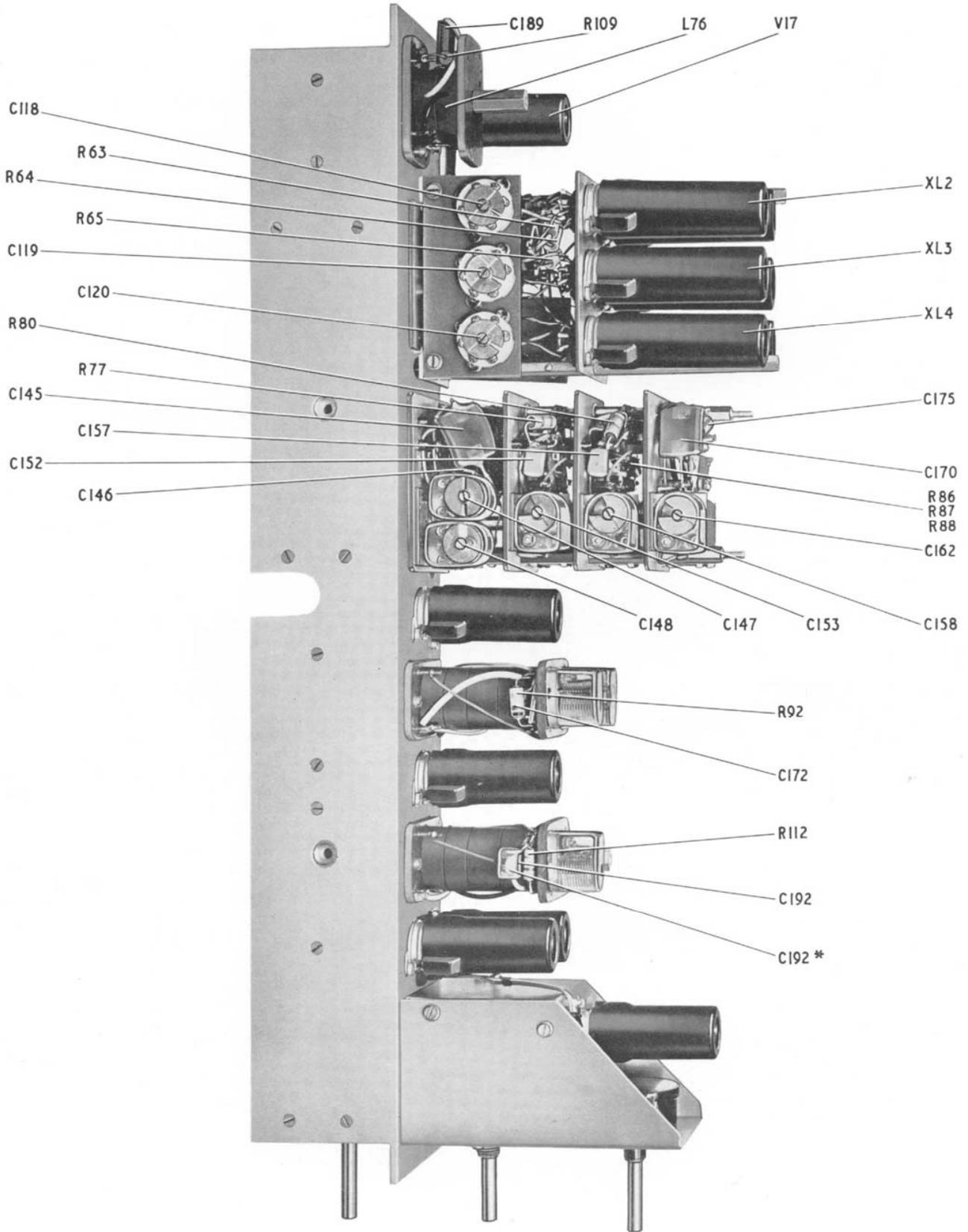
SECOND VFO UNIT (UNDERSIDE)

ILLUSTRATION 9



100 KC/S I.F. STRIP (RIGHT SIDE)

ILLUSTRATION 10



100 KC/S I.F. STRIP (LEFT SIDE)

ILLUSTRATION 11

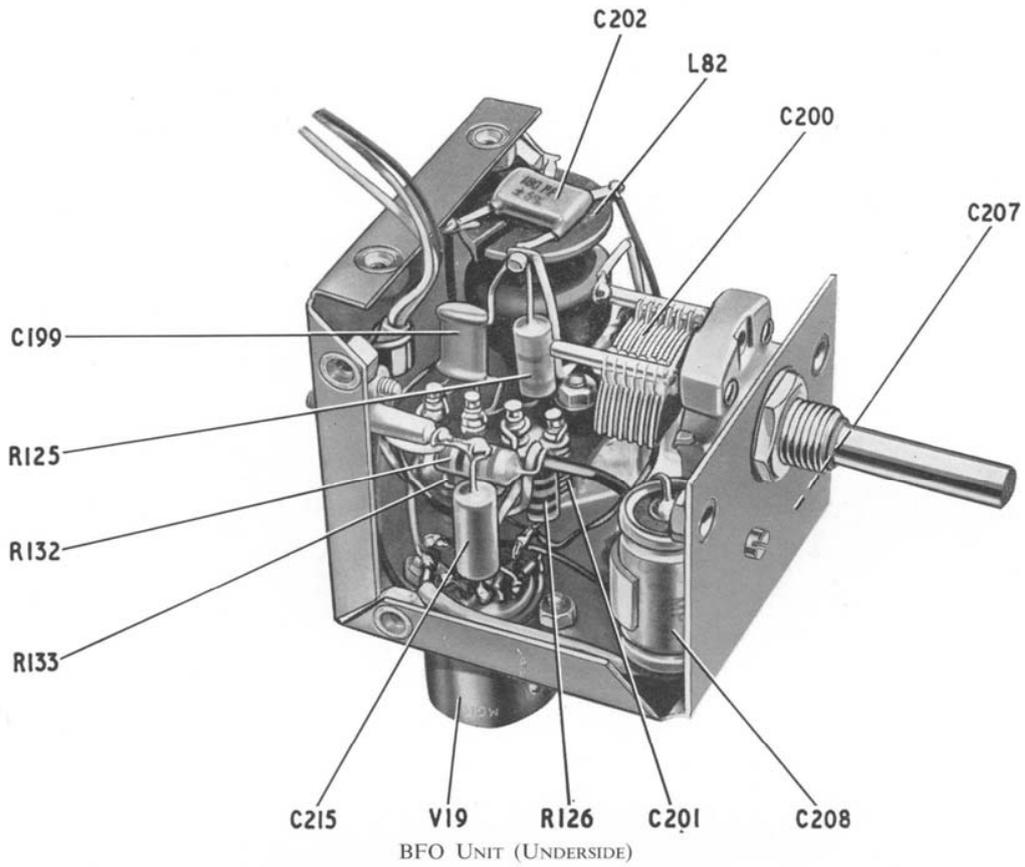
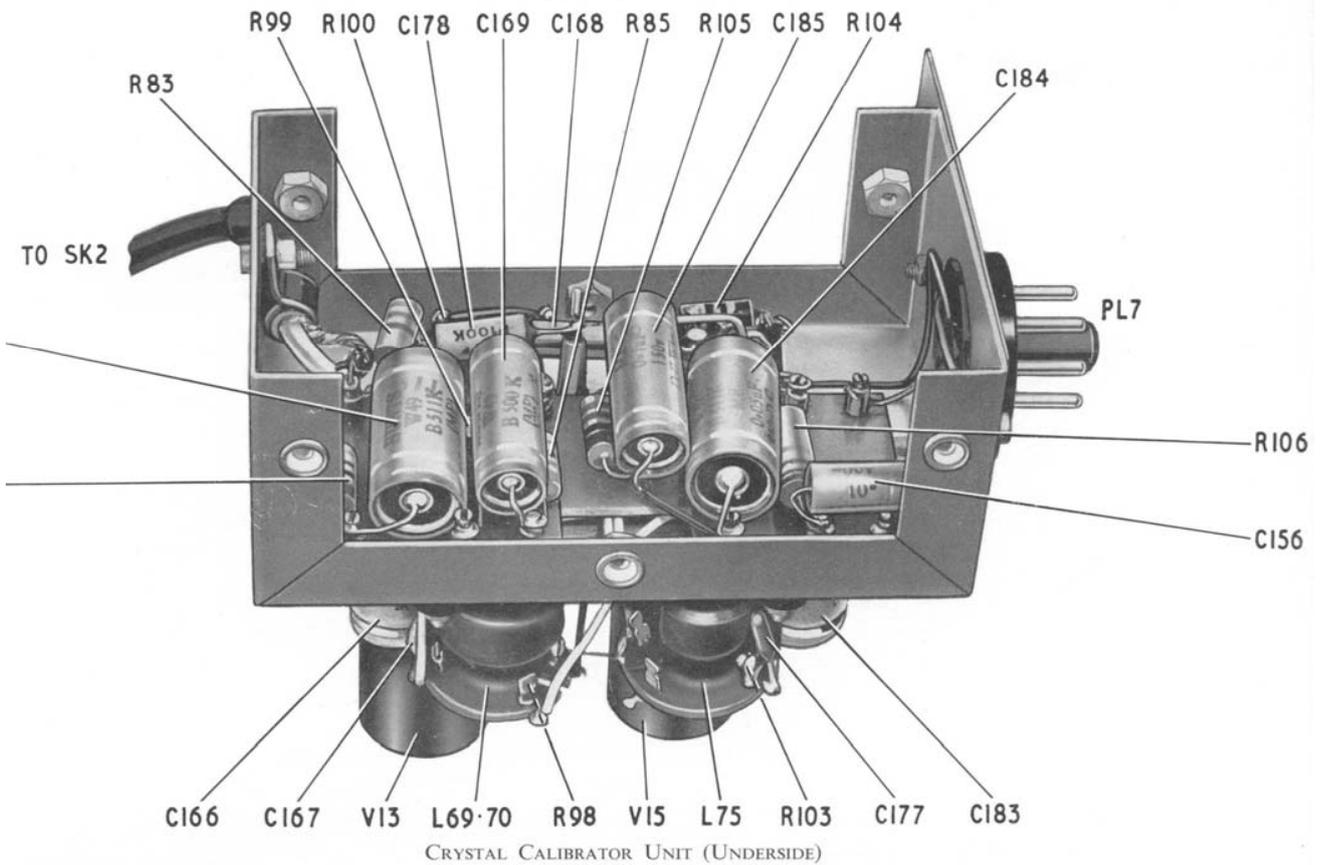


ILLUSTRATION 12



SECTION 9

PARTS LIST

- 9.1 Resistors
- 9.2 Potentiometers
- 9.3 Capacitors
- 9.4 Switches
- 9.5 Plugs and Sockets
- 9.6 Valve and Crystal Holders
- 9.7 Inductances
- 9.8 Transformers
- 9.9 Rectifiers
- 9.10 Loud Speaker
- 9.11 Meter
- 9.12 Crystals
- 9.13 Fuseholder and Fuse
- 9.14 Lamp
- 9.15 Voltage Selectors

9.1 RESISTORS

<i>Cct. Ref.</i>	<i>Inter-Service No.</i>	<i>Description</i>			<i>Manufacturer</i>	<i>Type or Drawing</i>
R1	Z223038	100kΩ	$\frac{1}{4}$ W	10%	Erie	9
R2	Z221110	100Ω	$\frac{1}{4}$ W	10%	"	9
R3	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R4	Z221110	100Ω	$\frac{1}{4}$ W	10%	"	9
R5	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R6	Z222090	4·7kΩ	$\frac{1}{2}$ W	10%	"	8
R7	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R8	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R9	Z222132	10kΩ	$\frac{1}{2}$ W	10%	"	8
R10	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R11	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R12	Z223038	100kΩ	$\frac{1}{4}$ W	10%	"	9
R13	Z222173	22kΩ	$\frac{1}{4}$ W	10%	"	9
R14	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R15	Z221110	100Ω	$\frac{1}{4}$ W	10%	"	9
R16	Z221215	680Ω	$\frac{1}{4}$ W	10%	"	9
R17	Z222006	1kΩ	$\frac{1}{2}$ W	10%	"	8
R18	Z221195	470Ω	$\frac{1}{2}$ W	10%	"	8
R19	Z223038	100kΩ	$\frac{1}{4}$ W	10%	"	9
R20	Z222005	1kΩ	$\frac{1}{4}$ W	10%	"	9
R21	Z221173	330Ω	$\frac{1}{4}$ W	10%	"	9
R22	Z221143	180Ω	$\frac{1}{4}$ W	10%	"	9
R23	Z222152	15kΩ	$\frac{1}{4}$ W	10%	"	9
R24	Z222131	10kΩ	$\frac{1}{4}$ W	10%	"	9
R25	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9
R26	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9
R27	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9
R28	Z221215	680Ω	$\frac{1}{4}$ W	10%	"	9
R29	Z222005	1kΩ	$\frac{1}{4}$ W	10%	"	9
R30	Z221152	220Ω	$\frac{1}{4}$ W	10%	"	9
R31	Z221194	470Ω	$\frac{1}{4}$ W	10%	"	9
R32	Z221080	56Ω	$\frac{1}{4}$ W	10%	"	9
R33	Z222131	10kΩ	$\frac{1}{4}$ W	10%	"	9
R34	Z223122	470kΩ	$\frac{1}{4}$ W	10%	"	9
R35	D E L E T E D					
R36	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9
R37	Z222005	1kΩ	$\frac{1}{4}$ W	10%	"	9
R38	Z221152	220Ω	$\frac{1}{4}$ W	10%	"	9

