FERGUSON RADIOGRAMOPHONE MODEL 653RG

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SERVICE MANUAL

SPECIFICATION

Description

Printed circuit AM/FM radiogramophone designed for AC operation. A six-valve (including rectifier) superheterodyne circuit is employed covering Medium, Long and VHF waveranges. Rotary-type wavechange switching is employed and the receiver incorporates capacitance tuning on all waveranges with a combined AM/FM tuning control. Internal aerials are fitted with socket provision for external aerials to be connected if required. The On-Off switch is combined with a continuously variable tone control.

Mains Supply

AC mains, 200-250 volts, 50 cycles per second.
Power consumption
Radio: 50 watts approximately.
Gram: 65 watts approximately.

Waverange Coverage

Medium: 188—550 Metres.
Long: 1100—1920 Metres.
VHF/FM: 87·2—101 Mc/s.

Valves

V1 **UCC85**—FM RF amplifier and mixer oscillator
V2 **UCH81**—{FM IF amplifier and FM audio amplifier; AM frequency changer}
V3 **UF89**—AM/FM IF amplifier
V4 **UABC80**—AM/FM detector, AGC and audio amplifier
V5 **UL84**—Audio output
V6 **UY85**—Half-wave rectifier

Record Changer

BSR Monarch UA14 fitted with turnover Monaural cartridge type TC8M, with sapphire styli TC8G (78) and TC8R (LP).

Output Power

2 Watts.

Loudspeaker

Permanent magnet, 8 inches × 5 inches elliptical. Speech coil impedance of 3 Ω. Extension sockets are provided.

Cabinet Dimensions

38¼ inches wide × 16 inches deep × 22¾ inches high including legs.

ALIGNMENT DATA

The chassis is directly connected to one side of the mains supply. When connecting a signal generator into circuit, isolating capacitors of adequate working voltage must be used.

AM CIRCUITS

IF Alignment

Switch the receiver to MW, turn tuning gang to minimum capacitance position and volume control to maximum. Inject a 470 Kc/s modulated signal through a 0·1μF capacitor at the grid of **V2** (tags 7 and 8 on printed board, see Fig. 1) and adjust **L17, L16, L15** and **L14** for maximum output.

RF Alignment

MW must be aligned first. Signals to be injected via a loop loosely coupled to the ferrite-rod aerial. With the tuning gang at maximum, set cursor to the right-hand edge of the scale lining. Pad and Trim markers are provided on MW and a Calibration check point on LW.

Range	Frequency	Cursor Position	Adjust	
MW	580 Kc/s	Pad Marker	L10	L8*
	1400 Kc/s	Trim Marker	C36	C23
LW	220 Kc/s	Tune to Signal / Check Calibration	C38	L9†

* Adjust by sliding RING along aerial rod.

† Adjust by sliding COIL FORMER along aerial rod.

FM CIRCUITS

IF Alignment

The following procedure is based on the use of a signal generator providing Band II coverage, also 10·7 Mc/s AM (30% modulated) and 10·7 Mc/s FM (25 Kc/s deviation) signals, at an output impedance of 75Ω. Throughout alignment the signal input to the receiver should be adjusted to maintain an audio output of about 100mW.

1. Switch the receiver to VHF and allow to warm up for at least ten minutes. Set the Volume control 90° back from maximum and the Tone control to maximum treble.
2. Inject 10·7 Mc/s FM signal via 400pF capacitor to **V2** grid (Tags 7 and 8 on printed board) and adjust **L18, L19, L13** and **L12** for maximum output.
3. AM Rejection Check
   (a) Switch generator to 10·7 Mc/s **AM** and tune **L19** for minimum output.
   (b) Switch generator to 10·7 Mc/s **FM** and check that FM output has been retained.
   Note: If maximum AM rejection does not coincide with maximum FM output, **L19** should be tuned for maximum rejection at the expense of a slight reduction in FM output.
4. Unscrew the core of **L7** in the VHF tuner so that it protrudes from the former by approximately ⅜ in. This can be seen with unit cover in position.
5. Inject 10·7 Mc/s FM signal to the tuner TEST POINT (see Fig. 1). Adjust **L6** for maximum output and then peak **L7**.

RF Alignment

Check that the cursor coincides with the right-hand end of the scale lining with the tuning gang at maximum capacitance position.

