ROBERTS R500

Portable Transistor Radio Receiver

COVERING long, medium and short wavebands, the Roberts R500 portable radio receiver employs seven transistors and three diodes. It operates from two 9V batteries and has built-in ferrite rod and telescopic aerials. Two external sockets allow the connection of an external aerial in one case and provide an output for use with a tape recorder in the other.

Waveband ranges are 1,120-2,000m (l.w.), 183-570m (m.w.), and 16-50m (s.w.). A printed circuit panel is incorporated and the chassis is contained in a fabric covered wooden case with a hinged back cover.

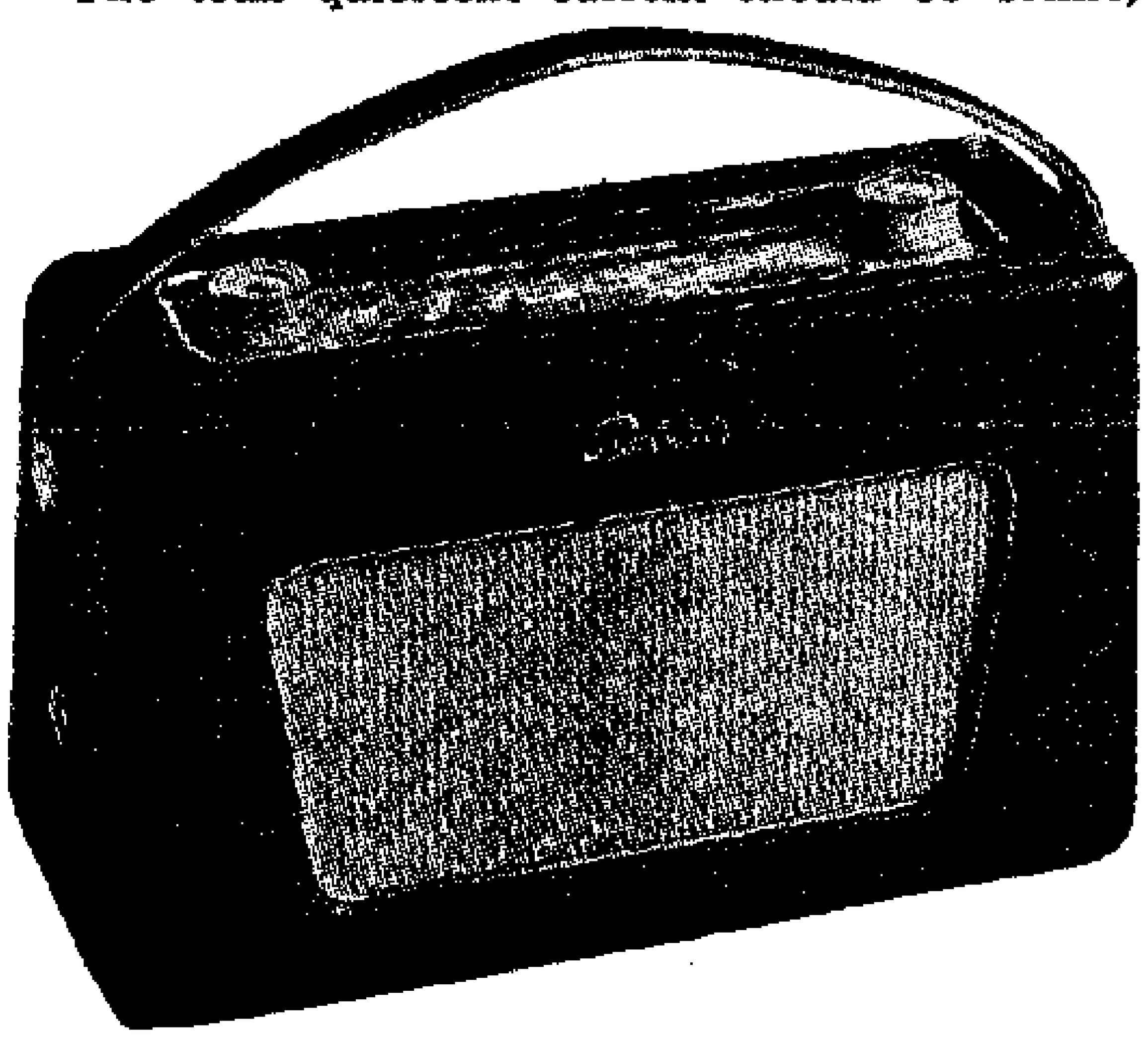
Release date and original price: September 1963 £15 16*s* 8*d*. *Purchase tax extra.*

