

TECHNICAL INSTRUCTION

T.9

Rebroadcast Receivers

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REBROADCAST RECEIVERS

SECTION 1

REBROADCAST RECEIVERS RBR/2 AND RBR/2A-J

Introduction

Rebroadcast Receivers Types RBR/2 and RBR/2A-J, are each designed for use at a transmitting site as an alternative source of programme in the event of failure of the normal S.B. line and amplifier.

The receivers are designed for simplicity of operation and maintenance, consistent with a performance satisfying certain specialised and stringent requirements of which one is that the receivers shall function satisfactorily in the strong r.f. fields existing at transmitting sites.

Tuning is preset for the particular source-transmitter frequency, and the output level is preset for the requirements of the input circuit of the local transmitter. The overall frequency response extends from 40 c/s to 5.5 kc/s.

L.t. and h.t. supplies are derived from a standard BBC mains unit.

It is intended that the receiver shall be connected to a 14-20 ft vertical aerial through a 75-ohm coaxial r.f. cable and an Aerial-coupling Unit Type ACU/4. See Section 2.

TYPE-RBR/2 RECEIVER

General Description

The Type-RBR/2 receiver is a 'straight' receiver designed for long-wave reception and normally used for picking up the Light Programme radiated by Droitwich on 200 kc/s.

The circuit diagram is given in Fig. 1. Three stages of r.f. amplification, using two CV131 pentodes and an L63 triode, are followed by an EB 34 double-diode. One half of the double-diode functions as detector and provides the a.f. input to the output valve while the other half is associated with the delay voltage for the a.g.c. on the first two r.f. stages. The output valve is an L63 triode.

The input circuit of the first valve includes a band-pass filter ($f_o = 200$ kc/s). The connection between the receiver input sockets and the filter input is made by a 75-ohm insulated and screened coaxial cable with its screen earthed at the filter end only.

Provision is made for mounting in the receiver a switchable low-pass filter, connected in the output

circuit. This is done when the receiver is used at a site where exceptional heterodyne interference is experienced.

Mechanical Construction

The receiver is constructed on both sides of a standard $6\frac{1}{2} \times 22\frac{1}{2}$ inch rack-mounting panel, with dust covers extending $5\frac{1}{2}$ inches back and front. The band-pass filter and the amplifier stages are contained in copper screening boxes.

Test Data

L.T. and H.T. Feeds

Heaters: 1.2 A at 6.3 V

H.T.: 46/56 mA at 300 V

To check the individual valve feeds, use a Model-7 Avometer on the 10-volt range and measure the voltages between the valve-cathode test sockets and earth. These should be as follows:—

V1	2.6 V \pm 10%
V2	2.6 V \pm 10%
V3	5.1 V \pm 10%
V5	6.6 V \pm 10%

These voltages are to be measured with no r.f. input to the receiver.

Low-Pass Filter

The insertion loss is measured between 600-ohm terminations. The measurements obtained should be as follows:—

Switch Position	Test Frequency	Measured Loss
1	—	Nil
2	—	Nil
3	Below 3 kc/s	Less than 1 db
	At 4 kc/s	Less than 5 db
	At 6 kc/s	Greater than 36 db
	Between 6 and 9 kc/s	Greater than 30 db
4	Below 2.5 kc/s	Less than 1 db
	At 3 kc/s	Less than 3 db
	At 4 kc/s	Greater than 36 db
	Between 4 and 9 kc/s	Greater than 25 db

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Section 1

Frequency Response

With the low-pass a.f. filter out of circuit the audio-output level relative to that obtained for a 1 kc/s modulated signal should be as follows:—

Modulation Frequency	Audio Output Level db
5 kc/s	Greater than -7 db
9 kc/s	Less than -40 db
10 kc/s and higher	Less than -50 db

Automatic Gain Control and Noise

With an r.f. input signal at 200 kc/s which is modulated to a depth of 40% by 400 c/s tone, an increase of r.f. input to 100 mV and a decrease in r.f. input to 100 μ V should not change the audio-output level by more than ± 3 db.

Set the volume control to give zero level output from a modulation depth of 40%. With no r.f. input, measure the noise level of the receiver on a 600-ohm amplifier detector. This noise level should not be less than -38 db or greater than -20 db.

Distortion

Connect a high-quality a.f. oscillator with a low-impedance output (600 ohms or less) between the glass-seal terminal feeding C33, and earth. Adjust the volume control to give zero level into 600 ohms at the output of the receiver.

