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KB KR021 "Cobra" RGD RR221 "Rover"

Portable Transistored Radio Receivers Incorporating Modular Construction

SEVEN transistors and a diode comprise the semiconductor complement of the KB Cobra and RGD Rover radio receivers. The outstanding features of these being modular construction of the circuit, a collector-bend a.m. detector operated in the common-emitter mode and bandspread on the medium waveband.

Three modules are used, r.f./mixer, i.f. amplifier and audio amplifier respectively, connection to each assembly being via multi-way connectors and p.v.c. insulated leads.

A ferrite rod internal aerial is used for reception on the m.w.1. (275-555m), m.w.2. (185-280m) and l.w. (1,333-1,900m) bands. An external socket provides for the connection of a car type aerial, while a second switched socket allows the output to be fed to an earphone for private listening, or a tape recorder input.

A transformerless four-transistor directly-coupled audio amplifier provides 400mW of audio power to a 5in 10Ω loudspeaker.

The power supply for the receiver is obtained from a 9V dry battery (Ever Ready PP7 or equivalent).

TRANSISTOR ANALYSIS

Transistor voltages given in the table Col. 1 were taken from information supplied by the manufacturers. They were measured on a 20,000Ω/V meter and are negative with respect to battery positive.

Transistor Table

Transistor		Emitter (V)	Base (V)	Collector (V)
TXm1	AF117	0·87	0·97	7·75
TXk1	AF117	1·58	1·66	5·65
TXk2	OC70	—	—	4·15
TXa1	AC127	4·15	—	0·6
TXa2	AC128	0·45	0·6	4·5
TXa3	AC128	4·7†	4·9	9·0
TXa4	AC127	4·7†	4·5	0

† *Measured at the junction of* **Ra12** *and* **Ra13**. *Quiescent current 15mA.*

CIRCUIT ALIGNMENT

Equipment Required.—An a.m. signal generator modulated 30 per cent at 1kc/s; an audio output meter with an impedance of 10Ω, or alternatively a model 8 Avometer set to its 10V a.c. range; a screened test coil (85 turns of enamel covered wire on a 2in diameter former); a 0·1μF capacitor; an oscilloscope; an a.f. signal generator and a 100kΩ resistor.

Before starting the alignment procedure it is advisable to check the output balance as described in the following paragraph.

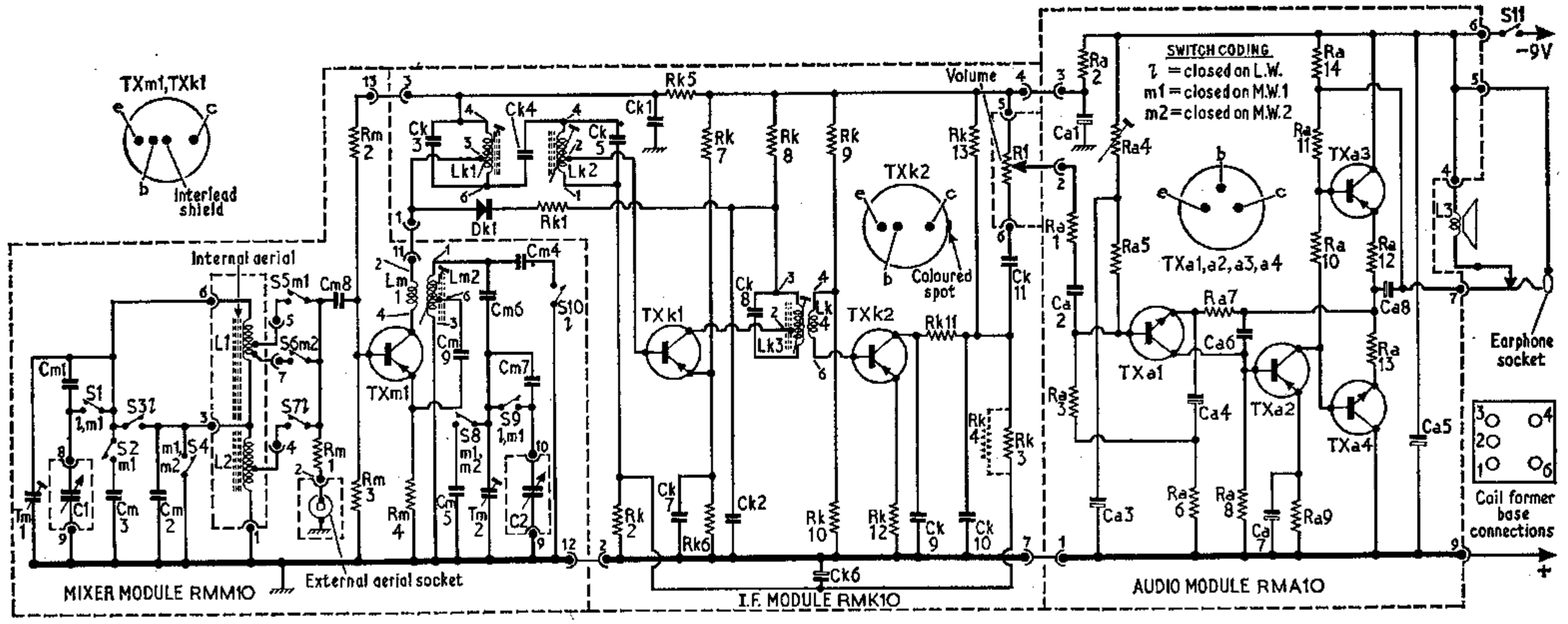
Output Balance Adjustment.—Set the slider of **Ra4** to the centre of its travel, connect the output meter and oscilloscope to the receiver output and disconnect loudspeaker (if using a model 8 Avometer, leave the loudspeaker in circuit).

