BUSH VHF54 and VHF55
a.m.-f.m. radio receivers

THESE two models are basically similar, the VHF54 being for a.c.-only operation and the VHF55 for a.c.-d.c. operation. Eight valves are used, including f.w. rectifier and tuning indicator, the receiver covering long, medium and f.m. bands.

Model VHF54—August, 1955. £23 10s. 0d. Tax extra.
Model VHF55—August, 1955. £23 15s. 2d. Tax extra.

CIRCUIT DETAILS

For a.m. reception, the signal input is fed to V3A, the mixer section of an ECH81 frequency changer. A built-in frame aerial is fitted, this being terminated in a 2-pin plug to mate with a socket at the left-hand side of the chassis.

Aerial Sockets

Sockets are also provided for an external aerial. One socket feeds the input direct to the r.f. transformers L4/5 or L6/7, and is for maximum sensitivity. The other includes a series capacitor where maximum selectivity is required.

I.F. and Detector

The i.f. signal is coupled via IFT4 to the i.f. amplifier V4 and thence via IFT5 to one of the diodes of V5 which functions as second detector. The audio component in the rectified output appearing across the load resistor R23 is fed via C44 and the volume control VR1 to the triode section of V5 which functions as an a.f. amplifier. The residual i.f. is filtered by R22 and C43.

The d.c. potential developed across R22 and R23 is used as a.g.c. bias voltage and is fed back to V3A and V4. This voltage is also fed, via the filter R37, C21, to the tuning indicator valve V8.

Audio

The audio output is r.c. coupled from V5 anode, via C52, R28, to the output stage V6. Tone correction is by C51 in the grid circuit and by C55, C53 and VR2 in the anode circuit, VR2 being the manual tone control. Negative feedback is provided by C57, R31.

The audio output is approximately 3 watts, and provision is made for a 2.5Ω p.m. external speaker. The a.c. power pack is conventional, smoothing for V4 and V5 by CH1, C58 and C47, with additional smoothing for V3 and V8 by R32 and C56.

F.M. Operation

An internal dipole aerial is fitted for v.h.f. reception, but an external 80 system may be used if required. V1 is a fixed-tuned r.f. stage, the grid and anode coils L1 and L2 being tuned to the centre of Band II. V2 is a pentode frequency changer, the oscillator coil L3 being operated by a cam attached to the drive drum and ganged to the variable capacitors VC1 and VC2.

On f.m. operation, the triode-heptode V3 functions as an audio and i.f. amplifier. The output from the mixer stage V2 is coupled to V3A (acting as an i.f. amplifier) and thence via IFT2 to the second f.m. i.f. stage V4.

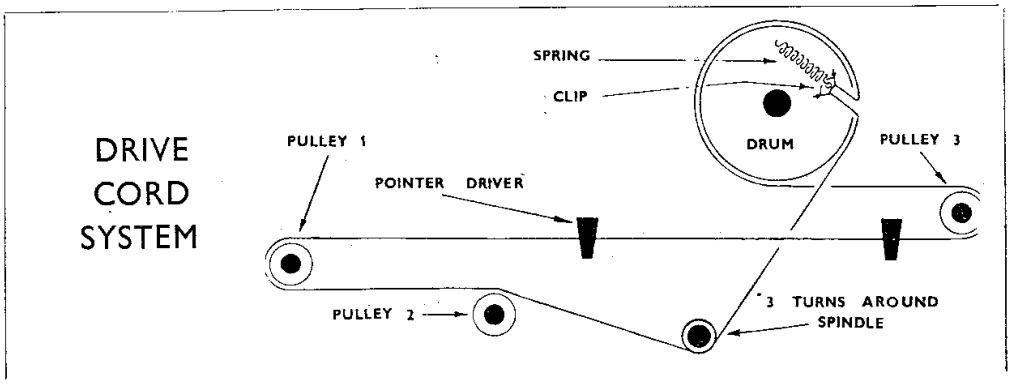
V4 now operates with bias resistor R13 shorted out, leaving only R18 in circuit. On a.m. operation, R13 is brought into circuit to limit the gain and prevent instability.

