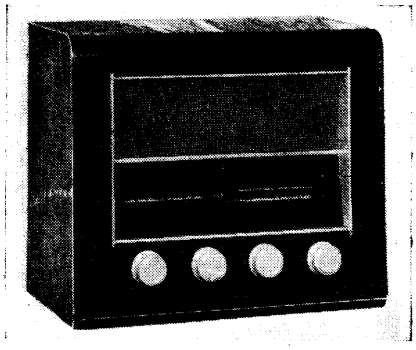
"TRADER" SERVICE SHEET

1203

BUSH VHF41 & RG46

A.M./F.M. V.H.F. Receiver and Autoradiogram



The Bush VHF41 table receiver.

THE Bush VHF41 is a 6-valve (plus rectifier) A.M./F.M. receiver designed to operate from A.C. mains of 110 V and 200-250 V, 50 c/s. Provision is made on F.M. for the connection of an internal plate aerial. The waveband ranges are: F.M., 87.5-100 Mc/s; A.M., 187-560m, 1,000-2,000m.

Model RG46 is an autoradiogram version of the VHF41. Differences between the two models are given in "General Notes" overleaf.

Release dates and original prices: VHF41, November 1954, £20 15*s* 4*d; RG46, May* 1955, £60 5*s* 5*d*.

CIRCUIT DESCRIPTION

A.M. aerial input via coupling coils **L4, L5** to single-tuned circuits **L6, C61** (M.W.) and **L7, C61** (L.W.). Section **a** of **V3 (Mullard ECH81)** operates as mixer, and section **b** as oscillator.

Oscillator grid coils **L8** (M.W.) and **L9** (L.W.) are tuned by **C62.** Parallel trimming by **C63** (M.W.) and **C30, C31** (L.W.); series tracking by **C29** (M.W.) and **C32** (L.W.). Reaction coupling from oscillator anode via **L10** (M.W.) and the common impedance of tracker **C32** (L.W.).

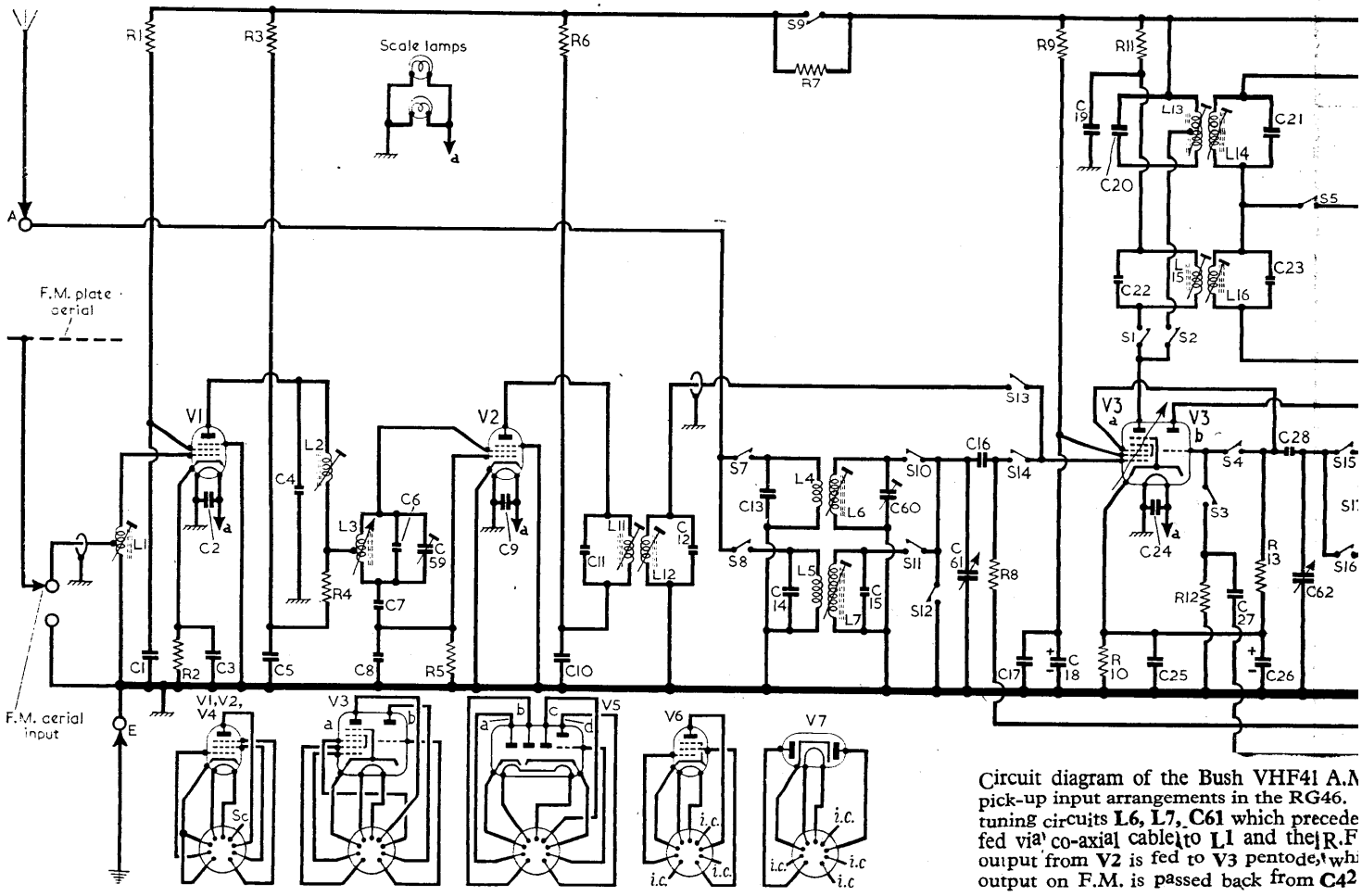
V4 operates as single-valve A.M. intermediate frequency amplifier with transformer couplings **C20, L13, L14, C21** and **C37, L17, L18, C38.**