VOLTAGE MEASUREMENTS

Circuit voltage readings given below were taken from information supplied by the manufacturers and indicate correct operating conditions for the associated stages. They were measured on a model 8 Avometer with the receiver switched to m.w., volume control at minimum and no signal input.

Across **R3**, 1.1V. Across **R8**, 2.2V. Across **R9**, 0.58V. Across **R12**, 1.0V. Across **C20**, 7.4V. Across **R20**, 0.42V. Across **C28**, 18.0V. Across **R23**, 0.32V. From the junction of **R25** and **R26** to chassis, 8.9V.

The total quiescent current should be 13mA, measured with the meter inserted in the 18V negative battery lead.



CIRCUIT DESCRIPTION

Signals from the ferrite rod aerial coils **L1-L8** are fed via **C2** to the base of the self-oscillating mixer **TR1**. Separate aerial circuits are used on each waveband comprising **L2** and coupling coil **L6** (s.w.), **L3/L7** (m.w.), and **L4/L8** (l.w.).

Tuning gang capacitor **CV1** is switched across the winding in use.

Local oscillator signals are generated by **TR1** in conjunction with **T1** and its associated tuning components on s.w., and by **T2** on m.w. and l.w. **T2** is tuned by **CV7** with trimming on m.w. by **CV6** with damping resistor **R4**, and on l.w. by **C3** and **CV5**. Tuning gang oscillator section **CV7** is connected across **T1** via **C6** or across **T2** via **C4** as required, and the appropriate feedback coupling coil is selected by **S10** and **S11**. The resultant intermediate frequency component in **TR1** collector is coupled by the double-tuned i.f. transformer **T3** to the base of the first i.f. amplifier **TR2**.

The cathode of damping diode **MR1** is biased by the volts drop across **R8** due to **TR2** collector current, keeping the diode normally in

(*Continued overleaf Col. 1*)

Component Values and Locations

Capacitors

C1	30pF	B2
C2	0·01μF	B2
C3	290pF	C2
C4	380pF	C1
C5	0·022μF	B2
C6	1,200pF	B2
C7	0·1μF	B2
C8	560pF	C3
C9	0·01μF	B2
C10	560pF	C3
C11	10μF	C3
C12	0·04μF	C2
C13	2μF	C2
C14	270pF	D2
C15	0·022μF	C2
C16	270pF	D2
C17	0·02μF	C2
C18	250pF	C1
C19	0·02μF	C2
C20	100μF	C2
C21	0·01μF	C1
C22	0·022μF	D1
C23	0·22μF	D2
C24	100μF	D2
C25	2μF	D2
C26	200μF	D2
C27	1,000pF	D2
C28	100μF	D2
C29	100μF	D2
C30	350μF	D2
CV1	—	A2
CV2	110pF	B2
CV3	80pF	B2
CV4	40pF	B2
CV5	110pF	C2
CV6	40pF	B2
CV7	—	A2
CV8	40pF	B2

Resistors

R1	33kΩ	B2
R2	8·5kΩ	B2
R3	1kΩ	B2
R4	180kΩ	B2
R5	68kΩ	B2
R6	68kΩ	C2
R7	1kΩ	C2
R8	2·2kΩ	C2
R9	560Ω	C2
R10	22kΩ	C2
R11	4·7kΩ	C2
R12	1kΩ	C2
R13	330Ω	D1
R14	8·2kΩ	D2
R15	390Ω	C2
R16	1kΩ	D2
R17	2·2kΩ	D2
R18	10kΩ	D2
R19	22kΩ	D2
R20	560Ω	D2
R21	10Ω	D3
R22	1·5kΩ	D3
R23	56Ω	D2
R24	1·5kΩ	D3
R25	4·7Ω	D2
R26	4·7Ω	D3
RV1	5kΩ	D1
RV2	10kΩ	D2
RV3	200Ω	D3

