L. F. CONVERTER

TYPE RA. 237B

Operating and Maintenance Manual

Technical Handbooks Department

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England.

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THE NEXT TWO PAGES

concern all users of electrical equipment from a different point of view

•

read carefully . . . . . it

COULD AFFECT YOU



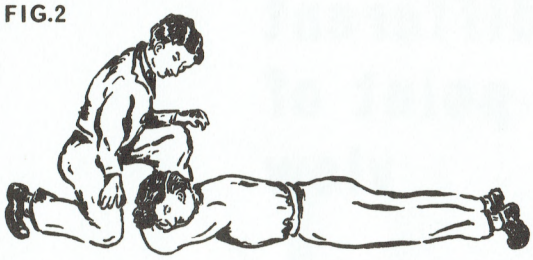
FIRST AID in case of Electric Shock

FIG.1



1. *SWITCH OFF.* If this is not possible, *PROTECT YOURSELF* with dry insulating material and pull the victim clear of the conductor.
   DON'T TOUCH THE VICTIM WITH YOUR BARE HANDS until he is clear of the conductor, but *DON'T WASTE TIME.*

FIG.2



2. (a) Lay patient face down with head to one side, arms bent and forehead on his hands to keep mouth and nose clear. (see Fig.1)
   (b) Give one or two firm thumps with flat of hand between his shoulders.
   (c) Kneel at his head, one knee near the head and your other foot alongside the elbow. (see Fig.2)
   (d) Place your hands on his shoulder blades with thumbs touching on the mid-line and and fingers pointing towards his feet. (see Fig.3)

FIG.3



3. (a) Bend forward with your arms straight and apply weight lightly. (see Fig.4)
   (b) Release pressure gradually and slide your hands to grip him just above the elbows. (see Fig.5)
   (c) Draw his arms and shoulders towards you by leaning backwards with your arms straight till you feel resistance, but without lifting his chest off the ground. (see Fig.6)
   (d) Lay his arms down and slide your hands on to the shoulder blades.

   Repeat paragraph 3 at a rate of 9 times to the minute until breathing is restored, & then omit the back pressure but continue the movement at a rate of 12 times to the minute.

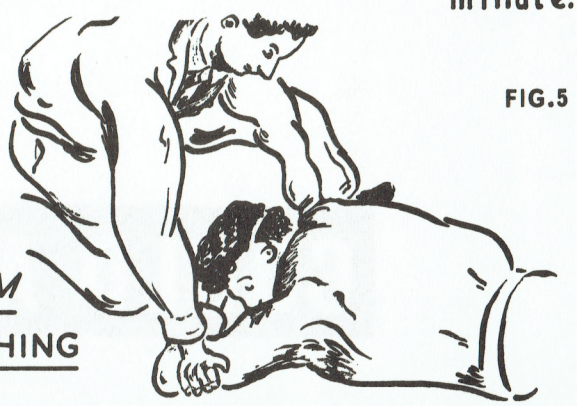
HAVE SOMEONE ELSE

SEND FOR DOCTOR

FIG.4



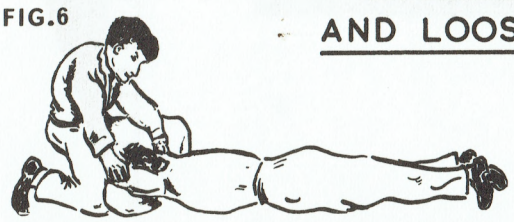
FIG.5



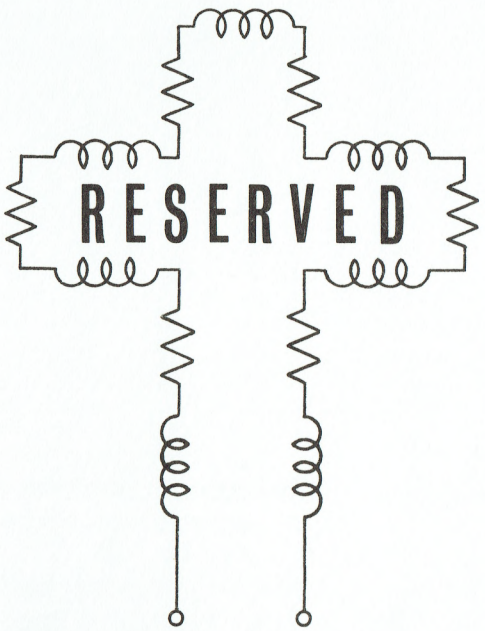
KEEP PATIENT WARM

AND LOOSEN HIS CLOTHING

FIG.6



DO NOT *give liquids until patient is conscious*



FOR THOSE WHO MEDDLE WITH *LIVE* WIRES

THE VOLTAGES EMPLOYED IN THIS EQUIPMENT ARE SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE.

EVERY REASONABLE PRECAUTION HAS BEEN OBSERVED IN DESIGN TO SAFEGUARD OPERATING PERSONNEL.

The Power MUST BE SWITCHED OFF
BEFORE SERVICING EQUIPMENT,

and

GREAT CARE taken
WHEN MAKING INTERNAL ADJUSTMENTS——— etc.,

SWITCH OFF —— PLAY SAFE !!

now . . .

proceed

with

CAUTION

HANDBOOK CHANGE INFORMATION

At RACAL, we continually strive to keep up with the latest electronic developments by adding circuit and component improvements to our equipments.

Sometimes, due to printing and despatch requirements, we are unable to incorporate these changes immediately into printed handbooks. Hence, your handbook may contain new change information on following pages.

NOTES

L. F. CONVERTER

TYPE RA. 237

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SECTION 1 INSTALLATION AND OPERATION

SECTION 2 MAINTENANCE

SECTION 1

INSTALLATION AND OPERATION

CONTENTS

TECHNICAL SPECIFICATION

CHAPTER 1 GENERAL DESCRIPTION

CHAPTER 2 INSTALLATION

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CHAPTER 4 BRIEF TECHNICAL DESCRIPTION

CHAPTER 5 DETAILED CIRCUIT DESCRIPTION

TECHNICAL SPECIFICATION

(When used in conjunction with an RA. 117 receiver)

Frequency range:	10 to 980 kc/s.
Stability:	After warm-up time, overall drift less than 50 c/s under conditions of constant supply voltage and ambient temperature.
Input impedance:	75Ω unbalanced.
Tuning - RA. 237:	6 ranges, displayed over 6 in. 10-20 kc/s 20-40 kc/s 40-210 kc/s 210-500 kc/s 500-980 kc/s Calibration accuracy better than 1%.
Tuning - RA. 117:	Effective scale length of approximately 145 feet, i.e. about 6 inches of scale length corresponds to 100 kc/s.
Sensitivity:	A1 reception, bandwidth 3 kc/s; 1μV for 15dB signal-to-noise ratio. A2 reception, 30% modulated, bandwidth 3 kc/s; 3μV for 15dB signal-to-noise ratio.
Image Response:	With tuned input, external image signals are reduced by at least 100dB.

Power supply:

100-125 and 200-250 volts, 45-65 c/s.
Power consumption 11W approximately.
H. T. supply from RA. 117 receiver.

Dimensions:

For rack mounting:

Height	Width	Depth	
$3\frac{1}{2}$	19	13	in.
9	48.25	33	cm.

Cabinet containing RA. 117 and RA. 237.

Height	Width	Depth	
16	$20\frac{1}{2}$	22	in.
40.6	52	55.6	cm.

Weight:

Rack mounted 13 lb. (6 kg.).

In cabinet with RA. 117, 110 lb. (50 kg.).

CHAPTER 1

GENERAL DESCRIPTION

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CHAPTER 1

GENERAL DESCRIPTION

Introduction

1. The L. F. Converter Type RA. 237 is designed primarily to extend the low frequency limit of the RACAL RA. 117 Communications Receiver from 980 kc/s to 10 kc/s. The addition of the converter to the RA. 117 receiver in no way impairs its performance.

2. The equipment, which is basically a frequency converter for raising the frequency of incoming signals by 2 Mc/s, derives h.t. supplies from the RA. 117 receiver and heater supplies from a built-in mains transformer.

3. The RA. 237 is assembled on a 19 in. panel for rack mounting. It can be supplied complete with the RA. 117 receiver in a bench mounting cabinet.

CHAPTER 2

INSTALLATION

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Installation of RA. 117	7

ILLUSTRATIONS

	Fig.
Interconnections between RA. 117 and RA. 237	1

CHAPTER 2

INSTALLATION

1. After carefully unpacking the equipment, ensure that all valves and screening cans are firmly in place and that no packing materials remain.

Power Supply

2. Ascertain that the l.t. transformer taps are set to the correct supply voltage tapping. The power lead is permanently fitted to the converter which can be connected directly to the power supply.

Fuse

3. Ensure that the rating of the supply fuse (FS1) is correct viz. 250mA.

Antenna

4. Connect a suitable antenna to the ANTENNA input socket on the rear of the unit. The input impedance of the converter at the coaxial antenna plug is designed to match a 75Ω unbalanced transmission line.

Connections to RA. 117

5. The following connections between the RA. 237 and the RA. 117 (fig. 1) should be made with the connectors supplied:-

(a) Coaxial connectors

RA. 237	RA. 117
R. F. OUTPUT	R. F.
1 MC/S INPUT	1 MC/S

(b) 3-way connector

RA. 237	RA. 117
HT1	HT1
HT2	HT2
AVC	AVC

6. The two coaxial connectors are of different length and the correct one to use will be obvious. The 3-way connector consists of two red wires and a white wire coded at either end with coloured sleeves to aid identification. The white wire should be used for the AVC connection.