With the volume control at maximum, feed in a 1kc/s sinewave from the a.f. signal generator via the 100kΩ resistor to the slider of the volume control **R1**.

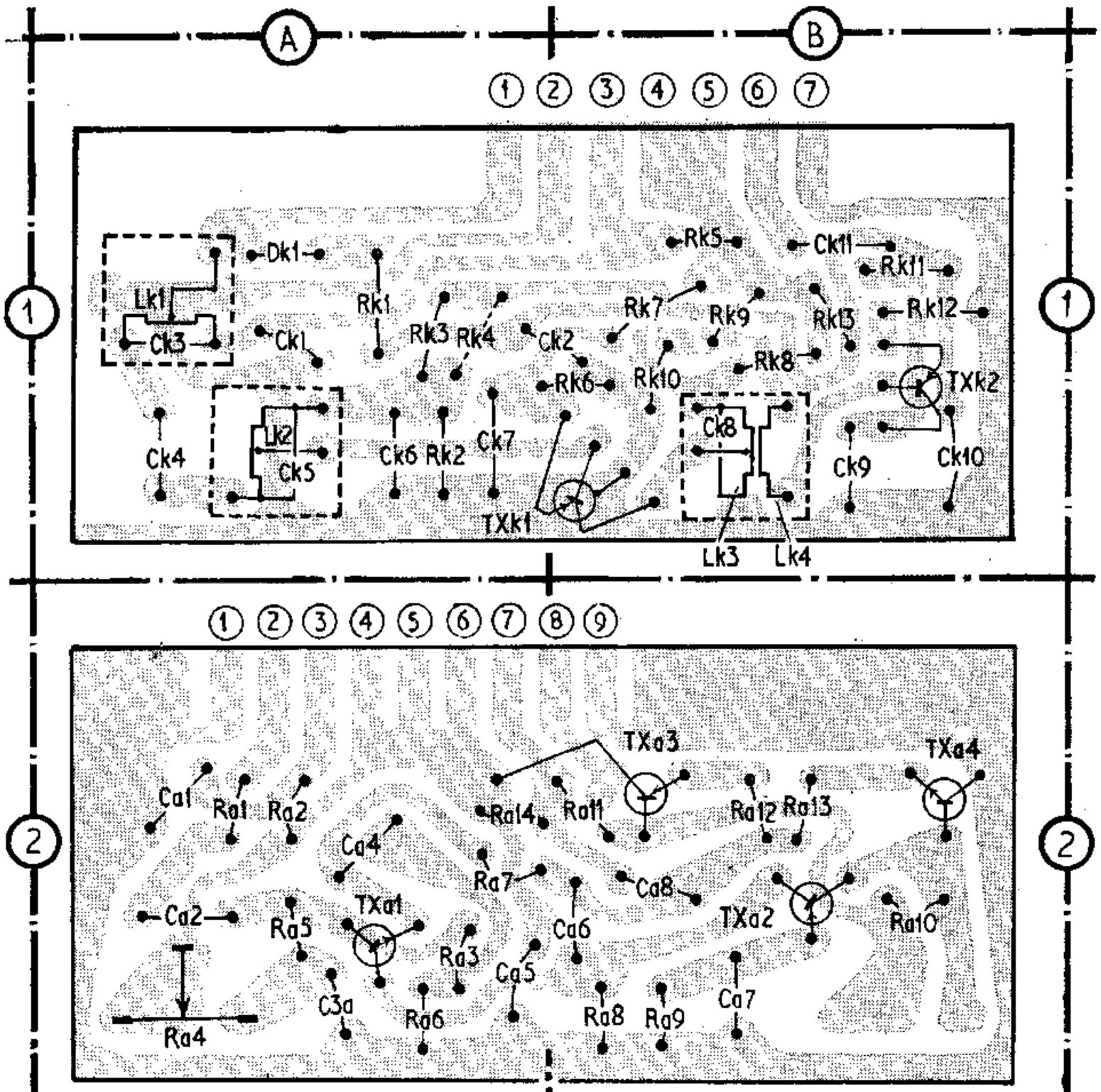
(*Continued overleaf col. 1*)