Connect a harmonic analyser across the receiver output and take measurements at 90 c/s and 1 kc/s. The total harmonic content of the output should not exceed 0.75% at 90 c/s and 0.4% at 1 kc/s.

Repeat the tests with an output level of 8 db above 1 milliwatt. The corresponding measurements should not exceed 1.5% and 1% respectively.

A.F. Amplification

Connect a 600-ohm tone source direct to the input of capacitor C33. Connect an amplifier detector across the receiver output. Turn the volume control of the receiver to maximum.

With an input at zero level the gain of the a.f. amplifier stage should be $+8 \pm 2$ db.

Maintenance

Maintenance on the receiver should be limited to the changing of valves and components which are not included in the filter box. *It is essential that no attempt should be made to adjust the r.f. filter on site.* The filter should not normally require maintenance and adjustments can only be made with specialised equipment. Any attempt to align on site will only cause serious errors in the frequency response of the

receiver. If the filter is found to be faulty it can easily be removed and replaced with a new filter.

TYPE—RBR/2A-J RECEIVERS

General Description

The Type RBR/2A-J receivers are 'superhet' receivers designed for M.W. reception. The standard tuning is as follows:—

RBR/2A	647 kc/s
RBR/2B	692 ..
RBR/2C	809 ..
RBR/2D	881 ..
RBR/2E	908 ..
RBR/2F	1052 ..
RBR/2G	1088 ..
RBR/2H	1151 ..
RBR/2J	1457 ..

The circuit diagram is given in Fig. 2. A single stage of r.f. amplification, using a CV 131 pentode, is followed by an oscillator and mixer stage, using a CV 2128 triode-hexode. The i.f. output (at 135 kc/s) is fed to the i.f. amplifying stages via a 3-section band-pass filter. The three stages of i.f. amplification, using two CV 131 pentodes and an L63 triode, are, in general, similar to the three r.f. stages of the RBR/2 receiver; the differences are matters of circuit-component details. The remainder of the receiver, including an EB 34 double-diode and an L63 triode, is identical with the corresponding part of the RBR/2 receiver.

Mechanical Construction

The same rack-mounting panel is used as for the RBR/2 receiver; indeed the general scheme of construction is that the panel can be equipped either as a 'superhet' receiver (RBR/2A-J) for medium-wave reception or as a 'straight' receiver (RBR/2) for long-wave reception.

Test Data

L.T. and H.T. Feeds

Heaters: 1.7 A at 6.3 V

H.T.: 63/77 mA at 300 V

To check the individual valve feeds, use a Model-7 Avometer on the 10-volt range and measure the voltages between the valve-cathode test sockets and earth. These should be as follows:—

V1	2.0 V $\pm 10\%$
V2	2.0 V $\pm 10\%$
V3	5.1 V $\pm 10\%$
V5	6.6 V $\pm 10\%$
V6	2.2 V $\pm 10\%$
V7	2.6 V $\pm 10\%$

These voltages are to be measured with no r.f. input.

R.F. Amplifier and Mixer

With a signal at the particular source transmitter frequency (f_r kc/s) the oscillator tuning should be at ($f_r + 135$) kc/s so that the resulting i.f. is 135.0 kc/s.

The oscillator tuning is determined by the value of C67 and the adjustment of L18. If maintenance has to be carried out on the oscillator, the oscillator frequency must be checked on a high-stability heterodyne frequency meter. It is not necessary, however, to re-adjust the oscillator tuning when the mixer valve V7 has been replaced. When the oscillator frequency requires correction it should be adjusted to an accuracy of better than ± 300 c/s of its correct frequency after allowing one hour for the unit to warm up. The oscillator frequency should be adjusted by varying the inductor L18.

The grid current of the oscillator should be 200 μ A $\pm 20\%$. R44 should be changed and the frequency checked if the grid current is outside these limits.

The anode circuit of the r.f. amplifier (V6) should be tuned for maximum response at the frequency f_r .

Frequency Response

With the low-pass a.f. filter out of circuit, the audio-output level relative to that obtained for a 1 kc/s modulated signal should be within the following limits:—

<i>Modulation Frequency</i>	<i>Audio Output Level db</i>
3 kc/s	Less than +2. Greater than -1
5 kc/s	Less than 0. Greater than -5
9 kc/s	Less than -25
12 kc/s	Less than -40

Automatic Gain Control and Noise

With an r.f. input at the correct frequency modulated by 400 c/s tone to a depth of 40%, an increase of r.f. input to 100 mV and a decrease to 100 μ V should not change the audio output level by more than ± 3 db.