A.M. intermediate frequency 470 kc/s

Diode section **c** of triple diode triode valve **V5 (Mullard EABC80)** functions as A.M. signal detector, and the A.F. component in its rectified output is developed across load resistor **R26** and passed via **C48,** volume control **R27,** and **C49** to triode section **d** of **V5.** I.F. filtering by **C47, R25** and the capacitance of the screened leads.

D.C. potential developed across A.M. diode load **R26** is fed back as bias to **V3a** and **V4** giving automatic gain control on the A.M. bands.

Resistance-capacitance coupling by **R29, C51** and **R30** between **V5d** and pentode output valve **V6 (Mullard EL84).** Tone correction by **C53** and variable tone control by **C52, R31** in **V6** anode circuit. Negative feed-back tone correction via **C55, R32** between windings **b, c** on the output transformer **T1** and **V5d** anode circuit.



Circuit diagram of the Bush VHF41 A.M pick-up input arrangements in the RG46. tuning circuits **L6, L7, C61** which precede fed via co-axial cable to **L1** and the R.F output from **V2** is fed to **V3** pentode, wh output on F.M. is passed back from **C42**

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V7, Mullard EZ80).** H.T. smoothing by **R35,** choke **L23,** and **C56, C57** and **C58.**

Operation on F.M.

Co-axial 80Ω F.M. aerial input to F.M. R.F. amplifier **(V1, Mullard EF80).** The aerial and R.F. tuning coils **L1** and **L2** are fixed-tuned to the centre of Band II.

Second valve **(V2, Mullard EF80)** is an R.F. pentode operating as F.M. frequency changer, the oscillator being formed by the screen and control grids. The amplified output from **V1** is combined in **V2** with the oscillator voltage via a tapping on the oscillator coil **L3.** F.M. tuning is by means of the variable core of **L3.**

V3a and **V4** form a two-valve F.M. intermediate frequency amplifier with tuned transformer couplings **C11, L11, L12, C12; C22, L15, L16, C23** and **L19, L20, C39.**

F.M. intermediate frequency 19.5 Mc/s

When operating at the A.M. intermediate frequency of 470 kc/s, the gain of **V4** is much higher than when it is working at the F.M. intermediate frequency of 19.5 Mc/s. In order, therefore, to prevent instability on A.M., the gain of **V4** is limited by inserting an additional bias resistor **R20** in its cathode lead via **S6** which opens for A.M. operation.