Resistors		
R1	20kΩ	D4
Rm1	1kΩ	C3
Rm2	39kΩ	C3
Rm3	6·8kΩ	C3
Rm4	1kΩ	C3
Rk1	680Ω	A1
Rk2	12kΩ	A1
Rk3	15kΩ	A1
Rk4	15kΩ	A1
Rk5	100Ω	B1
Rk6	330Ω	B1
Rk7	4·7kΩ	B1
Rk8	820Ω	B1
Rk9	47kΩ	B1
Rk10	100Ω	B1
Rk11	100Ω	B1
Rk12	270Ω	B1
Rk13	18kΩ	B1
Ra1	10kΩ	A2
Ra2	180Ω	A2
Ra3	12kΩ	A2
Ra4	10kΩ	A2
Ra5	10kΩ	A2
Ra6	10Ω	A2
Ra7	1kΩ	A2
Ra8	1kΩ	B2
Ra9	68Ω	B2
Ra10	47Ω	B2
Ra11	620Ω	B2
Ra12	2·2Ω	B2
Ra13	2·2Ω	B2
Ra14	390Ω	A2
Capacitors		
C1	166pF	D4
C2	166pF	D4
Cm1	49pF	C3
Cm2	35pF	C3
Cm3	23pF	C3
Cm4	175pF	C3
Cm5	23pF	C3
Cm6	190pF	C3
Cm7	49pF	C3
Cm8	0·047μF	C3
Cm9	0·02μF	C3
Tm1	30pF	C3
Tm2	30pF	C3
Ck1	0·047μF	A1
Ck2	0·047μF	B1
Ck3	250pF	A1
Ck4	2·7pF	A1
Ck5	250pF	A1
Ck6	25μF	A1
Ck7	0·47μF	A1
Ck8	250pF	B1
Ck9	2,200pF	B1
Ck10	4,700pF	B1
Ck11	0·22μF	B1
Ca1	160μF	A2
Ca2	0·22μF	A2
Ca3	50μF	A2
Ca4	320μF	A2
Ca5	160μF	A2
Ca6	1,800pF	B2
Ca7	100μF	B2
Ca8	320μF	B2
Coils and Transformers*		
L1	2·8Ω	D4
L2	11·2Ω	E4
L3	10Ω	E4
Lm1	—	C3
Lm2	1·8Ω	C3
Lk1	5·5Ω	A1
Lk2	5·5Ω	A1
Lk3	3·7Ω	B1
Lk4	—	B1
Miscellaneous		
S1-S10	—	C3
S11	—	D4
Dk1	CG64H	A1

* *Approximate d.c. resistance in ohms.*



Circuit diagram of the KB KRO21 and RGD RR221.



Above: The i.f. and a.f. printed panels.

Lk3, Lk2 and **Lk1** for maximum output. Readjust as necessary for optimum results.

3.—Connect the signal generator to the test coil and position the coil co-axially with the ferrite rod and 5in from the m.w. end (**L1** end). Switch receiver to m.w.1. and tune to 500m. Feed in a 600kc/s signal and adjust **Lm2** and **L1** for maximum output.

4.—Switch receiver to m.w.2. and tune to 200m. Feed in a 1,500kc/s signal and adjust **Tm2** and **Tm1** for maximum output.

5.—Repeat operations 3 and 4 in the order given, for optimum results.

6.—Switch receiver to l.w. Feed in a 225kc/s signal and accurately tune receiver to this signal then adjust **L2** for maximum output.