Installation of RA. 117

7. The RA. 117 receiver should be installed and connected in accordance with the instructions in the RA. 117 handbook.

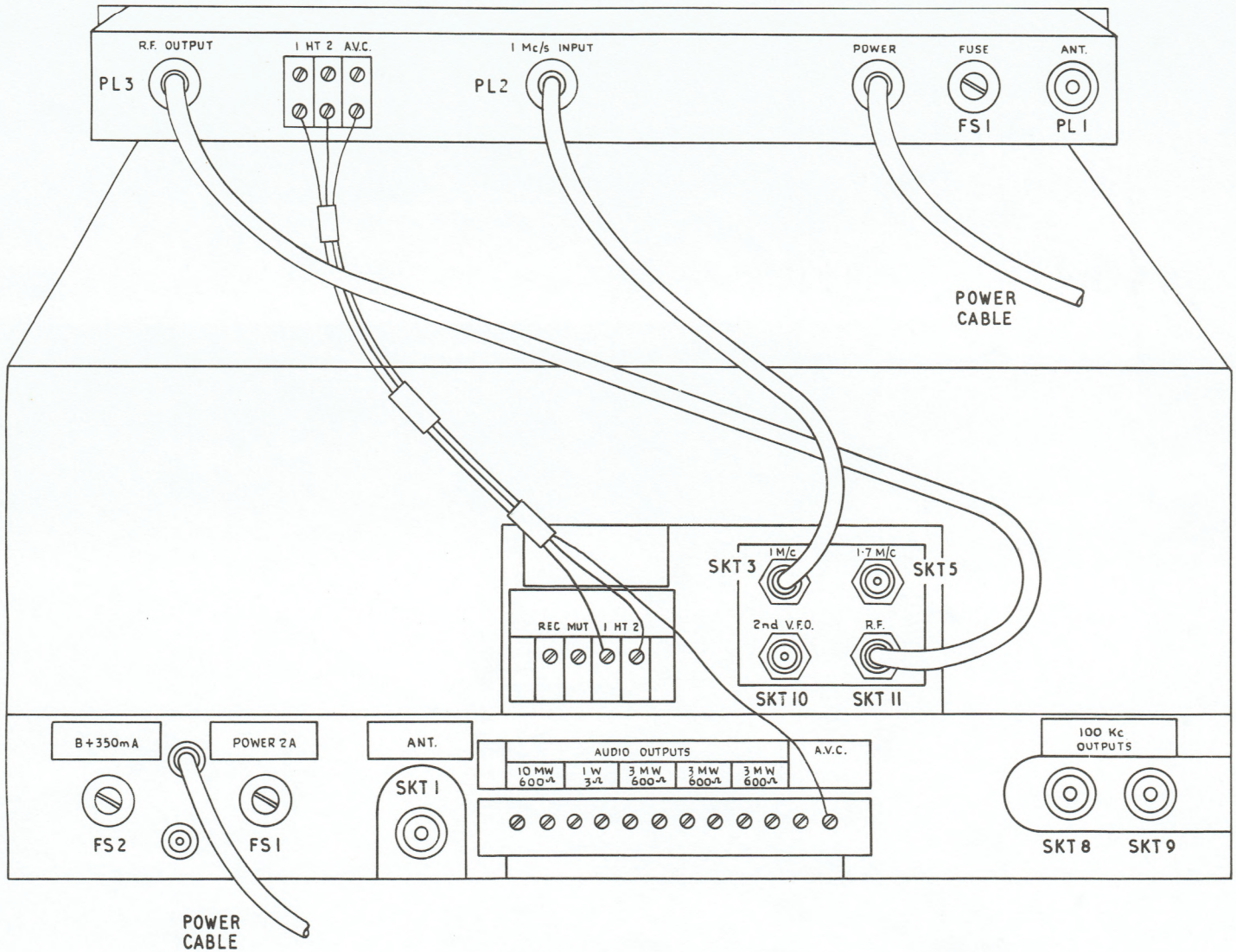


Fig.1 66225 Inter-Connections Between RA.117 & RA.237B

CHAPTER 3

OPERATION

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Antenna Attenuator	8
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ILLUSTRATIONS

	Fig.
Front Panel: RA. 237B	2

CHAPTER 3

OPERATION

1. The operating instructions should be used in conjunction with those for the RA. 117 Receiver, all controls of which remain operative, when operating between 10 kc/s and 980 kc/s, with the exception of MEGACYCLES, R. F. TUNE, R. F. RANGE MC/S and R. F. ATTENUATOR.

Switching on

2. (1) Set the RA. 117 MAINS (POWER) switch to on.

(2) Set the RA. 237 MAINS (POWER) switch to on.

Tuning - 10 to 980 kc/s

3. (1) Set RA. 237 OPERATION switch to 10 KC/S-980 KC/S. Set RA. 237 ANT RANGE to WIDEBAND or to the desired frequency band. The tuned aerial input circuits are intended for use where strong adjacent channel inteference is present.

(2) Set the RA. 237 ANT ATTENUATOR to MIN.

(3) Adjust the calibration of the RA. 117 receiver in accordance with the instructions in the RA. 117 handbook.

(4) Set the RA. 117 System switch to MAN.

(5) Rotate the KILOCYCLES control to the desired setting on the red scale.

(6) If the ANT RANGE switch is not set to WIDEBAND, adjust the ANT TUNE control on the RA. 237 for maximum signal (or noise).

(7) Set the RA. 117 System switch to A. V. C. if required.

4. All remaining adjustments on the RA. 117 Receiver are carried out in accordance with the RA. 117 handbook.

Tuning - 980 kc/s to 30 Mc/s

5. (1) Set RA. 237 OPERATION switch to 980 KC/S-30 MC/S.

6. Operate the RA. 117 Receiver in accordance with the RA. 117 handbook.

Antenna Tuning

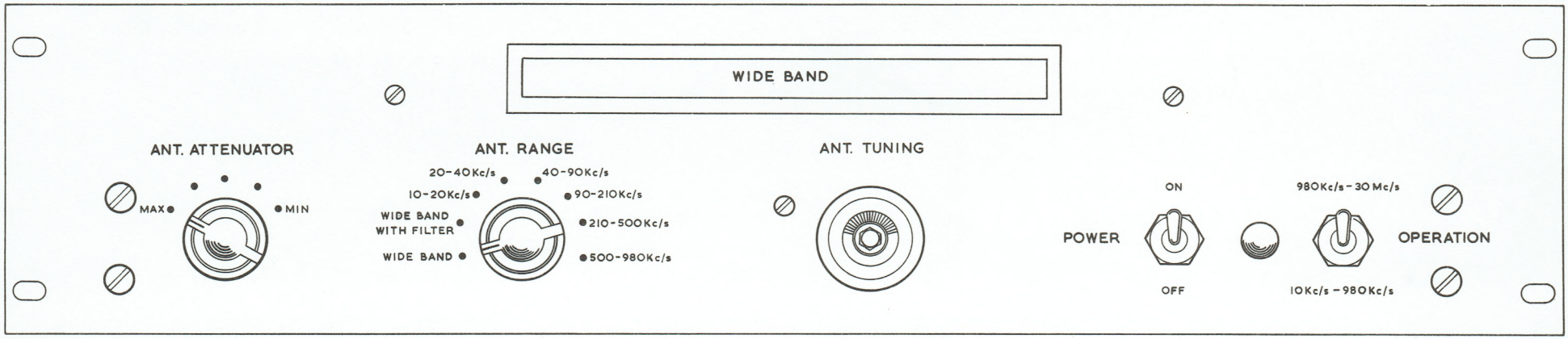
7. If maximum sensitivity is not required, the antenna need not be tuned except when strong unwanted signals are present. The presence of very strong signals, anywhere within the spectrum, may cause cross-modulation unless the antenna is tuned. Under these conditions, CARE MUST BE TAKEN TO AVOID TUNING THE INPUT TO THE INTERFERING SIGNALS instead of the signal required.

Antenna Attenuator

8. The ANT ATTENUATOR control enables the operator to reduce the level of all incoming signals when very strong unwanted signals are present which cannot be rejected sufficiently by tuning the antenna. It should also be employed if the required signal is causing overloading in the early stages of the receiver.

Antenna Filter

9. The antenna filter, which is in circuit on ranges 10 to 500 kc/s or wideband with filter, attenuates by an average of 40dB signals at frequencies greater than 500 kc/s. This is to reduce interference from powerful signals usually over 500 kc/s. Rejection frequencies of the filter are at 560 and 680 kc/s but should extra rejection be required at frequencies near to these, say ±5%, the appropriate cores should be re-adjusted to reject the undesired frequency. L2/C4 and L4/C6 reject 680 kc/s and L3/C5 reject 560 kc/s.



66231

Front Panel : RA. 237B

Fig. 2

CHAPTER 4

BRIEF TECHNICAL DESCRIPTION

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Harmonic Generator and Filter	3
Mixer	4
Cathode-Follower	5

CHAPTER 4

BRIEF TECHNICAL DESCRIPTION

1. This Chapter describes, with the aid of the block diagram (fig. 6), the basic operation. For a more detailed explanation of the converter, Chapter 5 (DETAILED CIRCUIT DESCRIPTION) should be read.

R. F. Amplifier and Filter

2. Input signals from the antenna are applied via the antenna attenuator to the R. F. Amplifier. Wideband (with or without filter) or tuned (10 to 980 kc/s) amplification can be selected according to reception conditions. The output is passed through a 1 Mc/s low-pass filter to eliminate image signals.

