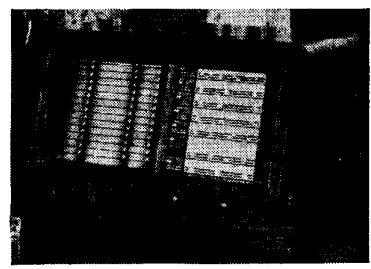
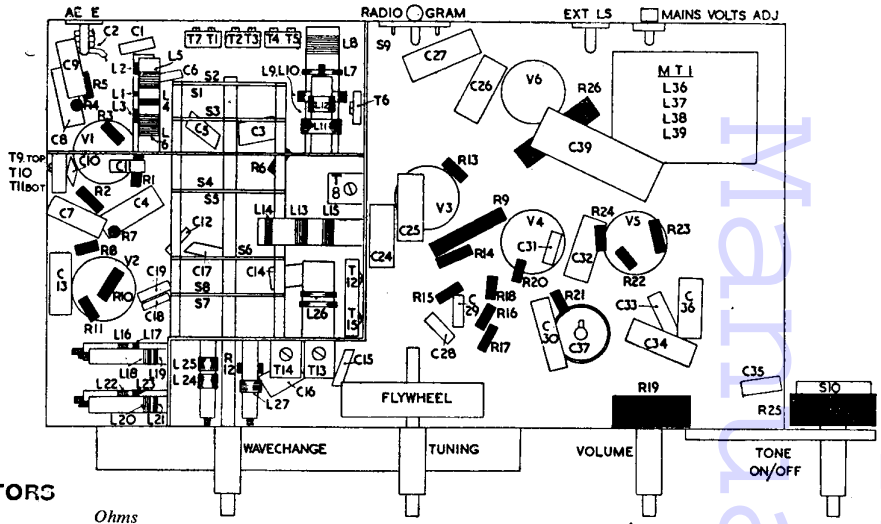
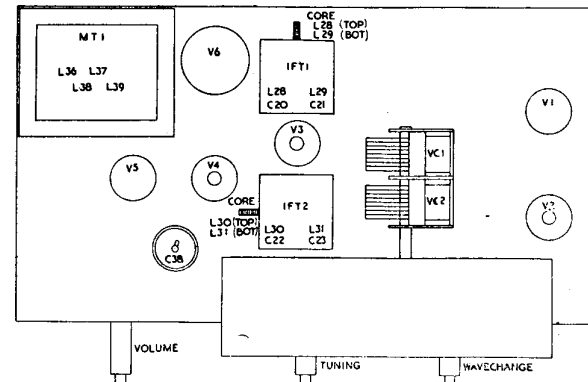


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PILOT BS648



Six-valve, seven-waveband superhet with electrical bandspread on the five short wave ranges. Sockets provided for gramophone pickup and a low impedance type extension loudspeaker. Designed to operate on 110-130, 200-250 volt, 40 to 100 cycle AC mains. Housed in walnut veneered cabinet. Made by Pilot Radio Ltd., 31-37, Park Royal Road, London, NW10.



