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OPERATING & MAINTENANCE

K-3011

L.F. CONVERTER
TYPE RA.37B

RACAL

R-3011

L.F. CONVERTER
TYPE RA.37B

Operating and Maintenance Manual

Technical Handbooks Department

RACAL ELECTRONICS LIMITED
Western Road
Bracknell Berkshire
England

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SECTION 1

GENERAL DESCRIPTION

The L.F. Convertor Type RA.37 is designed primarily to extend the low frequency limit of the RACAL RA.17 Communications Receiver from 980 kc/s to 12.5 kc/s. The addition of the convertor to the RA.17 receiver in no way impairs its performance.

The equipment, which is basically a frequency convertor for raising the frequency of incoming signals by 2 Mc/s, derives h.t. supplies from the RA.17 receiver and heater supplies from a built-in mains transformer.

The RA.37 is assembled on a 19 in. panel for rack mounting. It can be supplied complete with the RA.17 receiver in a bench mounting cabinet.

An alternative version, Type RA.37B, employs North American valves and aerial connectors. The differences between this version and the convertor RA.37 are described in this handbook.

SECTION 2

INSTALLATION

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

2.1 Supply

Check that the l.t. transformer taps are set to the correct supply voltage. Connect a mains lead (not provided) to the 3-pin plug already installed in the mains input socket. On North American versions of the RA.37, a mains lea is already fitted to the equipment which can be connected directly to the available supply.

2.2 Fuse

Ensure that the rating of the supply fuse (F1) is correct, viz.250 mA.

2.3 Aerial

Connect a suitable aerial to the AERIAL input plug on the rear of the unit. The input impedance of the convertor at the coaxial aerial plug is designed to match a 75Ω unbalanced transmission line.

2.4 Connections to RA.17

The following connections between the RA.37 and the RA.17 should be made with the connectors supplied:-

(a) Coaxial connectors

RA.37	RA.17
R.F. OUTPUT	R.F.
1 MC/S INPUT	1 MC/S

(b) 3-way connector

RA.37	RA.17
HT 1	HT 1
HT 2	HT 2
AVC	AVC

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.

2.5 Installation of RA.17

The RA.17 receiver should be installed and connected in accordance with the instructions in the RA.17 handbook.

SECTION 3

OPERATION

These instructions should be used in conjunction with those for the RA.17 Receiver, all controls of which remain operative, when operating between 12.5 kc/s and 980 kc/s, with the exception of MEGACYCLES, AE TUNE (ANT TUNE), AE RANGE MC/S (ANT RANGE MC/S) and AE ATTENUATOR (ANT ATTENUATOR). Control designations shown in brackets apply to North American versions of the RA.17 receiver and RA.37 convertor.

3.1 Preliminary

Set the RA.17 MAINS (POWER) switch to "on") "down" for British,
Set the RA.37 MAINS (POWER) switch to "on") "up" for North American.

3.2 Tuning - 12.5 to 980 kc/s

Set RA.37 OPERATION switch to 12KC/S-980KC/S. Set RA.37 AE RANGE (ANT RANGE) to WIDEBAND or to the desired frequency band. The tuned aerial input circuits are intended for use where strong adjacent channel interference is present.

Set the RA.37 AE ATTENUATOR (ANT ATTENUATOR) to MIN.

Adjust the calibration of the RA.17 Receiver in accordance with the instructions in the RA.17 handbook.

Set the RA.17 system switch to MAN.

Rotate the KILOCYCLES control to the desired setting on the red scale.

If the AE RANGE (ANT RANGE) switch is not set to WIDE BAND, adjust the AE TUNE (ANT TUNE) control on the RA.37 for maximum signal (or noise).

Set the RA.17 system switch to A.V.C. if required.

All remaining adjustments on the RA.17 Receiver are carried out in accordance with the RA.17 handbook.

3.3 Tuning - 980 kc/s to 30 Mc/s

Set RA.37 OPERATION switch to 980KC/S-30MC/S.

Operate the RA.17 Receiver in accordance with the RA.17 handbook.

3.4 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 possibility.

3.5 Aerial attenuator

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

SECTION 4

BRIEF TECHNICAL DESCRIPTION

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

4.1 R.F. Amplifier and filter

Input signals from the aerial are applied via the aerial attenuator to the R.F. Amplifier. Wide-band or tuned (12.5 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.

4.2 Harmonic generator and filter

Output from the 1 Mc/s crystal oscillator of the RA.17 receiver is fed to the harmonic generator, The band-pass filter in the output circuit selects the 2 Mc/s second harmonic.

4.3. Mixer

The output from the 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 2.0125 to 2.98 Mc/s.

4.4 Cathode-follower

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. amplifier (2-3 Mc/s) stage of the RA.17 receiver at low impedance. The required signal is finally selected in the interpolation stage of the RA.17 receiver by tuning the KILOCYCLES scale.

Range	Frequency	Adjustment
330-980 kc/s	315 kc/s	L8
	990 kc/s	
110-330 kc/s	105 kc/s	(a)
	350 kc/s	
37-110 kc/s	34 kc/s	L4
	120 kc/s	
12-37 kc/s	12 kc/s	(a)
	40 kc/s	

Note (a): Fixed inductors are used on the 12-37 kc/s and 100-330 kc/s ranges. Ensure that the frequencies are fully covered on these ranges.

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

Range	Frequency	Adjustment
12-37 kc/s	12 kc/s	88 dB relative to 1μV
	37 kc/s	84 dB relative to 1μV
37-110 kc/s	37 kc/s	94 dB relative to 1μV
	110 kc/s	89 dB relative to 1μV
110-330 kc/s	110 kc/s	94 dB relative to 1μV
	330 kc/s	91 dB relative to 1μV
330-980 kc/s	330 kc/s	103 dB relative to 1μV
	980 kc/s	98 dB relative to 1μV

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 Section 6.4 above.

SECTION 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; I.F. GAIN MAX; B.F.O. OFF; 1 Mc/s input to PL2 disconnected.
	2.5 Mc/s	225μV	100μA R.F. level	
	3.0 Mc/s	250μV	100μA R.F. level	
(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)	12 kc/s	200μV	100μA R.F. level	3 kc/s bandwidth; system switch to MAN; I.F. GAIN MAX; B.F.O. OFF; 1 Mc/s input to PL2.
	500 kc/s	150μV	100μA R.F. level	
	980 kc/s	200μV	100μA R.F. level	
(d) Aerial socket PL1	12 kc/s	20μV	100μA R.F. level	3 kc/s bandwidth; system switch to MAN; I.F. GAIN MAX; B.F.O. OFF; 1 Mc/s input to PL2; RA.37 AE RANGE (ANT RANGE) to WIDEBAND; RA.37 AE ATTENUATOR (ANT ATTENUATOR) to MIN.
	500 kc/s	15μV	100μA R.F. level	
	980 kc/s	20μV	100μA R.F. level	

Note...

The numerals in brackets indicate the valve pin number.