Diode sections **a** and **b** of **V5** operate in an F.M. ratio detector circuit, whose

(*Continued col. 1 overleaf*)

COMPONENT VALUES AND LOCATIONS

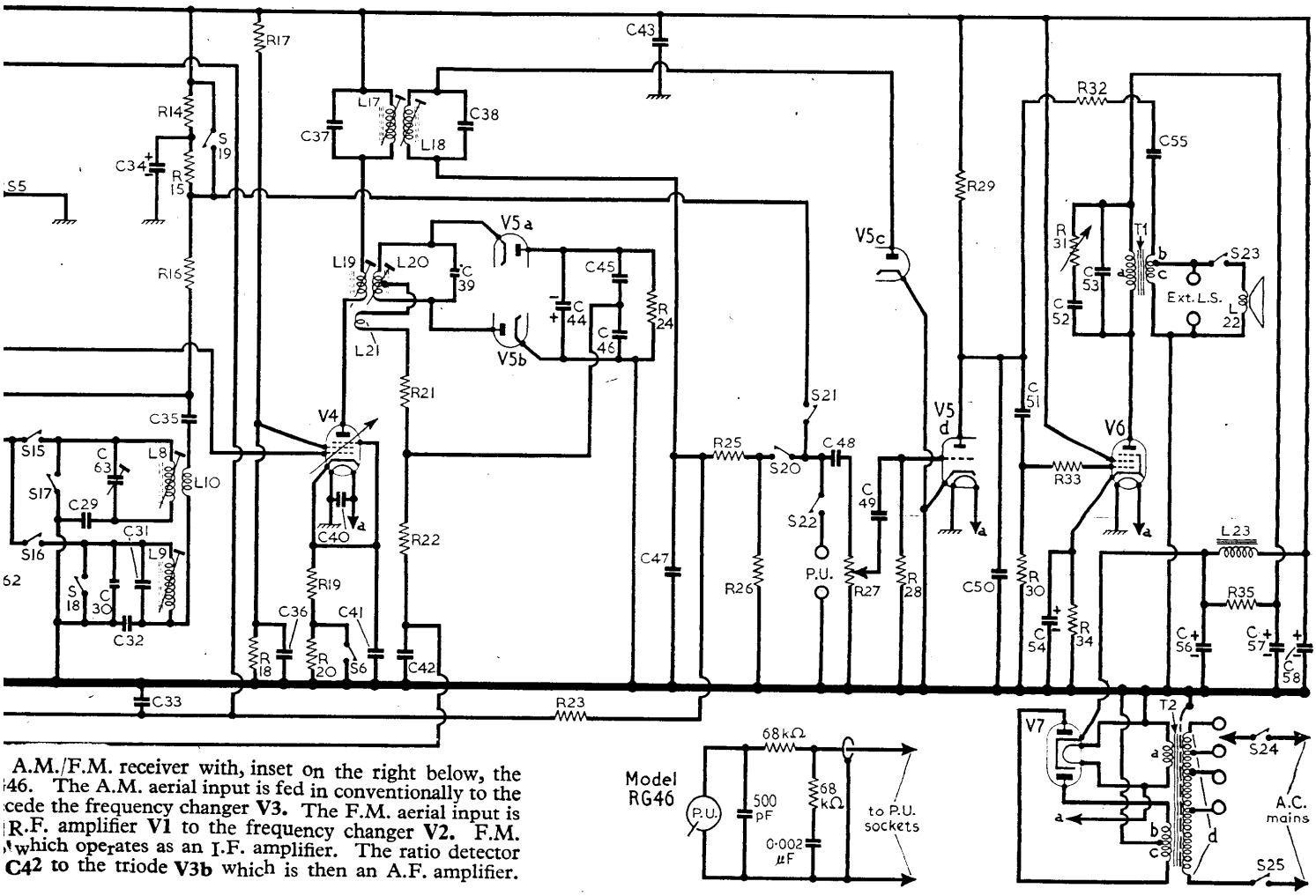
	RESISTORS	Values	Locations
R1	V1 S.G. H.T. feed	15kΩ	H4
R2	V2 G.B.	180Ω	H4
R3	V1 H.T. decoupling	470Ω	H4
R4	Part V1 load ...	2·2kΩ	H4
R5	V2 C.G.	47kΩ	H4
R6	V2 H.T. decoupling	2·2kΩ	H4
R7	H.T. bleed to V1, V2	100kΩ	G2
R8	V3a C.G.	680kΩ	F3
R9	V3a S.G. H.T. feed	22kΩ	F2
R10	V3 G.B.	180Ω	F2
R11	V3a H.T. decoupling ...	1kΩ	F3
R12	V3b A.F. C.G. ...	470kΩ	F3
R13	V3b osc. C.G. ...	47kΩ	F3
R14	V3b H.T. decoupling ...	47kΩ	G2
R15	V3b A.F. load ...	10kΩ	G2
R16	V3b osc. load ...	33kΩ	F2
R17	V4 S.G. H.T. ...	56kΩ	E2
R18*	pot. divider ...	100kΩ	E2
R19	V4 G.B. (F.M.) ...	150Ω	F2
R20	V4 stabilizing G.B. (A.M.)	1·2kΩ	F3
R21	A.F. feed ...	100Ω	E3
R22	Part de-emphasis...	100kΩ	E3
R23	A.G.C. decoupling	1·5MΩ	F3
R24	F.M. D.C. load ...	22kΩ	E3
R25	A.M. I.F. stopper	100kΩ	E3
R26	A.M. diode load ...	220kΩ	E3
R27	Volume control ...	500kΩ	E2
R28	V5a C.G.	15MΩ	E3
R29	V5a anode load	180kΩ	E3
R30	V6 C.G.	1MΩ	E3
R31	Tone control ...	50kΩ	D2
R32	Neg. feed-back ...	470kΩ	E2
R33	V6 C.G. stopper ...	3·3kΩ	E3
R34	V6 G.B.	220Ω	E3
R35	H.T. smoothing ...	1kΩ	D3