1. Adjust tuning control to set cursor to 91 Mc/s on scale.
2. Inject 91 Mc/s FM signal at the aerial sockets and tune in signal by adjusting **L5**. If two peaks occur within the tuning range, that obtained with the core nearest the coupling winding **L4** at the top end of the former must be chosen.
3. Adjust **L3** for maximum audio output with core towards bottom of coil former.
4. Check calibration over range.

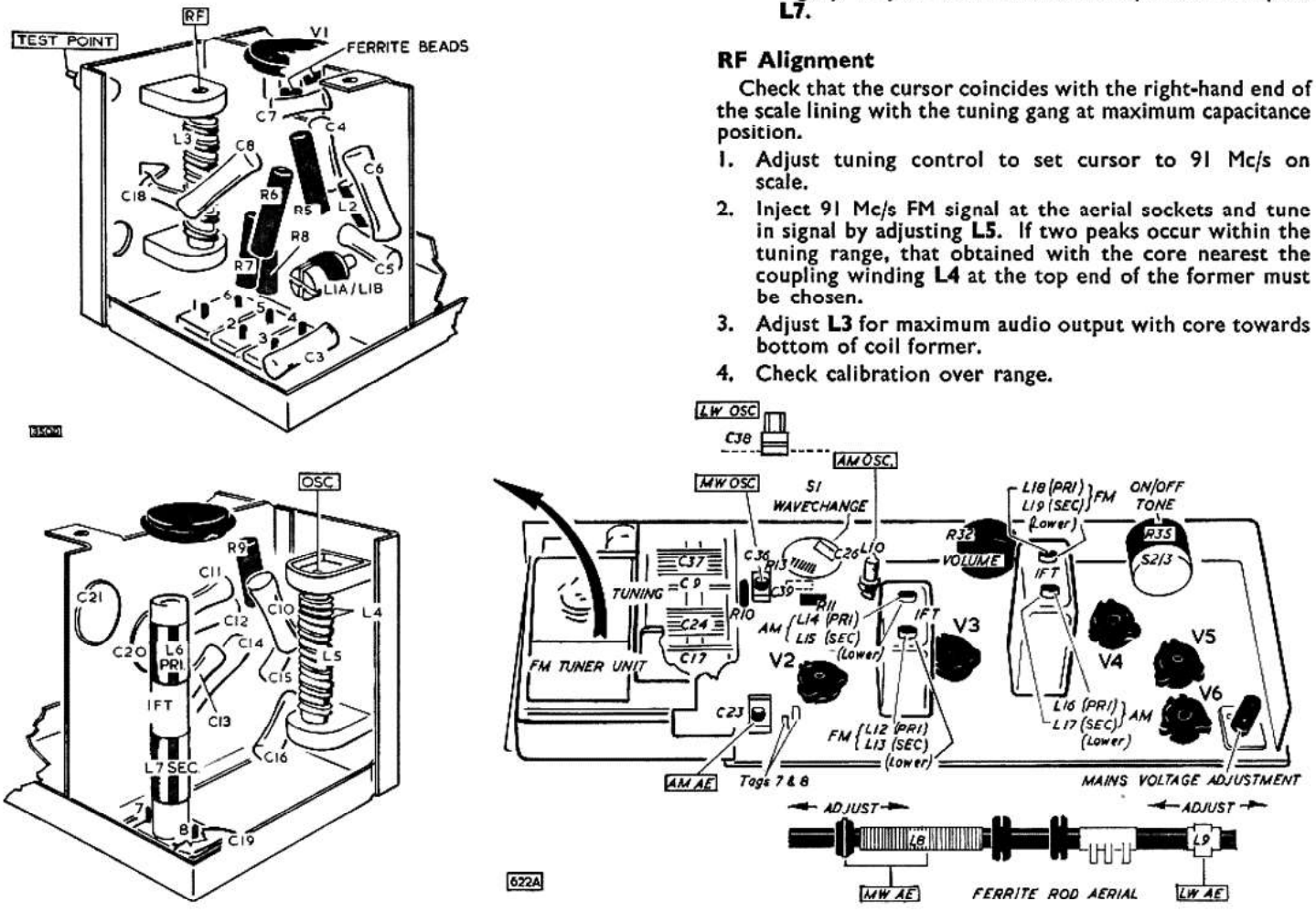

Fig. 1. VHF Tuner Unit and main chassis, showing trimming adjustments, etc., required for Alignment. For easy reference, RF alignment positions are shown in rectangles. Where practicable, components not shown in Fig. 3 are also indicated.

