

# ROBERTS R500

Portable Transistor Radio Receiver

**C**OVERING 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.

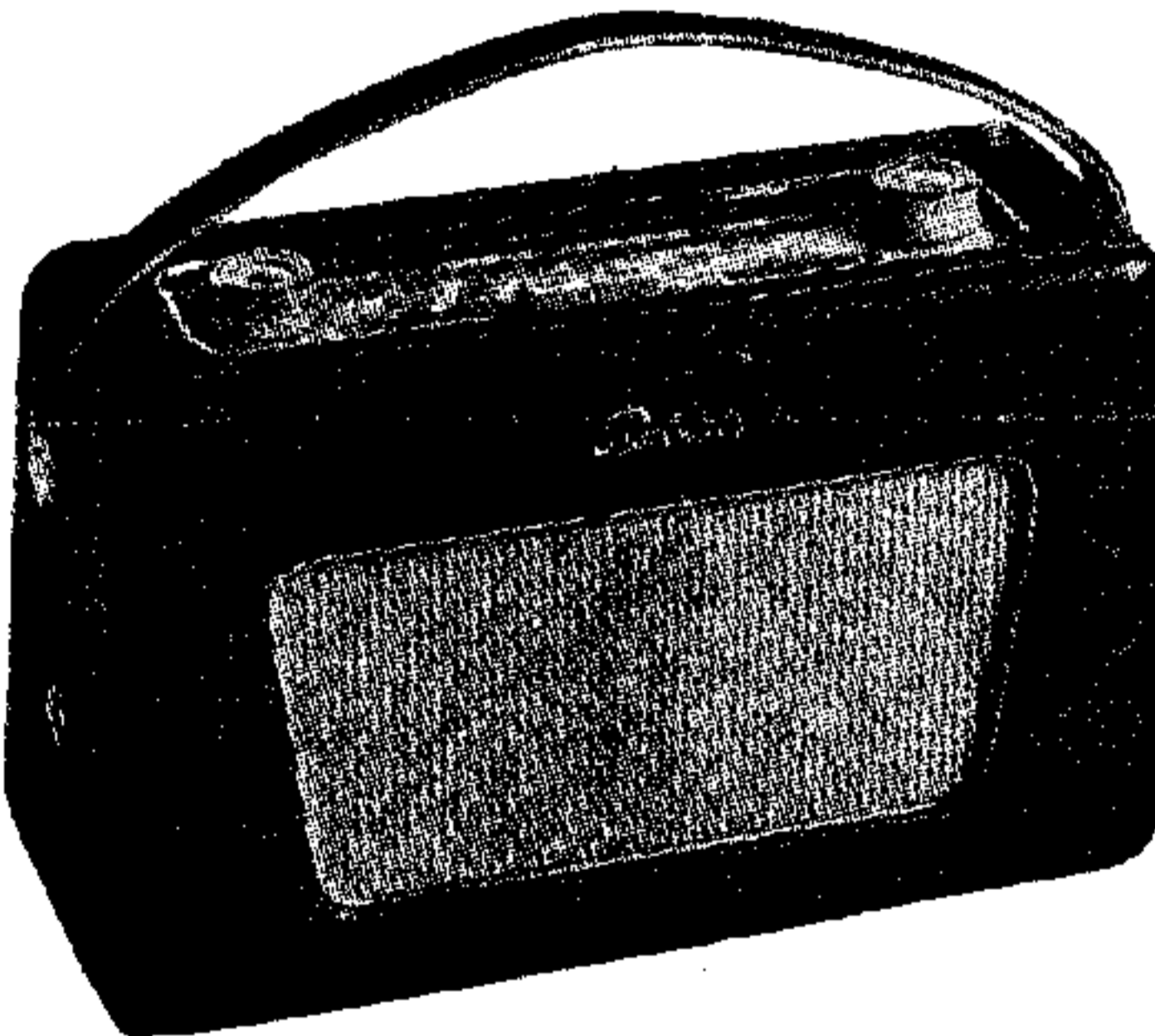
Release date and original price: September 1963 £15 16s 8d. Purchase tax extra.