Harmonic Generator and Filter

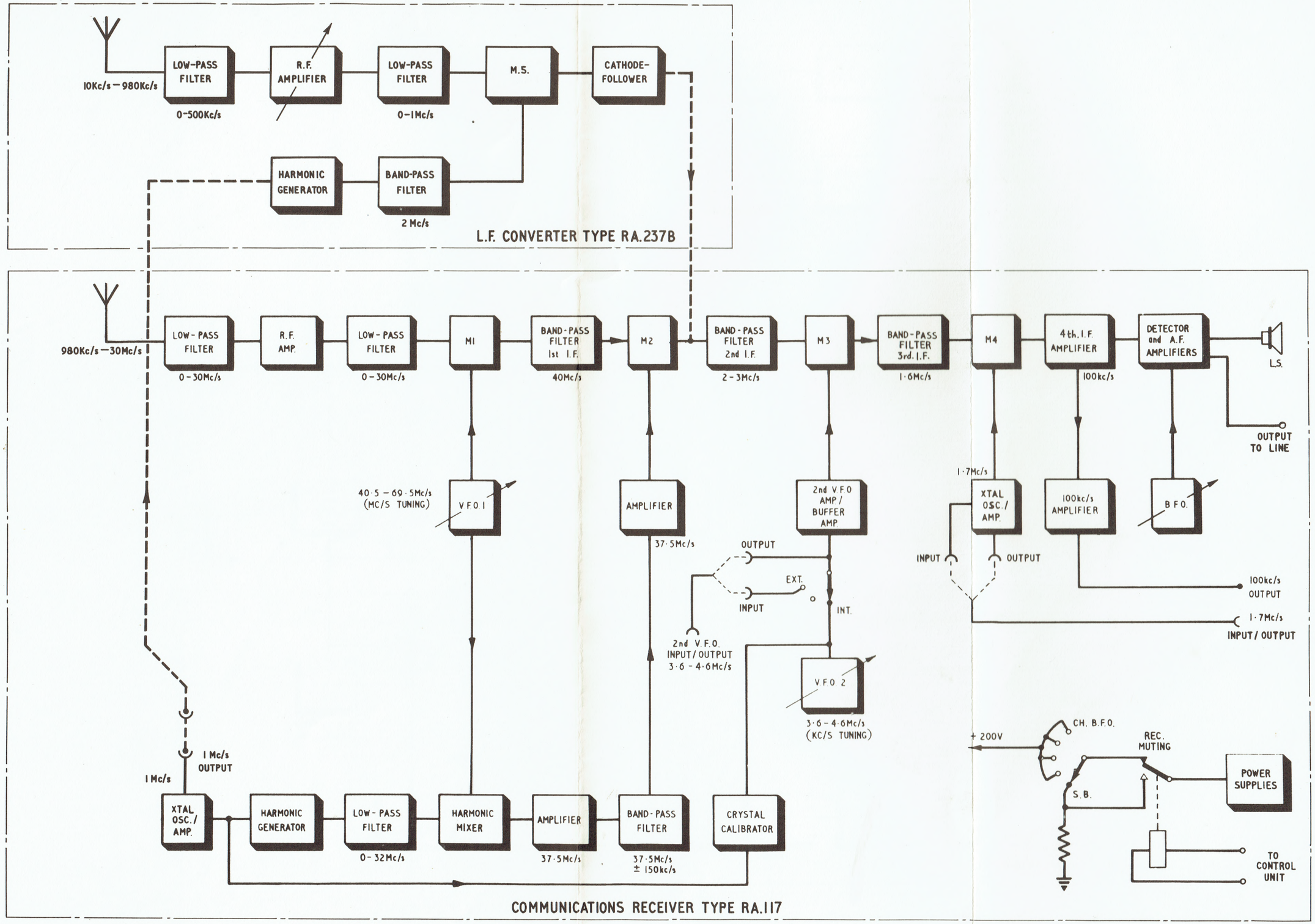
3. Output from the 1 Mc/s crystal oscillator of the RA. 117 receiver is fed to the harmonic generator. The band-pass filter in the output circuit selects the 2 Mc/s second harmonic.

Mixer

4. The output from the 1 Mc/s low-pass filter is mixed in M5 with the output from the 2 Mc/s band-pass filter. The selected output from the mixer is the sum frequency in the band 2.010 to 2.98 Mc/s.

Cathode-Follower

5. The output from the mixer is applied to a cathode-follower, the low-impedance output of which is applied to the input of the second I. F.



66222

Block Diagram : R.A. 237B

Fig. 3

CHAPTER 5

DETAILED CIRCUIT DESCRIPTION

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R.F. Amplifier	2
1 Mc/s Low-Pass Filter	3
Harmonic Generator and 2 Mc/s Band-Pass Filter	4
Balanced Mixer	5
Cathode-Follower	6
Power Supplies	7 - 9

CHAPTER 5

DETAILED CIRCUIT DESCRIPTION

Reference should be made to the circuit diagram (fig. 7) at the end of the handbook.

Antenna Circuit

1. A signal source, normally of 75 ohms impedance, is connected to the ANTENNA socket SK1 and fed via the five position ANT. ATTENUATOR switch (S1), covering an attenuation range of 0 to 40dB, to the 500 kc/s low-pass filter. The ANT. RANGE switch (S2) selects wideband amplification, with or without filter, or any one of the six tuned antenna sections. The 500 kc/s filter is selected by the ANT. RANGE switch for five of the six tuned bands, it is inoperative on the highest band (500-980 kc/s). The antenna coils are trimmed by C7 and C24 for the range 10-20 kc/s, C21 for the range 90-210 kc/s, C11 and C22 for the range 210-500 kc/s and C12 and C23 for the range 500-980 kc/s.

R.F. Amplifier

2. In the WIDEBAND position, the signal from the antenna attenuator is fed via capacitor C26 and grid stopper R14 to the control grid of the r.f. amplifier (V1). This grid is returned to the a.v.c. line via R13 and R12. When tuned input is employed, one end of the selected tuned circuit is connected to the control grid and the other is returned to the earth line. There are two stages of filtering in the a.v.c. line, they are C28, R12 and C27, R123; R123 is situated in the RA. 117 receiver. The anode load resistor R17 matches the output impedance of the amplifier to the characteristic impedance of the filter. R18 allows the screen potential of V1 to rise when a.v.c. is applied, thereby controlling the effective a.v.c. action.

1 Mc/s Low-Pass Filter

3. The amplified signal is fed to a low-pass filter consisting of three constant-K sections preceded and terminated by m-derived end-sections. Cut-off takes place at 980 kc/s. The output from the filter is fed via the coupling capacitor C47 to the filter terminating resistor R24.

Harmonic Generator and 2 Mc/s Band-Pass Filter

4. The 1 Mc/s crystal-controlled output from the RA. 117 receiver is fed via capacitor C33 and grid stopper R22 to the control grid of the harmonic generator (V2). R21, decoupled by C33, provides bias for this valve which operates in a non-linear condition. The anode load consists of a tuned circuit (L29, C42) which is the first stage of a 2 Mc/s band-pass filter. The second tuned circuit of the filter is formed by L30, L31 and C46 coupled by L31 to the third tuned circuit L31, L33, C48 and C50. Inductive coupling is provided to the balanced output winding L34. This filter has a passband of 50 kc/s, ensuring that only the 2 Mc/s harmonic is fed to the mixer.

Balanced Mixer

5. The signal across the terminating resistor R24 is fed to the control grid of V3. V3 and V4 form a balanced mixer in which the incoming signal is mixed with the output of the 2 Mc/s band-pass filter to produce an output lying between 2 and 3 Mc/s. The 2 Mc/s voltage is applied to grid 3 of V3 and V4 in anti-phase. R27 and R29 provide a correctly balanced load for the harmonic generator output. The 2 Mc/s component produced in the mixer balances out in the common anode load of V3 and V4. This anode load consists of L32 and R31. L32 (adjustable by iron dust core) is tuned by stray capacitance to 2.7 Mc/s and is heavily damped by R31 to produce wideband tuning covering the frequency range 2 to 3 Mc/s. The potentiometer RV1 equalizes the gains of V3 and V4, and the differential capacitor C52 equalizes the phase-shifts in these two valves to enable a precise balance to be achieved. The h.t. supply for the valves is stabilized by V5. The 2 to 3 Mc/s output from the mixer is fed via C57 to the junction of R36 and XL1, at this point the 2 Mc/s component is removed by the crystal notch circuit XL1, C66, the remaining frequencies being fed to the control grid of the cathode-follower.

Cathode-Follower

6. The cathode-follower stage (V6) enables the signal to be fed to the low-impedance tapping in the 2 to 3 Mc/s band-pass filter in the RA. 117 receiver.

The cathode load is formed by L36 and the input impedance of the band-pass filter. Resistor R38 is included to bias the valve to the correct operating conditions.

Power Supplies

7. The h.t. supply is obtained from the RA. 117 receiver by setting the OPERATION switch to 10-980 kc/s. When the switch is in this position, h.t. is disconnected from the first V. F. O. unit and the 2nd mixer in the receiver and is applied to the converter.

8. The heater supply is obtained from a mains transformer contained within the l.f. converter.

9. The mains input switch is interlocked with the h.t. circuit to prevent h.t. being fed to the converter when heater voltage is not applied to the valves.

SECTION 2

MAINTENANCE

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CHAPTER 2	VALVE DATA
CHAPTER 3	TYPICAL PERFORMANCE
CHAPTER 4	FAULT LOCATION
CHAPTER 5	REPRESENTATIVE TEST DATA
CHAPTER 6	ALIGNMENT PROCEDURE
CHAPTER 7	LIST OF COMPONENTS

IMPORTANT NOTE

The RA.237 converter is designed for use with the Racal RA.117 Communications Receiver. The ensuing Chapters assume that this converter is connected to a receiver which is operating to the correct specification.