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CIRCUIT NOTES

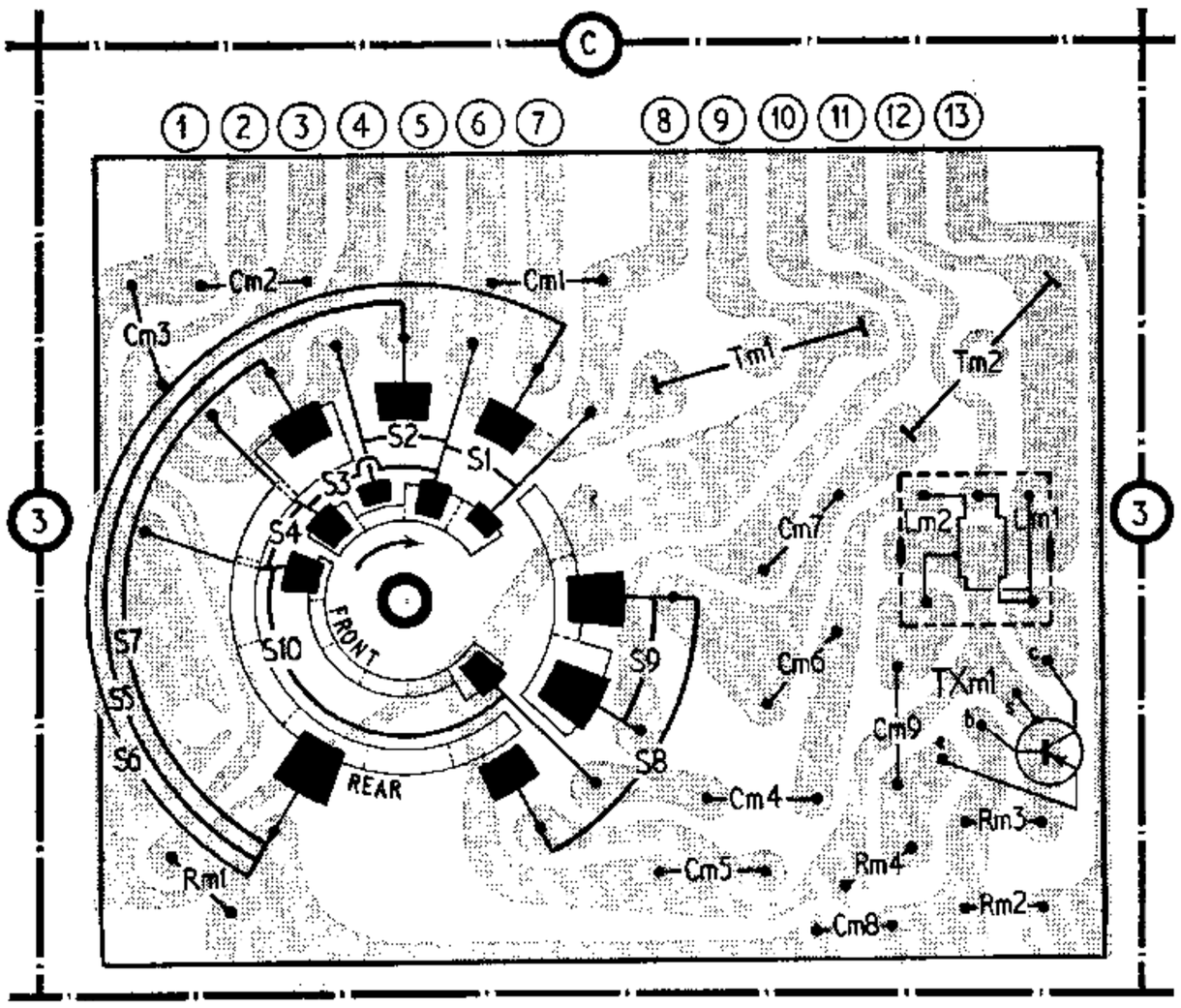
The demodulator circuit employed in this receiver incorporates a transistor **TXk2** operated in the common-emitter mode and biased towards cut-off. Operated in this condition the transistor is used as a collector-bend detector, analogous to an anode-bend detector when using a valve.