SECTION 2

VALVE DATA

2.1 Valve connections

Pin No.	CV.138 EF91	CV454 EF93	CV1832 150C2	CV2209 6F33
1	Grid 1	Grid 1	Anode	Grid 1
2	Cathode	Grid 3	Cathode	Cathode
3	Heater	Heater		Heater
4	Heater	Heater		Heater
5	Anode	Anode	Anode	Anode
6	Grid 3	Grid 2		Grid 3 Diode
7	Grid 2	Cathode	Cathode	Grid 2
Base	B7G	B7G	B7G	B7G

2.2 Valve complement and typical voltages

Cct. Ref.	CV No.	Equivalent	Anode	Screen	Cathode
V1	CV454	EF93	155(5)	95 (6)	0.85(7)
V2	CV138	EF91	205(5)	100(7)	-
V3	CV2209	6F33	150(5)	150(7)	2.0 (2)
V4	CV2209	6F33	150(5)	150(7)	2.0 (2)
V5	CV1832	150C2	150(1)	-	-
V6	CV138	EF91	205(5)	195(7)	1.25(2)

The above voltage-to-chassis measurements are approximate and are measured with a d.c. meter of 20 000 ohms per volt, the convertor and the receiver being in a quiescent state.

RV1 is set to mid-travel and the I.F. GAIN in the receiver is set at MAX.

The potential at terminal HT.1 is +200V.

SECTION 5

DETAILED CIRCUIT DESCRIPTION

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

5.1 Aerial circuit

An aerial source, normally of 75 ohms impedance, is connected through a five position attenuator switch (S2), covering an attenuation range of 0 to 40 dB, to an r.f. amplifier. Switch S1 selects wide-band amplification or any one of the four aerial coils L2, L4, L6 and L8, for tuned operation. The aerial coils are tuned by C5 for the ranges 100-330 kc/s and 330-980 kc/s. In the 12.5-37 kc/s and 37-110 kc/s ranges, C3 and C5 in parallel make up the tuning capacitor. The resistor R4 is included in the 12.5-37 kc/s tuned circuit (L2) to provide an adequate bandwidth.

5.2 R.F. amplifier

In the WIDE BAND position, the signal from the aerial attenuator is fed via capacitor C1 and grid stopper R13 to the control grid of the r.f. amplifier (V1). This grid is returned to the a.v.c. line via S1C and R11. 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 a.v.c. line. There are two stages of filtering in the a.v.c. line, they are C2, R12 and C4, R123; R123 is situated in the RA.17 receiver. The anode load resistor R16 matches the output impedance of the amplifier to the characteristic impedance of the filter. R17 allows the screen potential of V1 to rise when a.v.c. is applied, thereby controlling the effective a.v.c. action.

5.3 1 Mc/s low-pass filter

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 passed through the coupling capacitor C23 to the filter terminating resistor R23.

5.4 Harmonic generator and 2 Mc/s band-pass filter

The 1 Mc/s crystal-controlled output from the RA.17 receiver is passed via capacitor C10 and grid stopper R21 to the control grid of the harmonic generator (V2). R20, decoupled by C10, provides bias for this valve which operates in a non-linear condition. The anode load consists of a tuned circuit (L16, C17) which is the first stage of a 2 Mc/s band-pass filter. The second tuned circuit of the filter is formed by L17, L18 and C22 coupled by L18 to the third tuned circuit L18, L20, C24 and C27. Inductive coupling is provided to the balanced output winding L21. This filer has a passband of 50 kc/s, ensuring that only the 2 Mc/s harmonic is fed to the mixer.

5.5 Balanced mixer

The signal across the terminating resistor R23 is fed via the grid stopper R35 (omitted in North American versions) 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. R24 and R26 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 L19 and R27. L19 (adjustable by iron dust core) is tuned by stray capacitance to 2.7 Mc/s and is heavily damped by R27 to provide wide-band tuning covering the frequency range 2-3 Mc/s. The potentiometer RV1 equalises the gains of V3 and V4, and the differential capacitor C28 equalises the phase-shifts in these two valves to enable a precise balance to be achieved. The h.t. supply for the valves is stabilised by V5. The 2-3 Mc/s output from the mixer is fed through C33 and the grid stopper R31 to the control grid of the cathode-follower.

5.6 Cathode-follower

The cathode-follower stage (V6) enables the signal to be fed to the low-impedance tapping in the 2-3 Mc/s band-pass filter in the RA.17 receiver. The cathode load is formed by L23 and the input impedance of the band-pass filter. Resistor R33 is included to bias the valve to the correct operating conditions.

5.7 Power supplies

The h.t. supply is obtained from the RA.17 receiver by setting the OPERATION switch to 12.5-980 kc/s. When the switch is in this position, h.t. is disconnected from the first VFO unit and the 2nd mixer in the receiver and is applied to the convertor.

The heater supply is obtained from a mains transformer contained within the L.F. convertor.

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

SECTION 6

ALIGNMENT PROCEDURE

6.1 Standardization of RA.17 sensitivity

Connect the signal generator (matched to 75 ohms) via a 0.1μF capacitor to the R.F. socket of the RA.17 receiver. Set the I.F. GAIN to maximum, the BANDWIDTH to 3 kc/s, the meter switch to R.F. LEVEL and the system switch to MAN.

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).

Connect the RA.37 convertor correctly to the RA.17 receiver, but do not connect an aerial.

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

6.2 Harmonic generator

Ensure that the dust covers are fitted to the harmonic generator. Set C28 to the mid-position. Connect the valve-voltmeter between grid 3 of V3 (pin 6) and earth.

Adjust L16, L17 and C27 in turn to obtain maximum output. With the correct adjustment this output should not be less than 0.5V.

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

This reading should be within 0.05V of the previous reading.

6.3 Balanced mixer anode circuit

Disconnect the coaxial lead between the R.F. OUTPUT socket of the RA.37 and the R.F. socket of the RA.17.

Connect the valve-voltmeter in parallel with a 330 ohm resistor across the R.F. OUTPUT socket of the RA.37. 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.

Observe that the frequency response is sensibly level as the signal generator frequency is swept over the range of 2-3 Mc/s. Adjust L19 to obtain maximum output at 2.7 Mc/s.

Disconnect the valve-voltmeter and replace the coaxial lead between the R.F. OUTPUT socket of the RA.37 and the R.F. socket of the RA.17.

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

Sig. Gen. Frequency	RED Scale Setting	Max. input relative to that obtained in 6.1	
		RA.37	RA.37B
2.0 Mc/s	0 kc/s	-6 dB	-8 dB
2.5 Mc/s	500 kc/s	-10 dB	-12 dB
3.0 Mc/s	1000 kc/s	-10 dB	-12 dB

6.4 Balanced mixer adjustment and drift measurements

Set the RED KILOCYCLES scale on the RA.17 receiver to zero, the I.F. GAIN control to MIN and the meter switch to R.F. LEVEL. Connect the mains supply to the RA.17 and RA.37 via a voltage changing auto-transformer and set this transformer to supply the voltage to which the tappings of the receiver and convertor transformers are set.