9.1 RESISTORS (continued)

<i>Cct. Ref.</i>	<i>Inter-Service No.</i>	<i>Description</i>			<i>Manufacturer</i>	<i>Type or Drawing</i>
R39	Z222005	1kΩ	$\frac{1}{4}$ W	10%	Erie	9
R40	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9
R41	Z222215	47kΩ	$\frac{1}{4}$ W	10%	"	9
R42	Z222215	47kΩ	$\frac{1}{4}$ W	10%	"	9
R43	Z222047	2·2kΩ	$\frac{1}{4}$ W	10%	"	9
R44	Z222131	10kΩ	$\frac{1}{4}$ W	10%	"	9
R45	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9
R46	Z223038	100kΩ	$\frac{1}{4}$ W	10%	"	9
R47	Z221080	56Ω	$\frac{1}{4}$ W	10%	"	9
R48	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9
R49	Z221152	220Ω	$\frac{1}{4}$ W	10%	"	9
R50	Z222047	2·2kΩ	$\frac{1}{4}$ W	10%	"	9
R51	Z222005	1kΩ	$\frac{1}{4}$ W	10%	"	9
R52	Z222152	15kΩ	$\frac{1}{4}$ W	10%	"	9
R53	Z221194	470Ω	$\frac{1}{4}$ W	10%	"	9
R54	Z221111	100Ω	$\frac{1}{2}$ W	10%	"	8
R55	Z221195	470Ω	$\frac{1}{2}$ W	10%	"	8
R56	Z222152	15kΩ	$\frac{1}{4}$ W	10%	"	9
R57	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9
R58	Z223122	470kΩ	$\frac{1}{4}$ W	10%	"	9
R59	Z221080	56Ω	$\frac{1}{4}$ W	10%	"	9
R60	Z221152	220Ω	$\frac{1}{4}$ W	10%	"	9
R61	Z221194	470Ω	$\frac{1}{4}$ W	10%	"	9
R62	Z222131	10kΩ	$\frac{1}{4}$ W	10%	"	9
R63	Z223134	560kΩ	$\frac{1}{4}$ W	10%	"	9
R64	Z223101	330kΩ	$\frac{1}{4}$ W	10%	"	9
R65	Z223038	100kΩ	$\frac{1}{4}$ W	10%	"	9
R66	Z222006	1kΩ	$\frac{1}{2}$ W	10%	"	8
R67	Z221194	470Ω	$\frac{1}{4}$ W	10%	"	9
R68	Z222173	22kΩ	$\frac{1}{4}$ W	10%	"	9
R69	Z222165	18kΩ	$\frac{1}{2}$ W	10%	"	8
R70	Z223122	470kΩ	$\frac{1}{4}$ W	10%	"	9
R71	Z113346	12kΩ	3W	5%	Painton	P306
R72	Z221194	470Ω	$\frac{1}{4}$ W	10%	Erie	9
R73	Z221194	470Ω	$\frac{1}{4}$ W	10%	"	9
R74	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R75	Z222123	8·2kΩ	$\frac{1}{2}$ W	10%	"	8
R76	Z222195	33kΩ	$\frac{1}{2}$ W	10%	"	8
R77	Z223122	470kΩ	$\frac{1}{4}$ W	10%	"	9
R78	Z221195	470Ω	$\frac{1}{2}$ W	10%	"	8
R79	Z222047	2·2kΩ	$\frac{1}{4}$ W	10%	"	9
R80	Z223122	470kΩ	$\frac{1}{4}$ W	10%	"	9
R81	Z222048	2·2kΩ	$\frac{1}{2}$ W	10%	"	8
R82	D E L E T E D					
R83	Z222089	4·7kΩ	$\frac{1}{4}$ W	10%	"	9
R84	Z223164	1MΩ	$\frac{1}{4}$ W	10%	"	9
R85	Z221152	220Ω	$\frac{1}{4}$ W	10%	"	9
R86	Z221026	22Ω	$\frac{1}{4}$ W	10%	"	9
R87	Z221089	68Ω	$\frac{1}{4}$ W	10%	"	9
R88	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R89	Z222048	2·2kΩ	$\frac{1}{2}$ W	10%	"	8

9.1 RESISTORS (continued)

<i>Cct. Ref.</i>	<i>Inter- Service No.</i>	<i>Description</i>			<i>Manufacturer</i>	<i>Type or Drawing</i>
R90	Z222090	4·7kΩ	$\frac{1}{2}$ W	10%	Erie	8
R91	Z222090	4·7kΩ	$\frac{1}{2}$ W	10%	"	8
R92	Z223134	560kΩ	$\frac{1}{4}$ W	10%	"	9
R93	Z222216	47kΩ	$\frac{1}{2}$ W	10%	"	8
R94	Z222216	47kΩ	$\frac{1}{2}$ W	10%	"	8
R95	Z221110	100Ω	$\frac{1}{4}$ W	10%	"	9
R96	Z223122	470kΩ	$\frac{1}{4}$ W	10%	"	9
R97	Z222152	15kΩ	$\frac{1}{4}$ W	10%	"	9
R98	Z222047	2·2kΩ	$\frac{1}{4}$ W	10%	"	9
R99	Z222173	22kΩ	$\frac{1}{4}$ W	10%	"	9
R100	Z222173	22kΩ	$\frac{1}{4}$ W	10%	"	9
R101	Z221122	120Ω	$\frac{1}{4}$ W	10%	"	9
R102	Z223029	82kΩ	$\frac{1}{4}$ W	10%	"	9
R103	Z222047	2·2kΩ	$\frac{1}{4}$ W	10%	"	9
R104	Z223164	1MΩ	$\frac{1}{4}$ W	10%	"	9
R105	Z222005	1kΩ	$\frac{1}{4}$ W	10%	"	9
R106	Z223018	68kΩ	$\frac{1}{2}$ W	10%	"	8
R107	Z222048	2·2kΩ	$\frac{1}{2}$ W	10%	"	8
R108	Z222195	33kΩ	$\frac{1}{2}$ W	10%	"	8
R109	Z222090	4·7kΩ	$\frac{1}{2}$ W	10%	"	8
R110	Z221110	100Ω	$\frac{1}{4}$ W	10%	"	9
R111	Z222048	2·2kΩ	$\frac{1}{2}$ W	10%	"	8
R112	Z222215	47kΩ	$\frac{1}{4}$ W	10%	"	9
R113	Z222195	33kΩ	$\frac{1}{2}$ W	10%	"	8
R114	Z221110	100Ω	$\frac{1}{4}$ W	10%	"	9
R115	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R116	Z223122	470kΩ	$\frac{1}{4}$ W	10%	"	9
R117	Z221131	150Ω	$\frac{1}{4}$ W	10%	"	9
R118	Z223206	2·2MΩ	$\frac{1}{4}$ W	10%	"	9
R119	Z223122	470kΩ	$\frac{1}{4}$ W	10%	"	9
R119A	—	10kΩ	10W	5%	"	Style X
R120	Z223039	100kΩ	$\frac{1}{2}$ W	10%	"	8
R120A	Z222184	27kΩ	$\frac{1}{4}$ W	10%	"	9
R121	Z223039	100kΩ	$\frac{1}{2}$ W	10%	"	8
R122	Z222110	6·8kΩ	$\frac{1}{4}$ W	10%	"	9
R123	Z223030	82kΩ	$\frac{1}{2}$ W	10%	"	8
R124	—	165Ω	10W	5%	"	Style X
R125	Z222215	47kΩ	$\frac{1}{4}$ W	10%	"	9
R126	Z221110	100Ω	$\frac{1}{4}$ W	10%	"	9
R127	Z223029	82kΩ	$\frac{1}{4}$ W	10%	"	9
R128	Z222164	18kΩ	$\frac{1}{4}$ W	10%	"	9
R129	Z222164	18kΩ	$\frac{1}{4}$ W	10%	"	9
R130	Z222047	2·2kΩ	$\frac{1}{4}$ W	10%	"	9
R131	Z222089	4·7kΩ	$\frac{1}{4}$ W	10%	"	9
R132	Z222005	1kΩ	$\frac{1}{4}$ W	10%	"	9
R133	Z222089	4·7kΩ	$\frac{1}{4}$ W	10%	"	9
R134	Z223164	1MΩ	$\frac{1}{4}$ W	10%	"	9
R135	Z223176	1·2MΩ	$\frac{1}{4}$ W	10%	"	9
R136	Z113288	47Ω	3W	5%	Welwyn	—
R137	Z223185	1·5MΩ	$\frac{1}{4}$ W	10%	Erie	9
R138	Z221122	120Ω	$\frac{1}{4}$ W	10%	"	9
R139	Z221122	120Ω	$\frac{1}{4}$ W	10%	"	9
R140	Z221152	220Ω	$\frac{1}{4}$ W	10%	"	9
R141	Z221152	220Ω	$\frac{1}{4}$ W	10%	"	9
R142	Z222017	1·2kΩ	$\frac{1}{4}$ W	10%	"	9
R143	Z222017	1·2kΩ	$\frac{1}{4}$ W	10%	"	9
R144	Z221002	10Ω	$\frac{1}{4}$ W	10%	"	9

9.2 POTENTIOMETERS

<i>Cct. Ref.</i>	<i>Inter-Service No.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
RV1		Potentiometer 1k Ω	Colvern	CLR3001/22
RV2		Potentiometer 2M Ω log/law 1" spindle	A.B. Metals	Clarostat 37
RV3		Potentiometer 2M Ω log/law $\frac{3}{8}$ " spindle	"	Clarostat 37

9.3 CAPACITORS

C1		2.7pF 10% ceramic	Erie	P100K
C2	Z160047	trimmer 3-33pF	Wingrove & Rogers	C31-01/1
C3		220pF 10% insulated	Lemco	1106
C4		14.7pF 10% ceramic	Erie	N750K
C5		14.7pF 10% ceramic	"	N750K
C6		14.7pF 10% ceramic	"	N750K
C7		trimmer 10pF	Wingrove & Rogers	C32-01
C8	Z132425	10pF 5% ceramic	Erie	P100K
C9		100pF 10% insulated	Lemco	1106
C10	Z115827	.01 μ F 20% 400V sleeved	Hunt	W97/BM21
C11	Z115824	.005 μ F 20% 400V sleeved	"	W97/BM20
C12		14.7pF 10% ceramic	Erie	N750K
C13		14.7pF 10% ceramic	"	N750K
C14	Z115827	.01 μ F 20% 400V sleeved	Hunt	W97/BM21
C15	Z132425	10pF 5% ceramic	Erie	P100K
C16	Z115827	.01 μ F 20% 400V sleeved	Hunt	W97/BM21
C17		.001 μ F 350V ceramic	Erie	K3500/AD
C18		variable 220pF	Wingrove & Rogers	C73-01/IE
C19	Z132425	10pF 5% ceramic	Erie	P100K
C20	Z132425	10pF 5% ceramic	"	P100K
C21		trimmer 1.5-18pF 1000V height .468" with acetate case	Oxley	
C22		33pF 5% insulated	Lemco	1106
C23		.001 μ F 350V ceramic	Erie	K3500/AD
C24		trimmer 1.5-18pF 1000V height .468" with acetate case	Oxley	
C25		22pF 5% insulated	Lemco	1106
C26	Z115559	.05 μ F 20% 350V sleeved	Hunt	W49/B511
C27		.001 μ F 350V ceramic	Erie	K3500/AD
C28		220pF 10% insulated	Lemco	1106
C29		.001 μ F 350V ceramic	Erie	K3500/AD
C30		.001 μ F 350V ceramic	"	K3500/AD
C31	Z132425	10pF 5% ceramic	"	P100K
C32	Z132425	10pF 5% ceramic	"	P100K
C33		trimmer 1.5-18pF 1000V height .468" with acetate case	Oxley	
C34		39pF 5% insulated	Lemco	1106
C35		trimmer 1.5-18pF 1000V height .468" with acetate case	Oxley	
C36		33pF 5% insulated	Lemco	1106
C37	Z115827	.01 μ F 20% 400V sleeved	Hunt	W49/BM21
C38		.001 μ F 350V ceramic	Erie	K3500/AD
C39	Z115559	.05 μ F 20% 350V sleeved	Hunt	W49/B511
C40		.001 μ F 350V ceramic	Erie	K3500/AD
C41	Z115560	.1 μ F 20% 150V sleeved	Hunt	W49/B500
C42		220pF 350V insulated	Lemco	1106
C42A		.001 μ F 350V ceramic	Erie	K3500/AD
C43		trimmer 1.5-18pF 1000V height .468" with acetate case	Oxley	