Coils & Transformers

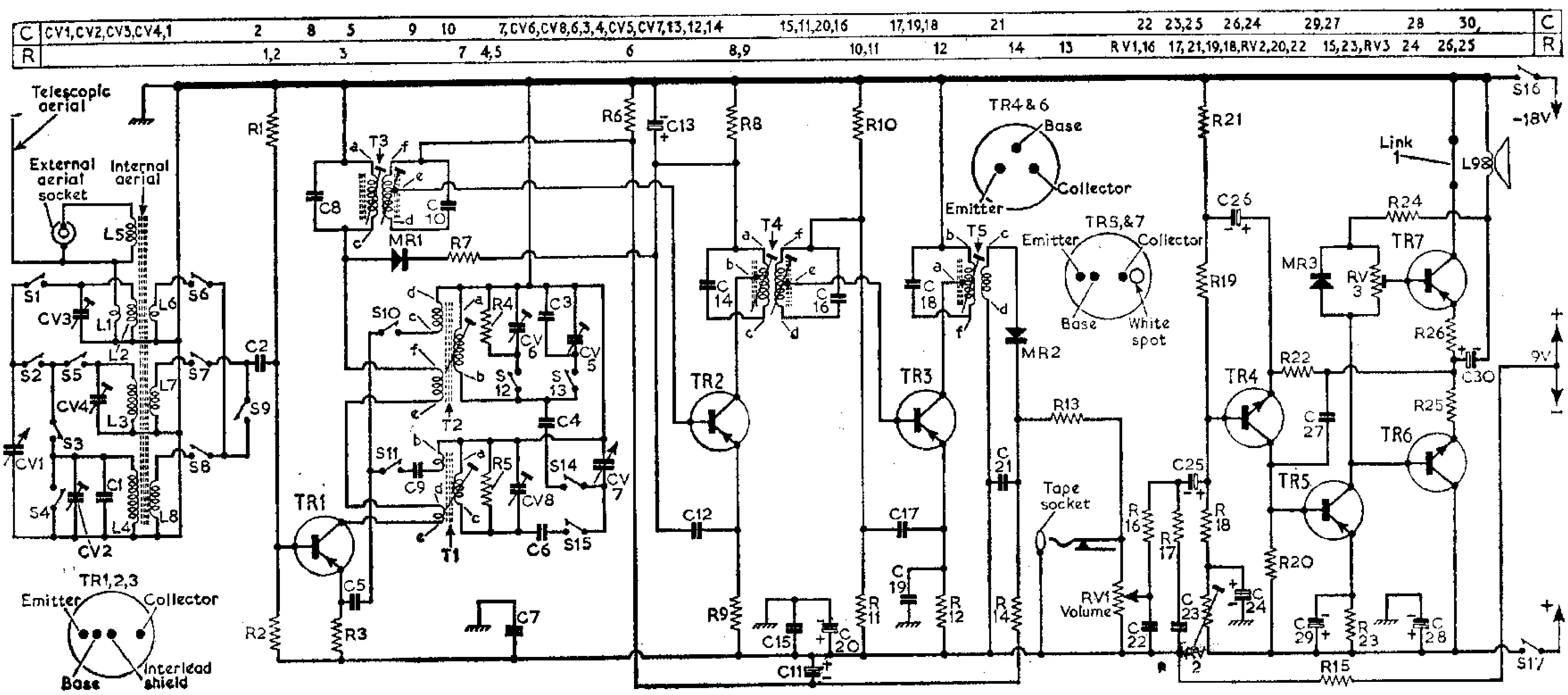
L1	—	B3
L2	—	C3
L3	—	A3
L4	—	D3
L5	—	C3
L6	—	B3
L7	—	A3
L8	—	D3
T1	—	B2
T2	—	C2
T3	—	C2
T4	—	C2
T5	—	C2