With no signal input, adjust RV1 and C28 alternately to obtain minimum diode current, increasing the setting of the I.F. GAIN control as necessary.

Reduce the input voltage by 10% and allow sufficient time for the heater temperature to stabilize. Adjust the 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 of the RA.37 and connect the lead via a 0.1μF capacitor to the signal generator. Tune the signal generator to 2 Mc/s (C.W.).

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

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

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

Replace the coaxial lead to the R.F. OUTPUT socket.

.5 Low-pass filter

Set I.F. GAIN to MAX, the system switch to STANDBY and connect the 1 MC/S output plug (RA.17) to the 1 MC/S INPUT plug (RA.37). Connect the signal generator (75 ohms output impedance) to the RA.37 AERIAL plug (ANTENNA socket) and set the AE ATTENUATOR (ANT ATTENUATOR) to MIN. Set the RA.37 AE RANGE switch (ANT RANGE) to WIDEBAND. Remove V3 and connect a valve-voltmeter to grid 1 (pin 1) of the valveholder. Remove V4 and V5.

Set the system switch to MAN. Adjust the frequency of the signal generator to precisely 1030 kc/s (C.W.). Tune the RA.17 receiver and adjust the signal generator output until the valve -voltmeter reads 2V approximately.

Increasing the signal generator output as necessary to a limit of 800mV, adjust L13 to obtain minimum indication on the valve-voltmeter.

Repeat the above procedure with the signal generator frequency set precisely to 1080 kc/s, adjusting L9 to obtain minimum output.

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.

Explore the passband from 12 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 L10, L11 and L12 as necessary to correct the response in the region of 900-980 kc/s.

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

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

6.6 R.F. tuned circuit

Remove V1 and connect the valve-voltmeter to grid 1 (pin 1) of the valveholder. Connect the signal generator to the RA.37 AERIAL plug (ANTENNA socket). Set the AE RANGE (ANT RANGE) switch to 330-980 kc/s.

Set the signal generator to 315 kc/s and tune the RA.17 receiver. Rotate the AE TUNE (ANT TUNE) control (capacitor C5) fully clockwise. Adjust L8 to obtain maximum output. Set the signal generator to 990 kc/s and ensure that the aerial (antenna) tuning capacitor C5 can be tuned through resonance.