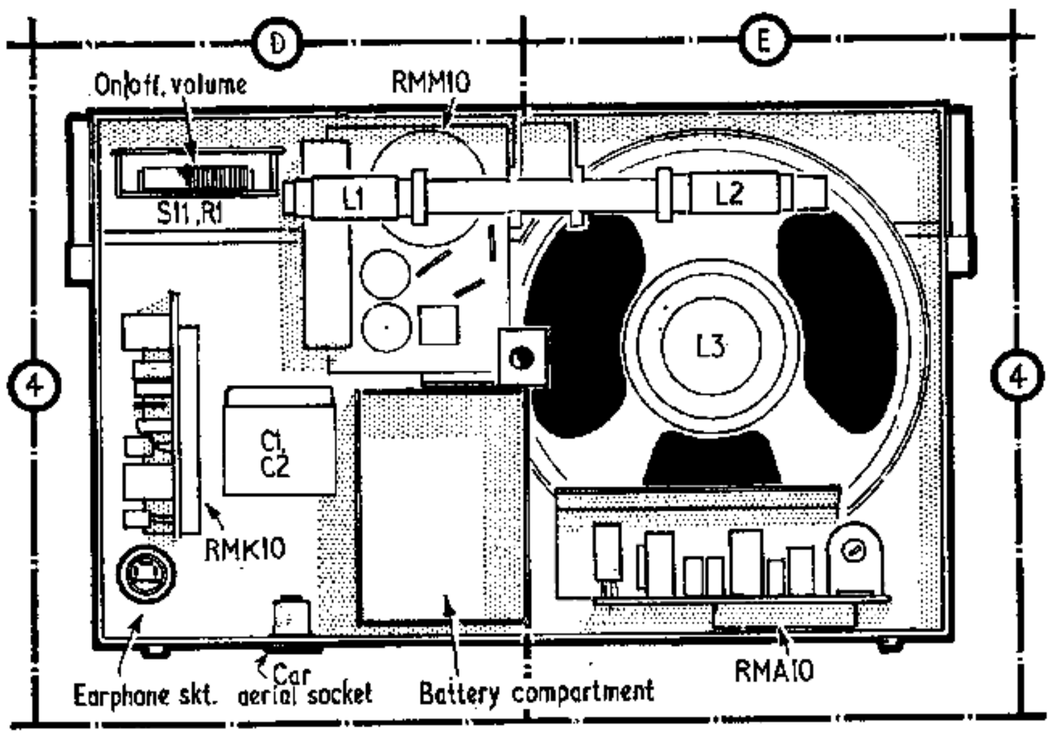
A potential divider **Rk9, Rk10** is used to provide d.c. stabilization and the value of the emitter resistor **Rk12** is chosen to give the required value of collector and emitter current. The value of the emitter current is particularly important for rectification and, in fact, its value must be a compromise between two conflicting requirements.

On the one hand, in order to provide efficient rectification the emitter-base function must be biased to a point on the dynamic characteristic where the curve has a sharp knee; at this point, the emitter current is reduced to a low level.

On the other hand, the transistor is expected to provide some audio gain, and as an audio amplifier the transistor emitter current should be of the order of 1mA.

Below: General view with the back cover removed. Left: The r.f. printed panel and waveband switch details.





Circuit Alignment—*continued*

Adjust the signal generator attenuator to obtain 400mW output (indicated on output meter), then adjust **Ra4**, together with the signal generator attenuator for equal clipping of the displayed waveform.

Disconnect the a.f. signal generator and oscilloscope.

Alignment Procedure.—All r.f. and i.f. measurements are to be made with an a.m. signal modulated to a depth of 30 per cent at 1kc/s. The signal input should be progressively attenuated with increasing sensitivity so as to maintain an output of approximately 50mW with the volume control at maximum.

1.—Switch receiver to m.w.2. and rotate tuning gang to maximum capacitance. Connect audio output meter in place of loudspeaker (if not already connected).

2.—Connect the signal generator via the 0·1μF capacitor to the base of mixer/oscillator **TXa1**, or via car aerial socket, whichever is more convenient. Feed in a 470kc/s a.m. signal and adjust

The potential difference across **Rk13** under quiescent conditions is approximately 3·75V. When an input signal is applied, the mean collector current rises thereby increasing the potential difference across **Rk13**. The collector potential will therefore become less negative as the magnitude of the applied signal increases, and this variation of potential is fed back to **TXk1** as a.g.c. bias.

Because the emitter current (in this application) is much smaller than is usual with a common-emitter configuration, the input resistance is therefore much higher and does not impose excessive damping on the tuned circuit feeding it.

Components **Ck9, Rk11** and **Ck10** comprise the normal i.f. filter network and the audio signal component developed across **Rk13** is fed via **Ck11** (d.c. blocking) to the top of the volume control **R1**.

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