9.3 CAPACITORS (continued)

<i>Cct. Ref.</i>	<i>Inter-Service No.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
C44		39pF 5% insulated	Lemco	1106
C45		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C46		33pF 5% insulated	Lemco	1106
C47	Z132424	8·2pF 10% ceramic	Erie	P100K
C48		·001μF 350V ceramic	"	K3500/AD
C49	Z115827	·01μF 20% 400V sleeved	Hunt	W97/BM21
C50		82pF 10% 350V insulated	Lemco	1106
C51		220pF 2% 350V insulated	"	1106
C52		·001μF 350V ceramic	Erie	K3500/AD
C53		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C54		39pF 5% insulated	Lemco	1106
C55		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C56		33pF 5% insulated	Lemco	1106
C57		·001μF 350V ceramic	"	K3500/AD
C58		·001μF 350V ceramic	Erie	K3500/AD
C59		·001μF 350V ceramic	"	K3500/AD
C60		·001μF 350V ceramic	"	K3500/AD
C61		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C62		39pF 5% insulated	Lemco	1106
C63		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C64		33pF 5% insulated	Lemco	1106
C65		·001μF 350V ceramic	Erie	K3500/AD
C66		·001μF 350V ceramic	"	K3500/AD
C67		82pF 10% 350V insulated	Lemco	1106
C68		220pF 2% 350V insulated	"	1106
C69		·001μF 350V ceramic	Erie	K3500/AD
C70		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C71		39pF 5% insulated	Lemco	1106
C72		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C73		33pF 5% insulated	Lemco	1106
C74		220pF 10% insulated	"	1106
C75	Z132288	47pF 5% ceramic	Erie	N750K
C76		variable 100pF nom. max.	Wingrove & Rogers	C1601
C77	Z160047	trimmer 3–33pF	Wingrove & Rogers	10/012SLF
C78		·001μF 350V ceramic	Erie	C31–01/1
C79		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	K3500/AD
C80		39pF 5% insulated	Lemco	1106
C81		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	

9.3 CAPACITORS (continued)

<i>Cct. Ref.</i>	<i>Inter-Service No.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
C82		33pF 5% insulated	Lemco	1106
C83		·001 μ F 350V ceramic	Erie	K3500/AD
C84		·001 μ F 350V ceramic	"	K3500/AD
C85	Z132419	3·3pF 10% ceramic	"	P100K
C86		·001 μ F 350V ceramic	"	K3500/AD
C87		·001 μ F 350V ceramic	"	K3500/AD
C88		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C89		33pF 5% insulated	Lemco	1106
C90		trimmer 1·5–18pF 1000V height ·468" with acetate case	Oxley	
C91		15pF \pm 1pF insulated	Lemco	1106
C92		·001 μ F 350V ceramic	Erie	K3500/AD
C93		·001 μ F 350V ceramic	"	K3500/AD
C94		·001 μ F 350V ceramic	"	K3500/AD
C95	Z115827	·01 μ F 20% 400V sleeved	Hunt	W49/BM21
C96		·001 μ F 350V ceramic	Erie	K3500/AD
C97	Z115563	·25 μ F 20% 150V	Hunt	W49/B501
C98	Z115827	·01 μ F 20% 400V sleeved	"	W49/BM21
C99		·001 μ F 350V ceramic	Erie	K3500/AD
C100		·001 μ F 350V ceramic	"	K3500/AD
C101	Z115559	·05 μ F 20% 350V sleeved	Hunt	W49/B511
C102		·001 μ F 350V ceramic	Erie	K3500/AD
C103	Z115560	·1 μ F 20% 150V sleeved	Hunt	W49/B500
C104		·001 μ F 350V ceramic	Erie	K3500/AD
C105	Z115827	·01 μ F 20% 400V sleeved	Hunt	W97/BM21
C106		·001 μ F 350V ceramic	Erie	K3500/AD
C107		220pF 10% 350V insulated	Lemco	1106
C108	Z160047	trimmer 3–33pF	Wingrove & Rogers	C31–01/1
C109		220pF 2% 350V insulated	Lemco	1106
C110	Z160047	trimmer 3–33pF	Wingrove & Rogers	C31–01/1
C111		·001 μ F 350V ceramic	Erie	K3500/AD
C112	Z115827	·01 μ F 20% 400V sleeved	Hunt	W97/BM21
C113	Z132279	27pF 5% ceramic	Erie	N750K
C114		·001 μ F 350V ceramic	"	K3500/AD
C115		·001 μ F 350V ceramic	"	K3500/AD
C116		33pF 5% insulated	Lemco	1106
C117	Z115827	·01 μ F 20% 400V sleeved	Hunt	W97/BM21
C118		differential trimmer 9·3pF max. ·0075" gap max.	Oxley	mini trimmer
C119		differential trimmer 9·3pF max. ·0075" gap max.	"	mini trimmer
C120		differential trimmer 9·3pF max. ·0075" gap max.	"	mini trimmer
C121		220pF 350V 2% insulated	Lemco	1106
C122		trimmer 70pF 12-vane with acetate case	Oxley	464
C123		See C139		
C124		220pF 350V 2% insulated	Lemco	1106
C125		trimmer 70pF 12-vane with acetate case	Oxley	464
C126		See C139		
C127		150pF 350V 2% insulated	Lemco	1106
C128		trimmer 70pF 12-vane with acetate case	Oxley	464
C129		See C139		
C130		·001 μ F 350V ceramic	Erie	K3500/AD

9.3 CAPACITORS (continued)

<i>Cct. Ref.</i>	<i>Inter-Service No.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
C130A	Z115827	.01 μ F 20% 400V sleeved	Hunt	W92/BM21
C131		.001 μ F 350V ceramic	Erie	K3500/AD
C132		.001 μ F 350V ceramic	"	K3500/AD
C133		.001 μ F 350V ceramic	"	K3500/AD
C134		2.2pF \pm .25pF ceramic	"	N750K
C135	Z115562	0.1 μ F 350V sleeved		
C136		trimmer 50pF	Wingrove & Rogers	C8-03
C137		220pF 5% insulated	Lemco	1106
C138	Z132288	47pF 5% ceramic	Erie	N750K
C139		4 Gang variable 443pF 20/.012	Wingrove & Rogers	C60-54/1
C140	Z115559	.05 μ F 20% 350V sleeved	Hunt	W49/B511
C141	Z115559	.05 μ F 20% 350V sleeved	"	W49/B511
C142	Z115827	.01 μ F 20% 400V sleeved	"	W97/BM21
C143		220pF 5% insulated	Lemco	1106
C144		39pF 5% insulated	"	1106
C145		.0068 μ F 5% silver mica	Hunt	L4/37
C146		220pF 5% insulated	Lemco	1106
C146A		150pF 5% ceramic	"	427N750
C147		trimmer 70pF 12-vane with acetate case	Oxley	464
C148		trimmer 70pF 12-vane with acetate case	"	464
C149		.001 μ F 350V ceramic	Erie	K3500/AD
C150	Z115560	0.1 μ F 20% 150V sleeved	Hunt	W49/B500
C151		.001 μ F 350V ceramic	Erie	K3500/AD
C152		270pF 5% insulated	Lemco	1106
C152A		120pF 5% ceramic	"	316N750
C153		trimmer 70pF 12-vane with acetate case	Oxley	464
C154	Z115563	0.25 μ F 20% 150V sleeved	Hunt	W49/B501
C155	Z115559	.05 μ F 20% 350V sleeved	"	W49/B511
C156	Z115827	.01 μ F 20% 400V sleeved	"	W92/BM21
C157		270pF 5% insulated	Lemco	1106
C157A		120pF 5% ceramic	"	316N750
C158		trimmer 70pF 12-vane with acetate case	Oxley	464
C159	Z115559	.05 μ F 20% 350V sleeved	Hunt	W49/B511
C160	Z115559	.05 μ F 20% 350V sleeved	"	W49/B511
C161		270pF 5% insulated	Lemco	1106
C161A		120pF 5% ceramic	"	316N750
C162		trimmer 70pF 12-vane with acetate case	Oxley	464
C163	Z115559	.05 μ F 20% 350V sleeved	Hunt	W49/B511
C164		330pF 10% insulated	Lemco	1106
C165	Z115559	.05 μ F 20% 350V sleeved	Hunt	W49/B511
C166	Z115559	.05 μ F 20% 350V sleeved	"	W49/B511
C167		470pF 5% insulated	Lemco	1106
C168	Z132425	10pF 5% ceramic	Erie	P100K
C169	Z115560	0.1 μ F 20% 150V sleeved	Hunt	W49/B500
C170		.0039 μ F 5% silver mica	"	L4/37
C171		trimmer 70pF 12-vane with acetate case	Oxley	464
C172		120pF 5% 350V insulated	Lemco	1106
C173	Z115560	0.1 μ F 20% 150V sleeved	Hunt	W49/B500
C174	Z115559	.05 μ F 20% 350V sleeved	"	W49/B511
C175	Z132282	33pF 5% ceramic	Erie	N750K
C176	Z115560	0.1 μ F 20% 150V sleeved	Hunt	W49/B500
C177		100pF 10% insulated	Lemco	1106
C178	Z132425	10pF 5% ceramic	Erie	P100K
C179		trimmer 70pF 12-vane with acetate case	Oxley	464
C180		100pF 5% 350V insulated	Lemco	1106
C181	Z115559	.05 μ F 20% 350V sleeved	Hunt	W49/B511
C182	Z115560	0.1 μ F 20% 150V sleeved	"	W49/B500
C183	Z115559	.05 μ F 20% 350V sleeved	"	W49/B511
C184	Z115559	.05 μ F 20% 350V sleeved	"	W49/B511
C185	Z115560	0.1 μ F 20% 150V sleeved	"	W49/B500

9.3 CAPACITORS (continued)

<i>Cct. Ref.</i>	<i>Inter-Service No.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
C186	Z115559	·05μF 20% 350V sleeved	Hunt	W49/B511
C187	Z115559	·05μF 20% 350V sleeved	"	W49/B511
C188	Z115559	·05μF 20% 350V sleeved	"	W49/B511
C189	Z115827	·01μF 20% 400V sleeved	"	W97/BM21
C190	Z115560	0·1μF 20% 150V sleeved	"	W49/B500
C191		trimmer 70pF 12-vane with acetate case	Oxley	464
C192		390pF 5% insulated	Lemco	1106
C193	Z132300	100pF 10% ceramic	Erie	N750L
C193A		·001μF 350V ceramic	"	K3500/AD
C194	Z115560	0·1μF 20% 150V sleeved	Hunt	W49/B500
C194A		0·001μF 350V ceramic	Erie	K3500/AD
C195	Z115562	0·1μF 20% 350V sleeved	Hunt	W49/B512
C195A		390pF 5% insulated	Lemco	1106
C195B		trimmer 70pF 12-vane with acetate case	Oxley	464
C196	Z115566	0·5μF 20% 350V sleeved	Hunt	W49/B502
C197		100μF 50V sleeved	"	JF104
				L37/1 85°
C198		32μF + 32μF 350V 85°	Plessey	CE818
C199		220pF 5% insulated	Lemco	1106
C200		variable 50pF	Wingrove & Rogers	C8-04/128
C201		trimmer 70pF 12-vane with acetate case	Oxley	464
C202		180pF 10% insulated	Lemco	1106
C203	Z132276	22pF 5% ceramic	Erie	N750K
C204	Z115560	0·1μF 20% 150V sleeved	Hunt	W49/B500
C205		·001μF 350V ceramic	Erie	K3500/AD
C206		32μF + 32μF 350V 85°	Plessey	CE818
C207	Z115559	·05μF 20% 350V sleeved	Hunt	W49/B511
C208	Z115559	·05μF 20% 350V sleeved	"	W49/B511
C209		330pF 10% insulated	Lemco	1106
C210		33pF 10% insulated	"	1106
C211		33pF 10% insulated	Lemco	1106
C212	Z115560	0·1μF 20% 150V sleeved	Hunt	W49/B500
C213	Z115560	0·1μF 20% 150V sleeved	"	W49/B500
C214	Z115562	0·1μF 20% 350V sleeved	"	W49/B512
C215		47pF 5% ceramic	Erie	N750K
C216	Z115827	·01μF 20% 400V sleeved	Hunt	W49/BM21
C217	Z115560	0·1μF 20% 150V sleeved	"	W49/B500
C218	Z115827	·01μF 400V 20% sleeved	"	W97/BM21
C219		·001μF 350V ceramic	Erie	K3500/AD
C220		·001μF 350V ceramic	"	K3500/AD
C221		·001μF 350V ceramic	"	K3500/AD
C222	Z145200	50μF 12V sleeved	Plessey	CE102/2
C223		·001μF ceramic	Erie	K3500/AD
C224		·01μF 750V 20% tubular	Lemco	420K
C225		·01μF 750V 20% tubular	"	420K