Repeat the above procedure at ranges and frequencies stated in the table below:-

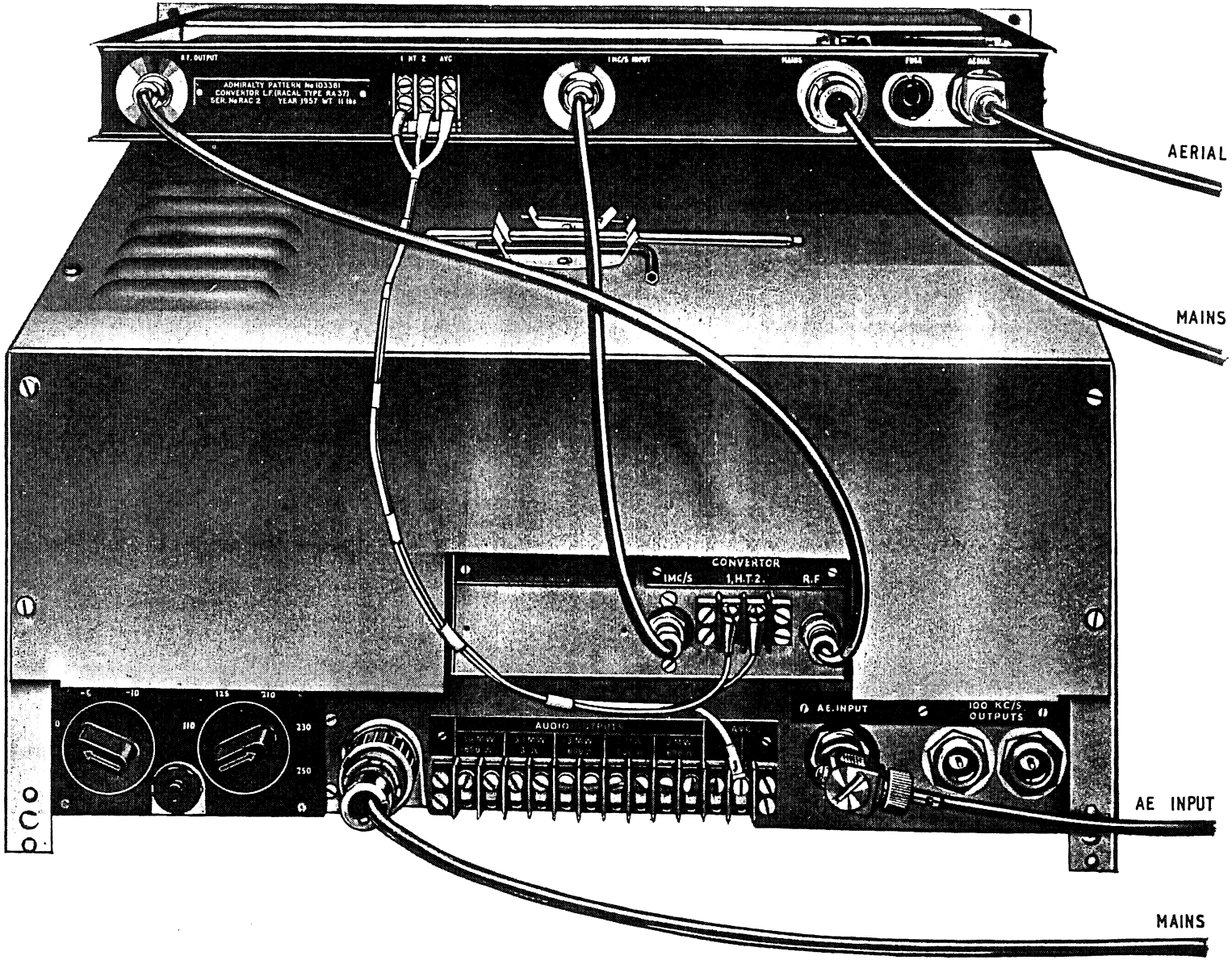


FIG.2 INTERCONNECTIONS BETWEEN RA.17 & RA.37

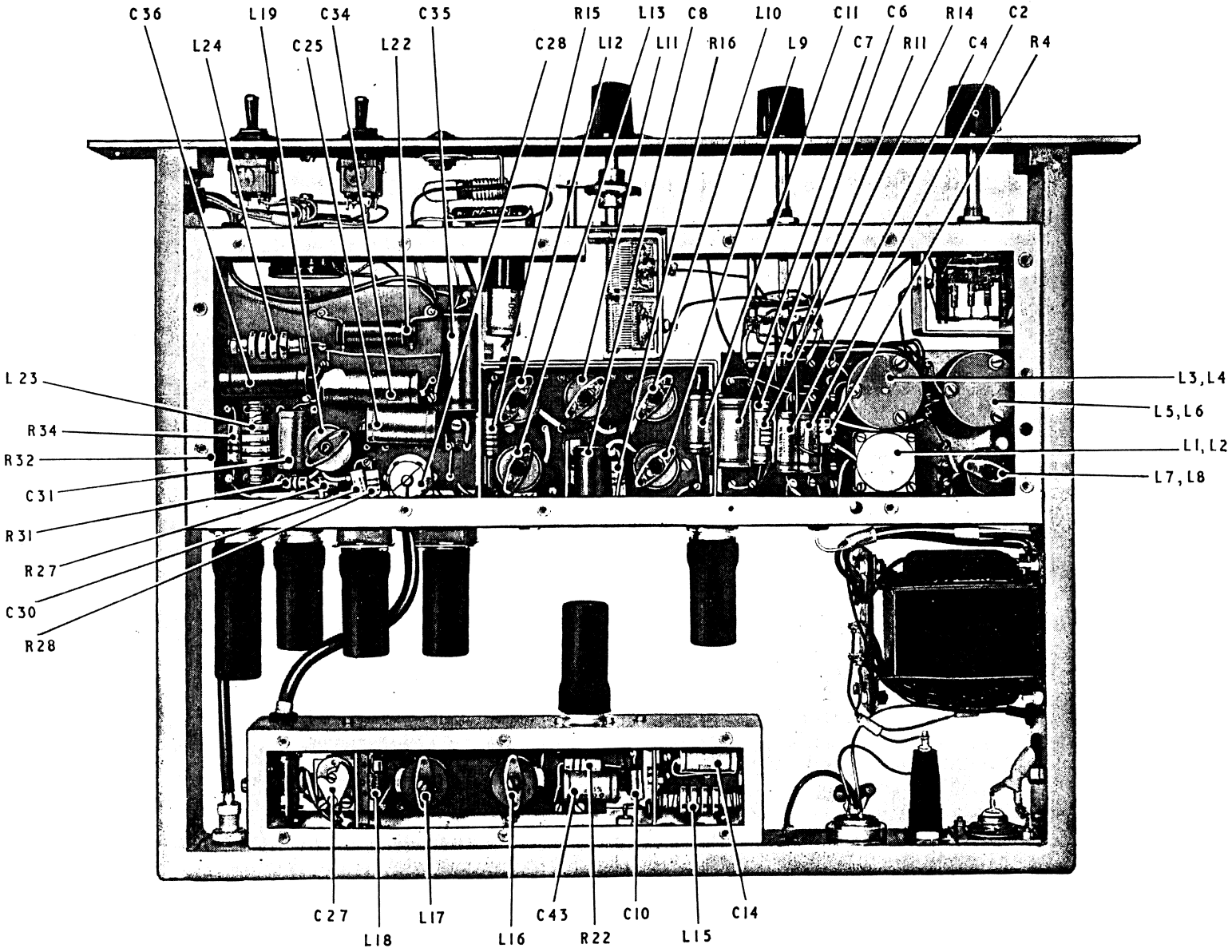


FIG. 3 R A.37 CHASSIS - TOP

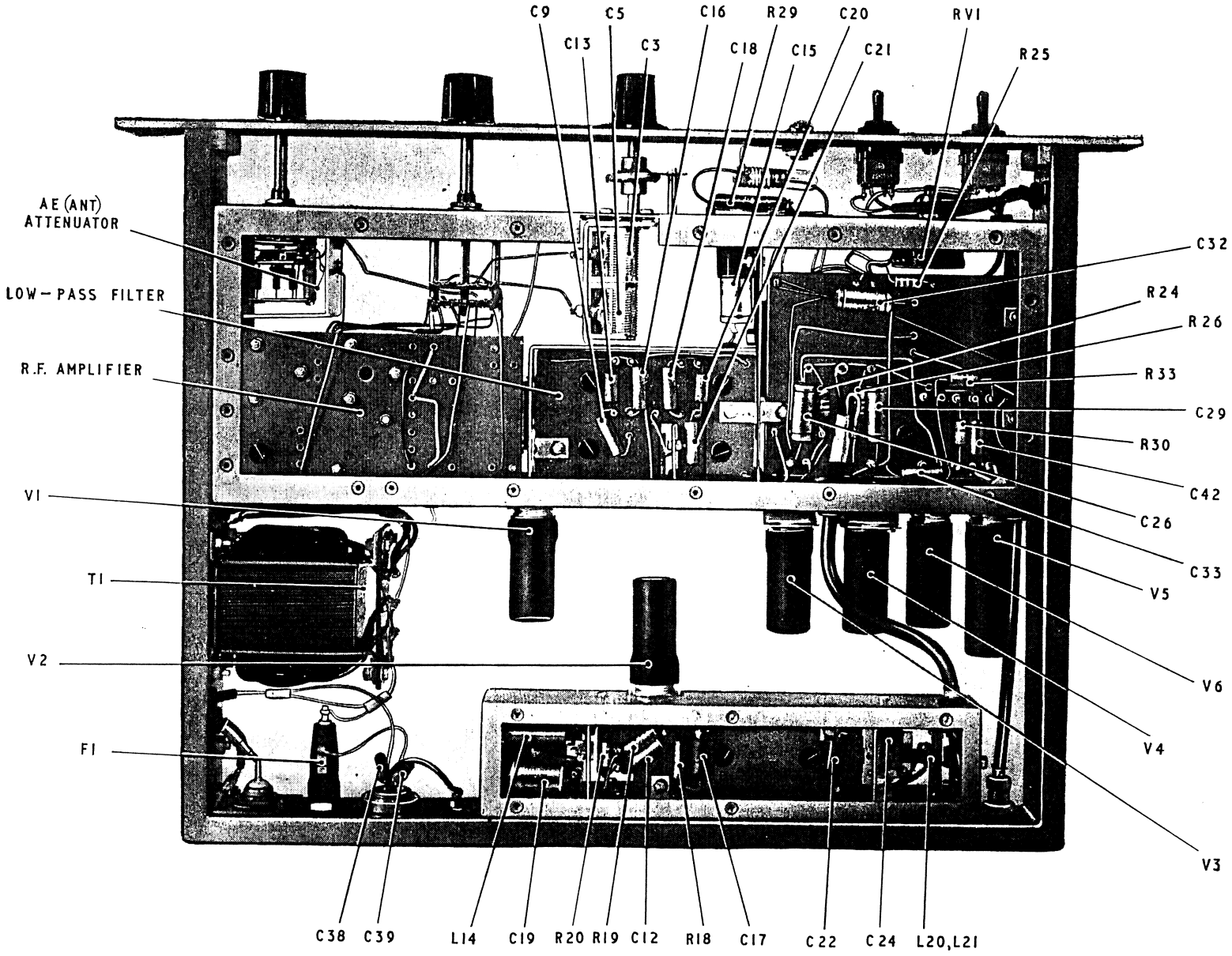
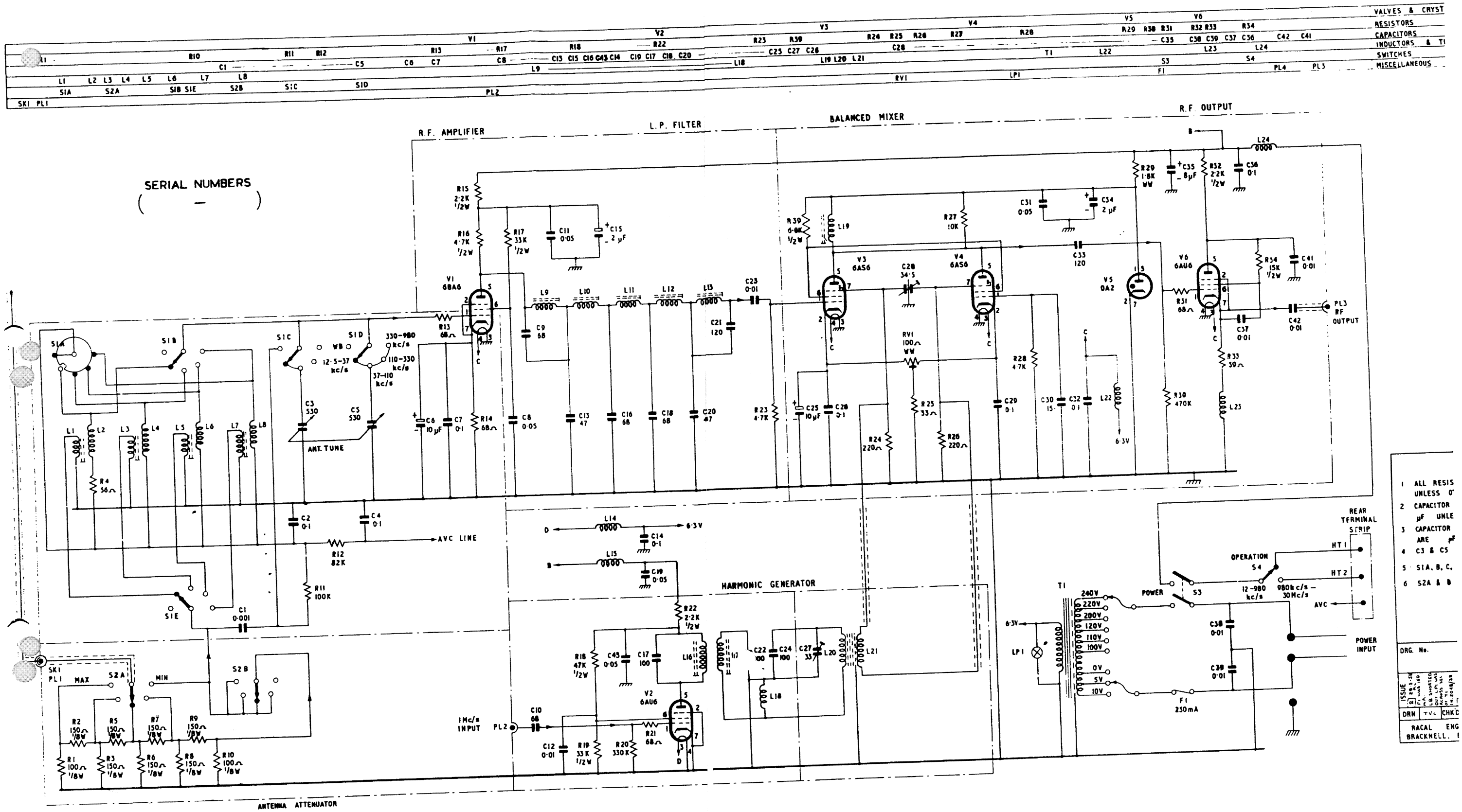