The i.f. output is coupled, via IFT3, to the remaining two diodes of V5 which are connected as a ratio detector. R27 is the ratio detector load, with C48/C49 as reservoir capacitors and C50 as voltage stabiliser. The audio output from the ratio detector is fed, via the de-emphasis circuit R26, C46 to the grid of V3B which now functions as an audio amplifier stage, the output of which is then r.c. coupled to the V5 triode section for further amplification and thence to the output stage V6.

SERVICE SNAPS

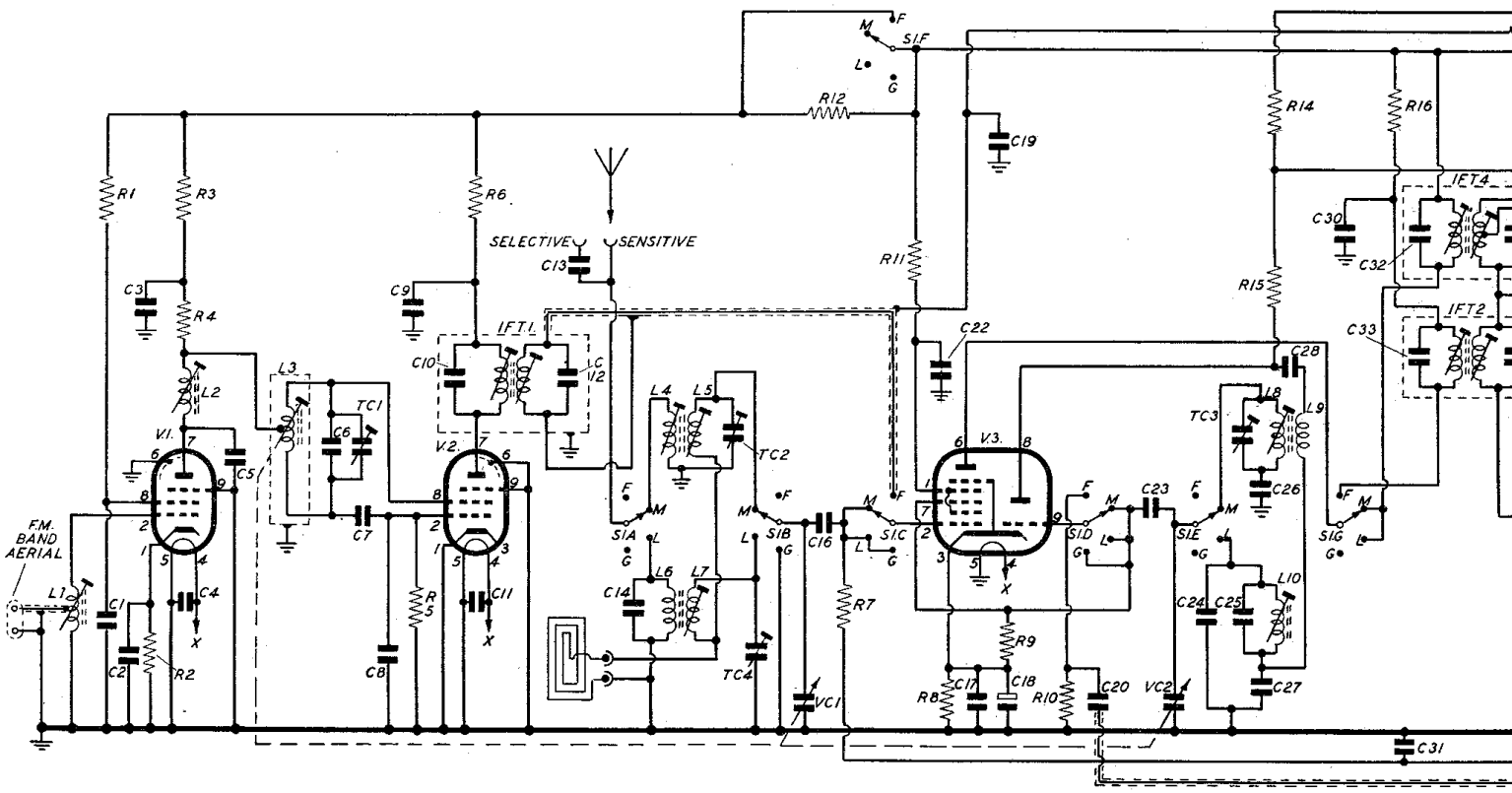
BUSH VHF54 AND VHF55

Valves: VHF54—two EF80, one each ECH81, EF85, EABC80, EL84, EZ80 and EM80 (or EM81). VHF55—two UF80, one each UCH81, UF85, UABC80, UL85, UY85, UM4.
Dial Lamps: three 6.5V, 0.3A.
Intermediate Frequencies: 470 kc/s (a.m.), 19.5 Mc/s (f.m.).
Volume Control: 2MΩ, with d.p. switch (500kΩ in model VHF55).
Tone Control: 50kΩ.
Electrolytics: 40+40+20μF, 350V; 5μF, 50V; 100μF, 6V.
Waveranges: MW, 1,600–535 kc/s (187–560m); LW, 300–150 kc/s (1,000–2,000m); FM, 87.5–100 Mc/s.
Mains Consumption: Approx. 65 watts.
Mains Input: VHF54—100–120V and 200–250V, 40–100 c/s a.c. VHF55—100–120V and 200–250V a.c. or d.c.