* Not fitted in early versions.

	CAPACITORS	Values	Locations
C1	V1 S.G. decoupling	0·001μF	H4
C2	V1 heater by-pass	0·001μF	H4
C3	V1 cath. by-pass ...	0·001μF	H4
C4	R.F. tuning ...	4·7pF	H4
C5	V1 H.T. decoupling	0·001μF	H4
C6	Oscillator tuning ...	4·7pF	H4
C7	V2 C.G.	22pF	H4
C8		4·7pF	H4
C9	V2 heater by-pass	0·001μF	H4
C10	V2 H.T. decoupling	0·003μF	H4
C11	1st F.M. I.F. trans. tuning	39pF	A1
C12		22pF	A1
C13	Aerial shunts ...	800pF	G3
C14		600pF	G3
C15	L.W. aerial trim. ...	85pF	G3
C16	V3a C.G.	100pF	G3
C17	V3a S.G. decoupling	0·003μF	F2
C18*		1μF	F2
C19	V3a H.T. decoupling	0·003μF	F2
C20	1st A.M. I.F. trans. tuning	110pF	B1
C21		110pF	B1
C22	2nd F.M. I.F. trans. tuning	39pF	B1
C23		39pF	B1
C24	V3 heater by-pass	0·02μF	F3
C25	V3 cath. by-passes	0·02μF	F2
C26*		100μF	F2
C27	A.F. coupling ...	0·02μF	F3
C28	V3b osc. C.G. ...	56pF	G2
C29	M.W. osc. tracker...	515pF	G2
C30	L.W. osc. trimmers	33pF	G2
C31		240pF	G2
C32	L.W. osc. tracker...	365pF	G2
C33	A.G.C. decoupling	0·1μF	F3
C34*	H.T. decoupling ...	16μF	F2
C35	Osc. anode coup. ...	0·001μF	G2
C36	V4 S.G. decoupling	0·003μF	E2

[(*Continued col. 1 overleaf*)

* Electrolytic.



A.M./F.M. receiver with, inset on the right below, the 46. The A.M. aerial input is fed in conventionally to the cede the frequency changer **V3.** The F.M. aerial input is R.F. amplifier **V1** to the frequency changer **V2.** F.M. which operates as an I.F. amplifier. The ratio detector **C42** to the triode **V3b** which is then an A.F. amplifier.

	CAPACITORS (*Continued*)	Values	Locations
C37	2nd A.M. I.F. trans.	110pF	B1
C38	tuning	110pF	B1
C39	3rd F.M. I.F. tun.	47pF	E2
C40	V4 heater by-pass	0·02μF	F3
C41	V4 cath. by-pass ...	0·02μF	F2
C42	Part de-emphasis...	500pF	E3
C43	H.T. decoupling ...	0·003μF	E3
C44*	F.M. D.C. reservoir	5μF	E3
C45	Ratio detector bal-	220pF	E3
C46	ancing capacitors	220pF	E3
C47	I.F. by-pass ...	100pF	E3
C48	A.F. couplings ...	0·01μF	E2
C49		0·01μF	E3
C50	I.F. by-pass ...	270pF	E2
C51	A.F. coupling ...	0·01μF	E3
C52	Part tone control...	0·1μF	E2
C53	Tone correction ...	0·001μF	D3
C54*	V6 cath. by-pass ...	50μF	D3
C55	Neg. feed-back ...	3,300pF	E2
C56*	H.T. smoothing ...	40μF	C1
C57*		40μF	C1
C58*		20μF	C1
C59‡	F.M. osc. trim. ...	8pF	H4
C60‡	M.W. aerial trim....	—	G3
C61†	Aerial tuning ...	—	A1
C62†	Oscillator tuning ...	—	A1
C63‡	M.W. osc. trim. ...	—	G2