FIG. 4 R A. 37 CHASSIS – UNDERSIDE



L. F. CONVERTOR TYPE RA37

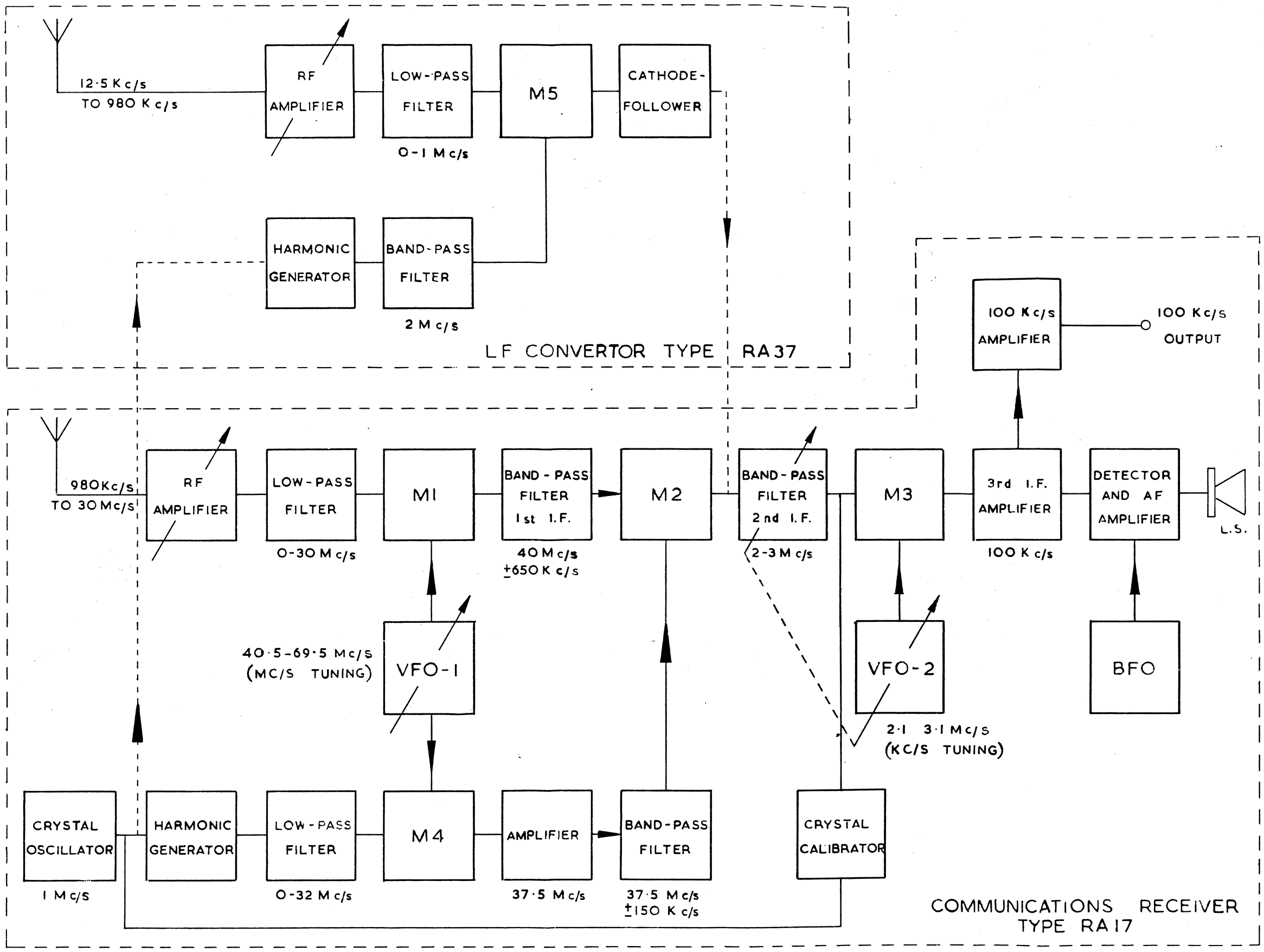


FIG.1 BLOCK DIAGRAM

PART 1

INSTALLATION AND OPERATION
RA.37

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L.F. CONVERTOR UNIT TYPE RA.37