The diagram shows the position of the drive drum with the tuning gang at maximum capacitance. The length of glass nylon cord required is 52¾in. after clenching in the clip.

To replace cord, hook the cord and clip to the spring and attach the other end of the spring to the drive drum. Then pass the cord through the opening in the drum and take three turns in a clockwise direction round the spindle. Then take cord over pulley 2 and around pulleys 1 and 3, and finally pass it round the drive drum in a clockwise direction.

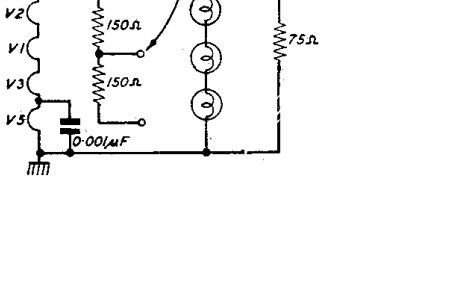


MODEL VHF55

This is the a.c.-d.c. version of the VHF54. The power supply is, of course, different, and a separate diagram shows the arrangement. The output transformer differs in that a tertiary winding is added. The main secondary feeds the speech coil of the speaker and is completely isolated. The tertiary winding is connected to C57 at one end and chassis at the other.

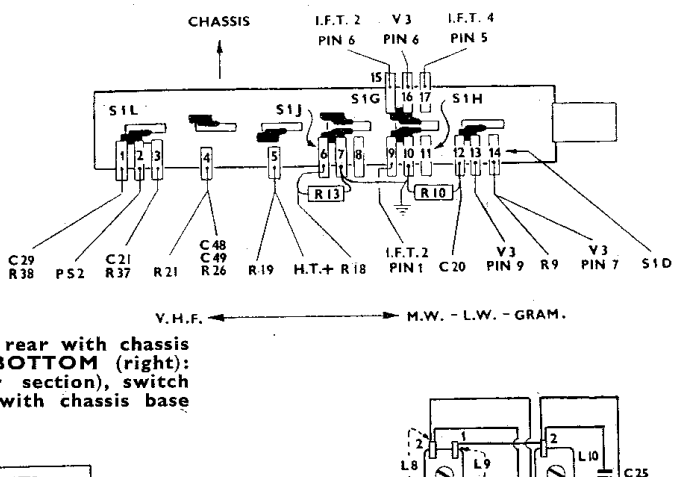
The valve complement is different and there are several small component changes. These are:—