With no r.f. input the noise level measured on a 600-ohm amplifier detector should not be less than -32 db or greater than -12 db.

Distortion and A.F. Amplification

The test procedure and data are the same as for the RBR/2. See pages 1 and 2.

Maintenance

Maintenance on these receivers should be limited to the changing of valves and components which are not included in the filter boxes. *It is essential that no attempt should be made to adjust the r.f. and i.f. filters on site.* These filters should not normally require maintenance, and adjustments can only be made with specialised equipment. Any attempt to align on site will only cause serious errors in the frequency response of the receiver. If any filter is found to be faulty it can easily be removed and replaced with a new filter.

SECTION 2

AERIAL-COUPLING UNIT ACU/4

General Description

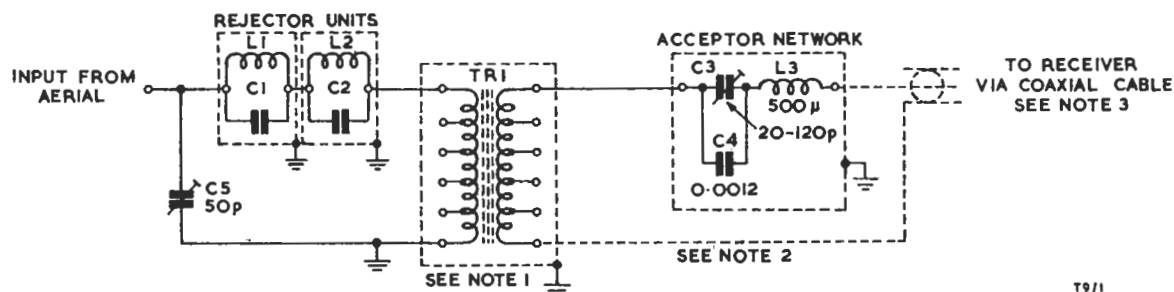
The Type-ACU/4 Aerial-coupling Unit is designed to transform the impedance of the vertical, or *Skyrod* aerial to 75 ohms (unbalanced) for matching a coaxial r.f. cable or a receiver input.

The circuit, given in Fig. 2.1, utilises the aerial capacitance as part of a network that is equivalent to a band-pass filter plus an ideal transformer. Provision is made for the addition of rejector units to prevent induction and cross-modulation trouble which may arise when the unit is employed in strong r.f. fields such as those present at high-power transmitting stations.

The screened coaxial output cable should be earthed at the distant, i.e. receiver, end only and the outer screen of this cable should not be in contact with the box of the ACU/4.

Adjustments

The rejector units and the acceptor network are already adjusted for the requirements of the station at which the unit is to be used, and are sealed. In the event of the source frequency or the rejected frequencies being changed, new acceptor or rejector units should be ordered and the existing units replaced.



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NOTES

- 1 TRANSFORMER DRB 67A1 TO BE USED ON MEDIUM-WAVE UNITS DRB 66A1 TO BE USED ON LONG WAVE-UNITS
- 2 CAPACITOR C4 (0.0012 μ F) TO BE FITTED ON LONG-WAVE UNITS ONLY
- 3 CABLE COAXIAL TELCON TYPE PT111YM. THE SCREEN OF THIS CABLE MUST BE EARTHED AT THE RECEIVER END ONLY AND SHOULD NOT BE IN CONTACT WITH THE OUTER BOX OF THE ACU/4

Fig. 2.1 Aerial-coupling Unit ACU/4

Installation

To instal the unit, remove the cover and undo the four screws holding the panel. The box can then be drilled and countersunk for fixing in position. It should be fixed at the base of the aerial with its aerial terminal underneath and with the lower side level so that any condensed moisture can drain off through the hole provided. The panel can then be remounted, connected up and adjusted. Finally the cover of the unit should be replaced.

It is essential that the box be securely bonded to a local earth as close as possible to the aerial as this earth provides the return path for the aerial.

The only adjustments required on site are as follows:—

Long-wave Unit

Adjust C5 (Fig. 3) to give maximum output at the desired frequency.