TECHNICAL SPECIFICATION

(When used in conjunction with an RA.17 receiver)

Frequency range	-	12.5 to 980 kc/s
Stability	-	After warm-up time of $1\frac{1}{2}$ hours, overall drift less than 150 c/s under conditions of constant supply voltage and ambient temperature.
Input impedance	-	75Ω unbalanced.
Tuning	-	Effective scale length approximately 4'9", i.e. about 6" of scale length corresponds to 100 kc/s.
Sensitivity	-	A1 reception, bandwidth 3 kc/s, 1μV for 20 dB signal/noise ratio. A3 reception, 30% modulated bandwidth 3 kc/s, 3μV for 20 dB signal/noise ratio.
Image response	-	With tuned input, external image signals are reduced by at least 60 dB.
Controls	-	Aerial range switch Aerial attenuator Mains on/off Aerial tuning RA.17/RA.37 selector switch
Power supply	-	100-125 and 200-250 volts, 45-65 c/s. Power consumption 11W approximately. H.T. supply from RA.17 receiver
Dimensions	-	For rack mounting:

Height	Width	Depth	
1.75	19	13	in
4.5	48.25	33	cm

Cabinet containing RA.17 and RA.37

Height	Width	Depth	
14.25	20.5	21.985	in
36.2	52	55.6	cm

Weight	Rack mounted 11 lb (5 kg) In cabinet with RA. 17, 110 lb (50 kg).

CORRIGENDA

Fig. 3: the annotations for C6 and C7 to be interchanged.

Fig. 5: the switch S4 (OPERATION) to be reconnected so that the pole (wiper) of the switch is connected to terminal H. T. 1; in the 980 KC/S-30 MC/S position, H. T. 1 and H. T. 2 are joined, and in the 12-980 KC/S position, H. T. 1 is joined to S3.

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IMPORTANT NOTE

The RA.37 convertor is designed for use with the Racal RA.17 Communications Receiver. The ensuing sections assume that this convertor is connected to a receiver which is operating to the correct specification.

SECTION 1

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 5.0 volts at frequencies up to 3.0 Mc/s.

(b) Signal Generator capable of operating on fundamental frequencies up to 3.0 Mc/s.

(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 250 volts and supplying 120 watts.

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

SECTION 3

TYPICAL PERFORMANCE

3.1 Stability

After a warm-up time of $1\frac{1}{2}$ hours, overall drift is less than 150 c/s under conditions of constant supply voltage and ambient temperature.

3.2. Sensitivity

A1 emission, bandwidth 3 kc/s:-
1μV for 20 dB signal-to-noise ratio.

A3 emission, 30% modulation, bandwidth 3 kc/s:-
3μV for 20 dB signal-to-noise ratio.

3.3 Selectivity

	-6dB	-66dB
Position 1	100 c/s)	
" 2	300 c/s)	Less than 3.5 kc/s
" 3	750 c/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 the crystal bandwidths does not change by more than 50 c/s when the bandwidth is changed.

3.4 Cross modulation

Using the aerial attenuator with a tuned input, an i.f. bandwidth of 3 kc/s and a wanted signal amplitude of 1 mV then an unwanted signal, differing by 10 kc/s and modulated 30%, must have a level at least 30 dB greater than the wanted signal in order to produce a cross modulation output equivalent to 1% modulation of the wanted signal.

3.5 Image and spurious responses

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

3.6 Automatic volume control

An increase in signal strength of 20 dB above 1μV improves the signal-to-noise ratio by 18 dB.

An increase of 70 dB above the a.v.c. threshold increases the audio output by not more than 6 dB.

SECTION 4

FAULT LOCATION

4.1 Signal input circuits

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 aerial input and the attenuator circuits.

4.2 R.F. stage

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 section 6.4. If the mixer can be balanced, the fault is in the R.F. stage or band-pass filter.

4.3. Mixer stage

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

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 SK2. Remove V3, V4 and V5 and check that 0.8 volts at 2 Mc/s appears at pin 6 of the valve holders of both V3 and V4.

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.17 receiver.

4.4 Voltage stabilizer

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

SECTION 7

PARTS LIST

Circuit references are shown in fig. 5 at the end of the handbook. Components may be located by the use of figures 3 and 4.

Components marked + are omitted from the North American version of the adaptor. Components marked * are fitted only in the North American version.

7.1 RESISTORS

Cct. Ref.	Value	Description	Rating	Tol.	Inter Service No.	Manufacturer and Type or Drawing No.
R1	100Ω	Carbon	¼W	10%	5905-99-022-1109	Erie-16
R2	150Ω	Carbon	¼W	10%	5905-99-022-1130	Erie-16
R3	150Ω	Carbon	¼W	10%	5905-99-022-1130	Erie-16
R4	56Ω	Carbon	¼W	10%	5905-99-022-1080	Erie- 9
R5	150Ω	Carbon	¼W	10%	5905-99-022-1130	Erie-16
R6	150Ω	Carbon	¼W	10%	5905-99-022-1130	Erie-16
R7	150Ω	Carbon	¼W	10%	5905-99-022-1130	Erie-16
R8	150Ω	Carbon	¼W	10%	5905-99-022-1130	Erie-16
R9	150Ω	Carbon	¼W	10%	5905-99-022-1130	Erie-16
R10	100Ω	Carbon	¼W	10%	5905-99-022-1109	Erie-16
R11	100kΩ	Carbon	¼W	10%	5905-99-022-3038	Erie- 9
R12	82kΩ	Carbon	¼W	10%	5905-99-022-3029	Erie- 9
R13	68Ω	Carbon	¼W	10%	5905-99-022-1089	Erie- 9
R14	68Ω	Carbon	¼W	10%	5905-99-022-1089	Erie- 9
R15	2.2kΩ	Carbon	½W	10%	5905-99-022-2048	Erie- 8
R16	4.7kΩ	Carbon	½W	10%	5905-99-022-2090	Erie- 8

RESISTORS - continued.....