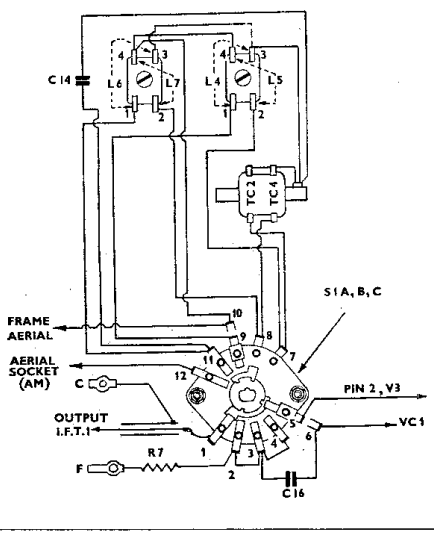
R15 is changed from 15kΩ to 6.8kΩ. VR1 is changed from 2MΩ to 500kΩ. R9 is omitted. A 470pF capacitor is inserted in each of the f.m. aerial leads, and a 0.01μF capacitor inserted between chassis and earth. A 100kΩ resistor is placed between chassis and G3 of V3A. 0.005μF capacitors are inserted in each pick-up lead, and a 0.01μF capacitor placed between the grid of V8 and chassis.

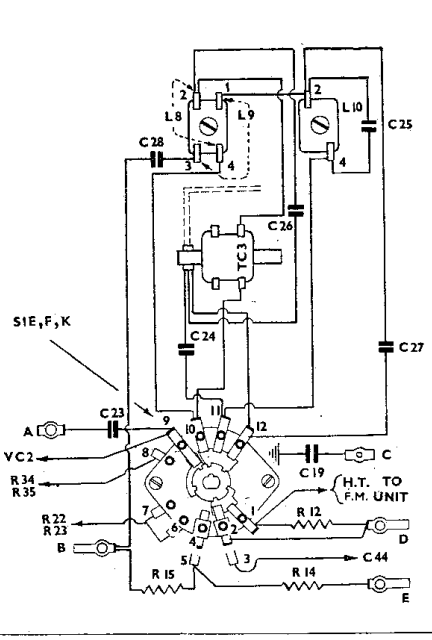


SWITCH AND COIL DECK CONNECTIONS

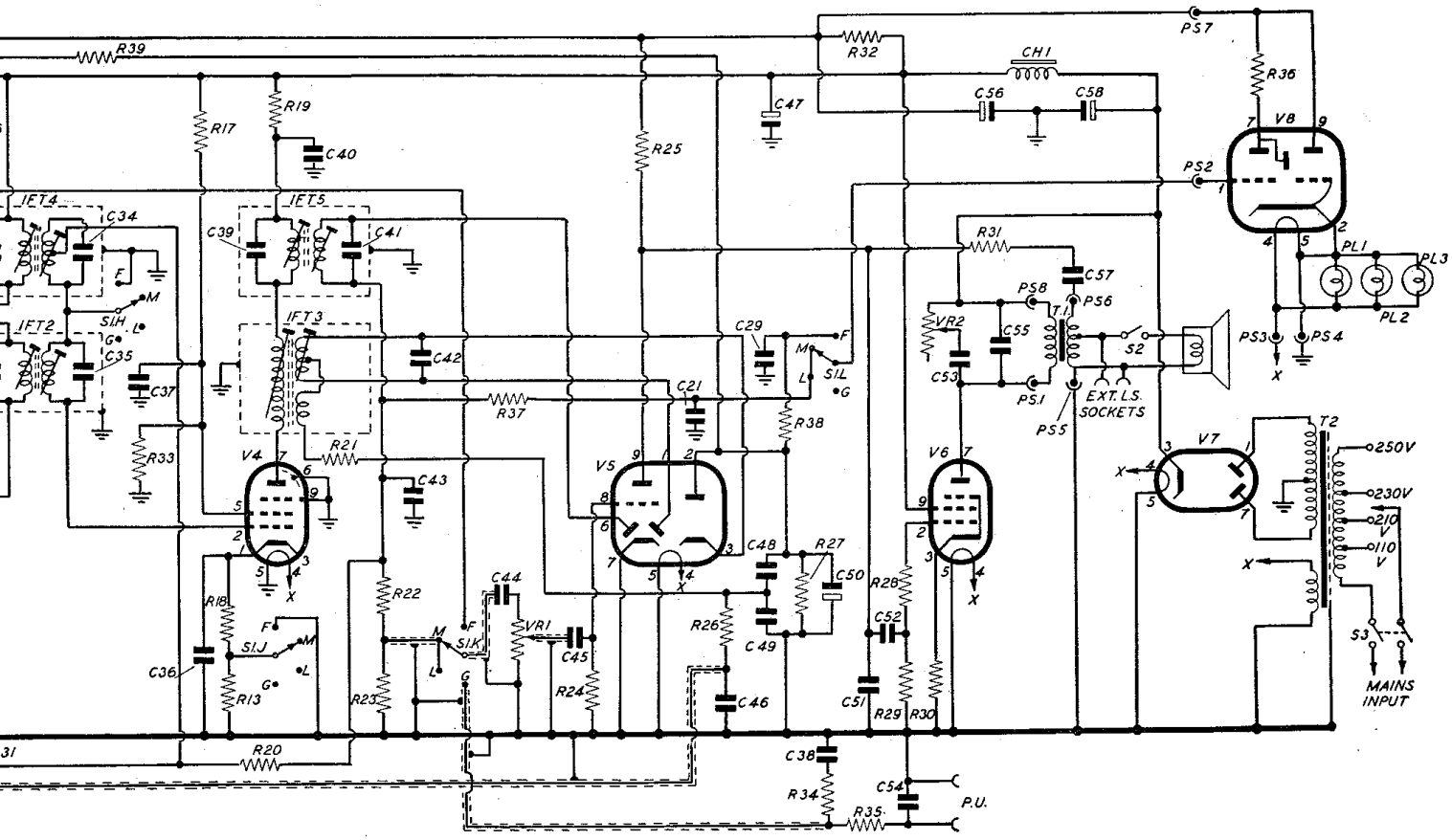
RIGHT: Connections to slider switch. BOTTOM (left): Coil deck (aerial section) showing switch positions, switch viewed from rear with chassis base uppermost. BOTTOM (right): Coil deck (oscillator section), switch viewed from front with chassis base uppermost.







	Capacitor
C1	0.