### 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)

### 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

### Component Values and Locations

#### 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

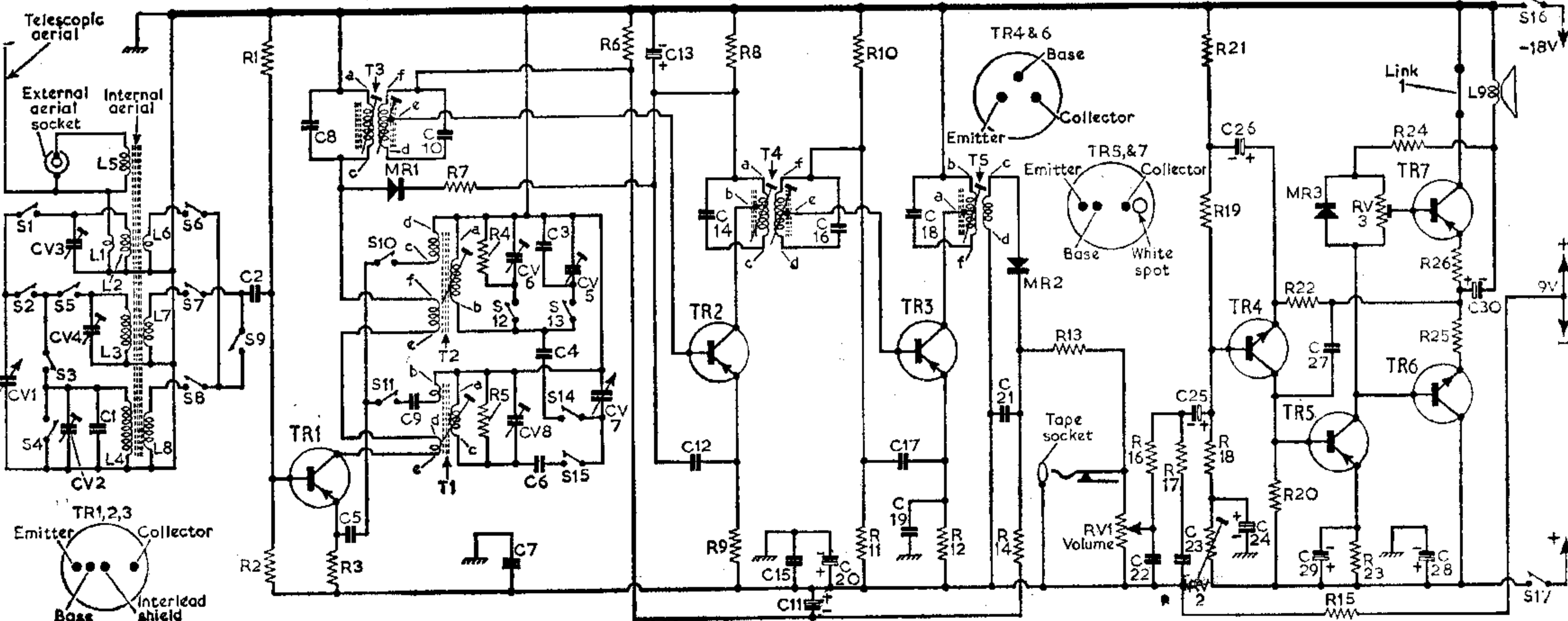
#### Transistors

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

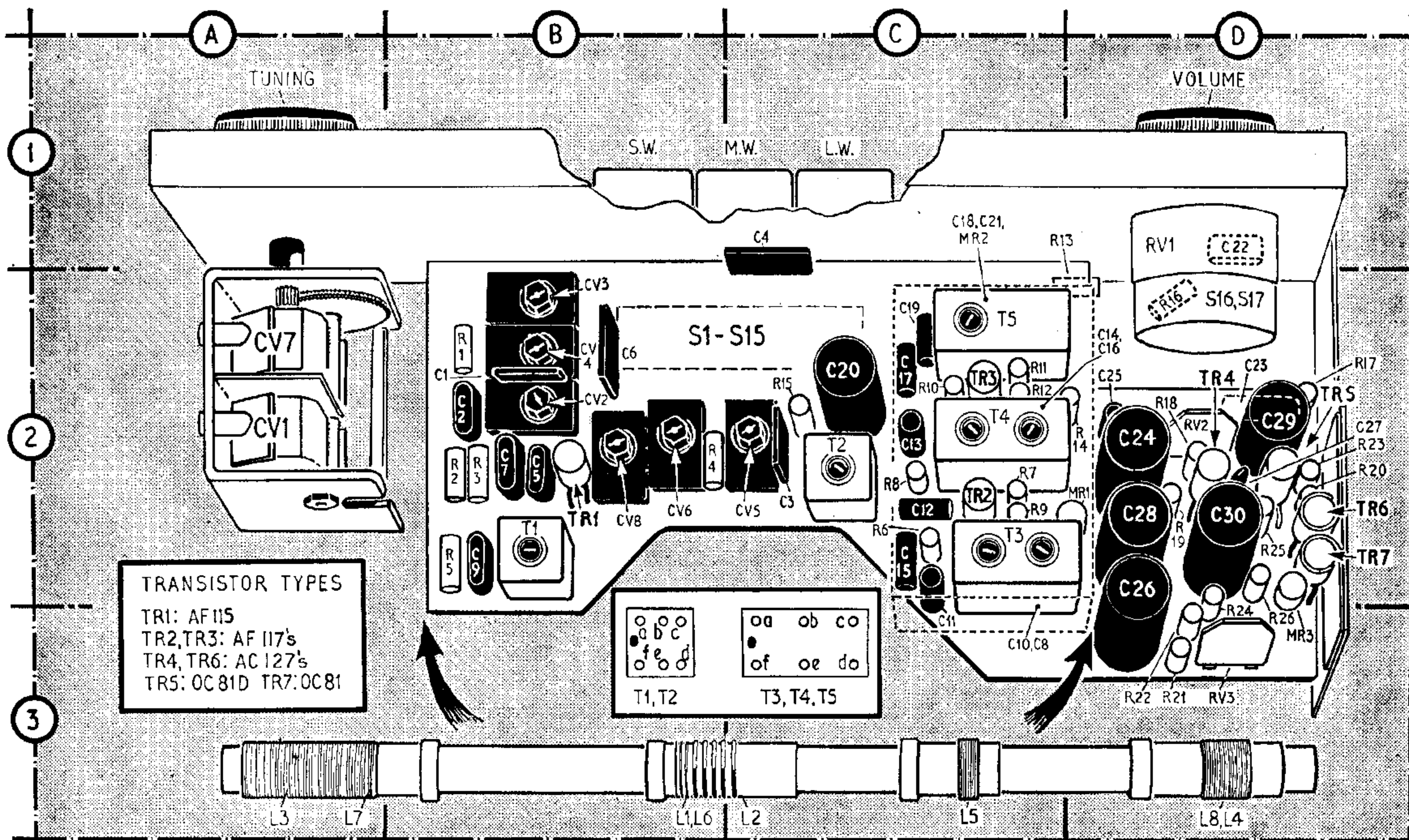
#### Miscellaneous

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

C	CV1, CV2, CV3, CV4, 1	2	8	5	9	10	7, CV6, CV8, 6, 3, 4, CV5, CV7, 13, 12, 14	15, 11, 20, 16	17, 19, 18	21	22	23, 25	26, 24	29, 27	28	30,	C