RESISTORS

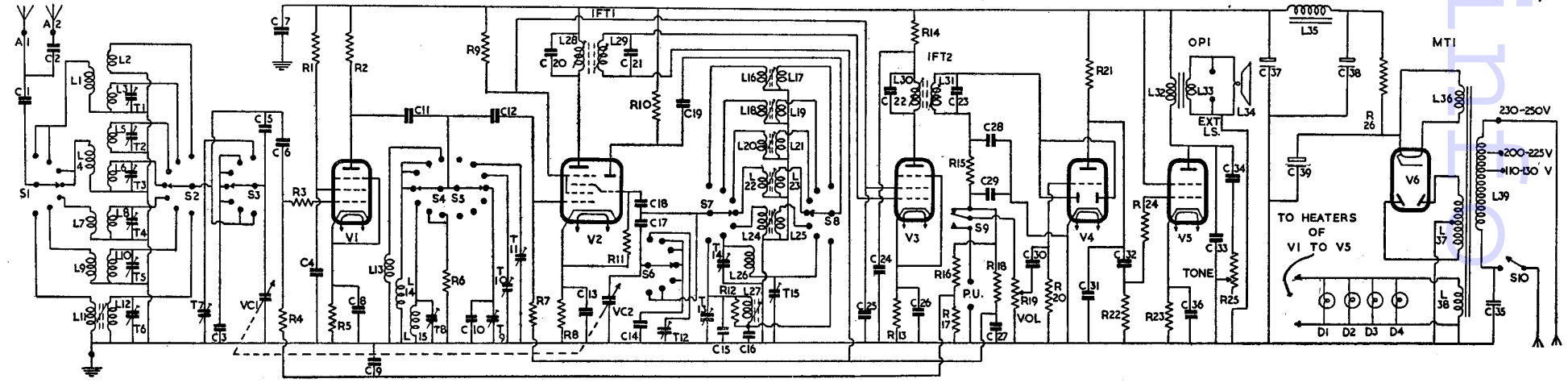
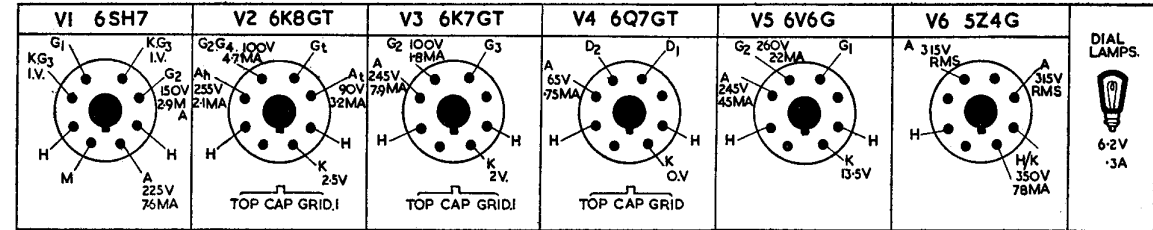
R	Ohms	Watts	R	Ohms	Watts
1	33K		14	1K	
2	3.9K		15	47K	
3	10		16	2.2M	
4	1M		17	470K	
5	100		18	1M	
6	1K		19	500K	Potr.
7	220K		20	10M	
8	220		21	270K	
9	22K		22	470K	
10	47K		23	270	
11	47K		24	4.7K	
12	22K		25	25K	Potr. with switch
13	220		26	390	2

INDUCTORS

L	Ohms	L	Ohms
1	.15	14	.25
4	.15	15	.7
9	1.75	16	.3
10	16.5	17	.3
7	2.2	19	.3
11	150	21	.4
12	26.5	22	Very low
13	.5	24	.2
		25	.5
		26	3.25
		27	10 (Shunted by R12)
		28	7.25
		29	7.25
		30	7.25
		31	7.25
		32	280
		33	.25
		34	2.25
		35	800
		37	450
		39	22 total

CAPACITORS

C	Capacity	Type	C	Capacity	Type
1	500 pF Mica		20	100 pF Silver Mica	
2	Formed with wire around A1 sockets		21	100 pF Silver Mica	
3	310pF Silver Mica		22	100 pF Silver Mica	
4	.1 Tubular 350V		23	100 pF Silver Mica	
5	120 pF Silver Mica		24	.1 Tubular 350V	
6	100 pF Tubular Cer.		25	.1 Tubular 350V	
7	.1 Tubular 350V		26	.1 Tubular 350V	
8	.1 Tubular 350V		27	.1 Tubular 350V	
9	.1 Tubular 350V		28	100pF Tubular Cer.	
10	60 pF Silver Mica		29	100pF Tubular Cer.	
11	500pF Mica		30	.005 Tubular 500V	
12	100pF Tubular Cer.		31	100pF Tubular Cer.	
13	.1 Tubular 350V		32	.05 Tubular 500V	
14	.1 Tubular 350V		33	.002 Tubular 500V	
15	310 pF Silver Mica		34	.1 Tubular 500V	
16	150 pF Silver Mica		35	.01 Tubular 500V	
17	260 pF Silver Mica		36	.1 Tubular 500V	
18	120 pF Silver Mica		37	16 Electrolytic 450V	
19	60 pF Tubular Cer.		38	16 Electrolytic 450V	
	300 pF Mica		39	8 Electrolytic 500V	



Continued overleaf

AERIAL is fed to S1 and thence to coupling coils L3 (SW), L6 (LW) and through C1 to MW tuned coil L5. L1, T7 (MW) and L2, T8 (LW) are IF filters shunted across aerial input and earth.