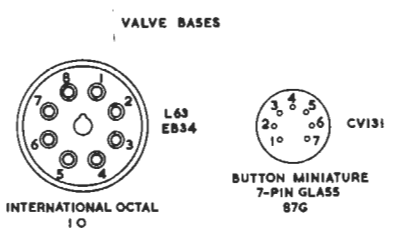
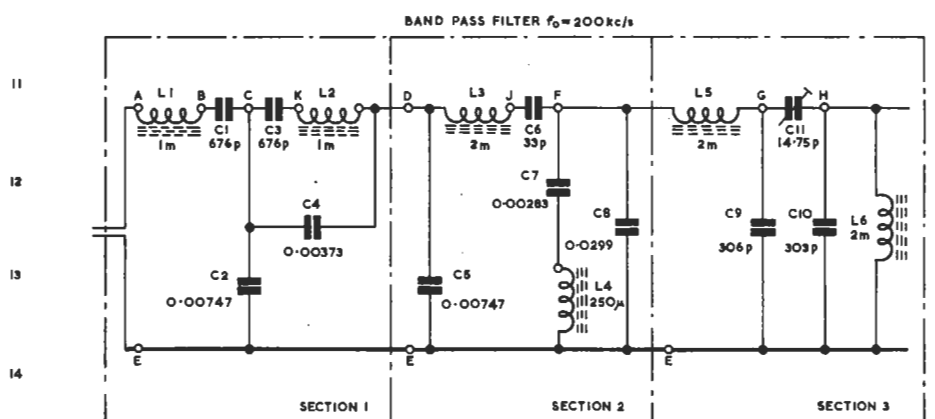
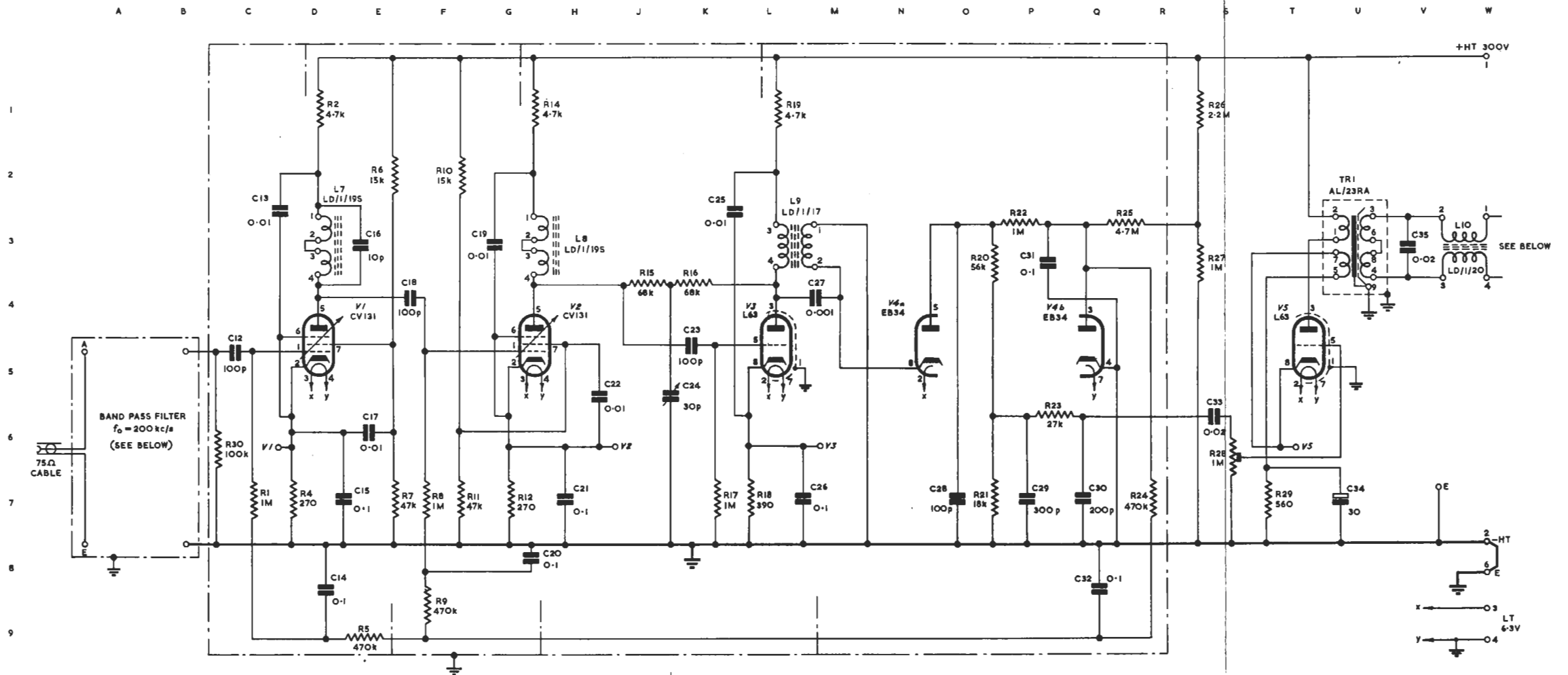
Medium-wave Unit

- (i) Adjust the transformer primary tap and C5 to give maximum output at the desired frequency.
 - (ii) Adjust the transformer secondary tap to give maximum output at the desired frequency.
- Adjustments (i) and (ii) should be repeated until the best maximum is achieved.