C2	0.
C3	0.
C4	0.
C5	4.7pF,
C6	4.7pF,
C7	22pF,
C8	4.7pF,
C9	0.
C10	39p
C11	0.
C12	22p
C13	
C14	
C16	
C17	0.02μF,
C18	100
C19	
C20	0.02μF
C21	
C22	0.
C23	56pF,
C24	33p
C25	240p
C26	515p
C27	365p
C28	0.001μF
C29	0.05μF,
C30	0.
C31	0.1μF,
C32	110p
C33	39p
C34	110p
C35	39p
C36	0.1μF,
C37	0.
C38	0.002μF,
C39	110p
C40	0.01μF,
C41	110p
C42	47p
C43	
C44	



COMPONENT LIST

Capacitors	
0.001μF	
0.001μF	
0.001μF	
0.001μF	
4.7pF, 750V	
4.7pF, 750V	
22pF, 750V	
4.7pF, 750V	
0.003μF	
39pF, 5%	
0.001μF	
22pF, 5%	
50pF	
600pF	
100pF	
0.02μF, 150V	
100μF, 6V	
0.01μF	
0.02μF, 150V	
0.01μF	
0.003μF	
56pF, 750V	
33pF,2%	
240pF, 2%	
515pF, 1%	
365pF, 1%	
0.001μF, 500V	
0.05μF, 500V	
0.003μF	
0.1μF, 150V	
110pF, 2%	
39pF, 5%	
110pF, 2%	
39pF, 5%	
0.1μF, 150V	
0.003μF	
0.002μF, 500V	
110pF, 2%	
0.01μF, 500V	
110pF, 2%	
47pF, 5%	
100pF	
0.01μF	