Cct. Ref.	Value	Description	Rating	Tol.	Inter Service No.	Manufacturer and Type or Drawing No.
R17	33kΩ	Carbon	½W	10%	5905-99-022-2195	Erie- 8
R18+	33kΩ	Carbon	½W	10%	5905-99-022-2195	Erie- 8
R18*	47kΩ	Carbon	½W	10%	5905-99-022-2216	Erie- 8
R19	33kΩ	Carbon	½W	10%	5905-99-022-2195	Erie- 8
R20	330kΩ	Carbon	¼W	10%	5905-99-022-3101	Erie- 9
R21	68Ω	Carbon	¼W	10%	5905-99-022-1089	Erie- 9
R22	2.2kΩ	Carbon	½W	10%	5905-99-022-2048	Erie- 8
R23	4.7kΩ	Carbon	¼W	10%	5905-99-022-2089	Erie- 9
R24	220Ω	High stab.	1/8W	1%	5905-99-021-9458	Erie-109
R25+	82Ω	High stab.	1/8W	5%	5905-99-011-9732	Erie-109
R25*	33Ω	Carbon	½W	5%	5905-99-022-1045	Erie- 8
R26	220Ω	High stab.	1/8W	1%	5905-99-021-9458	Erie-109
R27	10kΩ	Carbon	¼W	10%	5905-99-022-2131	Erie- 9
R28	4.7kΩ	Carbon	¼W	10%	5905-99-022-2089	Erie- 9
R29	1.8kΩ	Wirewound	4.5W	5%	5905-99-011-3493	Welwyn-AW 3111
R30	470kΩ	Carbon	¼W	10%	5905-99-022-3122	Erie- 9
R31	68Ω	Carbon	¼W	10%	5905-99-022-1089	Erie- 9
R32	2.2kΩ	Carbon	½W	10%	5905-99-022-2048	Erie- 8
R33+	82Ω	High stab.	1/8W	5%	5905-99-011-9732	Erie-109
R33*	39Ω	High stab.	1/8W	5%	5905-99-011-9708	Erie- 109
R34+	4.7kΩ	Carbon	½W	10%	5905-99-022-2090	Erie- 8
R34*	15kΩ	Carbon	½W	10%	5905-99-022-2153	Erie- 8

RESISTORS- continued.....

Cct. Ref.	Value	Description	Rating	Tol.	Inter Service No.	Manufacturer and Type or Drawing No.
R35+	180Ω	Carbon	¼W	10%	5905-99-022-1142	Erie-16
R36+	180Ω	Carbon	¼W	10%	5905-99-022-1142	Erie-16
R37+	180Ω	Carbon	¼W	10%	5905-99-021-1142	Erie-16
R38+	180Ω	Carbon	¼W	10%	5905-99-021-1142	Erie-16
R39*	6.8kΩ	Carbon	½W	10%	5905-99-022-2111	Erie- 8

7.2 POTENTIOMETERS

RV1	100Ω	Wirewound		10%	5905-99-972-8313	Colvern-CLR 3001/115

7.3 CAPACITORS

C1	0.001μF	Ceramic		20%		F.E.c-310K
C2	0.1μF	Paper	150V	20%	5910-99-011-5560	Hunt-W49 B 500KY
C3) C5)	523pF	Variable air (2-gang)			5910-99-972-8331	Wingrove & Rogers C73-02/101
C4	0.1μF	Paper	150V	20%	5910-99-011-5560	Hunt-W49 B 500KY
C6	10μF	Electroylytic	25V		5910-99-014-5098	Hunt-JB 59KY
C7	0.1μF	Paper	150V	20%	5910-99-011-5560	Hunt-W49 B 500KY
C8	0.05μF	Paper	350V	20%	5910-99-011-5559	Hunt-W49 B 511KZ
C9	68pF	Ceramic		5%	5910-99-013-2294	Erie-N750L
C10	68pF	Ceramic		10%	5910-99-013-2295	Erie-N750K
C11	0.05μF	Paper	350V	20%	5910-99-011-5559	Hunt-W49 B 511KZ

CAPACITORS - continued.....

Cct. Ref.	Value	Description	Rating	Tol.	Inter Service No.	Manufacturer and Type or Drawing No.
C12	0.01μF	Paper	400V	20%	5910-99-011-5827	Hunt-BM21KZ
C13	47pF	Ceramic		5%	5910-99-013-2288	Erie-N750K
C14	0.1μF	Paper	150V	20%	5910-99-011-5560	Hunt-W49 B 500KY
C15	2μF	Electrolytic	350V	20%	5910-99-014-5010	Hunt-JB570Z
C16	68pF	Ceramic		5%	5910-99-013-2294	Erie-N750L
C17	100pF	Silv'd mica	350V	2%	5910-99-012-3923	Lemco-CMMIG
C18	68pF	Ceramic		5%	5910-99-013-2294	Erie-N750L
C19	0.05μF	Paper	350V	20%	5910-99-011-5559	Hunt-W49 B 511KZ
C20	47pF	Ceramic		5%	5910-99-013-2288	Erie-N750K
C21	120pF	Ceramic		5%	5910-99-013-2302	Erie-N750L
C22	100pF	Silv'd mica	350V	2%	5910-99-012-3923	Lemco-CMMIG
C23	0.01μF	Paper	400V	20%	5910-99-012-5827	Hunt-BM21KZ
C24	100pF	Silv'd mica	350V	2%	5910-99-012-3923	Lemco-CMMIG
C25	10μF	Electrolytic	25V	+100% - 20%	5910-99-014-5097	Hunt-JB59Z
C26	0.1μF	Paper	150V	20%	5910-99-011-5560	Hunt-W49 B 500KY
C27	33pF	Variable air			5910-99-016-0047	Wingrove & Rogers C31-01/1
C28	34.5pF	Differential Trimmer	1000V			Oxley

CAPACITORS—continued.....

Cct. Ref.	Value	Description	Rating	Tol.	Inter Service No.	Manufacturer and Type or Drawing No.
C29	0.1μF	Paper	150V	20%	5910-99-011-5560	Hunt-W49 B 500KY
C30	15pF	Ceramic		10%	5910-99-911-5481	Erie-NPOK
C31	0.05μF	Paper	350V	20%	5910-99-011-5559	Hunt-W49 B 511KZ
C32	0.1μF	Paper	150V	20%	5910-99-011-5560	Hunt-W49 B 500KY
C33	120pF	Ceramic		5%	5910-99-013-2302	Erie-N750L
C34	2μF	Electrolytic	350V	+50% -20%	5910-99-014-5010	Hunt-JB570Z
C35	8μF	Electrolytic	350V	+50% -20%	5910-99-014-5503	Hunt-JB403KZ
C36	0.1μF	Paper	350V		5910-99-011-5562	Hunt-W49B512 KZ
C37	0.01μF	Paper	400V	20%	5910-99-011-5827	Hunt-BM21KZ
C38	0.01μF	Ceramic	750V	20%	5910-99-972-8307	Lemco-420K
C39	0.01μF	Ceramic	750V	20%	5910-99-972-8307	Lemco-420K
C41	0.01μF	Paper	400V	20%	5910-99-011-5827	Hunt-BM21KZ
C42	0.01μF	Paper	400V	20%	5910-99-011-5827	Hunt-BM21KZ
C43	0.05μF	Paper	350V	20%	5910-99-011-5559	Hunt-W49-B 511KZ

7.4 SWITCHES

S1		Aerial (Ant) range switch			5930-99-972-8854	Racal-BS8035
S2		Aerial (Ant) attenuator switch			5930-99-972-9328	Racal-AA8034

SWITCHES - continued.....