9.4 SWITCHES

S1		Aerial Attenuator	Racal	SW5
S2		Frequency Selection	"	SW4
S3		Crystal Filter	"	SW7
S4		100 kc/s Filter	"	SW8-9-11
S5		System Switch	"	SW6
S6		AVC	"	SW3
S7	Z510554	BFO	NSF	
S8	Z510554	Noise Limiter	DPCO	
S9	Z510554	Meter	DPCO	
S10	Z510554	Mains	DPCO	
S11	Z510554	Speaker	DPCO	

9.5 PLUGS AND SOCKETS

<i>Cct. Ref.</i>	<i>Inter-Service No.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
PL1	Z540101	Aerial input	Films and Equipment	
SK1	Z549028	Aerial input	" " "	
PL2	Z540151	1 Mc/s output	Power Controls	
SK2	Z540155	1 Mc/s Crystal calibrator	" "	
PL3	Z541051	1 Mc/s output	" "	
PL3A	Z540152	1 Mc/s output	" "	
SK3	Z540155	RA.37 output	" "	
PL4	Z540151	2-3 Mc/s B.P. filter input	" "	
SK4	Z540155	2-3 Mc/s B.P. filter input	" "	
PL5	Z540152	RA.37 input	" "	
PL6	Z540151	Crystal filter input	" "	
SK6	Z540155	Crystal filter input	" "	
PL7		Crystal calibrator input	McMurdo	C8/USP
SK7		Crystal calibrator input	"	X8/U
PL8	Z540101	100 kc/s I.F. output	Power Controls	
SK8	Z549028	100 kc/s I.F. output	" "	
PL9	Z540101	100 kc/s I.F. output	" "	
SK9	Z549028	100 kc/s I.F. output	" "	
PL10	Z560060	Mains input MkIV fixed 3 pin	Plessey	CZ48993
SK10	Z560100	Mains input MkIV free 3 pin	"	CZ49015

9.6 VALVE AND CRYSTAL HOLDERS

XL1		Crystal Holder	McMurdo	X2/UB
XL2 to XL7	Z560127	Valve Holder	"	
	Z563005	Screening Can	"	
V1 and V2	Z560127	Valve Holder	"	
	Z563003	Screening Can	"	
V3	Z560131	Valve Holder	"	
	Z560146	Screening Can	"	
V4 to V6	Z560127	Valve Holder	"	
	Z563003	Screening Can	"	
V7	Z560131	Valve Holder	"	
	Z560146	Screening Can	"	
V8	Z560127	Valve Holder	"	
	Z563003	Screening Can	"	
V9	Z560131	Valve Holder	"	
	Z560146	Screening Can	"	
V10 to V19	Z560127	Valve Holder	"	
	Z563003	Screening Can	"	
V20		Valve Holder	"	8/U
		Valve Retainer	Electrothermal	VRK31
V21 to V23	Z560127	Valve Holder	McMurdo	
	Z563003	Screening Can	"	

9.7 INDUCTANCES

L1	0-30 Mc/s filter	Racal	BD4586
L2	Crystal anode coil	"	AA4768
L3	Common assembly with L1		
L4	Aerial tuning	"	AA4770
L5	Aerial tuning	"	AA4778

9.7 INDUCTANCES (continued)

<i>Cct. Ref.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
L6	Aerial tuning	Racal	AA4774
L7	Aerial tuning	„	AA4775
L8	Aerial tuning	„	AA4776
L9	Aerial tuning	„	AA4773
L10	Common assembly with L1		
L11	Common assembly with L1		
L12	Common assembly with L1		
L13	Harmonic filter	„	AD4589
L14	Common assembly with L13		
L15	Common assembly with L1		
L16	Common assembly with L13		
L17	Common assembly with L1		
L18	Common assembly with L13		
L19	Common assembly with L13		
L20	First VFO anode coil	„	AA4780
L21	Common assembly with L13		
L22	Common assembly with L13		
L23	40 Mc/s filter	„	AA4815
L24	37·5 Mc/s filter	„	AA4632
L25	Common assembly with L23		
L26	Common assembly with L24		
L27	R.F. amplifier anode coil	„	AA4759
L28	37·5 Mc/s mixer anode	„	AA4763
L29	Common assembly with L23		
L30	Common assembly with L24		
L31	40 Mc/s filter	„	AA4761
L32	Common assembly with L24		
L33	37·5 Mc/s amplifier anode	„	AA4763
L34	Common assembly with L31		
L35	37·5 Mc/s filter	„	AA4632
L36	First VFO	„	AA4668
L37	Common assembly with L31		
L38	Common assembly with L35		
L39	Common assembly with L31		
L40	Common assembly with L35		
L41	Common assembly with L31		
L42	Common assembly with L35		
L43	Choke	Bulgin	SW68
L44	Filter coil	Racal	AA4655
L45	Choke	Bulgin	SW68
L46	Filter coil	Racal	AA4655
L47	Crystal input transformer	„	AA4771
L48	Crystal input transformer	„	AA4771
L49	Crystal input transformer	„	AA4771
L50	37·5 Mc/s tapped anode coil	„	AA4772
L51	Second mixer anode choke 37 Mc/s	„	AA4765
L52	Second mixer trap 37·5 Mc/s	„	AA4764
L53	Filter	„	AA4760
L54	Filter	„	AA4760
L55	Coil	„	BA4531 (part of)
L56	Choke	Bulgin	SW68
L57	2-3 Mc/s band pass filter	Racal	AA4766
L58	2-3 Mc/s band pass filter	„	AA4766
L59	2-3 Mc/s band pass filter	„	AA4767
L60	Common assembly with L59		
L61	First L/C filter stage	„	BA4758

9.7 INDUCTANCES (continued)

<i>Cct. Ref.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
L62	Common assembly with L61		
L63	Second L/C filter stage	Racal	AA4915
L64	Common assembly with L63		
L65	Choke	Bulgin	SW68
L66	Filter coil	Racal	AA4655
L67	Third L/C filter stage	"	AA4915
L68	Common assembly with L67		
L69	0.1 Mc/s coupling coil	"	AA4777
L70	0.1 Mc/s anode coil	"	AA4777
L71	Final L/C filter stage	"	BA4843
L72	100 kc/s I.F. first stage	}	BA4782 (part of)
L73	100 kc/s I.F. first stage		
L74	100 kc/s I.F. first stage		
L75	0.9 Mc/s anode coil	"	AA4779
L76	I.F. output	"	BA4783
L77	100 kc/s I.F. final stage	}	BA4942 (part of)
L78	100 kc/s I.F. final stage		
L79	100 kc/s I.F. final stage		
L80	Smoothing choke	"	T1081
L81	150m H choke	"	AA4762
L82	BFO	"	AA4769

9.8 TRANSFORMERS

T1	Mains	Racal	T1078
T2	Line output	"	T1079
T3	Audio	"	T1090

9.9 RECTIFIER

MR1	Meter rectifier	S.E.I. Ltd.	1mA
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9.10 LOUD SPEAKER

—	3Ω, 2½" square	Goodmans	T24/201/3
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9.11 METER

M1	200 microamp FSD	Ernest Turner	W909
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9.12 CRYSTALS

XL1	1 Mc/s ± .005	Cathodeon	Style D
XL2	100,036 c/s ± .005%	Brookes	Type G1
XL3	100,110 c/s ± .005%	"	Type G1
XL4	100,270 c/s ± .005%	"	Type G1
XL5	99,964 c/s ± .005%	"	Type G1
XL6	99,890 c/s ± .005%	"	Type G1
XL7	99,730 c/s ± .005%	"	Type G1

9.13 FUSEHOLDER AND FUSE

<i>Cct.</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Type or Drawing</i>
<i>Ref.</i>			
—	Mains input fuseholder	Belling Lee	L/356
F1	Mains input fuse (2 amp)	„ „	L/1055

9.14 LAMP

ILP1	Mains indicating 8V 1·6W M.E.S.	Luxram	983
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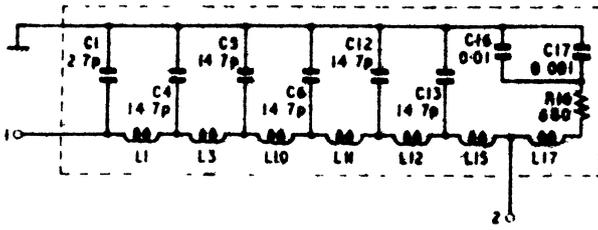
9.15 VOLTAGE SELECTORS

—	0, —5, —10 volts	McMurdo	BV5/4
—	110, 125, 210, 250 volts	„	BV5/4

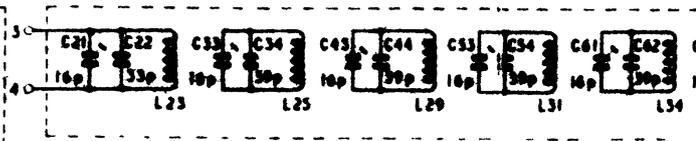
SECTION 10
CIRCUIT DIAGRAM

XL1 R1 C1 L1 S2A VI R5 SIA PL1-SKI R10 C3-10 L3-10 V2 R15 S2B S1B S2D S2C L15 L20 S2C L25 L30 V3-4 R20 R25 R30 C25 C30 C35-40 C45-50 L25 L30 V5-6 R35 R40 C55 C60 C65 L35

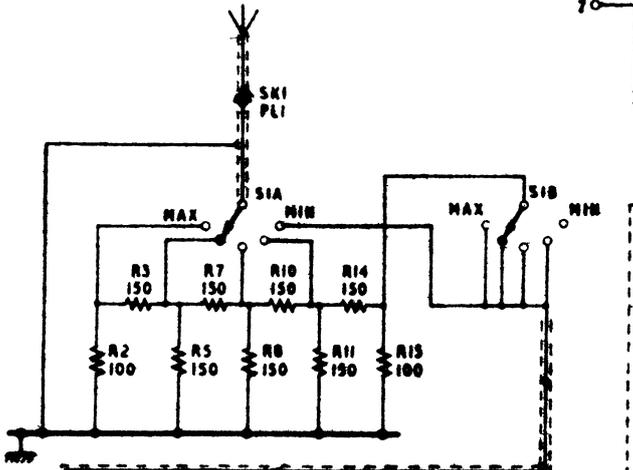
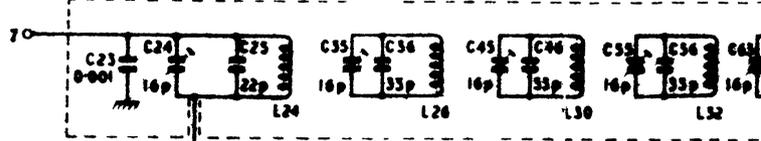
0-30Mc/s LOW PASS FILTER