C45	0.01μF
C46	500pF
C47	40μF
C48	300pF
C49	300pF
C50	5μF, 50V
C51	300pF
C52	0.01μF
C53	0.1μF
C54	500pF
C55	0.001μF,500V
C56	20μF
C57	0.003μF
C58	40μF

All capacitors 350V wkg., unless otherwise stated.

Variable Capacitors

TC1	2–8pF
TC2	4–40pF
TC3	4–40pF
TC4	60–120pF
VC1	528pF
VC2	528pF

Resistors

R1	15kΩ
R2	180Ω
R3	470Ω
R4	2.2kΩ
R5	47kΩ
R6	2.2kΩ
R7	680kΩ
R8	180Ω
R9**	47kΩ
R10	470kΩ
R11	22kΩ, ½W
R12	100kΩ, ½W
R13	470Ω
R14	10kΩ
R15*	15kΩ
R16	1kΩ
R17	56kΩ, ½W
R18	150Ω
R19	1kΩ
R20	1.5MΩ
R21	100Ω
R22	100kΩ
R23	220kΩ
R24	15MΩ
R25	180kΩ
R26	100kΩ
R27	22kΩ
R28	3.3kΩ
R29	1MΩ
R30	220Ω, ½W
R31	470kΩ
R32	4.7kΩ½W
R33	100kΩ
R34	68kΩ
R35	68kΩ
R36	470kΩ
R37	2.2MΩ
R38	2.2MΩ
R39	1MΩ

All resistors are ¼ watt rating unless otherwise stated.

Variable Resistors

VR1†	2MΩ
VR2	50kΩ

* 6.8KΩ in VHF55
† 500KΩ in VHF55
** not used in VHF55.

Dial Lamps

PL1/3	6.5V, 0.3A

VALVES

	VHF54	VHF55	Function
V1	EF80	UF80	R.f. amp. (f.m. only)
V2	EF80	UF80	Frequency changer (f.m. only)
V3	ECH81	UCH81	Freq. changer (a.m.) or i.f. amp./audio amp. (f.m.)
V4	EF85	UF85	I.f. amplifier
V5	EABC80	UABC80	Detector/a.g.c./ a.f. (a.m.) or ratio detector a.f. (f.m.)
V6	EL84	UL85	Audio output
V7	EZ80	UY85	H.t. rectifier
V8	EM80*	UM4	Tuning indic.

* May be EM81 in later models.

INDUCTORS

L1	F.m. aerial coil	v.l.
L2	F.m. r.f. anode coil	v.l.
L3	F.m. oscillator coil	v.l.
L4	M.w. aerial coil (pri)	2Ω
L5	M.w. aerial coil (sec)	6.5Ω
L6	L.w. aerial coil (pri)	50Ω
L7	L.w. aerial coil (sec)	20Ω
L8	M.w. osc. grid coil	5Ω
L9	M.w. osc. feedback coil	1Ω
L10	L.w. oscillator coil	5Ω
IFT1	1st i.f.t. (f.m.)	v.l.
IFT2	2nd i.f.t. (f.m.)	v.l.
IFT3	3rd i.f.t. (f.m.)	v.l.
IFT4	1st i.f.t. (a.m.) each wdg.	12.5Ω
IFT5	2nd i.f.t. (a.m.) each wdg.	12.5Ω
T1	Audio output transformer primary	410Ω
	secondary	350 + 0.28Ω
T2	Mains transformer primary	27Ω
	h.t. secondary	280Ω
	heater wdg.	0.1Ω
Ch1	H.t. smoothing choke	550Ω