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	F.M. aerial coup....	—	H4
L2	F.M. R.F. coil ...	—	H4
L3	F.M. osc. coil ...	—	A1
L4	A.M. aerial	14·0	G3
L5	coupling coils	50·0	G3
L6	A.M. aerial	14·0	G3
L7	tuning coils	20·0	G3
L8	A.M. oscillator	5·0	G2
L9	tuning coils	5·0	G2
L10	M.W. reaction coup	1·0	G2
L11	1st F.M. Pri.	—	A1
L12	I.F. trans. Sec. ...	—	A1
L13	1st A.M. Pri.	12·5	B1
L14	I.F. trans. Sec. ...	12·5	B1
L15	2nd F.M. Pri.	—	B1
L16	I.F. trans. Sec. ...	—	B1
L17	2nd A.M. Pri.	12·5	B1
L18	I.F. trans. Sec. ...	12·5	B1
L19	3rd F.M. Pri.	—	B1
L20	I.F. trans. Sec. ...	—	B1
L21	Tert.	—	B1
L22	Speech coil ...	2·5	—
L23	Smoothing choke...	550·0	B1
T1	O.P. trans. a...	410·0	—
	b...	360·0	—
	c...	0·28	—
T2	Mains trans. a...	0·1	
	b...	140·0	C1
	c...	140·0	
	d, total	27·0	
S1-S6	A.M./F.M. switches	—	F3
S7-S22	Waveband switches	—	G2
S23	Speaker switch ...	—	—
S24, S25	Mains sw., g'd R27	—	E2

Circuit Description—*continued*

A.F. output is fed via de-emphasis circuit **R22, C42** to grid of **V3b**, which on F.M. functions as A.F. amplifier.

Resistance-capacitance coupling by **R15, C48,** volume control **R27** and **C49** between **V3b** and triode section **d** of **V5, S19** being open for F.M. operation.

For A.M. operation, **S9** opens to mute the F.M. tuner unit. **R7** shunts this switch to maintain a low H.T. current supply to **V1** and **V2,** thus preventing cathode "poisoning" of these valves.

VALVE ANALYSIS

Valve voltages given in the table (next col.) are derived from the manufacturers' information. They were measured on the 1,000V and 10V ranges of a Model 7 Avometer, chassis being the negative connection. The receiver, except where otherwise indicated, was switched to M.W., but there was no signal input.

Valve	Anode V	Screen V	Cath. V
V1 EF80... ...	180†	180†	2·0†
V2 EF80... ...	200†	*	—
V3 ECH81 a ...	250	80	2·8
b ...	90	—	2·8
V4 EF85... ...	250	150	7·6‡
V5 EABC80 a–c	—	—	—
d...	85	—	—
V6 EL84... ...	220	250	8·4
V7 EZ80... ...	220§	—	270·0

* No reading quoted. † Receiver switched to F.M. ‡ 1·5V on F.M. § A.C. reading each anode.

GENERAL NOTES

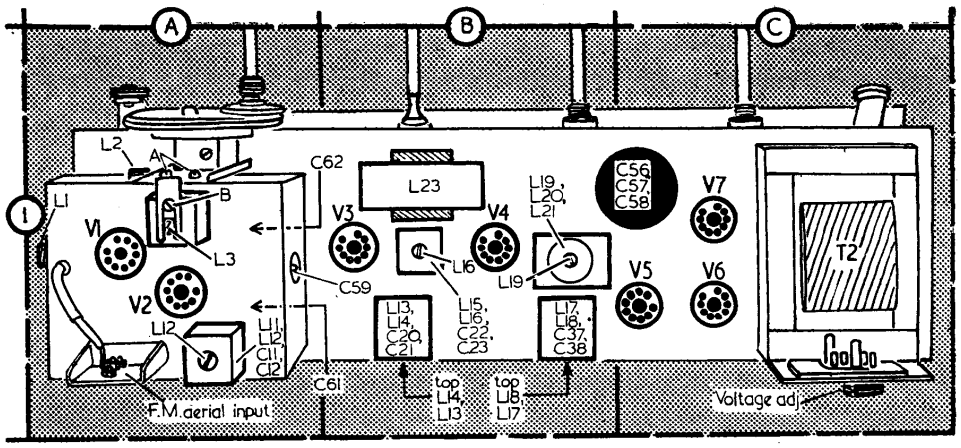
Switches.—**S1-S6** are special A.M./F.M. change-over switches which are ganged in a single slide type unit under the chassis. This unit is indicated in the main under-chassis illustration (location reference F3) where the individual switch contacts are identified. The unit is lever-operated from the spindle of the waveband switch control. Switches **S1, S3, S5** and **S6** close for F.M. operation, and switches **S2** and **S4** close for A.M.