CHAPTER 1

TEST EQUIPMENT REQUIRED FOR MAINTENANCE

CHAPTER 1

TEST EQUIPMENT REQUIRED FOR MAINTENANCE

1. 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 5.0 volts at frequencies up to 3.0 Mc/s.

   (b) Signal Generator capable of operating on fundamental frequencies up to 3.0 Mc/s, output impedance 75 ohms.

   (c) Multi-range meter measuring a.c. and d.c. up to 500 volts with resistance of 20 000 ohms per volt.

   (d) Voltage changing auto-transformer, preferably of the continuously variable type, operating up to 200 volts and supply 120 watts.

   (e) Coupling aids: viz. 0.1μF capacitor, 330 ohm resistor, 75 ohms matching pad for the Signal Generator.

CHAPTER 2

VALVE DATA

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TABLES

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Valve connections	1
Valve complement and typical voltages	2

CHAPTER 2

VALVE DATA

Introduction

1. Details of valves used in the RA. 237 are given in Tables 1 and 2 below. Voltages were obtained from a B7G stand-off valve base using a 20 000 ohms per volt meter on the optimum range in each case. Valve pin numbers are indicated in brackets in Table 2.

2. The R. F. /I. F. GAIN control on the receiver was set at MAX and RV1 in the 1. f. converter set to its mid position.

TABLE 1

VALVE CONNECTIONS

Pin No.	6BA6	6AU6	6AS6	OA2
1	Grid 1	Grid 1	Grid 1	Anode
2	Grid 3	Grid 3	Cathode	Cathode
3	Heater	Heater	Heater	I. C.
4	Heater	Heater	Heater	-
5	Anode	Anode	Anode	Anode
6	Grid 2	Grid 2	Grid 2	I. C.
7	Cathode	Cathode	Grid 3	-
Base	B7G	B7G	B7G	B7G

TABLE 2

VALVE COMPLEMENT AND TYPICAL VOLTAGES

Cct. Ref.	Anode	Screen	Cathode	American Type	Equivalent
V1	150(5)	85(6)	0.8(7)	6BA6	EF93
V2	190(5)	55(6)	-	6AU6	EF94
V3	150(5)	100(6)	1.5(2)	6AS6	-
V4	150(5)	100(6)	1.5(2)	6AS6	-
V5	150(1)	-	-	OA2	-
V6	180(5)	135(6)	0.8(7)	6AU6	EF94

CHAPTER 3

TYPICAL PERFORMANCE

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Cross Modulation	5
Image and Spurious Responses	6
Automatic Volume Control	7

CHAPTER 3

TYPICAL PERFORMANCE

Stability

1. After warm-up time, overall drift is less than 50 c/s under conditions of constant supply voltage and ambient temperature.

Sensitivity

2. A1 emission, bandwidth 3 kc/s;
   1μV for 15dB signal-to-noise ratio.
   A2 emission, 30% modulation, bandwidth 3 kc/s;
   3μV for 15dB signal-to-noise ratio.

Selectivity

3.

Position 1	100 c/s	Less than 1.5 kc/s
" 2	300 c/s	Less than 2 kc/s
" 3	1.2 kc/s	8 kc/s
" 4	3 kc/s	15 kc/s
" 5	6.5 kc/s	20 kc/s
" 6	13 kc/s	28 kc/s

4. The centre frequency on the crystal bandwidths does not change by more than 50 c/s when the bandwidth is changed.

Cross Modulation

5. Using the antenna attenuator with a tuned input, an i.f. bandwidth of 3 kc/s and a wanted signal amplitude of 1mV then an unwanted signal,

differing by 10 kc/s and modulated 30%, must have a level of at least 40dB greater than the wanted signal in order to produce a cross modulation output equivalent to 1% modulation of the wanted signal.

Image and Spurious Responses

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

Automatic Volume Control

7. An increase in signal level of 70dB results in an increased audio output of less than 6dB.

CHAPTER 4

FAULT LOCATION

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Signal Input Circuits	1
R.F. Stage	2
Mixer Stage	3 - 5
Voltage Stabilizer	6

CHAPTER 4

FAULT LOCATION

Signal Input Circuits

1. If the R.F. stage is functioning correctly, a rise of noise will occur when the input circuit is tuned through the frequency to which the kilocycle scale is set. Should this not occur, check the antenna input and the attenuator circuits.

R.F. Stage

2. Should no signal be received, switch on the b.f.o. and set the RED KILOCYCLES scale to zero. A strong 2 Mc/s carrier from the harmonic generator should be heard. If this signal is received, adjust the balanced mixer in accordance with paras. 12. to 18., Chapter 6. If the mixer can be balanced, the fault is in the R.F. stage or the 1 Mc/s low-pass filter.

Mixer Stage

3. If the 2 Mc/s signal is not received, carry out the following check:-

4. Ensure that the stabilizer V5 has ignited. Check with the valve voltmeter that at least 2 volts of 1 Mc/s drive is present at PL2. Remove V3, V4 and V5 and check that 0.5 volts at 2 Mc/s appears at pin 6 of the valveholders of both V3 and V4.

5. Should this drive be present the fault lies in the balanced mixer, the cathode-follower, or the connection between the R.F. OUTPUT socket and the 2-3 Mc/s band-pass filter in the RA.117 receiver.

Voltage Stabilizer

6. Should V5 fail to function then the balance will drift rapidly.

CHAPTER 5

REPRESENTATIVE TEST DATA

CHAPTER 5

REPRESENTATIVE TEST DATA

Signal Input To	Frequency	Input	Output	Remarks
(a) Grid V6 (1)	2.0 Mc/s	220μV	100μA R.F. level	3 kc/s bandwidth System switch to MAN:
	2.5 Mc/s	225μV	100μA R.F. level	R.F./I.F. GAIN MAX.; B.F.O. OFF:
	3.0 Mc/s	250μV	100μA R.F. level	1 Mc/s input to PL2 disconnected:
(b) Drive to PL2	1.0 Mc/s	2.0V	0.5V at V3 (6) 0.5V at V4 (6)	System switch to MAN.; use valve voltmeter.
(c) Grid V3 (1)	10 kc/s	200μV	100μA R.F. level	3 kc/s bandwidth; System switch to MAN.;
	500 kc/s	150μV	100μA R.F. level	R.F./I.F. GAIN MAX.; B.F.O. OFF:
	980 kc/s	200μV	100μA R.F. level	1 Mc/s input to PL2.
(d) Antenna socket SKT1	10 kc/s	20μV	100μA R.F. level	3 kc/s bandwidth; System switch to MAN.;

Signal Input To	Frequency	Input	Output	Remarks
(d) Antenna socket SKT1	500 kc/s	15μV	100μA R.F. level	R.F./I.F. GAIN MAX.; B.F.O. OFF:
	980 kc/s	20μV	100μA R.F. level	1 Mc/s input to PL2; RA.237 ANT. RANGE to WIDE-BAND; RA.237 ANT. ATTENUATOR to MIN.

Note ...

The numerals in brackets indicate the valve pin number.

CHAPTER 6

ALIGNMENT PROCEDURE

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CHAPTER 6

ALIGNMENT PROCEDURE

Standardization of RA. 117 Sensitivity

1. Connect the signal generator (matched to 75-ohms) via a 0. 1μF capacitor to the R. F. socket of the RA. 117 receiver. Set the R. F. /I. F. GAIN to maximum, the BANDWIDTH to 3 kc/s, the meter switch to R. F. LEVEL and the System switch to MAN.

2. Record the c. w. input required to produce 100μA of diode current in the R. F. LEVEL meter at 2. 0 Mc/s, 2. 5 Mc/s and 3. 0 Mc/s (i. e. with the RED scale set to 0 kc/s, 500 kc/s and 1, 000 kc/s respectively).

3. Connect the RA. 237 converter correctly to the RA. 117 receiver; but do not connect an antenna.

Note: The above results should be used as standards during subsequent measurements described below.

Harmonic Generator

4. Ensure that the dust covers are fitted to the harmonic generator. Set C52 to the mid-position. Connect the valve voltmeter between grid 3 of V3 (pin 6) and earth.

5. Adjust L29, L30 and C50 (fig. 4) in turn to obtain maximum output. With the correct adjustment this output should not be less than 0. 5V.

6. Remove the valve voltmeter from V3 and connect it to grid 3 of V4 (pin 6).

Balanced Mixer Anode Circuit

7. Disconnect the coaxial lead between the R. F. OUTPUT socket of the RA. 237 and the R. F. socket on the RA. 117.

8. Connect the valve voltmeter in parallel with a 330-ohm resistor across the R. F. OUTPUT socket of the RA. 237. Connect the signal generator (set to C. W.) via a 0. 1μF capacitor to grid 7 of V3 (pin 1). Set the valve voltmeter to the 1. 5V range.

9. Observe that the frequency response is sensibly level as the signal generator frequency is swept over the range of 2-3 Mc/s. Adjust L32 to obtain maximum output at 2. 7 Mc/s.

10. Disconnect the valve voltmeter and replace the coaxial lead between the R. F. OUTPUT socket of the RA. 237 and the R. F. socket of the RA. 117.