VALVE VOLTAGES AND CURRENTS

Model VHF54

	Anode	Screen	Cathode	
	V	V	V	mA
V1	180*	175*	2*	10*[1]
V2	195*	180*	—	15*[2]
V3A	240	115	2.5	14
V3B	105			
V4	240	110	3.5[3]	5
V5	85	—	—	1
V6	245	240	8	36
V7	220a.c.	—	260	66[4]
V8	215	—	—	—

Model VHF55

	Anode V	Screen V	Cathode V
V1	155*	150*	1.5*
V2	170*	155*	—
V3A	200	95	2.2
V3B	115	—	—
V4	195	90	2.9[5]
V5	70	—	—
V6	190	165	12
V7	220a.c.	—	210
V8	170	—	—

All readings are for m.w. operation except those marked (*) which are for f.m. operation.
[1] 1mA on m.w.; [2] 1.5mA on m.w.; [3] 1.3V on f.m.; [4] 86mA on f.m.; [5] .2V on f.m.

Alignment Procedure

First remove receiver from cabinet. With tuning capacitor at maximum, clip a temporary pointer to the drive cord to coincide with the datum mark on the auxiliary calibration scale at the front of the receiver chassis.

A.M. ALIGNMENT

I.F. Stages

Switch receiver to medium waveband, connect output meter (50 to 1,000mW) to the secondary of T1 (disconnecting speaker speech coil) and connect signal generator to pin 2 of V4.

Inject modulated signal of 470kc/s and tune secondary and primary of IFT5 for maximum output. Transfer signal generator to pin 2 of V3 and tune secondary and primary of IFT4 for maximum output. (Note: primaries are on top, secondaries below.)

R.F. Stages

Connect generator to aerial socket via standard dummy aerial.

Medium wave: Inject signal of 600 kc/s, set receiver to calibration mark 0.6 and adjust L8/9 and L4/5 for maximum output. Inject signal of 1,500 kc/s (calibration mark 1.5) and adjust TC3 and TC2 for maximum output. Repeat these operations and check calibration.

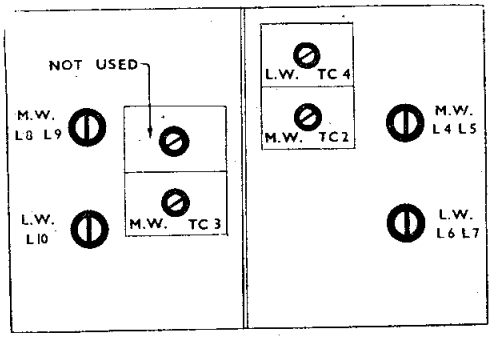
Long wave: Inject signal of 150 kc/s (calibration mark 0.15) and adjust L10 and L6/7 for maximum output. Inject signal of 300 kc/s (calibration mark 0.3) and adjust TC4 for maximum output. Repeat these operations and check calibration.

F.M. ALIGNMENT

Equipment required: Signal generator covering 19.5 mc/s (i.f.) and 87.5–100 Mc/s (r.f.), high resistance multimeter *or* a.c. valve voltmeter and microammeter with 50μA f.s.d., and two ¼- or ½-watt 47KΩ resistors (matched).

I.F. Stages

Connect the two 47kΩ resistors in series between the anode (pin 2) of V5 and chassis. Connect testmeter or valve-voltmeter across the resistors. Turn volume control to minimum. Inject unmodulated signal of 19.5 Mc/s to pin 2 of V3, ensuring during alignment that the generator output is just sufficient to maintain a reading of 4V on the meter.



Key to cores and trimmers in coil deck (a.m.).

Adjust primary and secondary of IFT2 and primary of IFT3 for maximum voltage output.

Connect meter (50μA range) between the junction of the 47kΩ resistors and the junction of R26/C46. Adjust secondary of IFT3 to produce zero reading on the microammeter.