S7-S22 are the waveband and gram switches which are ganged in two rotary units beneath the main chassis. These units are identified in the main underchassis illustration, where the numbered arrows show the directions in which they are viewed in the diagrams in column 3. The switch operations for the four control settings, starting with the control in the fully anti-clockwise position, are given in the associated switch table below the switch diagrams.

Scale Lamps.—These are 6.5V, 0.3A lamps with M.E.S. bases.

Model RG46.—This is a 3-speed auto-radiogram version of the VHF41. The RG46 circuit is basically the same as that of the VHF41, but there are the following small differences.

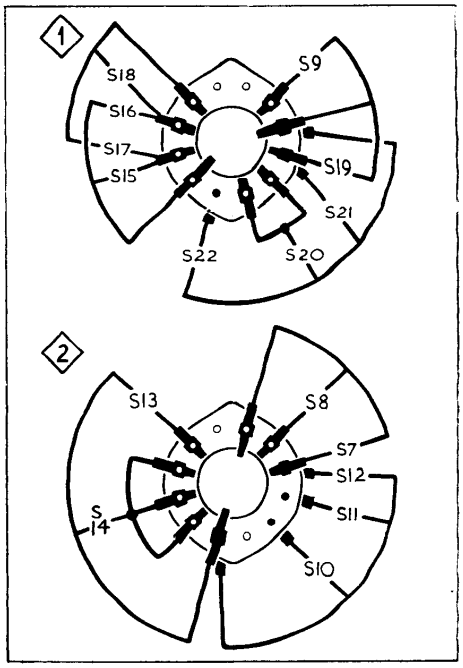
A tone correction circuit is connected between the pick-up and the P.U. socket on the receiver chassis. This circuit is shown inset to the left of the mains transformer section of the main circuit diagram overleaf. Two A.M. aerial sockets are provided, one labelled "Sensitive" being connected direct to the junction **S7, S8,** and the other labelled "Selective" being connected to the same point via a 50pF capacitor. **C55** is increased to 0.01μF. An additional 6.5V, 0.3A lamp is employed for P.U. illumination.



Plan view of the chassis. The A.M. and F.M. I.F. transformers are in separate screening cans. The F.M. tuner forms a separate unit on the left in this illustration.

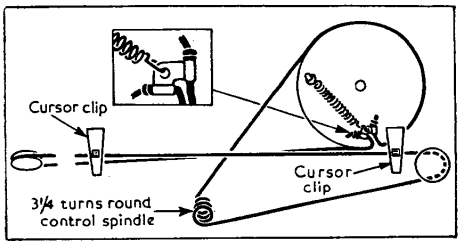
DISMANTLING

Removing F.M. Tuner Unit.—Unsolder a flexible rubber covered lead and a sleeved 20 s.w.g. tinned copper lead from the 4-way tag strip at the rear of the tuner unit;

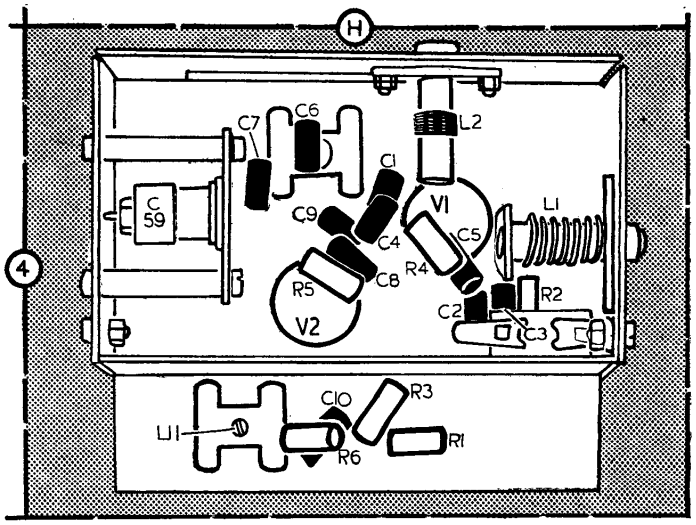


Diagrams of the rotary waveband switch units, drawn as seen in the directions of the arrows in the underchassis view. Below is the associated switch table.