40Mc/s BAND PASS FILTER

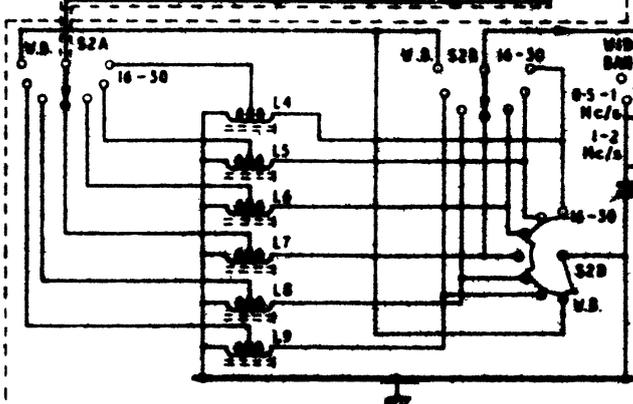
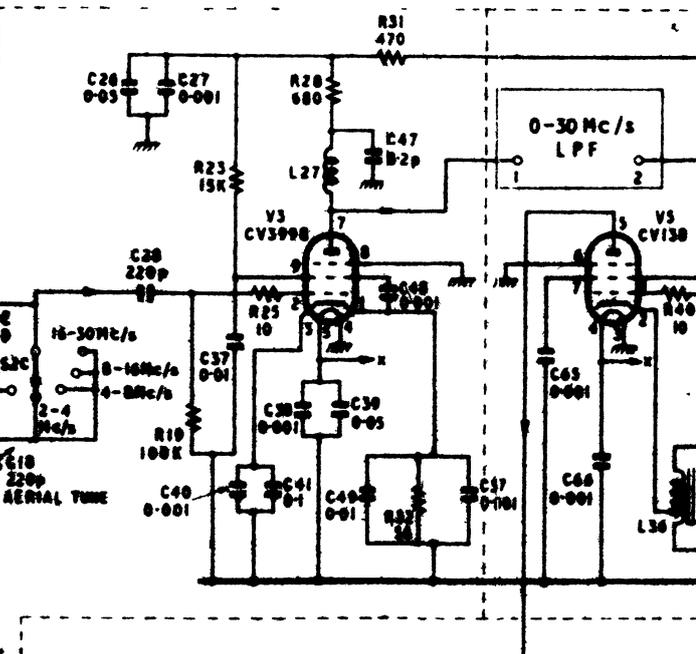


37.5Mc/s BAND PASS FILTER



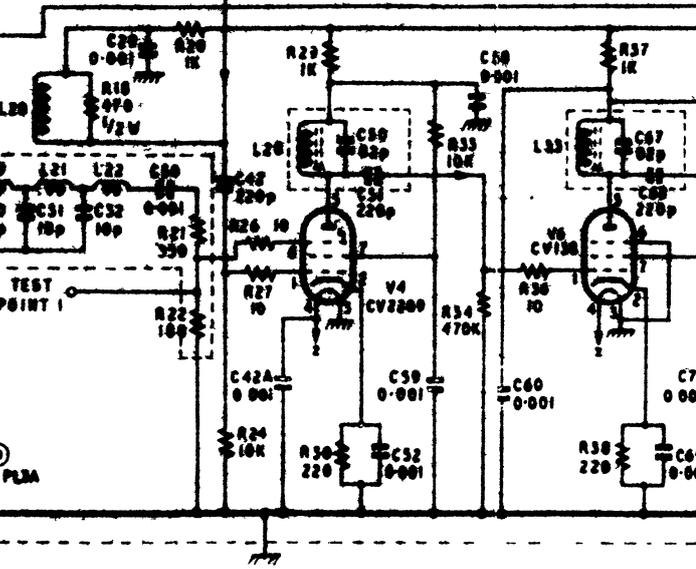
RF AMP

1st VFO



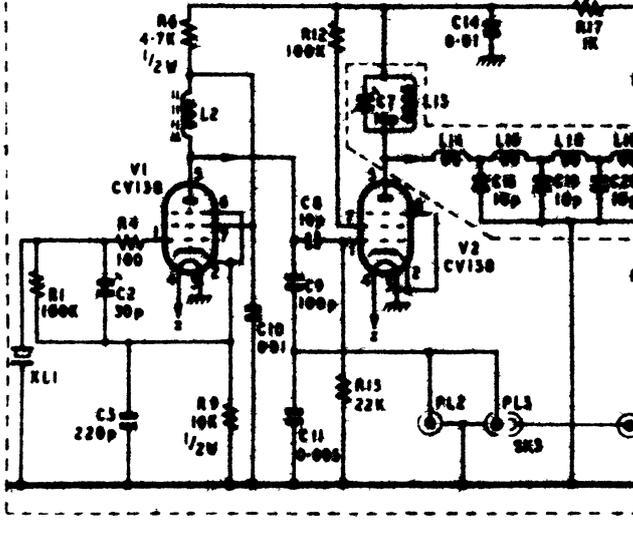
HARMONIC MIXER

37.5Mc/s AMP



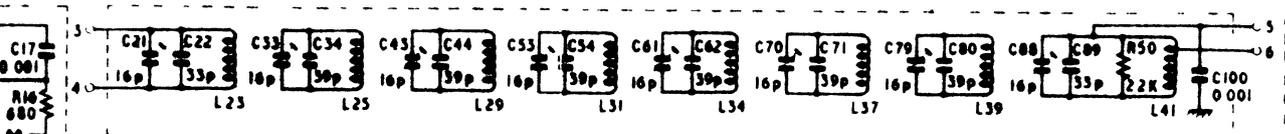
XTAL OSC

HARMONIC GEN

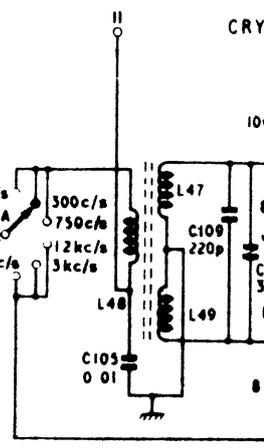
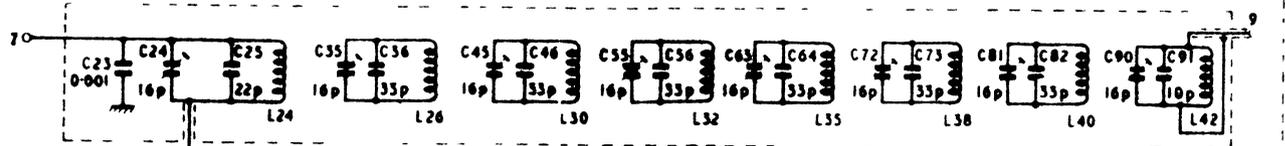


C20 L20 S2D TP1 V3 4 R20 R25 R30 R35 R40 R45 R50 R55 V9-10 R60 C110 L50
 C25 C30 C35-40 L25 L30 C55 C60 C65 L35 C70 C75 C80-85 C90 C95 C100 L40 L45 S3A TP3
 C105 C110 L50