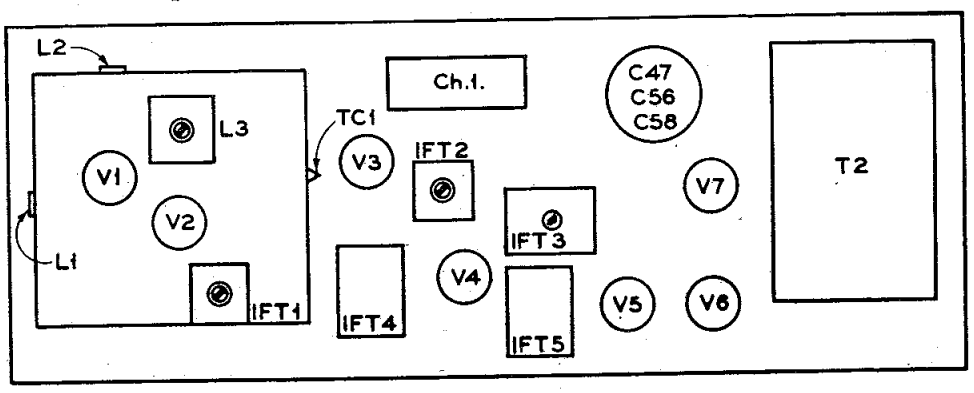
Zero response can only occur when the secondary of IFT3 is in balance. When de-tuned, either positive or negative output will be obtained.

Re-connect voltmeter between V5 anode and chassis. Re-trim primary of IFT3 for maximum output. Re-connect microammeter as before and check IFT3 secondary for zero response. Note that it is essential that maximum voltage output coincides with minimum response on the microammeter.

R.F. Stages

Reconnect voltmeter between V5 anode and chassis and transfer signal generator to the f.m. aerial sockets.

Inject signal of 87.5 Mc/s (receiver calibration mark 87.5) and trim L3 for maximum output. Inject signal of 100 Mc/s and adjust TC1 for maximum output. Inject signal of 94 Mc/s and adjust cores of L2 and L1 for maximum output. Repeat above operations and check calibration.



Top view of chassis showing location of i.f.t.s and f.m. coil adjustments.

DISMANTLING

Removal of Chassis

Set the tuning control so that the pointers are near the right-hand side of the tuning scale (when viewed from the rear). Remove control knobs, the f.m. aerial plug, the a.m. aerial plug and the octal plug.

Remove the two bolts securing chassis to cabinet. Then gently ease the chassis back about ½-in. and lift the pointer drivers off their respective carriages.

Removal of f.m. Sub-chassis

Turn the tuning capacitor to minimum. Remove the two fixing bolts on either side of the slider return spring. Remove the screw at the top of the slider and carefully lift out the core from the coil L3 adjacent to the screw.

After removing the four screws at the corners of the sub-chassis, the whole unit may be lifted in an arc, hinging on the flexible leads at the rear.

Re-assembly should present no difficulty if it is remembered that the core of L3 must be free to move in the coil. The holes for the fixing bolts are elongated and the top of the slider is slotted to give the necessary latitude for aligning the core in the coil.

Removal of Coil Deck

Electrical operations: (A) Aerial section. Remove the following connections—coaxial inner from tag 1 of S1C, the coaxial outer from tag C, the green lead from tag C, the yellow lead from tag F, the lead from pin 2 of V3, the lead from VC1 stator, the connection to frame aerial socket and lead to a.m. aerial socket.

(B) Oscillator section.—Remove:—red lead from tag 1 of S1F, screened lead from tag 3 of S1K, orange lead from tag E, blue lead from tag B, and disconnect red lead from tag D. Remove screened lead from junction of R22/R23, screened lead, from junction of R34/R35, green lead from tag A, lead from VC2 stator, earthing braid from the frame of VC1/VC2. Note that certain of the above connections must be removed from the old coil deck and replaced on the new one.

Mechanical operations: Turn waveband switch to "Gram," unbolt and remove the slider switch operating lever from the end of the switch operating bar. Unscrew the switch locating plate from the front of the chassis. Withdraw the switch operating bar from the coil deck. Unbolt and remove coil deck.