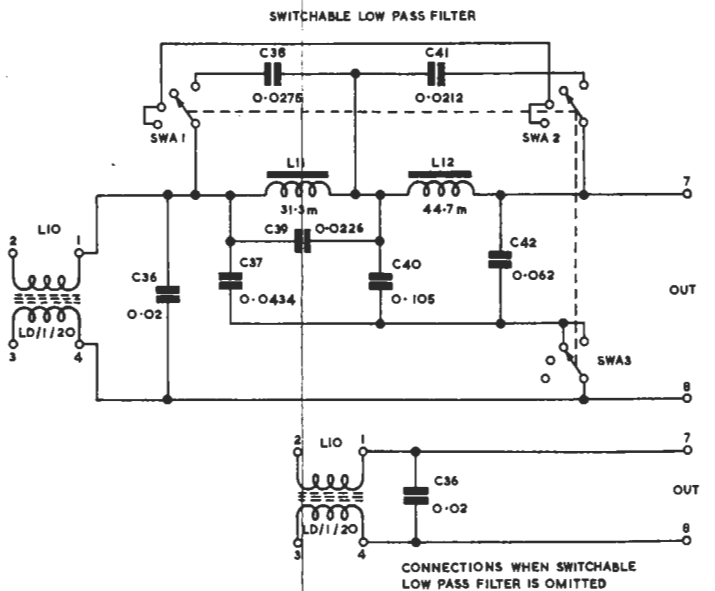
L.F.O. 0856

COMPONENT TABLE : FIG. I

Comp.	Loc.	Type	Tolerance per cent	Comp.	Loc.	Type	Tolerance per cent
C1	A11	L.E.M. 3220 350V wkg	± 1	C42	U13	Muirhead 80 in Type-33AT Case 250 V	± 1
C2	B13	" 2515 " "	"	L1	A11	EA 8006 Det 30	
C3	B11	" 3220 " "	"	L2	C11	" "	
C4	B12	" 2515 " "	"	L3	D11	" Det 32	
C5	D13	" " " "	"	L4	E13	" Det 31	
C6	E11	" " " "	"	L5	G11	" Det 32	
C7	E12	" 2010 " "	"	L6	J13	" "	
C8	F12	" 3220 " "	"	L7	D3	Spec ED/LD/1/195	
C9	G12	" 2515 " "	"	L8	G3	" "	
C10	H12	" " " "	"	L9	L3	" ED/LD/1/17	
C11	G11	T.C.C. TCK 0330	"	L10	V3	" ED/LD/1/205	
C12	C5	" SCT 2		L11	S12	D/187	
C13	C2	" CP 113N		L12	T12	D/188	
C14	D8	" CP 36H		R1	C7	Erie 9	± 10
C15	D7	" "		R2	D1	" 8	"
C16	E3	" 101 SMP	± 10	R4	D7	" 9	"
C17	E6	" CP 113N		R5	E9	" "	"
C18	E4	" SCT 2		R6	E2	" 2	"
C19	G3	" CP 113N		R7	E7	" "	"
C20	G8	" CP 36H		R8	F7	" 9	"
C21	H7	" "		R9	F9	" "	"
C22	H5	" CP 113N		R10	F2	" 2	"
C23	K5	" SCT 2		R11	F7	" "	"
C24	K6	30-32 pF max Air Trimmer		R12	G7	" 9	"
C25	K2	T.C.C. CP 113N		R14	G1	" 8	"
C26	L7	" CP 36H		R15	J3	" 9	"
C27	M 4	" MWN		R16	K3	" "	"
C28	O7	" SCT 2		R17	K7	" "	"
C29	P7	" SCT 3		R18	L7	" "	"
C30	Q7	" "		R19	L1	" 8	"
C31	P3	" CP 36H		R20	O4	" 9	"
C32	Q8	" "		R21	O7	" "	"
C33	S5	" 346		R22	P3	" "	"
C34	U7	" CE 71B		R23	P5	" "	"
C35	V3	" 346		R24	R7	" "	"
C36	R13	" "		R25	Q3	" "	"
C37	S13	Muirhead 80 in Type-33AT Case 250 V	± 1	R26	S1	" "	"
C38	S11	Muirhead 80 in Type-33AT Case 250 V	"	R27	S3	" "	"
C39	S12	Muirhead 80 in Type-33AT Case 250 V	"	R28	S6	Morganite LHNAR 10550 20800	
C40	T13	Muirhead 80 in Type-33AT Case 250 V	"	R29	T7	Erie 9	± 10
C41	T11	Muirhead 80 in Type-33AT Case 250 V	"	R30	B6	" 109	± 5
				TR1	U3	Spec ED/TC/AL/23R	