Switches	F.M.	M	L	Gram
S7	—	C	—	—
S8	—	—	C	—
S9	C	—	—	—
S10	—	C	—	—
S11	—	—	C	—
S12	—	—	—	C
S13	C	—	—	—
S14	—	C	C	C
S15	—	C	—	—
S16	—	—	C	—
S17	C	—	—	—
S18	C	C	—	—
S19	—	C	C	—
S20	—	C	C	—
S21	C	—	—	—
S22	—	—	—	C



Left: Drive cord system as seen from the chassis front. About 50in of nylon braided glass yarn is required. *Right:* Underside view of the F.M. tuner unit.



unsolder the co-axial output lead from the tags of **L12** at the rear of the unit;
remove two 6 B.A. bolts (labelled A on right of **L2** in location reference A1) from front edge of tuner unit;
remove 6 B.A. bolt (labelled B in location A1) securing **L3** core adjustment to gang coupling bracket and withdraw core adjustment;
remove four 4 B.A. bolts securing corners of tuner unit to the main chassis and withdraw tuner unit.
When replacing, the flexible rubber covered lead should be connected to the right-hand tag on strip at rear of the unit, and the single-core lead to the second tag from the left on the same strip.

CIRCUIT ALIGNMENT

Apparatus Required.—An accurately calibrated spot-frequency (unwobbulated) signal generator; an F.M. signal generator (wobbulated with 400 c/s modulation); a 0-100 mW output meter with an impedance of 3.5 Ω. Instead of the F.M. signal generator, the spot-frequency signal generator may be used in conjunction with a D.C. valve voltmeter or a 20,000 Ω/V meter.

During alignment, an output meter reading of 50 mW (or 4V on valve voltmeter) should be maintained. It is necessary to remove the chassis from its cabinet to make the following adjustments accessible.

A.M. I.F. Stages.—Switch receiver to M.W. Connect the output of the spot-frequency signal generator to control grid (pin 2) of **V4** and chassis. Connect sound output meter across **T1** secondary winding, and disconnect the speech coil connection.

A.M. R.F. Alignment Table

Wave band	Sig. Gen. Output (kc/s)	Tune to	Adjust	Location
M.W.	600	0·6	L8	G2
M.W.	600	0·6	L6	G3
M.W.	1,500	1·5	C63	G2
M.W.	1,500	1·5	C60	G3
Repeat above and check calibration.				
L.W.	214	0·214	L9	G2
L.W.	214	0·214	L7	G3
Repeat last two operations and check calibration.				

Feed in a 470 kc/s 30% modulated signal and adjust the cores of **L18** and **L17** (location reference B1) for maximum output.

Transfer "live" signal generator lead to control grid (pin 2) of **V3** and, still feeding in a 470 kc/s signal, adjust the cores of **L14** and **L13** (B1) for maximum output. Do not re-adjust the cores of **L17, L18.**

F.M. I.F. Stages.—Switch receiver to F.M. Connect the output leads of the F.M. signal generator to the F.M. aerial socket (alternative alignment using the spot-frequency signal generator and the high-resistance voltmeter is given at the end of this section).

Feed in a 19.5 Mc/s signal deviated by ±22.5 kc/s and adjust the cores of **L20** (E2), **L19** (B1), **L16** (B1), **L15** (F2), **L12** (A1), and **L11** (A1), in that order, for maximum output.

If an F.M. signal generator is not available, connect the output of the spot-frequency signal generator to the F.M. aerial socket, and connect a D.C. valve voltmeter (or 20,000 ohms-per-volt meter) across **R24** (positive connection to chassis) as output meter.

With the receiver switched to F.M., feed in an unmodulated 19.5 Mc/s signal and adjust the cores of **L19** (B1), **L16** (B1), **L15** (F2), **L12** (A1) and **L11** (A1) for maximum deflection on the output meter.

Disconnect output meter leads from **R24** and re-connect them across **C42** (positive connection to chassis). Unscrew the core of **L20** (E2) to its full extent. Then, feeding in an unmodulated 19.5 Mc/s signal as before, screw the core of **L20** slowly into its former, passing through a "dip" in the response (minimum meter deflection) and setting the core to the "peak" (maximum meter deflection) that occurs beyond this point.