11. With correct alignment, the input required to produce 100μA of diode current should be approximately those stated in the table below:-

Sign. Gen. Frequency	RED Scale Setting	Max. input relative to that obtain in paras. 1. to 3.
2. 0 Mc/s	0 kc/s	-8dB
2. 5 Mc/s	500 kc/s	-12dB
3. 0 Mc/s	1000 kc/s	-12dB

Balanced Mixer adjustment and Drift Measurements

12. Set the RED KILOCYCLES scale on the RA. 117 receiver to zero, the R. F. /I. F. GAIN control to MIN. and the meter switch to R. F. LEVEL. Connect the mains supply to the RA. 117 and RA. 237 via a voltage changing auto-transformer and set the transformer to supply the voltage to which the tappings of the receiver and converter transformers are set.

13. With no signal input, adjust RV1 and C52 (fig. 5) alternately to obtain minimum diode current, increasing the setting of the R. F. /I. F. GAIN control as necessary.

14. Reduce the input voltage by 10% and allow sufficient time for the heater temperature to stabilize. Adjust the R. F. /I. F. GAIN to provide a suitable reference reading on the R. F. LEVEL meter. Disconnect the coaxial lead from the R. F. OUTPUT socket on the RA. 237 and connect the lead via a 0. 1μF capacitor to the signal generator. Tune the signal generator to 2 Mc/s (C. W.).

15. The output required to produce the reference R. F. LEVEL current should not exceed 50mV.

16. Repeat with the mains input voltage set to 10% above the nominal supply voltage.

17. The output required from the signal generator should not exceed 50mV as above.

18. Replace the coaxial lead on the R. F. OUTPUT socket.

1 Mc/s Low-Pass Filter

19. Set the R. F. /I. F. GAIN to MAX., the System switch to STANDBY and connect the 1 MC/S output plugs (RA. 117) to the 1 MC/S OUTPUT plug (RA. 237). Connect the signal generator (75-ohms output impedance) to the RA. 237 ANTENNA socket and set the ANT. ATTENUATOR to MIN. Set the RA. 237 ANT RANGE switch to WIDEBAND without filter. Remove V3 and connect a valve voltmeter to grid 1 (pin 1) of the valveholder. Remove V4 and V5.

20. Set the System switch to MAN. Adjust the frequency of the signal generator to precisely 1030 kc/s (C. W.). Tune the RA. 117 receiver and adjust the signal generator output until the valve voltmeter reads 2V approximately.

21. Increasing the signal generator output as necessary to a limit of 800mV, adjust L26 to obtain minimum indication on the valve voltmeter.

22. Repeat the above procedure with the signal generator frequency set precisely to 1080 kc/s, adjust L22 to obtain minimum output.

23. Set the signal generator to 500 kc/s with an output of 100mV. Ensure that the valve voltmeter reading is not less than 0.8V.

24. Explore the passband from 10 kc/s to 980 kc/s. The response obtained should be within the limits of +1dB and -3dB relative to the level at 500 kc/s. Adjust L23, L24 and L25 as necessary to correct the response in the region of 900-980 kc/s.

25. With an input level of 800mV, ensure that no indication is obtained, on the 1.5V range of the valve voltmeter, above 1020 kc/s.

26. Remove the valve voltmeter and signal generator, replace V3, V4 and V5.

R.F. Tuned Circuit

27. Remove V1 and connect a valve voltmeter shunted to 6.8pF to pin 1 (grid) of V1. Connect a signal generator to the RA.237 ANTENNA socket. Set the OPERATION switch to 10-980 kc/s the RA.237 ANT RANGE switch to 500-980 kc/s and set the scale pointer to 500 kc/s.

28. Set the signal generator to 500 kc/s and adjust the cores of L15 and L21 (fig. 6) for maximum output in the valve voltmeter. Reset the scale pointer and signal generator to 980 kc/s and adjust capacitors C12 and C23 for maximum output in the valve voltmeter. Check the l.f. end and adjust if necessary at the h.f. end.

29. Repeat the above procedure for the remaining aerial coils and their associated capacitors at ranges and frequencies stated in the table below.

Note: It will be found that on range 10-20 kc/s the adjustment of L5 and C7 is very flat and consequently is not critical.

Range	Frequency	Adjustment
210-500 kc/s	120 kc/s	L13-L20
	500 kc/s	C11-C22
90-210 kc/s	90 kc/s	L11-L19
	210 kc/s	C10-C21

Range	Frequency	Adjustment
20-40 kc/s	20 kc/s	L7-L17
	40 kc/s	C8-C19
10-20 kc/s	10 kc/s	L5-L16
	20 kc/s	C7-C24

Ensure that the input required to produce a 1.0V deflection on the valve voltmeter does not exceed the value stated in the table below:-

Range	Frequency	Max. input relative to 1μV
10- 20 kc/s	10 kc/s	90dB
	20 kc/s	90dB
20- 40 kc/s	20 kc/s	92dB
	40 kc/s	92dB
40- 90 kc/s	40 kc/s	94dB
	90 kc/s	94dB
90-210 kc/s	90 kc/s	92dB
	210 kc/s	92dB
210-500 kc/s	210 kc/s	94dB
	500 kc/s	94dB
500-980 kc/s	500 kc/s	102dB
	980 kc/s	100dB

30. Remove the valve voltmeter and signal generator. Replace V1 and balance the mixer by adjusting RV1 and C28 for minimum current in the R.F. LEVEL meter in accordance with paras. 12. to 18.

2 Mc/s Crystal Adjustment

31. The R.F. LEVEL meter on the front panel of the RA.117 is used as the output indicator when adjusting the frequency of crystal XL1.

32. Set the ANT. RANGE switch to WIDEBAND and the OPERATION switch to 10-980 kc/s.

33. Set the receiver controls as follows:-

R. F. /I. F. GAIN to the mid-position.

R. F. RANGE Mc/s to WIDEBAND.

Meter switch to R. F. LEVEL.

BANDWIDTH to 3 Kc/s.

34. With no signal input, adjust trimmer capacitor C66 to obtain minimum output on the R. F. LEVEL meter, increasing the setting of the R. F. / I. F. GAIN control as necessary.

CHAPTER 7

LIST OF COMPONENTS

Note: It is recommended that users quote the Serial No. of the equipment on all orders for spare parts.

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Resistors					5905-99-	
R1	100Ω	carbon	¼W	10	022-1109	Erie 16
R2	150Ω	carbon	¼W	10	022-1130	Erie 16
R3	150Ω	carbon	¼W	10	022-1130	Erie 16
R4	150Ω	carbon	¼W	10	022-1130	Erie 16
R5	150Ω	carbon	¼W	10	022-1130	Erie 16
R6	150Ω	carbon	¼W	10	022-1130	Erie 16
R7	150Ω	carbon	¼W	10	022-1130	Erie 16
R8	150Ω	carbon	¼W	10	022-1130	Erie 16
R9	100Ω	carbon	¼W	10	022-1109	Erie 16
R10	2.2kΩ	carbon	¼W	10	022-2046	Erie 16
R11	2.2MΩ	carbon	¼W	10	022-3205	Erie 16
R12	82kΩ	carbon	¼W	10	022-3028	Erie 16
R13	2.2MΩ	carbon	¼W	10	022-3205	Erie 16
R14	68Ω	carbon	¼W	10	022-1088	Erie 16
R15	68Ω	carbon	¼W	10	022-1088	Erie 16
R16	2.2kΩ	carbon	½W	10	022-2048	Erie 8
R17	4.7kΩ	carbon	½W	10	022-2090	Erie 8
R18	33kΩ	carbon	½W	10	022-2195	Erie 8
R19	47kΩ	carbon	½W	10	022-2216	Erie 8
R20	33kΩ	carbon	½W	10	022-2195	Erie 8
R21	330kΩ	carbon	¼W	10	022-3100	Erie 16
R22	68Ω	carbon	¼W	10	022-1088	Erie 16
R23	2.2kΩ	carbon	½W	10	022-2048	Erie 8
R24	4.7kΩ	carbon	¼W	10	022-2088	Erie 16
R25	DELETED					
R26	DELETED					
R27	220Ω	High Stab.	1/8W	1	021-9064	Erie 109
R28	33Ω	carbon	½W	5	022-1048	Erie 8
R29	220Ω	High Stab.	1/8W	1	021-9064	Erie 109
R30	DELETED					
R31	10kΩ	carbon	¼W	10	022-2130	Erie 16
R32	DELETED					
R33	4.7kΩ	carbon	¼W	10	022-2088	Erie 16
R34	1.8kΩ	wirewound	4½W	5	011-3493	Welwyn Elect.
R35	470kΩ	carbon	¼W	10	022-3121	Erie 16
R36	68Ω	carbon	¼W	10	022-1088	Erie 16
R37	2.2kΩ	carbon	½W	10	022-2048	Erie 8
R38	39Ω	High Stab.	1/8W	5	011-9708	Erie 109
R39	15kΩ	carbon	½W	10	022-2153	Erie 8
R40	6.8kΩ	carbon	½W	10	022-2111	Erie 8