40Mc/s BAND PASS FILTER



37.5Mc/s BAND PASS FILTER

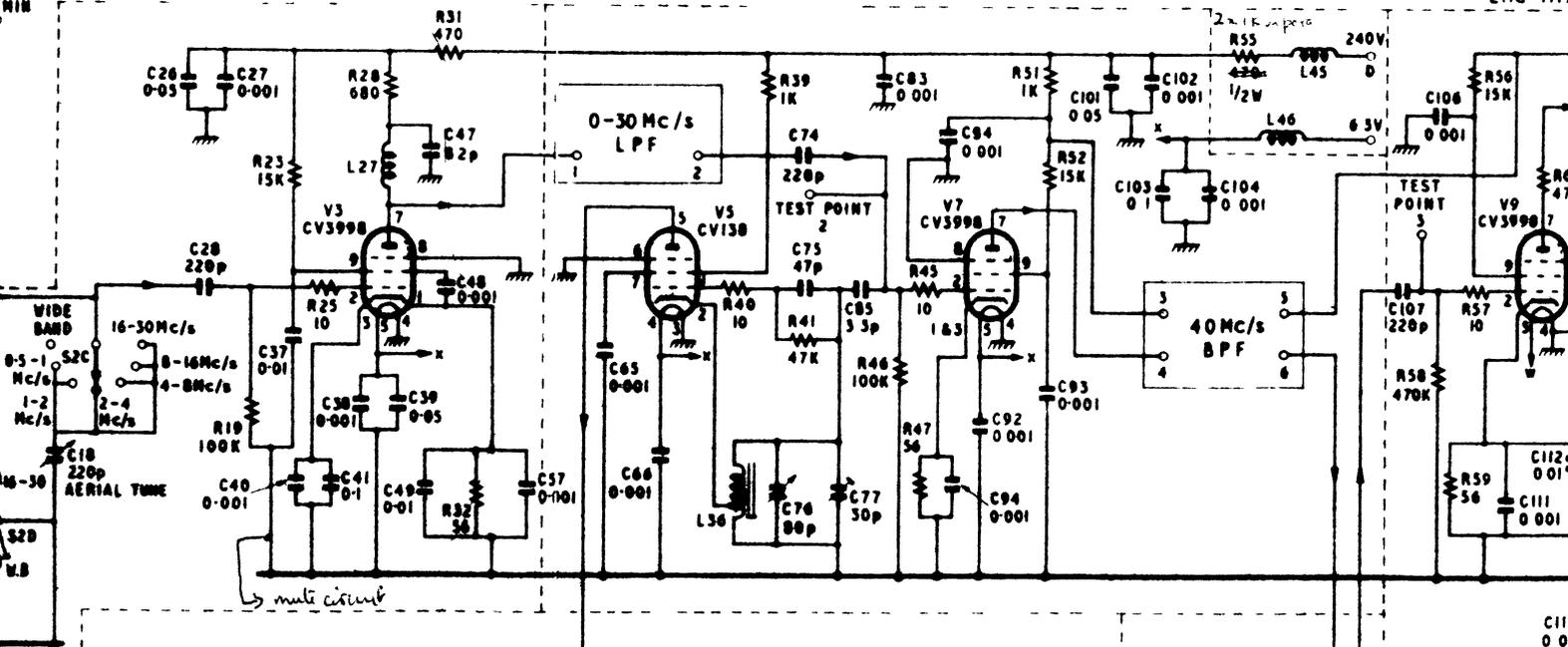


RF AMP

1st VFO

1st MIXER

2nd MIX

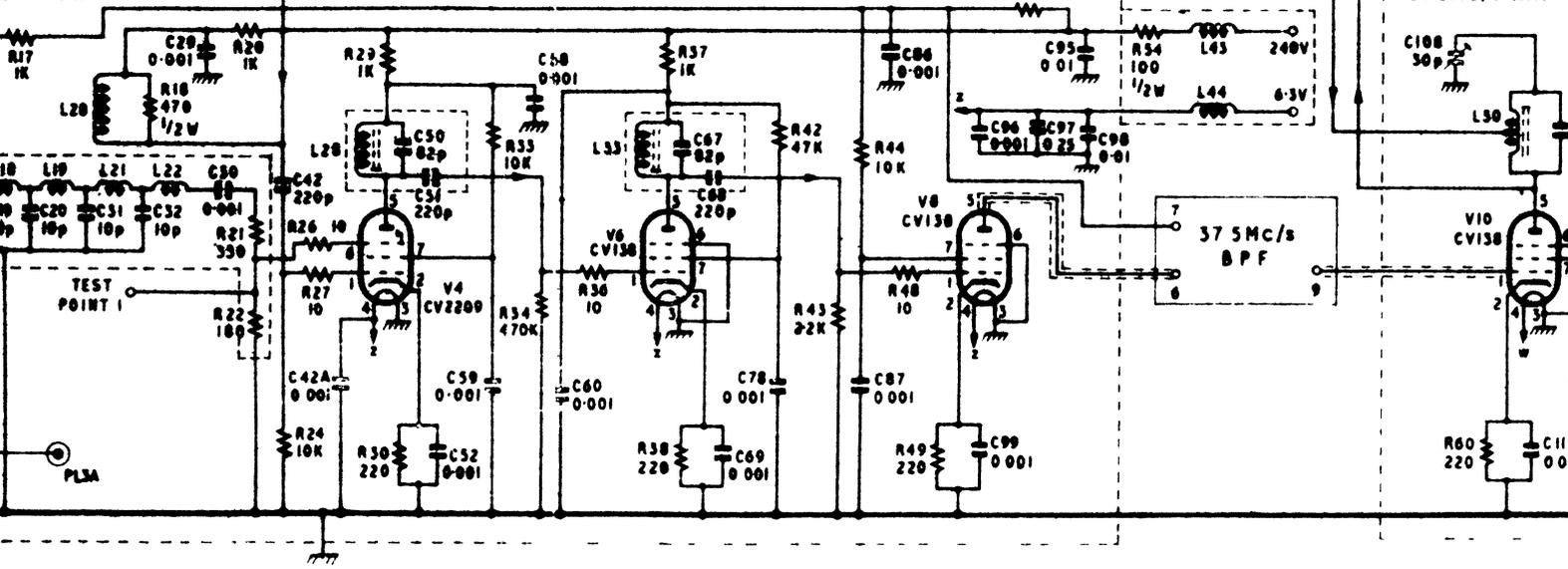


HARMONIC MIXER

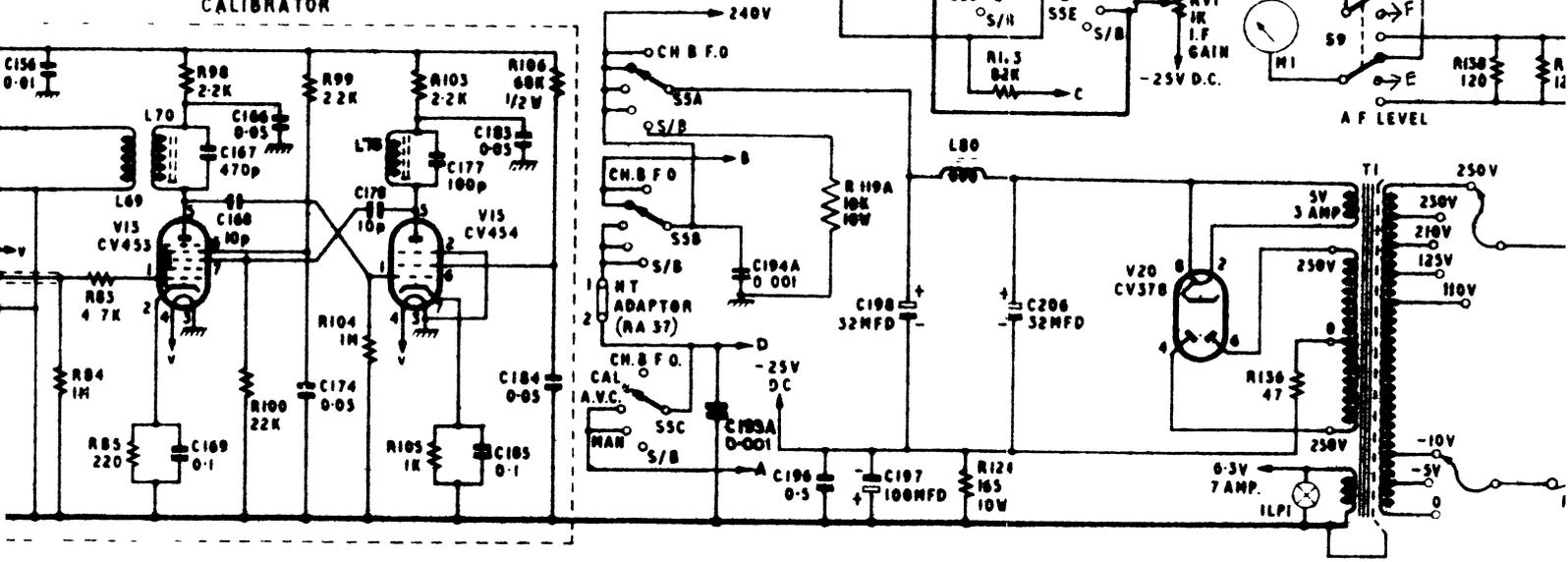
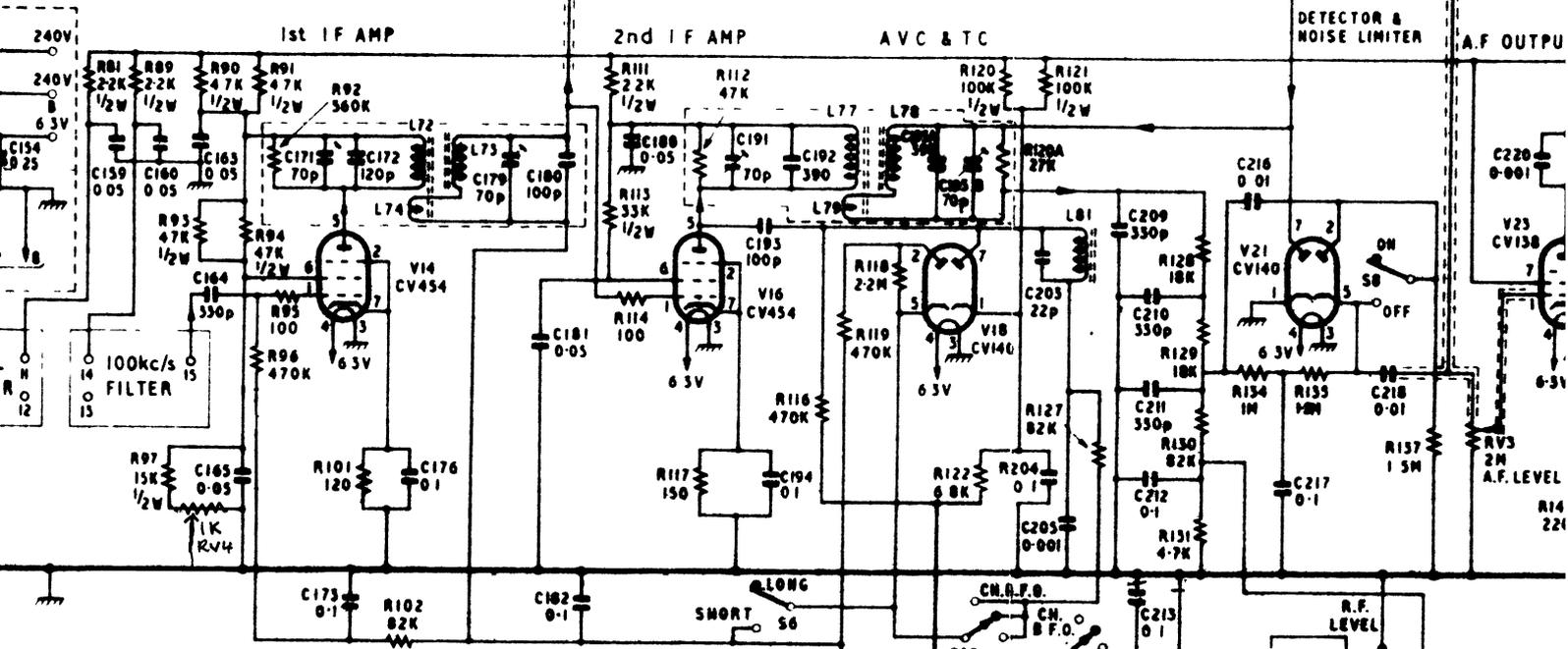
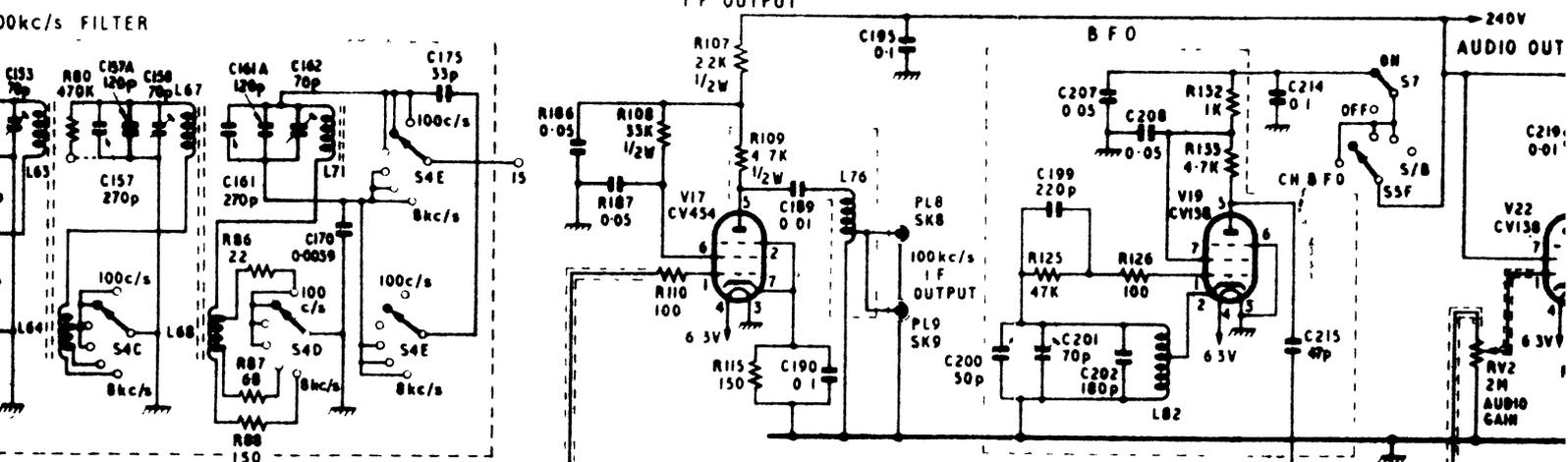
37.5Mc/s AMP

37.5Mc/s AMP

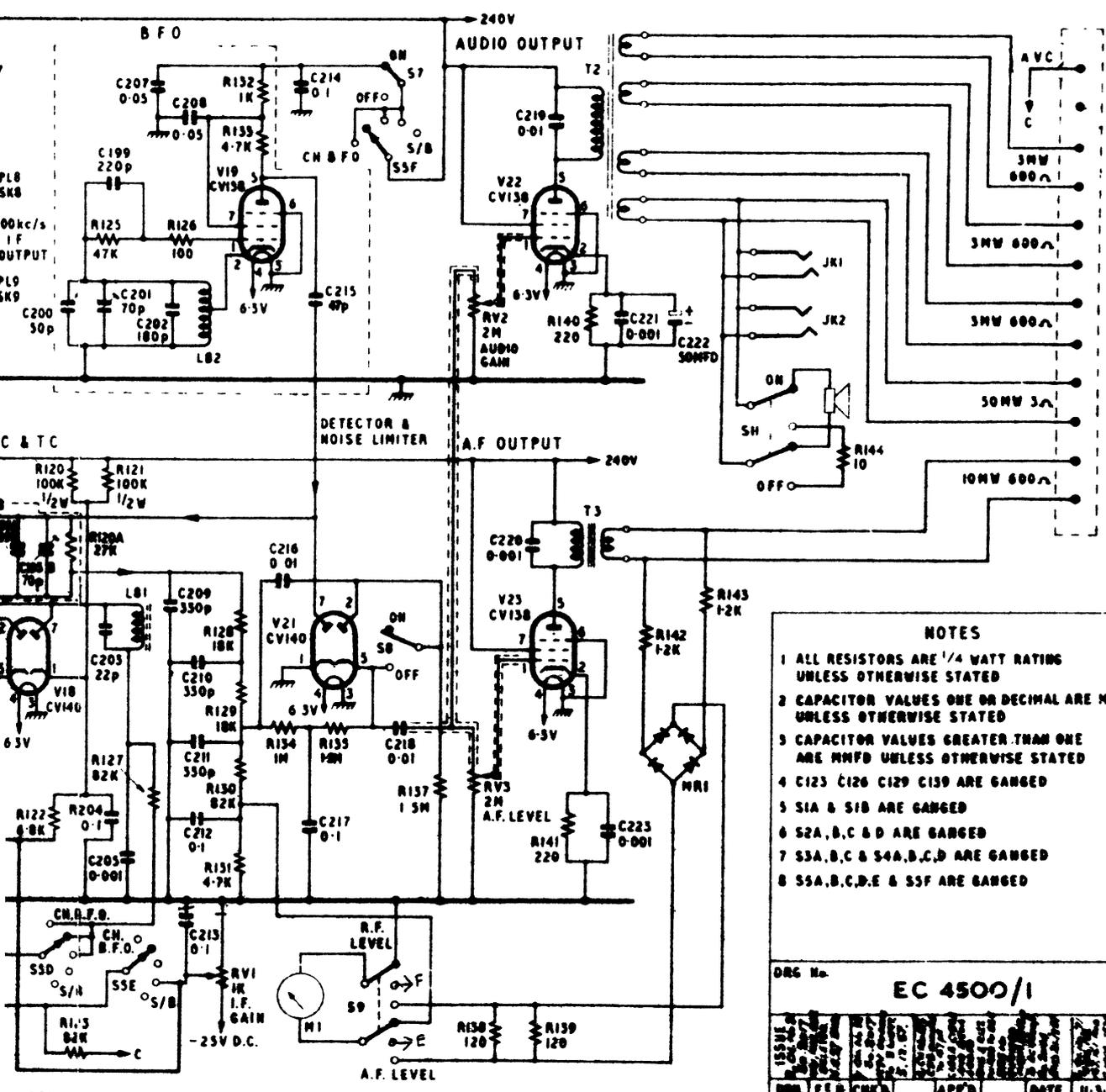
37.5Mc/s AMP



V13 V14 V15 V16 V17 V18 V19-20
 R80 R85 R90 R95-100 R105 R110 R115 R120 R125 R130 R135
 C160 C165 C170 C175 C180-185 C190 C195 C200 C205 C210 C215
 L70 L75 L80 L82 L88 L90 L95 L100 L105 L110 L115 L120 L125 L130 L135
 S4C S4D S4E S5A-C S6 S5D S5E S5F S7 S8-9
 PL0-9 SK0-9 RV1 RV2-3