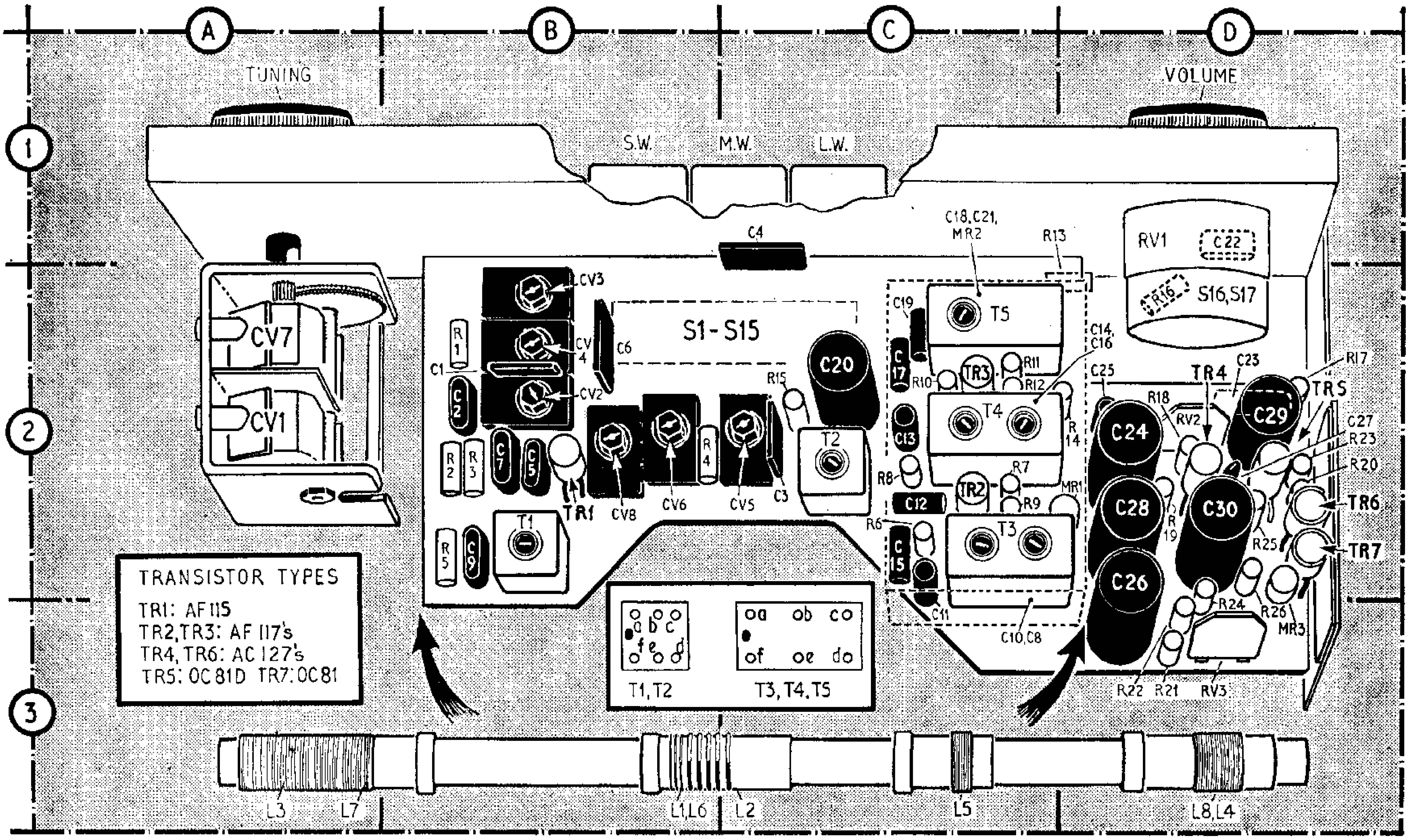
Transistors

TR1	AF115	B2
TR2	AF117	C2
TR3	AF117	C2
TR4	AC127	D2
TR5	OC81D	D2
TR6	AC127	D2
TR7	OC81	D2

Miscellaneous

MR1	OA79	D2
MR2	OA90	C1
MR3	BA114	D3
S1-S15	—	B2
S16, S17	—	D2





Component-side view of the chassis with the ferrite rod drawn out of position for clarity

Circuit Description—*continued*

a non-conductive condition. **TR2** however is a.g.c.-controlled and a fall in its collector current overcomes the bias on **MR1** taking it into the conducting region, thus damping **T3** primary on large signal inputs and preventing overloading.