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Potentiometers					5905-99-	
RV1	100Ω	wirewound		10	972-8313	Colvern CLR. 3001/ 11S
Capacitors					5910-99-	
C1	3750pF	silv'd mica	200V	2		J. M. C. C22R
C2	5550pF	silv'd mica	200V	2		J. M. C. YC. 41R
C3	6300pF	silv'd mica	200V	2		J. M. C. YC. 41R
C4	4350pF	silv'd mica	200V	2		J. M. C. C22R
C5	4650pF	silv'd mica	200V	2		J. M. C. C22R
C6	4350pF	silv'd mica	200V	2		J. M. C. C22R
C7	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C8	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C9	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C10	22pF	trimmer	400V		014-2327	Mullard AC2002/22
C11	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C11A	12pF	silv'd mica				
C12	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C13	82pF	silv'd mica	350V	2		Johnson Matthey C22S
C14	523pF	variable (2-gang)			972-8331	Wingrove & Rogers C73-02/101
C15	8.2pF	ceramic	750V	10		Erie P. 100K
C16	4.7pF	ceramic	750V	10		Erie P. 100K
C17	3.3pF	ceramic	750V	10		Erie P. 100K
C18	56pF	silv'd mica	350V	2		Johnson Matthey C22S
C19	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C20	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C21	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C22	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C23	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C24	22pF	trimmer	400V		914-2327	Mullard AC2002/22
C25	See C14					
C26	0.001μF	ceramic	350V		972-8948	Erie Hik/AD
C27	0.1μF	paper	150V	20	011-5560	Hunts W49/B500K
C28	0.1μF	paper	150V	20	011-5560	Hunts W49/B500K
C29	10μF	electrolytic	25V		014-5098	Hunts UB59KY
C30	0.1μF	paper	150V	20	011-5560	Hunts W49/B500K
C31	0.05μF	paper	350V	20	011-5559	Hunts W49/B511K
C32	68pF	ceramic	750V	5	013-2294	Erie N750L
C33	68pF	ceramic	750V	10	013-2294	Erie N750K

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Capacitors continued.....					5910-99-	
C34	0.05µF	paper	350V	20	011-5559	Hunts W49/B511K
C35	0.01µF	paper	400V	20	011-5827	Hunts BM21K
C36	47pF	ceramic	750V	5	013-2288	Erie N750K
C37	2µF	electrolytic	350V		014-5010	Hunts
C38	68pF	ceramic	750V	5	013-2294	Erie N750L
C39	0.05µF	paper	350V	20	011-5559	Hunts W49/B511K
C40	0.1µF	paper	150V	20	011-5560	Hunts W49/B500K
C41	0.05µF	paper	350V	20	011-5559	Hunts W49/B511K
C42	100pF	ceramic	350V	2	012-3923	Lemco CMMIG
C43	68pF	ceramic	750V	5	013-2294	Erie N750L
C44	47pF	ceramic	750V	5	013-2288	Erie N750K
C45	120pF	ceramic	750V	5	013-2302	Erie N750L
C46	100pF	silv'd mica	350V	2	012-3923	Lemco CMMIG
C47	0.01µF	paper	400V	20	011-5827	Hunts BM21K
C48	100pF	silv'd mica	350V	2	012-3923	Lemco CMMIG
C49	10µF	electrolytic	25V		014-5097	Hunts
C50	33pF	trimmer			016-0047	Wingrove & Rogers C31-01/1
C51	0.1µF	paper	150V	20	011-5560	Hunts W49/B500K
C52	34.5pF	trimmer	1000V		972-8323	Oxley Circular
C53	0.1µF	paper	150V	20	011-5560	Hunts W49/B500K
C54	0.05µF	paper	350V	20	011-5559	Hunts W49/B511K
C55	15pF	ceramic	750V	10	911-5481	Erie NPOK
C56	0.1µF	paper	150V	20	011-5560	Hunts W49/B500K
C57	120pF	ceramic	750V	20	013-2302	Erie N750L
C58	2µF	electrolytic	350V		014-5010	Hunts
C59	8µF	electrolytic	350V		014-5503	Hunts JB.403T
C60	0.01µF	paper	750V	20	972-8307	Lemco 420K
C61	0.01µF	paper	750V	20	972-8307	Lemco 420K
C62	0.1µF	paper	350V	20	011-5562	Hunts W49/B512K
C63	0.01µF	paper	400V	20	011-5827	Hunts BM21K
C64	0.01µF	paper	400V	20	011-5827	Hunts BM21K
C65	0.01µF	paper	400V	20	011-5827	Hunts BM21K
C66	11pF	trimmer			911-4011	Wingrove & Rogers Type C32-01
Switches					5930-99-	
S1		Antenna attenuator			972-8854	Racal AA8034

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Switches continued.....					5930-99-	
S2		Antenna range			972-9328	Racal BSW14436
S3		Mains and h.t. interlock			051-0554	N. S. F.
S4		Operation			051-0554	N. S. F.
Plugs and Sockets					5935-99-	
PL1		Antenna (free)			943-7576	Films and Equipment PL259
SK1		Antenna (fixed)			911-0965	Films and Equipment SO239
PL2		1 Mc/s Input (free)				Amphenol UG260B/U
SK2		1 Mc/s Input (fixed)				Amphenol UG1094/U
PL3		R. F. Output (free)				Amphenol UG260B/U
SK3		R. F. Output (fixed)				Amphenol UG910/U
Valves						
V1		R. F. Amplifier				Mullard 6BA6 (CV4009)
V2		Harmonic Generator				Mullard 6AU6 (CV2524)
V3		Balanced Mixer				Mullard 6AS6 (CV2522)
V4		Balanced Mixer				Mullard 6AS6 (CV2522)
V5		Stabilizer				Mullard OA2 (CV1832)
V6		Cathode Follower				Mullard 6AU6 (CV2524)
Valveholders and Screening Cans					5960-99-	
V1		Screening can			056-3003	McMurdo
		Valveholder			5935-99-056-0127	McMurdo
V2		Screening can			056-3003	McMurdo
		Valveholder			5935-99-056-0127	McMurdo
V3 and V4		Screening can			056-0145	McMurdo
		Valveholder			5935-99-911-1103	McMurdo XM7/UXT1

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Valveholders and Screening Cans continued.....						
V5		Screening Can			5960-99-056-3005	McMurdo
		Valveholder			5935-99-056-0127	McMurdo
V6		Screening Can			5960-99-056-3003	McMurdo
		Valveholder			5935-99-056-0127	McMurdo
Inductors						
L1		Filter Coil Assembly				Racal AA14822/C
L2		Filter Coil Assembly				Racal AA14822/A
L3		Filter Coil Assembly				Racal AA14822/B
L4		Filter Coil Assembly				Racal AA14822/A
L5)		Coil Assembly				Racal BA14663/A
L6)						
L7)		Coil Assembly				Racal BA14663/B
L8)						
L9)		Coil Assembly				Racal BA14663/C
L10)						
L11)		Coil Assembly				Racal BA14663/G
L12)						
L13)		Coil Assembly				Racal BA14663/H
L14)						
L15		Coil Assembly				Racal AA15233/A
L16		Coil Assembly				Racal BA14663/D
L17		Coil Assembly				Racal BA14663/E
L18		Coil Assembly				Racal BA14663/F
L19		Coil Assembly				Racal BA14663/J
L20		Coil Assembly				Racal BA14663/K
L21		Coil Assembly				Racal AA15233/B
L22		Coil Assembly			5950-99-972-9584	Racal AA7842
L23		Coil Assembly			5950-99-972-9585	Racal AA7843
L24		Coil Assembly			5950-99-972-9585	Racal AA7843
L25		Coil Assembly			5950-99-972-9585	Racal AA7843
L26		Coil Assembly			5950-99-972-9588	Racal AA8029
L27		Filter Coil Assy.			5950-99-972-9555	Racal AA4655
L28		Choke			5950-99-972-8084	Racal AD16987
L29		Coil Assembly			5950-99-972-9666	Racal AA9199

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Inductors continued.....						
L30		Coil Assembly			5950-99-972-9586	Racal AA7844
L31		Coil Assembly				Racal AA8313
L32		Coil Assembly				Racal AA8030
L33)		Coil Assembly			5950-99-972-9587	Racal AA7846
L34)						
L35		Filter Coil Assy.			5950-99-972-9555	Racal AA4655
L36		Choke			5950-99-972-8084	Racal AD16987
L37		Choke			5950-99-972-8084	Racal AD16987
Transformer						
T1		Mains			5950-99-972-9372	Racal BT8288
Fuse and Fuseholder						
F1		Fuse, 250mA				Belling Lee L338
		Fuseholder			5910-99-059-0100	Belling Lee L356
Lamps and Lampholders						
ILP1 and ILP2		Indicator lamp 8V., 0.156A 10 mm. tub. (M.E.S.)				
ILP1 and ILP2		Lampholder				Bulgin M.E.S. 55R
Miscellaneous						
XL1		Crystal (1999.3 kc/s)				Racal BD21294
		Knob Assembly (for S1 and D2)			5355-99-943-9730	Racal AA15472
		Knob (tuning)			5355-99-943-4818	Racal AA6817
		Coaxial Cable				Uni Radio UR. 70
		Slow motion tuning drive				Jackson DR. 645
		Barrier terminal strip			5940-99-949-1288	Cinch 77/508/3
		1 Mc/s connecting cable				Racal AA8026/B
		R.F. output cable				Racal AA8027/B

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Miscellaneous continued.....						
		H. T. and A. V. C. cableform			5820-99-949-1377	Racal AA8028
		Attenuator switch assembly			5930-99-972-9328	Racal AA8034
		Harmonic generator filter assembly				Racal AA7848
		Low-pass filter assembly				Racal BA7530
		Electrostatic screen assembly			5999-99-949-1392	Racal AA11016
		Front panel (engraved)				Racal CD14376/B
		Rear panel (engraved)				Racal BD7529
		Cover, bottom (harmonic generator)				Racal BD7508
		Cover, top (harmonic generator)				Racal BD8025
		Cover, top (Main component box assembly)				Racal BD14818
		Cover, bottom (Main component box assembly)				Racal BD14499