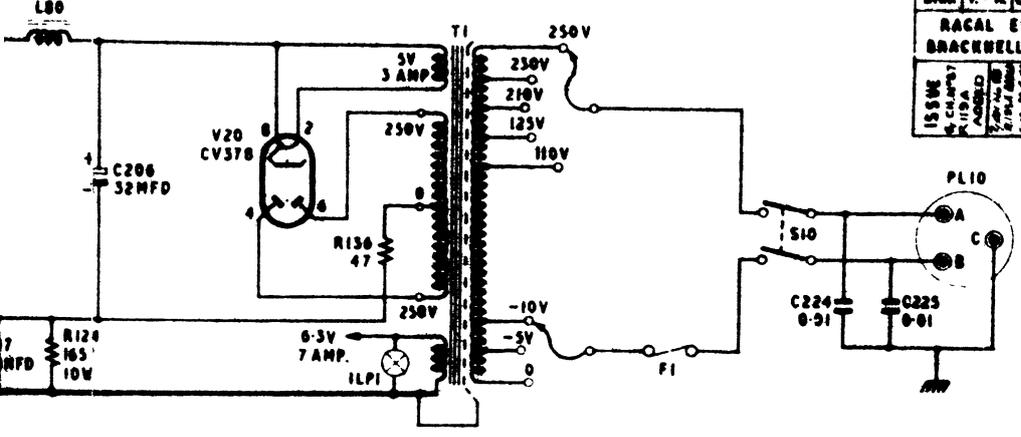
V18 R120 C200 L80 S5D SK8-9
 V19-20 R125 C205 L82 S5E RVI
 R130 C210 L82 R132 1K R133 4.7K
 R135 C215 T1 SSF S7 S8-9
 V22-23 R140 C220 T2-3 FI
 R144 C225 S10 S11 JK1-2 PL10
VALVES & CRYSTALS
RESISTORS
CAPACITORS
INDUCTANCES & TRANSFORMERS
SWITCHES
MISCELLANEOUS



NOTES

- 1 ALL RESISTORS ARE 1/4 WATT RATING UNLESS OTHERWISE STATED
- 2 CAPACITOR VALUES ONE OR DECIMAL ARE MFD UNLESS OTHERWISE STATED
- 3 CAPACITOR VALUES GREATER THAN ONE ARE MMFD UNLESS OTHERWISE STATED
- 4 C123 C126 C129 C139 ARE GANGED
- 5 S1A & S1B ARE GANGED
- 6 S2A, B, C & D ARE GANGED
- 7 S3A, B, C & S4A, B, C, D ARE GANGED
- 8 S5A, B, C, D, E & S5F ARE GANGED

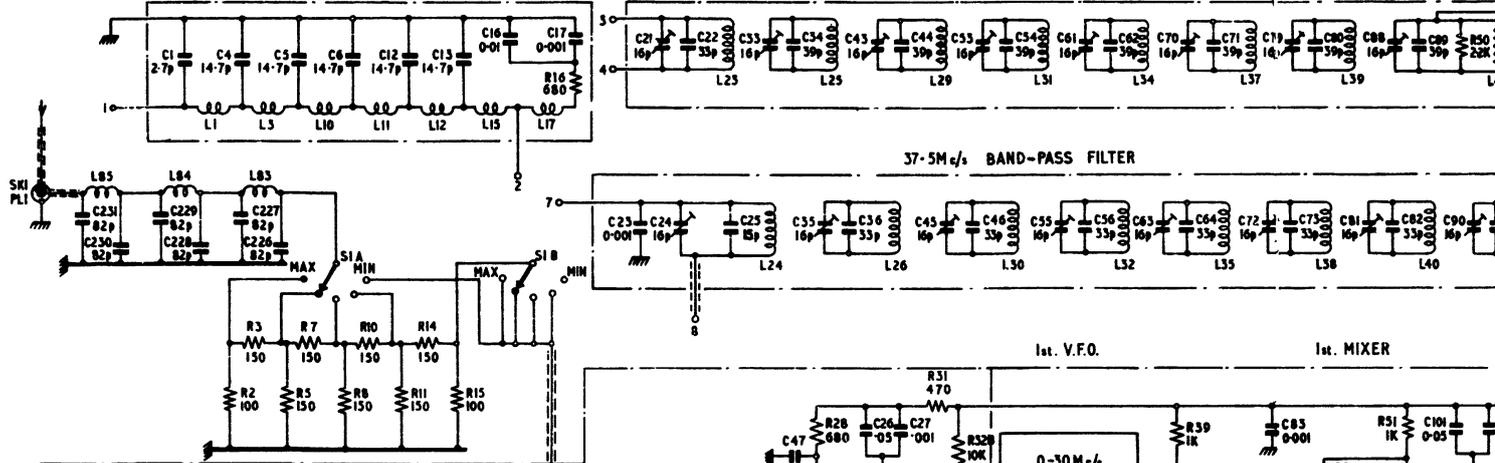
DRG No. **EC 4500/1**
 RAGAL ENGINEERING LTD.
 BRACKNELL, BERKS, ENGLAND.
 DATE 11-3-57



XL1	V1			V2			V3-V4			V5-V6			V7-V8				
	R5	R10	R15				R20	R25	R30	R35	R40		R45	R50			
	C1	C3-10	C15	C20	C25	C30	C35-40	C45-50	C55	C60	C65	C70	C75	C80-85	C90	C95	C100
	L1	L5-10			L15	L20	L25	L30	L35	L40							
	S2A	S1A	S2B	S1B	S2D	S2C											
	PL1-SK1			PL2	PL3	TPI								TP2			

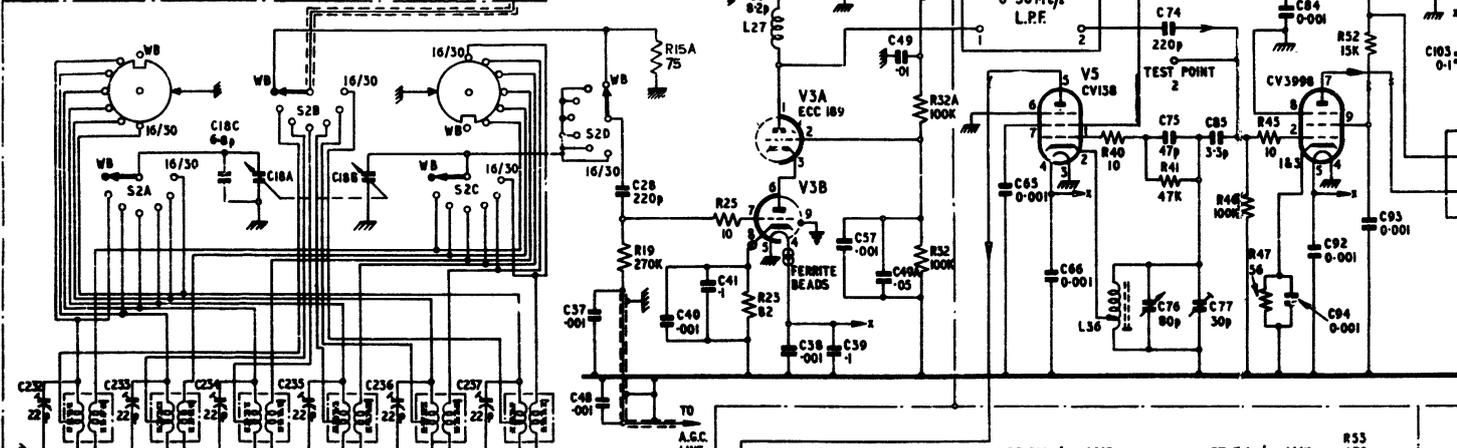
0-30Mc/s LOW-PASS FILTER

40Mc/s BAND-PASS FILTER



1st. V.F.O.

1st. MIXER



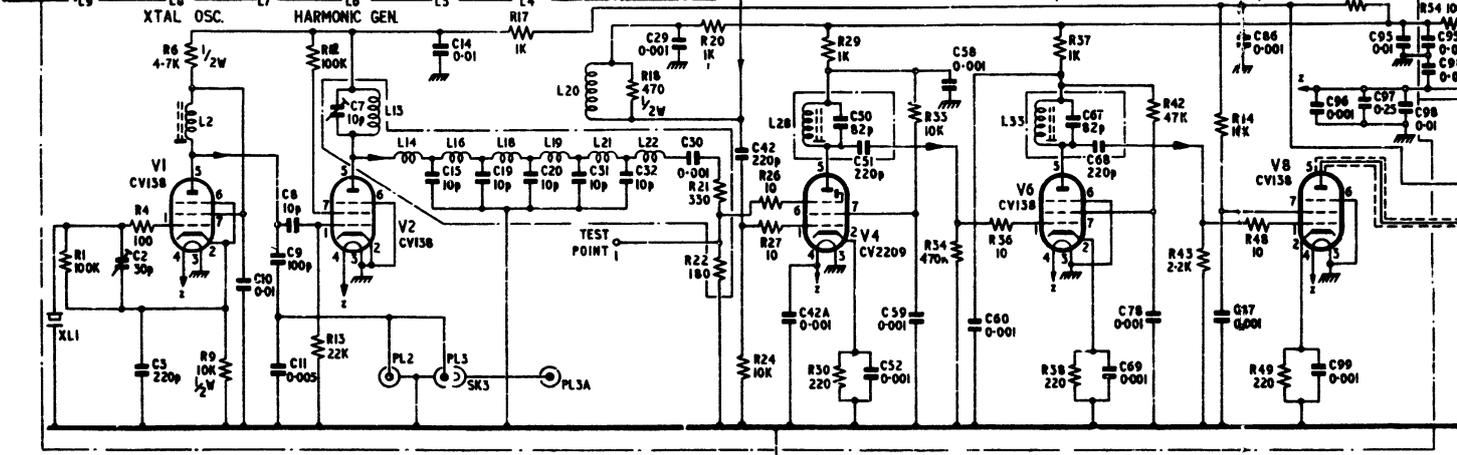
XTAL OSC.

HARMONIC GEN.