NOTE. DESIGNATIONS 'A, B' ETC ARE TEST REFERENCE POINTS ONLY & CORRESPOND TO TAGS ON CONNECTION BLOCKS



CONNECTIONS WHEN SWITCHABLE LOW PASS FILTER IS OMITTED

REBROADCAST RECEIVER RBR/2 (LONG WAVE) CIRCUIT

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COMPONENT TABLE : FIG. 2

Note: For details of input filter components see Equipment Department Parts List EA 8493.

Comp.	Loc.	Type	Tolerance per cent	Comp.	Loc.	Type	Tolerance per cent
C12	M4	T.C.C. SCT2	± 10	C70	I11	L.E.M. 1510	± 1
C13	N2	" CPI13N		C71	I12	" 2010	"
C14	N8	" CP 36H		C72	J11	" "	"
C15	N6	" "		C73	K12	" 1510	"
C17	N5	" CPI13N		C74	K11	" 2010	"
C18	N4	" SCT2	± 10	C75	L11	" 2515	"
C19	P2	" CPI13N		C76	L12	" 2010	"
C20	P8	" CP36H		C77	L11	" "	"
C21	Q7	" "		C78	M12	" 1510	"
C22	Q6	" CPI13N		C79	M11	" "	"
C23	Q4	" SCT2	± 10	C80	N11	" 2010	"
C25	R3	" CPI13N		C81	N12	" 1510	"
C26	S7	" CP36H		C82	O11	" "	"
C27	S4	" MWN		C83	O12	" 2515	"
C28	T6	" SCT2	± 10	C84	P11	" 1510	± 1
C29	U6	" SCT3	"	C85	P12	" 2010	"
C30	V6	" "	"				
C31	U3	" CP36H		L9	S3	Spec ED/LD/1/17	
C32	V8	" "		L10	Z3	" ED/LD/1/20	
C33	W6	" 346		L11	W11	D/187	
C34	X7	" CE71B		L12	X11	D/188	
C35	Y3	" 346		L17	D2	EB8500 Det 53	
C36	U13	" "		L18	J6	" Det 54	
C37	V13	Muirhead 80 in Type 33AT Case 250 V	± 1	L19	H12	" Det 47	
C38	V11	Muirhead 80 in Type 33AT Case 250 V	± 1	L20	J11	" Det 48	
C39	W12	Muirhead 80 in Type 33AT Case 250 V	± 1	L21	L12	" Det 49	
C40	X13	Muirhead 80 in Type 33AT Case 250 V	± 1	L22	M12	" Det 50	
C41	X11	Muirhead 80 in Type 33AT Case 250 V	± 1	L23	N11	" Det 51	
C42	Y13	Muirhead 80 in Type 33AT Case 250 V	± 1	L24	P12	" Det 52	
C53	B5	T.C.C. SCHI	± 10	R1	N6	Erie 9	± 10
C54	C7	" CP37N		R2	N1	" 8	"
C55	F4	" CM20N	± 20	R3	N4	" 9	"
C56	D3	" CPI13N		R4	N7	" "	"
C57	D6	" "		R5	N8	" "	"
C58	E7	" 401SMP 350 V	± 10	R6	O2	" 2	"
C59	E7	" 101SMP "	"	R7	O7	" 8	"
C60	E6	" TCK2012		R8	O6	" 9	"
C61	F7	" CP37N		R9	O8	" "	"
C62	G7	" "		R10	P2	" 2	"
C63	G5	" CPI13N		R11	P7	" 8	"
C64	I5	" "		R12	Q7	" 9	"
C65	H4	" "		R13	Q3	" "	"
C66	I4	" 425SMP 350 V	± 10	R14	Q1	" 8	"
C67	J6	See end of table		R15	Q4	" 9	"
C68	J3	T.C.C. CM20N	± 20	R16	R4	" "	"
C69	H12	L.E.M. 2010	± 1	R17	Q7	" "	"
				R18	R7	" "	"
				R19	S1	" 8	"
				R20	U3	" 9	"
				R21	U7	" "	"
				R22	U3	" "	"