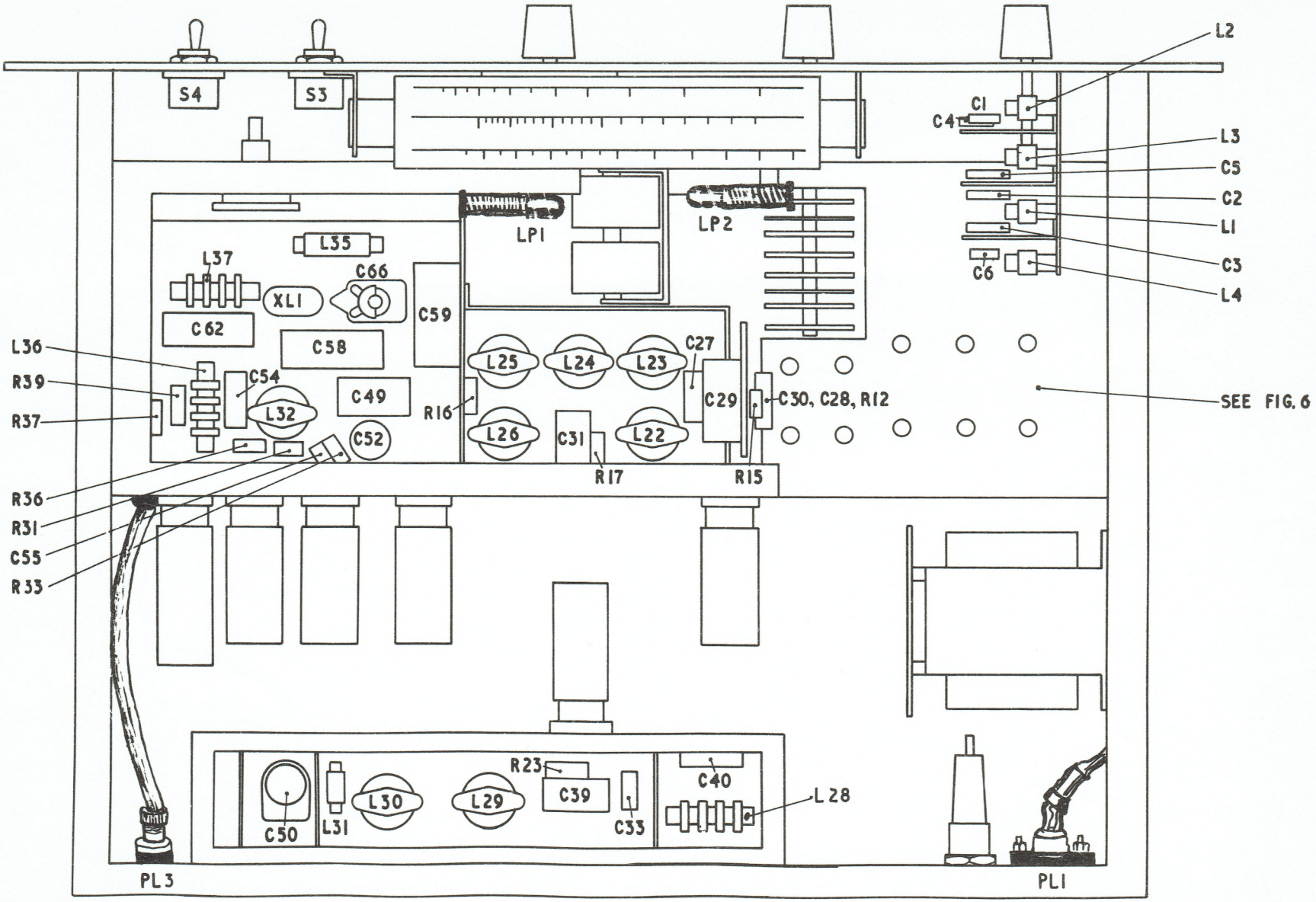
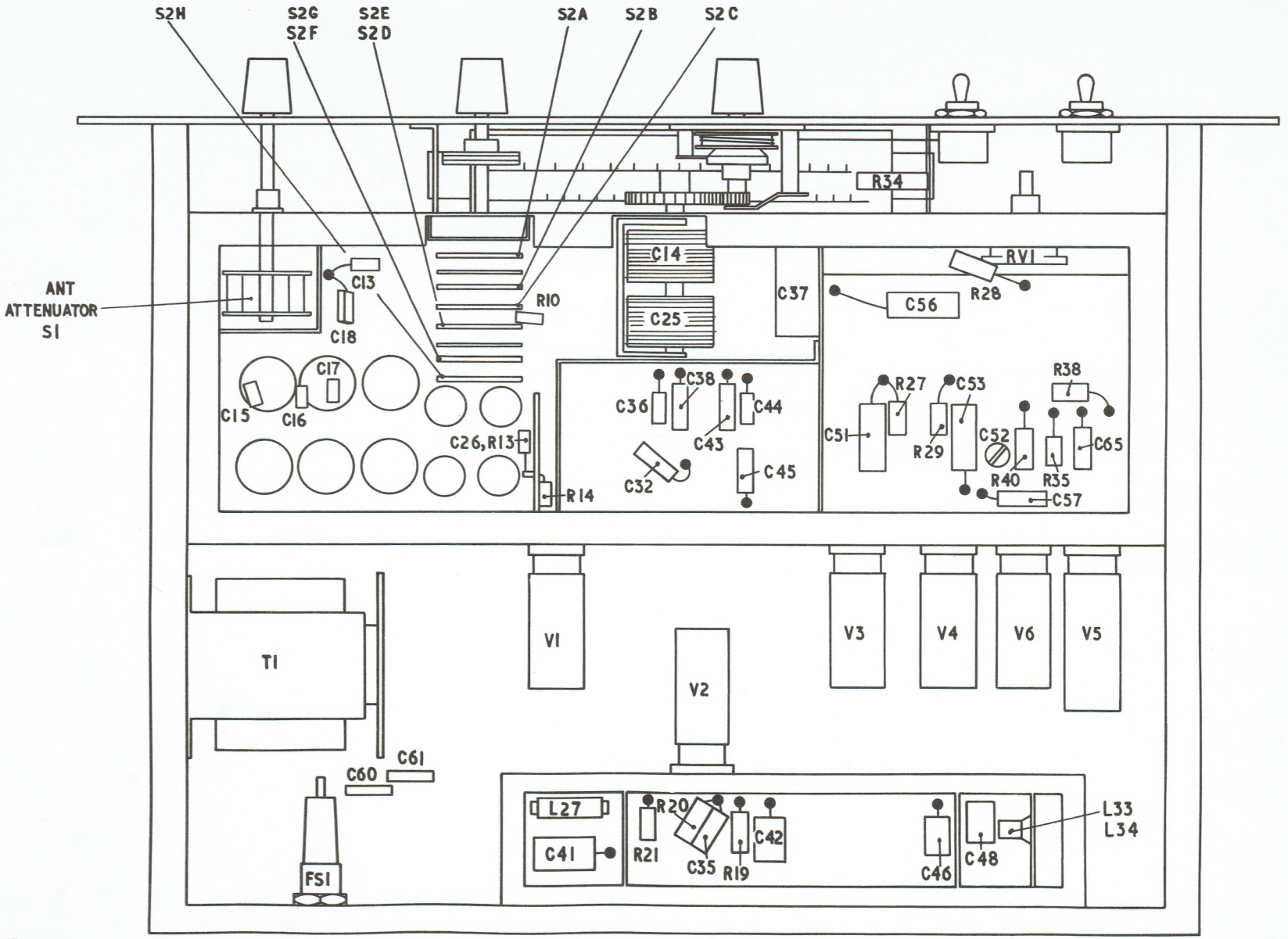


Fig.4

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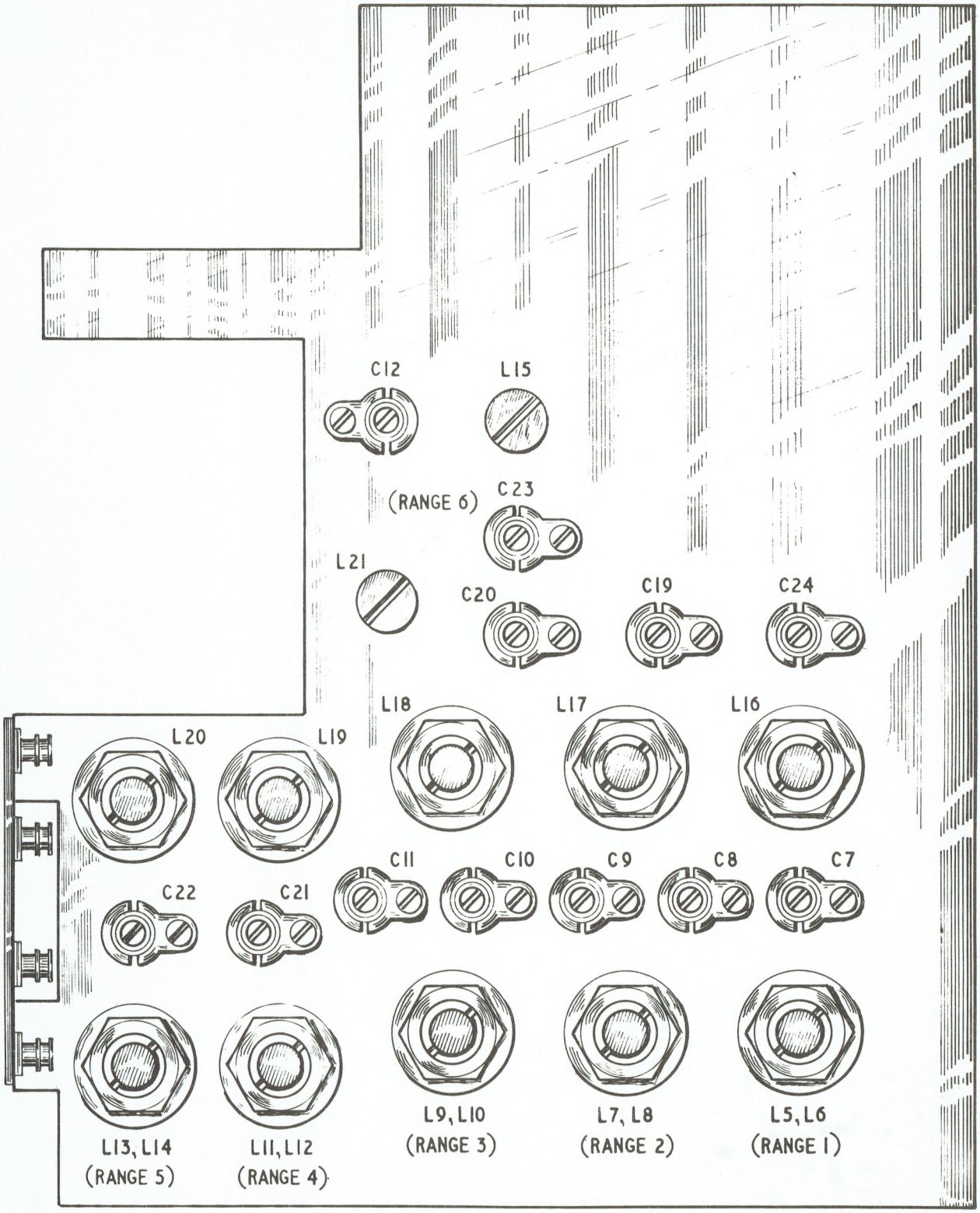
RA.237B Chassis-Top