Intermediate frequency signals receive two stages of amplification by **TR2** and **TR3**, and they are then applied to the detector diode **MR2**. Inter-stage couplings **T3** and **T4** are double-tuned transformers with suitable tappings to match transistor impedances. Rectified audio output from **MR2** is developed across the volume control **RV1**, which also operates as load resistance and, which is shunted by a socket to provide a low level output for tape recording. A positive d.c. potential dropped along **R13** and **RV1** is fed via **R14** to **TR2** base as a.g.c. voltage, reducing forward bias to produce a consequent fall in collector current and stage gain.

Audio signals from the slider of the volume control are coupled via **R16** and **C25** to the base of the pre-amplifier **TR4**. The use of an n.p.n.-type transistor here, in addition to providing audio gain, permits d.c. feedback coupling to maintain stability of the output stage balance. Its emitter feed resistor **R22** is connected to the output stage emitter junction reference point, so that a change in d.c. potential there produces a compensating change in the current of **TR4** collector. Balance is initially achieved by the setting of **RV2**. **TR4** collector is coupled to **TR5** base, and the output in **TR5** collector circuit, which appears across **R24**, is d.c.-coupled simultaneously to the bases of the push-pull output transistors **TR6** and **TR7**.

Phase-splitting is achieved by the use of complementary n.p.n.- and p.n.p.-type transistors, thus dispensing with the usual split-secondary transformer. During negative half-cycles, **TR7** conducts, lowering the potential between its emitter and chassis, and during positive half cycles, **TR6** conducts raising the potential between its emitter and chassis. The variations in potential feed the loudspeaker **L9** via **C30**. The collector of **TR5** is directly coupled to **TR6** and **TR7** bases, and the load resistor **R24** is a.c.-coupled via **C30** to their emitters so that the input signal is effectively applied between their base and emitter circuits. **RV3** adjusts the output transistor bias for correct operation.

CIRCUIT ALIGNMENT

Alignment of the i.f. circuits should not be required unless a transformer has been replaced or the cores accidentally disturbed.

Equipment Required.—An a.m. signal generator; an audio output meter with an impedance of 25Ω or alternatively an a.c. voltmeter; an r.f. coupling coil and a narrow-bladed trimming tool.

1.—Connect the audio output meter in place of the loudspeaker or the a.c. voltmeter across the loudspeaker. Connect the signal generator across the r.f. coupling coil and loosely couple the coil to the ferrite rod aerial.

2.—Switch receiver to m.w. and check that with the tuning gang fully meshed, the cursor coincides with the l.f. end of the tuning scale apertures. Turn the volume control to maximum and tune to a quiet spot at the h.f. end of m.w. band.

3.—Feed in a 470kc/s signal and adjust **T3**, **T4** and **T5** for maximum output.

4.—Tune receiver to 200m (calibration mark on scale). Feed in a 1,500kc/s signal and adjust **CV6** and **CV4** for maximum output.

5.—Tune receiver to 536m (calibration mark). Feed in a 560kc/s signal and adjust **T2** and **L3** for maximum output.

6.—Repeat operations 4 and 5.

7.—Switch receiver to l.w. and tune to "Kalundborg." Feed in a 245kc/s signal and adjust **CV5** and **CV2** for maximum output.

8.—Tune receiver to "Allouis." Feed in a 164kc/s signal and adjust **L4** for maximum output.

9.—Repeat operations 7 and 8.