L4 (SW), L5 (MW), L7 (LW) are the grid coils and S2 switches them to tuning capacitor VC1 and to g1 of frequency changer V1.

T1 (SW), T2 (MW) and T3 (LW) are trimmers. AVC voltages, decoupled by R7, C8, R21, C24, are fed through the MW and LW tuned coils to g1 of V1. Cathode bias is provided by R3, decoupled by C3. Screen (g2, g4) voltage is obtained from potential divider formed by R1, R2 and is decoupled by C2. L14, T9, which form the primary of IFT1, are in the hexode anode circuit.

Oscillator is connected in a parallel-fed tuned anode circuit. L9 (SW), L11 (MW), L13 (LW) are the anode coils and S4 switches them to tuning capacitor VC2 and through C5 to oscillator anode of V1, of which R5 is the load resistor. T4 (SW), T5 (MW), T6 (LW) are trimmers and C6 (MW), C7 (LW) padders. VC3, which is shunted across L9, T4, is the SW bandspread tuning capacitor. Although this control can be used to bandspread any portion of the 16 to 50 metres band the dial is calibrated only for the 17, 20, 25 and 30 metre bands.

The grid reaction coils L8 (SW), L10 (MW) and L12 (LW) are switched by S3, through C4, to oscillator grid (Gt) of V1. Automatic bias for oscillator grid is developed on C4 with R4 as leak resistor.

IF amplifier operates at 450 kc/s. L15, T10, the secondary of IFT1, applies signal and AVC voltages to grid of IF amplifier valve V2. R22, C9 provide decoupling of the AVC line to grid of V2. Cathode bias is provided by R8 and decoupled by C10. Screen voltage is obtained from R6 and is decoupled by C11. Suppressor grid is strapped to cathode. L16, T11, which form the primary of IFT2, are in the anode circuit.

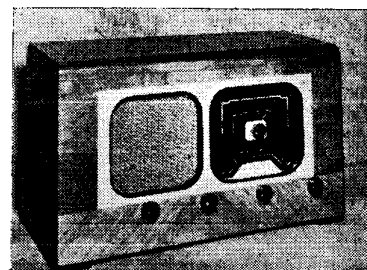
Signal rectifier. L17, C16, the secondary of IFT2, feeds signal to one of diodes of V3. R11 is diode load resistor and R12, C13, C14 form an IF filter.

AVC. C15 feeds signal from primary of IFT2 to second diode of V3. R14, R15 form a tapped load resistor. Full AVC voltages, decoupled by R7, C8, R21, R24, are applied to g1 of V1. A lower AVC voltage, decoupled by R22, C9 and obtained from junction of R14, R15, is applied to grid of V2. The cathode bias developed across R10 provides the delay voltage for the AVC diode.

AF amplifier. C12 feeds rectified signal to R9, the volume control, and thence through R23 to grid of triode section of V3. Cathode bias is provided by R10 decoupled by C20. R13 is the anode load resistor and C17 anode RF bypass capacitor.

Pickup. Sockets are fitted across the volume control R9 for the connection of any high impedance type gramophone pickup.

Output stage. C18 feeds signal through R18 and stopper resistor R17 to grid of pentode output valve V4. R16 is the grid resistor and C21 provides a variable top cut tone control. Cathode bias and negative feedback voltages are provided by R20. Screen voltage is obtained from HT line, through stopper resistor R19. L19, the primary of OP1, the output matching transformer, is in the anode circuit of V4, the HT for which is obtained direct from the reservoir capacitor C23. C19 is a fixed



tone correction capacitor. L20, the secondary of OP1, feeds into an 8-inch PM loudspeaker, L21. Sockets are fitted on L20 to allow the use of a low impedance type extension speaker. The internal speaker of the receiver may be silenced by withdrawing plug, S5.