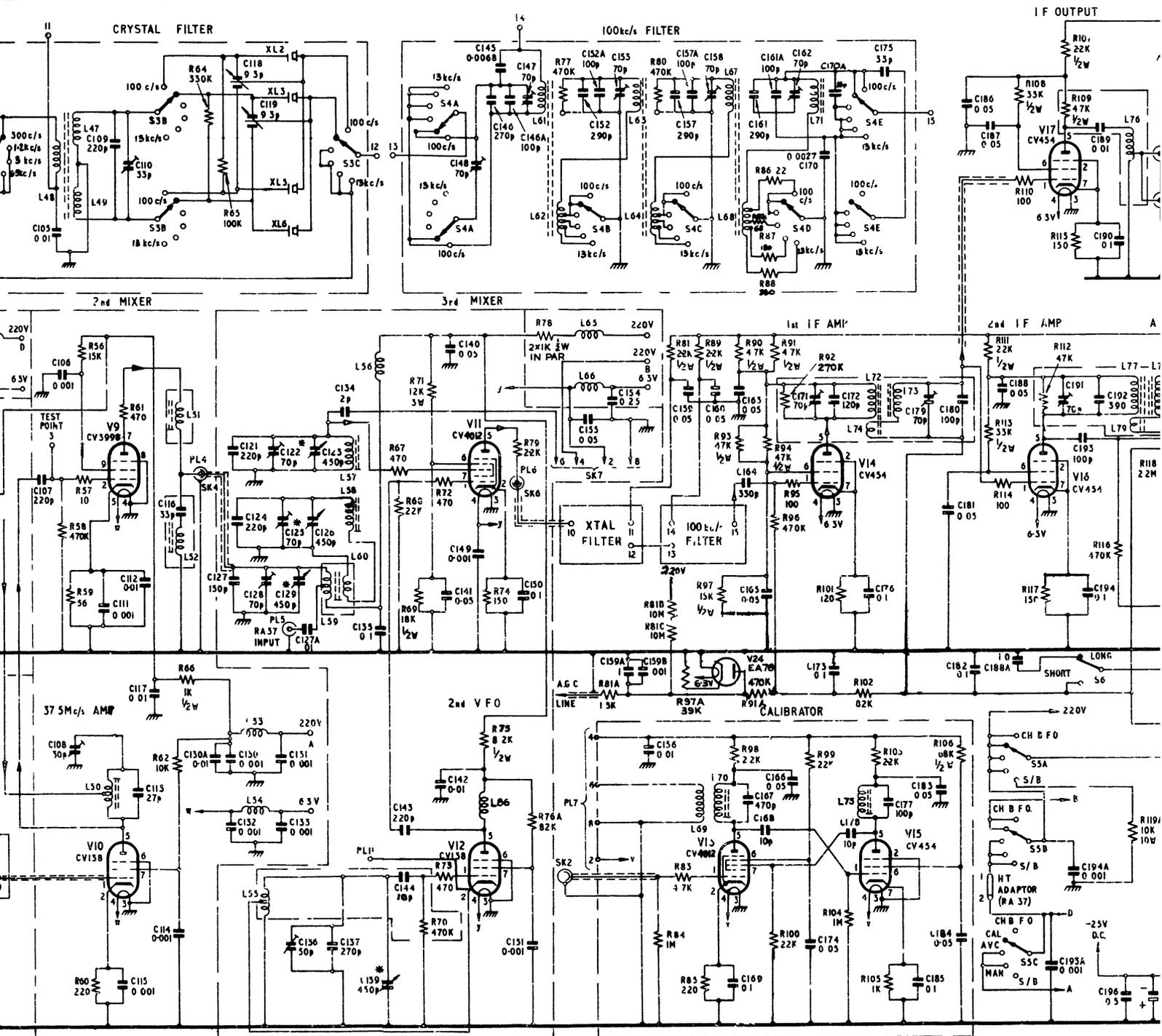
HARMONIC MIXER

37.5Mc/s AMP.

37.5Mc/s AMP.

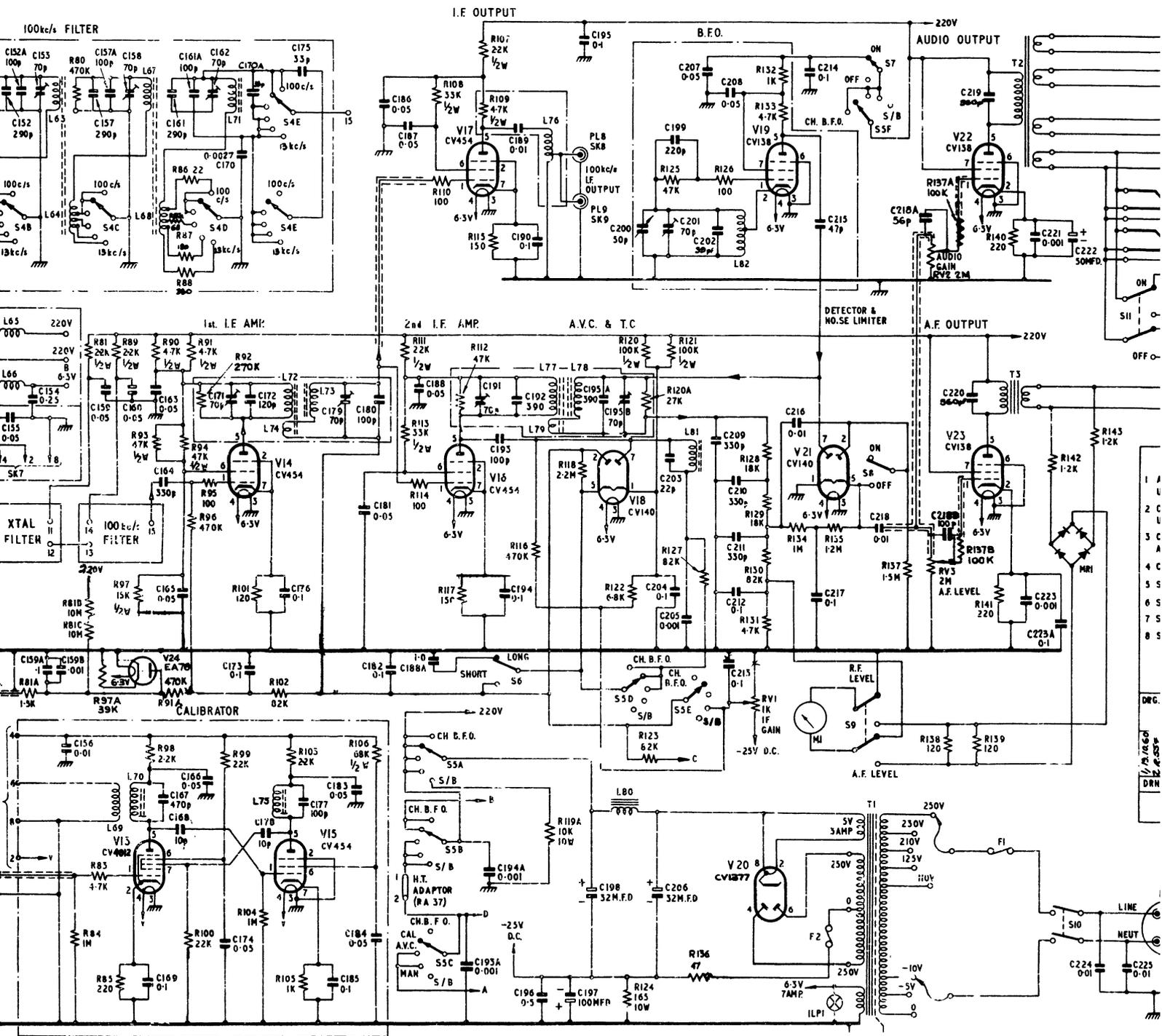


V9-V10	XL2-7	VII-V12	V13	V14	V15	V16	V17
R60	R65	R70	R80	R85	R90	R95-100	R105
C105	C110-115	C120-125-130	C135	C140	C145-150	C155	C160
L50	L55	L60	L65	L70	L75	L80	L85
TP3	PL4-SK4	PL5	PL6	SK2	PL7-SK7	SK4	SK5
S3B	S3C	S4A	S4B	S4C	S4D	S4E	S5A-C
							S6
							PL8

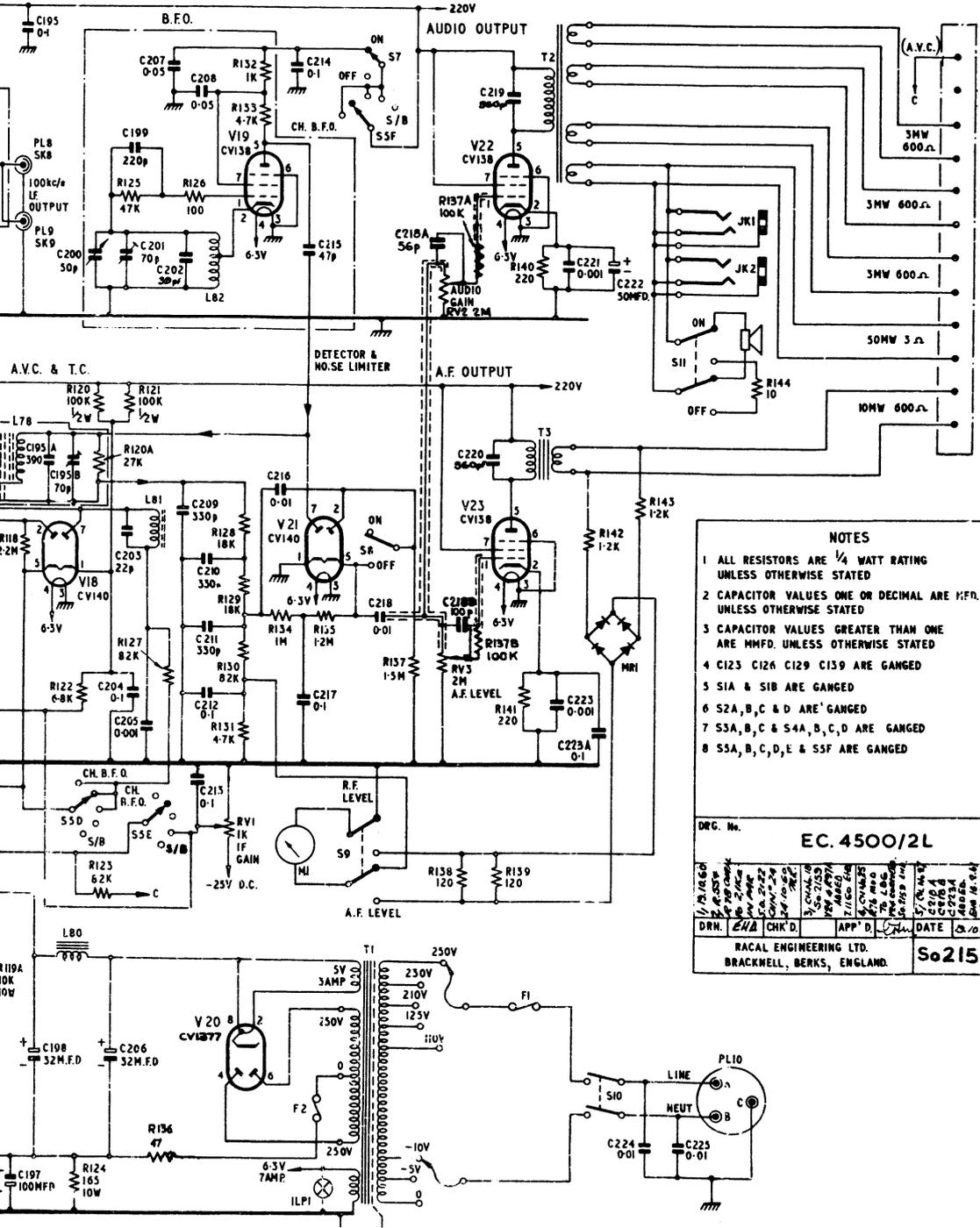


RECEIVER TYPE RA17L

	V13	V14	V15	V16	V17	V18	V19-V20	V21	V22-V23				
R80	R85	R90	R95-100	R105	R110	R115	R120	R125	R130	R135	R140		
C155	C160	C165	C170	C175	C180-185	C190	C195	C200	C205	C210	C215	C220	C225
L65	L70	L75	L80	L85	L90	L95	L100	L105	L110	L115	L120	L125	L130
S4B	S4C	S4D	S4E	S5A-C	S6	S5D	S5E	S5F	S7	S8-9	S10	S11	S12
SK2	PL7	SK7				PLB-9	SKB-9		RV1		RV2-3	F1	



V18	V19-V20	V21	V22-V23	VALVES & CRYSTALS					
R120	R125	R130	R135	R140	RISISTORS				
C195	C200	C205	C210	C215	C220	C225	CAPACITORS		
L80	S5D	S5E	L82	T1	T2-3	INDUCTANCES & TRANSFORMERS			
PL8-9	SK8-9	RV1	S5F	S7	S8-9	SWITCHES			
			RV2-3	F1	S10	S11	JK1-2	PL10	MISCELLANEOUS



NOTES

- 1 ALL RESISTORS ARE 1/4 WATT RATING UNLESS OTHERWISE STATED
- 2 CAPACITOR VALUES ONE OR DECIMAL ARE MHF. UNLESS OTHERWISE STATED
- 3 CAPACITOR VALUES GREATER THAN ONE ARE MHFD. UNLESS OTHERWISE STATED
- 4 C123 C124 C129 C139 ARE GANGED
- 5 S1A & S1B ARE GANGED
- 6 S2A, B, C & D ARE GANGED
- 7 S3A, B, C & S4A, B, C, D ARE GANGED
- 8 S5A, B, C, D, E & S5F ARE GANGED

DRG. No. **EC. 4500/2L**

1/21/60	2/23/60	3/2/60	4/1/60	5/1/60	6/1/60	7/1/60	8/1/60	9/1/60	10/1/60
DRN.	CHK'D.	APP'D.	DATE						

RACAL ENGINEERING LTD.
BRACKWELL, BERKS, ENGLAND.

So2159