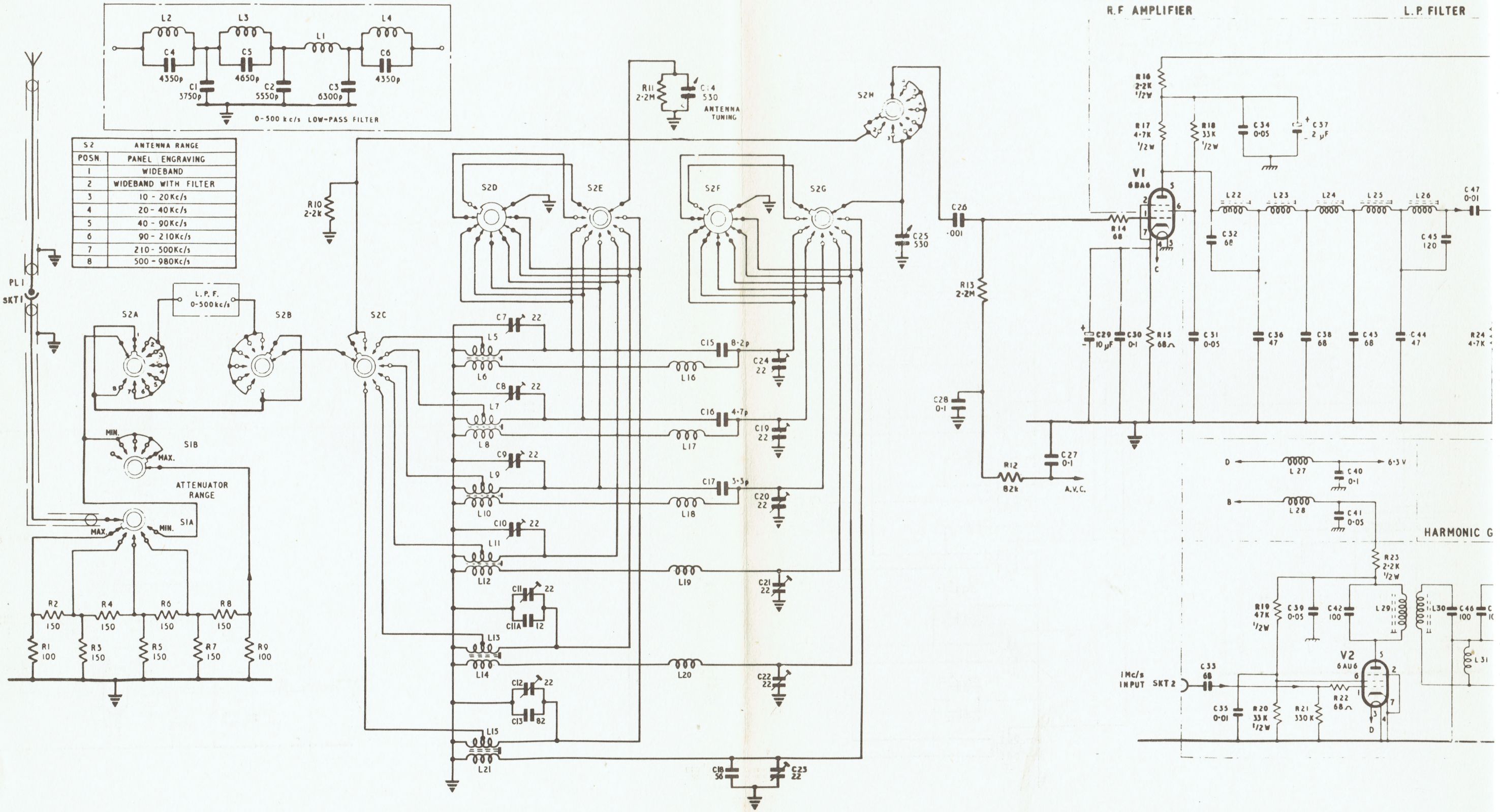
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RA.237B Chassis-Underside

Fig.5

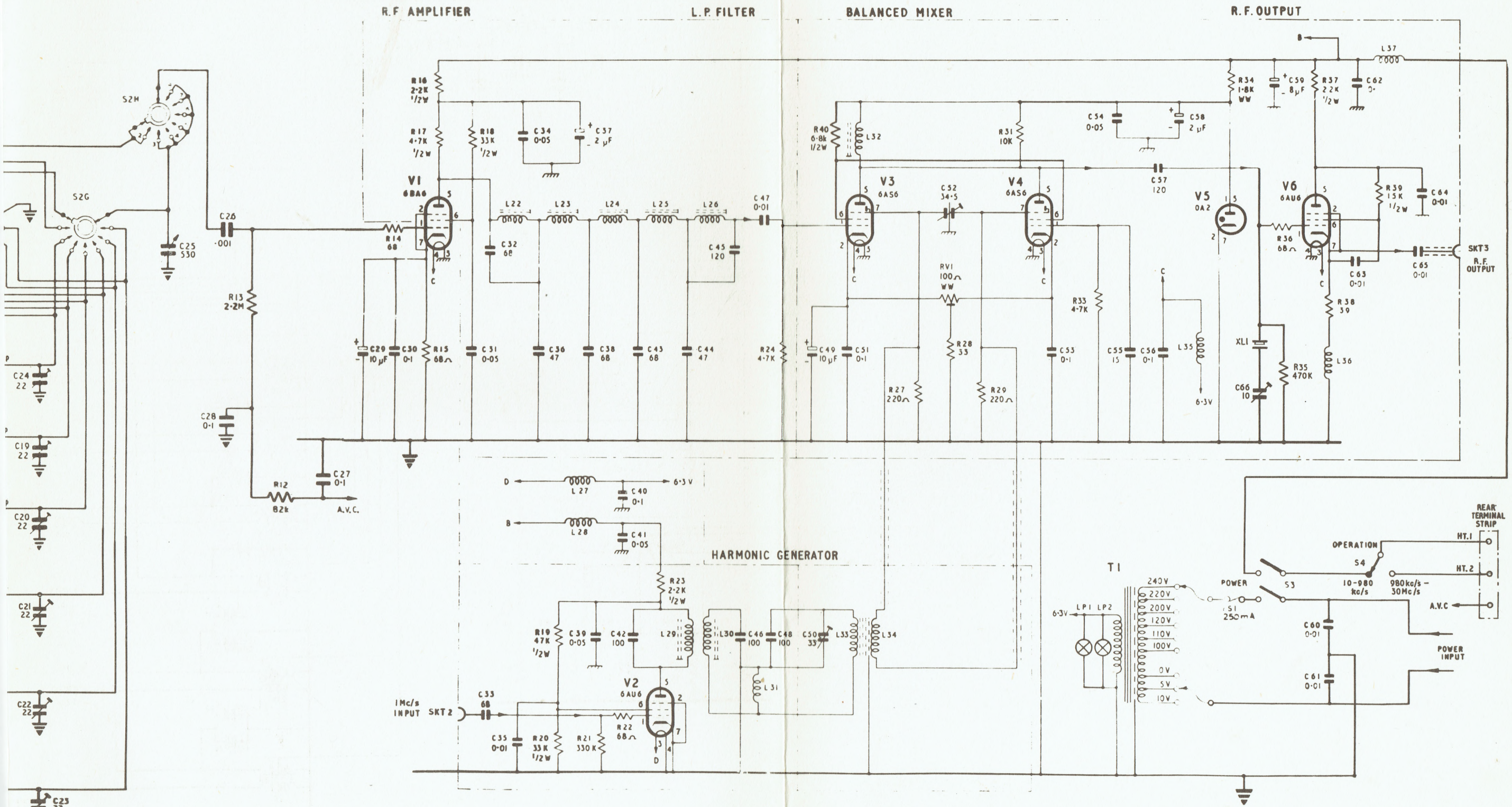


36312 R.F. coil chassis assembly Fig.6



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L.F. CONVERTER TYPE RA.237B



L.F. CONVERTER TYPE RA.237B

FIG.7