High tension is provided by a directly heated, full-wave rectifier V5. L23, the HT secondary of the mains input transformer, MTL, provides its anode voltages and L22 its heater current. Choke-capacity smoothing is provided by L18, C22, C23. C25 is an RF bypass capacitor.

Heaters of V1 to V4 and dial lights obtain their current from L24.

L25, the primary of MT1, is tapped for input voltages of 200-210, 220-230, 240-250 V, 50-100 c/s AC. S6, which is ganged to the volume control spindle, is the ON/OFF switch.

Chassis removal. Remove the four push-on control knobs and rear panel. Unplug loudspeaker cable from receiver chassis. Unscrew and remove the single chassis retaining bolt located at centre of rear of chassis.

Note: later versions of this chassis have the following modifications:

- (1) AVC line decoupling—R21, C24, R22 omitted.
- (2) Grid circuit of V3—R23 omitted.
- (3) RF bypass capacitor C25 across HT supply omitted.
- (4) Anode stopper resistor of 100 ohms inserted between anode V4 and L19 of OP1.

TRIMMING INSTRUCTIONS

Apply signal as stated below	Tune Receiver to	Trim in Order stated for Max. Output
(1) 450 kc/s to g1 of V1, via .01 mF with VC2 short circuited	—	T12, T11, T10, T9
(2) 450 kc/s to AE socket, via dummy aerial	—	T7 for minim.
(3) 600 kc/s as above	500 metres	Core L11
(4) 1.304 mc/s as above	230 metres	T5, T2, repeat (3) and (4)
(5) 158 kc/s as above	1898 Metres	Core L13
(6) 334 kc/s as above	898 metres	T6, T3, repeat (5) and (6)
(7) 17.65 mc/s as above but with VC3 at min. capacity	16.9 metres	T4, T1
(8) LW rejector circuit to eliminate any het on the LW band	should be set rodyne whist	by adjusting T8 le which is found

AERIAL is connected through C1 to S1, when using A1 socket or through C2, C1 to S1, when A2 socket is used. S1 switches the aerial to coupling coils L1, L4, L7 (SW), L9 (MW), L11 (LW).

L2, L3, L5, L6, L8 (SW), L10 (MW), L12 (LW) are the grid coils which are switched by S2, through C6 and grid stopper resistor R3, to g1 of RF amplifier V1, and through C5 to tuning capacitor VC1. S3 is used to bring in trimmer T7 across VC1 on the lowest SW range (13 to 16 metres) and to place C3 across VC1 on the remaining four SW ranges. On MW and LW ranges C5, which is in series with VC1 on the SW ranges, is short circuited by S3. T1 to T7 are the aerial trimmers. AVC is applied to g1 of V1 through grid resistor R4 and is decoupled by C9.

Cathode bias is provided by R5 decoupled by C8. Screen voltage is obtained from R1 and decoupled by C4 and suppressor gri is connected to cathode. R2 is anode load resistor.

C11 feeds signal at anode V1 to S4, S5, which are used to switch in circuit the intervalve coupling coils L13, L14, L15 and associated trimmers T8, T9, T10, T11, which are used on the SW ranges, and resistor R6 for the MW and LW ranges. The signal developed across these circuits is then fed by C12 to g1 of frequency-changer V2. AVC is applied to g1 through grid resistor R7 and is decoupled by C27. Cathode bias is provided by R8, decoupled by C13.

Screen (g2, g4) voltage is obtained from R9 and decoupled by C25. L28, C20, which form the primary of IFT1, are in the hexode anode circuit.

Oscillator is connected in a tuned-grid parallel-fed HT circuit. L16, L18, L20, L22, L24 (SW) and L26 (MW), L27 (LW) are the grid coils and these are switched by S7, through C18, to grid of triode oscillator section of V2, and through C17 to tuning capacitor VC2. S6 is used to switch in trimmer T12 across VC2 on the lowest SW range (13 to 16 metres), and C14 on the remaining four SW ranges. On MW and LW ranges C17, which is in series with VC2, is short circuited by S6.