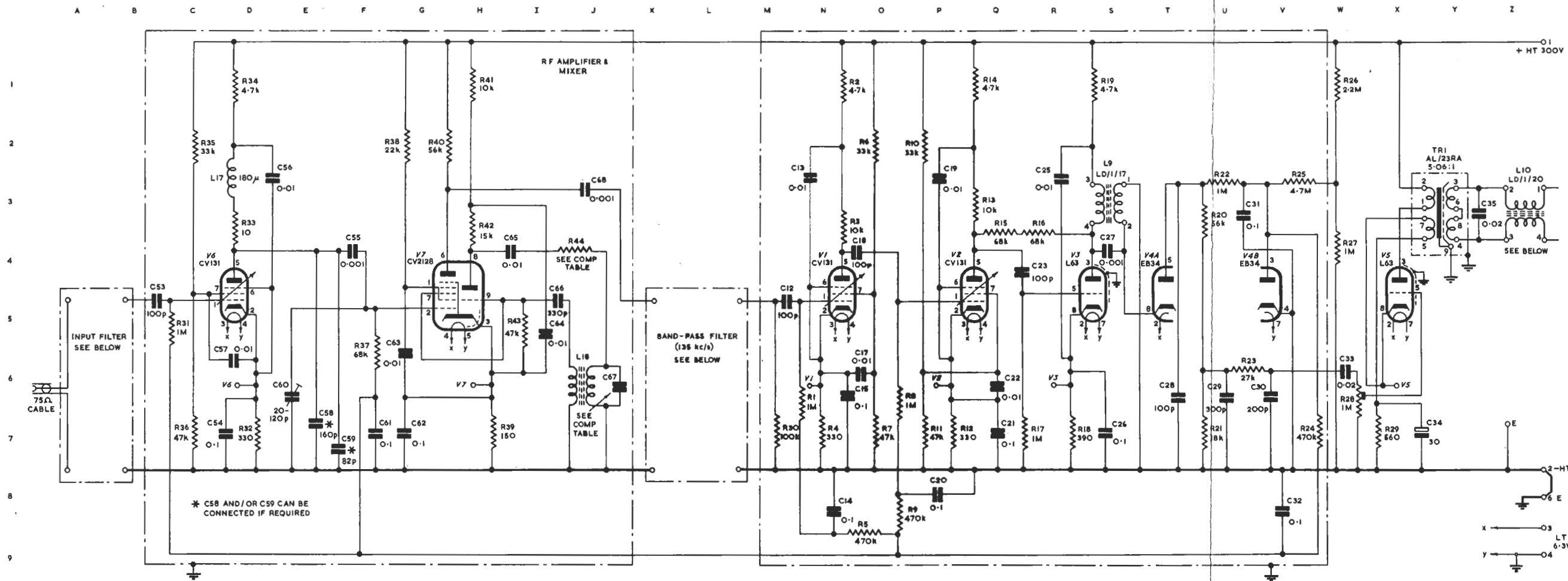
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COMPONENT TABLE : FIG. 2 (continued)