Cct. Ref.	Value	Description	Rating	Tol.	Inter Service No.	Manufacturer and Type or Drawing No.
S3		Mains and HT Interlock			5930-99-051-0554	NSF-DPDT
S4		Operation switch			5930-99-051-0554	NSF-DPDT
7.5	PLUGS AND SOCKETS					
PL1+		AERIAL			5935-99-054-0101	Films & Equipment
PL1*		AERIAL				Films & Equipment
SK1+		AERIAL			5935-99-054-0104	Films & Equipment
SK1*		AERIAL				Films & Equipment
PL2+		1 MC/S INPUT			5935-99-054-0151	Power Controls
PL2*		1 MC/S INPUT				Amphenol UG260B/U
SK2+		1 MC/S INPUT			5935-99-054-0155	Power Controls
SK2*		1 MC/S INPUT				Amphenol UG-1094/U
PL3+		R.F. OUTPUT			5935-99-054-0152	Power Controls
PL3*		R.F. OUTPUT				Amphenol UG260B/U
SK3+		R.F. OUTPUT			5935-99-054-0155	Power Controls
SK3*		R.F. OUTPUT				Amphenol UG-1094/U
PL4+		MAINS fixed 3-pin			5935-99-056-0060	Plessey-CZ48993
SK4+		MAINS free 3-pin			5935-99-056-0100	Plessey-CZ49015

7.6 VALVES American valve types are those shown in brackets.

Cct. Ref.	Description	Inter Service No.	Manufacturer and Type or Drawing No.
V1	R.F. amplifier		Mullard-EF93 (6BA6)
V2	Harmonic generator		Mullard EF91 (6AU6)
V3	Balanced mixer		Mazda-6F33(6AS6)
V4	Balanced mixer		Mazda-6F33(6AS6)
V5	Stabilizer		Mullard-150C2 (OA2)
V6	Cathode-follower		Mullard-EF91 (6AU6)

7.7 VALVEHOLDERS and SCREENING CANS

V1, V2, V6	Valveholder	5935-99-056-0127	McMurdo-XM7 / UC1
	Screening can	5935-99-056-3003	McMurdo
V3, V4	Resilient valveholder	5935-99-911-1103	McMurdo-XM/ UXT1
	Check plate		McMurdo-CP7
	+ Screening can	5935-99-056-3003	McMurdo
	* Screening can	5935-99-056-0145	McMurdo
V5	Valveholder	5935-99-056-0127	McMurdo-XM7/ UC1
	Screening can	5935-99-056-3005	McMurdo

7.8 INDUCTORS

L1) L2)	Aerial tuning coil 12.0-37 kc/s	5950-99-972-9580	Racal-BA7838

INDUCTORS - continued.....

Cct. Ref.	Description	Inter Service No.	Manufacturer and Type or Drawing No.
L3) L4)	Aerial tuning coil 37-110 kc/s	5950-99-972-9581	Racal;BA7839
L5) L6)	Aerial tuning coil 110-330 kc/s	5950-99-972-9582	Racal-BA7840
L7) L8)	Aerial tuning coil 330-980 kc/s	5950-99-972-9583	Racal-AA7841
L9	980 kc/s low-pass filter	5950-99-972-9584	Racal-AA7842
L10	980 kc/s low-pass filter	5950-99-972-9585	Racal-AA7843
L11	980 kc/s low-pass filter	5950-99-972-9585	Racal-AA7843
L12	980 kc/s low-pass filter	5950-99-972-9585	Racal-AA7843
L13	980 kc/s low-pass filter	5950-99-972-9588	Racal-AA8029
L14	Filter coil (l.t. supply)	5950-99-972-9555	Racal-AA1655
L15	Choke (V2 anode)	5950-99-972-8084	Bulgin-SW68
L16	Harmonic generator filter	5950-99-972-9666	Racal-AA9199
L17	Harmonic generator filter	5950-99-972-9586	Racal-AA7844
L18+	Harmonic generator filter	5950-99-972-9395	Racal-AA7845
L18*	Harmonic generator filter		Racal-AA8313
L19	Anode load V3 and V4	5950-99-972-9589	Racal-AA8033

INDUCTORS - continued, ...

Cct. Ref.	Description	Inter Service No.	Manufacturer and Type or Drawing No.
L20) L21)	Harmonic generator output coil	5950-99-972-9587	Racal-AA7846
L22	Filter coil (l.t. supply)	5950-99-972-9555	Racal-AA4655
L23	Choke	5950-99-972-8084	Bulgin-SW68
L24	Choke	5950-99-972-8084	Bulgin-SW68

7.9 MISCELLANEOUS

T1	Mains transformer	5950-99-972-9372	Racal-BT8288
	Mains input fuse holder		Belling-Lee-L356
F1	Mains input fuse		Belling-Lee-L338/ 250mA
LP1	Mains indicating lamp 8 volts 1.6W	6240-99-995-1201	Luxram 983 (M.E.S.)

7.10 ADDITIONAL ITEMS RECOMMENDED AS SPARES

The following items are recommended as replacement spares in addition to the electrical components shown in Sections 7.1 to 7.9 above:-

Description	Inter Service No.	Manufacturer and Type or Drawing No.
Signal lamp fittings	6250-99-943-4042	Bulgin-D187 Red
Control knob (switches)	5355-99-943-4799	Racal-AD6735
Control knob (tuning)	5355-99-943-4818	Racal-AD6817
Slow-motion drive	5895-99-943-6511	Jackson-DR64511F
Terminal strip		Cinch-77/508/3
1 Mc/s connecting cable		Racal-AA8026
R.F. output cable		Racal-AA8027

ADDITIONAL ITEMS RECOMMENDED AS SPARES - continued.....

Description	Inter Service No.	Manufacturer and Type or Drawing No.
H.T. and A.V.C. cable		Racal-AA8028
Attenuator switch assembly (includes S1, R1 to R10)		Racal-AA8034
Harmonic generator filter assembly (includes L14, L15, C14, C19)		Racal-AA7848
Low-pass filter assembly (includes C8, C9, C11, C13, C16, C18, C20, C21, C23, L9 to L13, R15, R16, R17, R23)		Racal-BA7530

SECTION 8

LIST OF ILLUSTRATIONS

RA.37 L.F. Convertor and RA.17 Receiver	Frontispiece
Block diagram	Fig. 1
Rear view showing interconnections between RA.17 and RA37	Fig. 2
Chassis - top	Fig. 3
Chassis - underside	Fig. 4
Circuit diagram	Fig. 5