The SW oscillator circuits are trimmed by their adjustable iron dust cores and no padding capacitors are incorporated. On MW, however, T14 is trimmer and T15 is padder. The LW coil L27, although of the permeability tuned type, is provided with T13, C15 as trimmers and C16 as fixed padder. Padding adjustments are made by means of its iron dust core. L27 has a damping resistor R12 connected across it. Bias for oscillator grid is developed on C18 with R11 as leak resistor.

The anode reaction voltages are developed inductively on L17, L19, L21, L23, and L 25 on the SW ranges, but capacitively across T15 and C16 on the MW and LW ranges. S8 switches the reaction voltages through C19 to oscillator anode of V2. R10 is the anode load resistor.

IF amplifier operates at a frequency of 451 kc/s. L29, C21, the secondary of IFT1, feeds signal and AVC voltages to grid of IF amplifier V3. R18, C27 decouple the AVC line. Cathode bias is provided by R13, decoupled by C26. Screen voltage is obtained from R9 and decoupled by C25. Suppressor grid is connected to cathode. L30, C22, which form the primary of the IFT2, are in the anode circuit, the HT for which is decoupled by R14, C24.

Signal rectifier. L31, C23, the secondary of IFT2, feeds signal to the strapped diodes of V4,

R19, the volume control, shunted by R16, R17, forms the diode load resistor and R15, C28, C29 a filter circuit.

Pickup. Sockets are fitted to allow a high impedance gramophone pickup to be used.

When S9 is in the gram. position, then pickup is connected across the volume control R19 and the radio signal is disconnected. Similarly when S9 is switched to radio, then the pickup is disconnected from across R19. This enables the pickup to be left permanently plugged in.

AVC is provided by the DC component of the rectified signal. Full AVC voltage is fed by R18 to grids of V2 and V3 and approximately one fifth, from potential divider formed by R16, R17 to grid of V1. C9, C27 are decoupling capacitors.

AF amplifier. C30 feeds signal from volume control R19 to grid of triode section of V4. Negative bias for grid is developed on C30 with R20 as leak resistor. Cathode is connected down to earth. R21 is the anode load resistor and C31 anode RF bypass capacitor.

Output stage. C32 feeds signal from anode V4 through grid stopper R24 to grid of output tetrode V5. R22 is grid resistor. Cathode bias is provided by R23, decoupled by C36. C36 is a fairly low value capacitor and consequently negative feedback is introduced in the cathode circuit to a greater degree at the lower than at the higher frequencies.

Screen voltage is obtained direct from HT line. L32, the primary of OP1, the output matching transformer, is in the anode circuit of V5. C33 provides fixed, and C34, R25 variable tone control. L33, the secondary of OP1, feeds into an 8 inch energised loudspeaker, L34. Sockets are fitted on L33 for connection of a low impedance type extension loudspeaker.

High tension is provided by an indirectly heated full-wave rectifier V6. L37, the HT secondary of the mains input transformer MT1, supplies its anode voltages and L36 its heater current.

Continued on page 15

TRIMMING INSTRUCTIONS

Apply signal as stated below	Tune receiver to	Trim in order stated for maximum output
(1) 451 kc/s to g1 of V2 via .01 capacitor	—	Core L31, L30, L29, L28
(2) 22 mc/s to AE socket via dummy aerial	22 mc/s calibration mark on dial plate	T12, T7
(3) 18 mc/s as above	18 mc/s mark	Core L16, repeat (2) and (3)
(4) 15.4 mc/s as above	15.4 mc/s mark	Core L18, T11, T1
(5) 12 mc/s as above	12 mc/s mark	Core L20, T10, T2
(6) 9.7 mc/s as above	9.7 mc/s mark	Core L22, T9, T3
(7) 6.1 mc/s as above	6.1 mc/s mark	Core L24, T8, T4
(8) 1.4 mc/s as above	1.4 mc/s mark	T14, T5
(9) 600 kc/s as above	600 kc/s mark	T15, repeat (8) and (9)
(10) 300 kc/s as above	300 kc/s mark	T13, T6
(11) 200 kc/s as above	200 kc/s mark	Core L27, L12 and repeat (10) and (11)