Re-connect output meter across **R24,** and still feeding in an unmodulated 19.5 Mc/s signal, re-adjust the core of **L19** (B1) for maximum deflection on the output meter. Then adjust signal generator output for a 4V reading.

Re-connect output meter across **C42** and unscrew the core of **L20** (E2) in an anti-clockwise direction until the output meter reads 1.6V.

R.F. and Oscillator Stages.—As the tuning scale remains fixed in the cabinet when the chassis is withdrawn for alignment, reference must be made to the substitute tuning scale fixed to the front edge of the chassis. A temporary cursor should be clipped to the front horizontal run of the drive cord and adjusted so that with the gang at maximum capacitance the temporary cursor coincides with the datum line on the substitute scale. Calibration points on this scale are referred to under "Tune to" in the alignment tables.

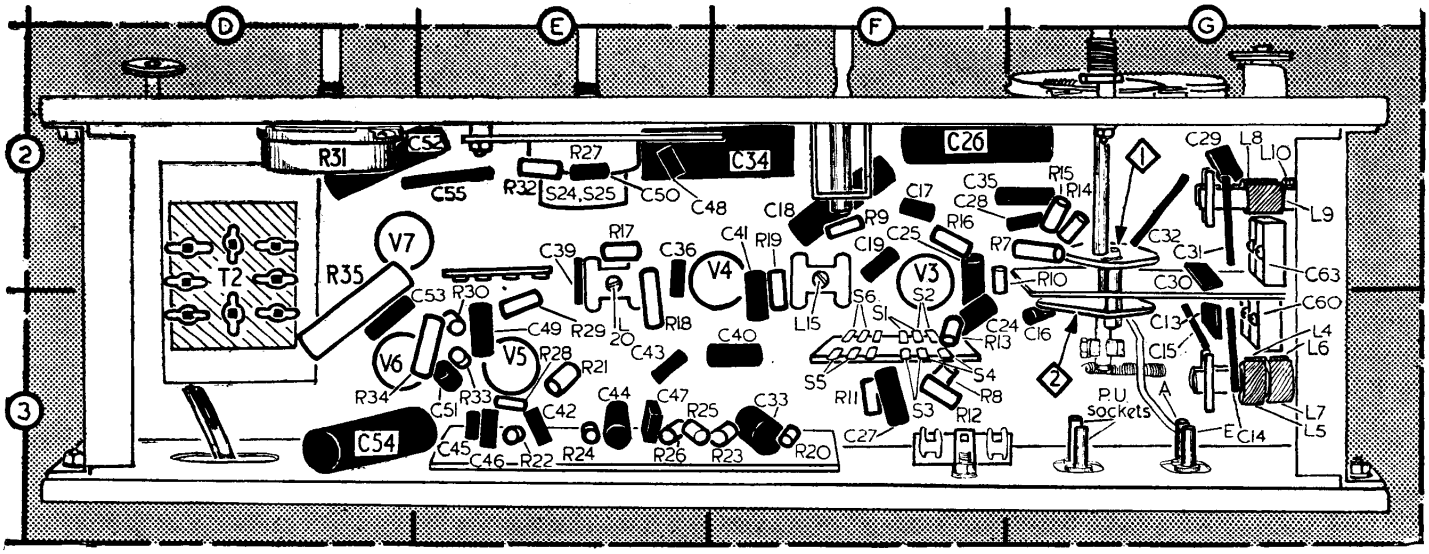
Connect spot-frequency signal generator (using a 30% modulated signal) to A.M. aerial and earth sockets for A.M. alignment, and connect F.M. signal generator to F.M. aerial socket for F.M. alignment. If an F.M. signal generator is not available, the spot-frequency signal generator can be used (with an unmodulated output) and with a D.C. valve voltmeter (or 20,000 ohms-per-volt meter) connected across **R24** as an output indicator.

Where two peaks are found during F.M. alignment the peak should be chosen with the core nearer to the adjusting end of the coil former. Carry out the adjustments in the order shown in the alignment tables, commencing with the A.M. R.F. alignment table.

F.M. R.F. Alignment Table

Sig. Gen. Output(Mc/s)	Tune to	Adjust	Location
87·5*	87·5	L3	A1
100·0*	100	C59	A1
94·0*	94	L2	A1
94·0*	94	L1	A1
Repeat above operations and check calibration.			

* Deviated by ±22·5kc/s.



Underside view of the chassis. The A.M./F.M. switch unit tags are identified individually.

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