R	1, 2	3	7	4, 5	6	8, 9	10, 11	12	14	13	RV1, 16	17, 21, 19, 18, RV2, 20, 22	15, 23, RV3	24	26, 25	R	







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 tapings 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 i.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.

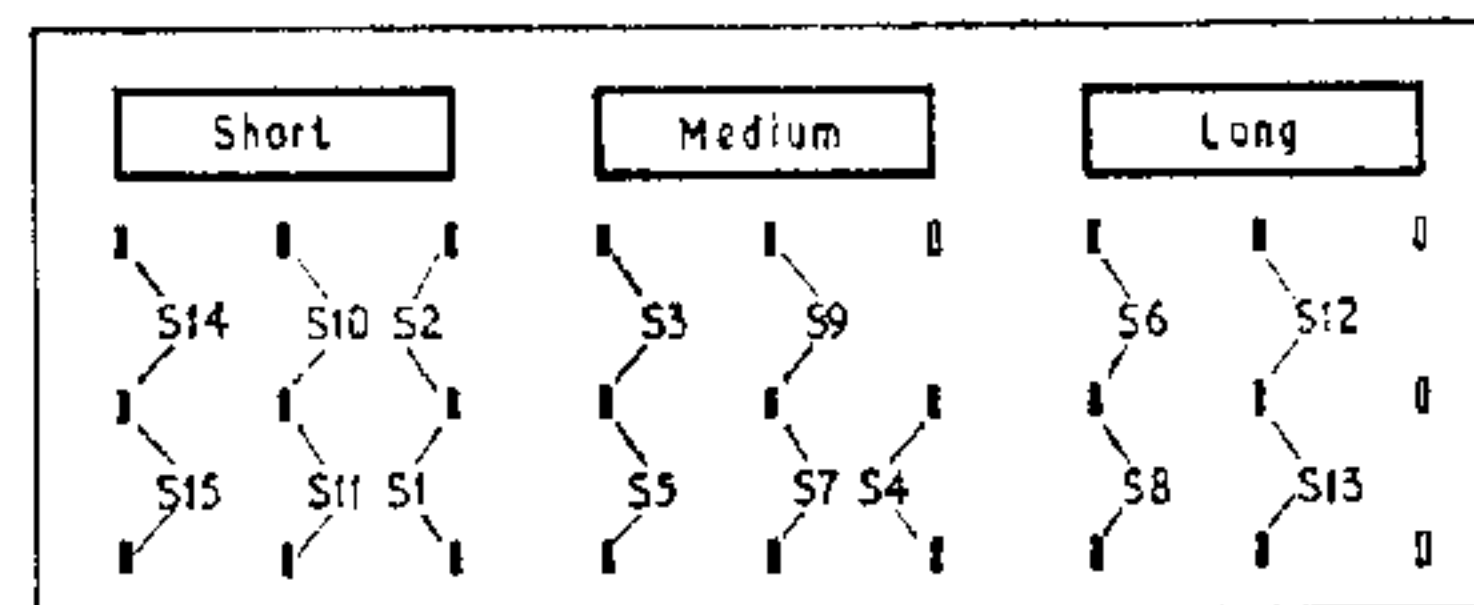
Disconnect the leads from the telescopic aerial and the external aerial and tape sockets.

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 milliammeter 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.