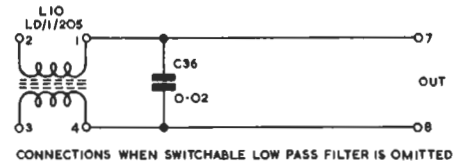
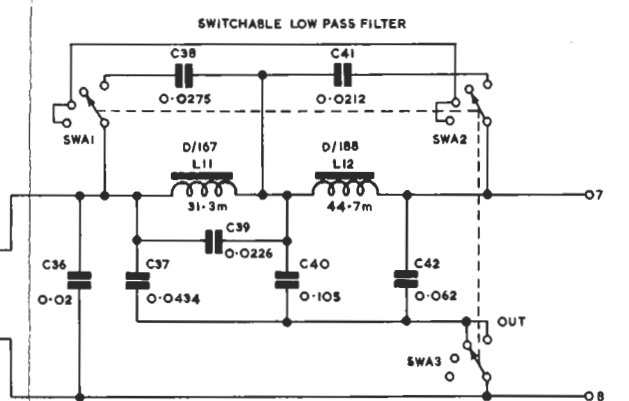
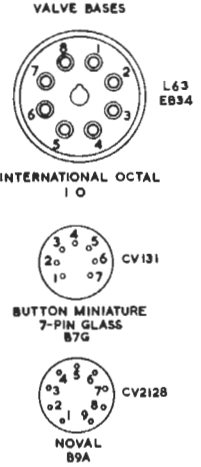
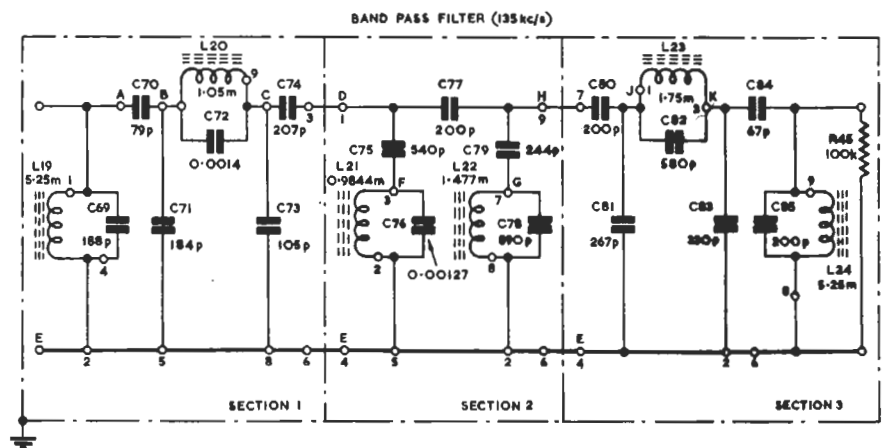
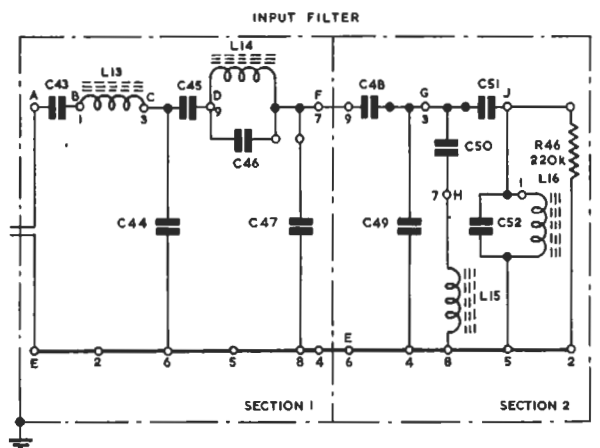
Comp.	Loc.	Type	Tolerance per cent	Comp.	Loc.	Type	Tolerance per cent
R23	U6	Erie 9	± 10	R36	C7	Erie 9	± 10
R24	V7	" "	"	R37	F5	" "	"
R25	V3	" "	"	R38	G2	" "	"
R26	W1	" "	"	R39	H7	" "	"
R27	W4	" "	"	R40	G2	" "	"
R28	W6	Morganite LHNAR 10550 20800	"	R41	H1	" 8	"
R29	W7	Erie 9	± 10	R42	H4	" 9	"
R30	M7	" 109	± 5	R43	I5	" "	"
R31	C5	" 9	± 10	R44	J4	Erie 9 For value, see end of Table	"
R32	D7	" "	"	R45	P11	Erie 109	± 5
R33	D3	" "	"	TR1	Y3	Spec. ED/TC/AL/23R	
R34	D1	" "	"				
R35	C2	" "	"				

Values of C 67 and R 44

Receiver	Frequency kc/s	C67 pF	R44 kΩ
RBR/2A	647	680	39
RBR/2B	692	620	27
RBR/2C	809	470	22
RBR/2D	881	390	22
RBR/2E	908	360	22
RBR/2F	1052	270	22
RBR/2G	1088	270	22
RBR/2H	1151	220	22
RBR/2J	1457	150	22



* C58 AND/OR C59 CAN BE CONNECTED IF REQUIRED



NOTE:- DESIGNATIONS A' B' ETC ARE TEST REFERENCE POINTS ONLY & CORRESPOND TO TAGS ON CONNECTION BLOCKS

REBROADCAST RECEIVER RBR/2A-J (MEDIUM WAVE) CIRCUIT

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ERRATA

To Editor,

Technical Instructions,

305, St. Hilda's, Maida Vale.

The following errors have been noted in **Instruction**

Station..... Date..... Signature.....

ERRATA

To Editor,

Technical Instructions,

305, St. Hilda's, Maida Vale.

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To Editor,

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