10.—Switch receiver to s.w. and tune to 16.7m (calibration mark on scale). Feed in an 18Mc/s signal and adjust **CV8** and **CV3** for maximum output.

11.—Tune receiver to 50m (calibration mark). Feed in a 6Mc/s signal and adjust **T1** and **L2** for maximum output. (**L2** is adjusted by expanding or contracting the turns.)

12.—Repeat operations 10 and 11 for optimum results finishing with operation 10.

GENERAL NOTES

Dismantling.—To remove the chassis from the case, remove the batteries and lay the receiver face down.

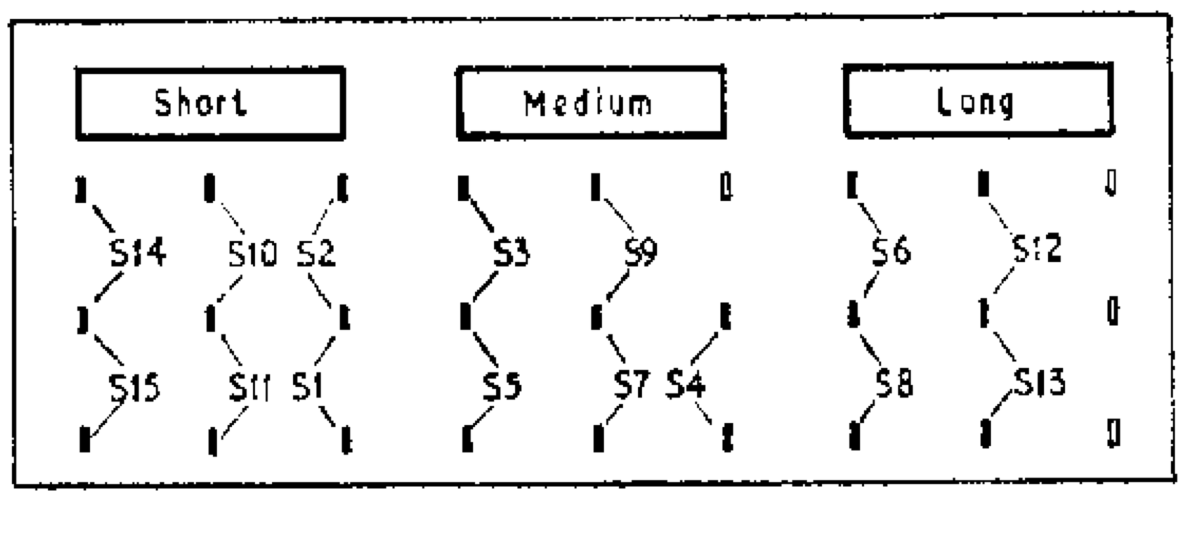
Disconnect the leads from the telescopic aerial and the external aerial and tape sockets.

Take out two Phillips-head wood screws securing the control panel brackets to the sides of the case.

Withdraw the chassis by first sliding it upwards to free the front edge of the control panel from its slot in the cabinet front.

When removing or inserting a component on the printed circuit panel, do not use excessive pressure as this may cause the copper print to separate from the panel base.

Output Stage Bias.—The output stage bias is controlled by the setting of **RV3**. To adjust it, insert a low-impedance milliameter in **TR7**



The switch unit printed panel connections seen from same angle as in the main chassis drawing above

collector by disconnecting the flex link (Link 1) provided for this purpose on the foil side of the panel. With no signal input adjust **RV3** for a reading of 4mA.

Output Stage Balance.—For correct output stage balance, connect a high-resistance voltmeter between the junction **R25**, **R26**, **C30** and chassis, and adjust **RV2** for a reading of half the total supply voltage.

Switches.—**S1-S15** are waveband switches combined in a three-way press-button unit which is soldered directly into place on the printed panel. The connections for each switch are shown separately above. On/off switches **S16** and **S17** are ganged with the volume control.

Batteries.—Two 9v Ever Ready PP9 or equivalent.

MODIFICATIONS

In early receivers **R2** was 6.8kΩ, not 8.2kΩ. In some receivers **C27** is connected directly between **TR4** collector and base, and not as shown.

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