Figures adjacent to valve electrodes denote valve pin connections.

Ringed figures show printed board connecting points (see Fig. 3).

Figures in rectangles indicate voltages measured with a 20,000 Ω/volt meter.

DC resistance readings are shown against inductances where these are 1 Ω or greater.

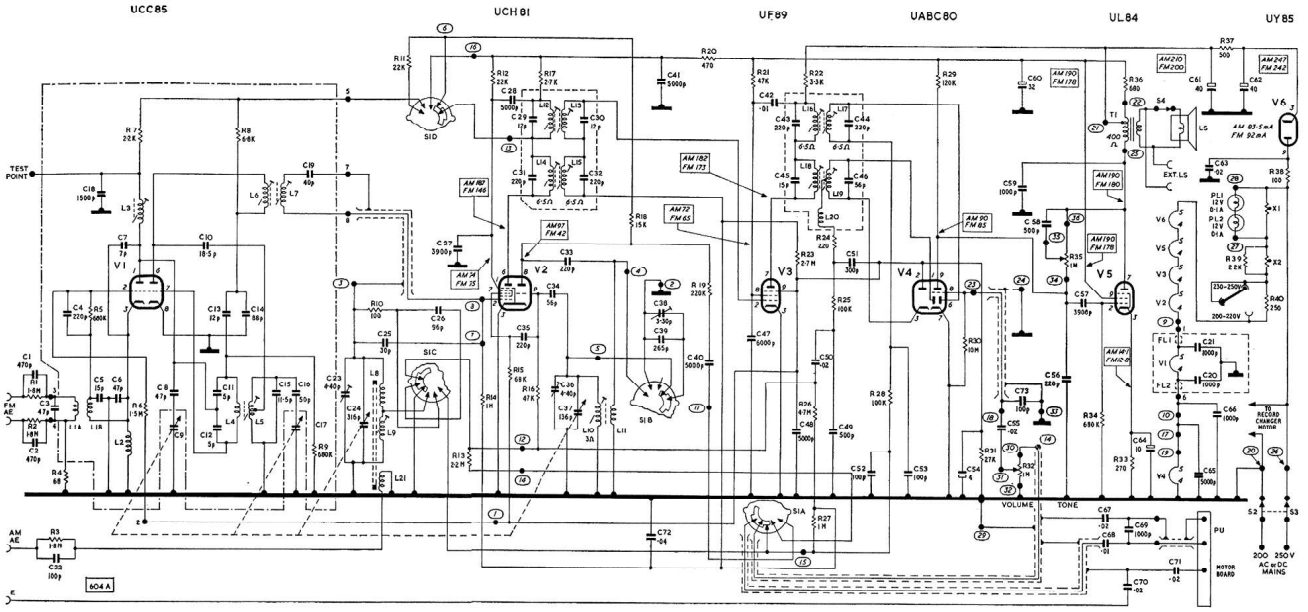

Fig. 2. CIRCUIT DIAGRAM OF MODEL 653RG.

CIRCUIT NOTES

V2 TRIODE SECTION

FM, operating as audio amplifier: FM audio feed from **C50** through **R16** to triode grid. **C33** in anode circuit is earthed, short circuiting oscillator feedback coil **L11** through **S1D** (Contacts 5 and 4), and functions as an RF bypass. The audio voltage developed across **R11** in series with **R18**, which comprise the anode load, is applied through **R19, C40, S1B** (Contacts 9 and 8) to volume control **R32**.

AM, operating as a tuned grid oscillator: Oscillator grid leak **R16** is earthed through **S1A** (Contacts 1 and 3). **R11** is shorted out by **S1C** (Contacts 7 and 6) and HT is fed through **R18** to oscillator anode. As **S1D** (Contacts 4 and 5) are open circuited, feedback coil **L11** is coupled to the oscillator anode by **C33**. **C40** is disconnected from **R32** (volume control) by **S1B** (Contacts 9 and 8) and **R32** connected through **S1B** (Contacts 7 and 8) into the AM detector circuit.

AUTOMATIC GAIN CONTROL

FM—AM AGC line is shorted out by **S1A** (Contacts 6 and 3) connecting **R27** to earth in parallel with **C72**. This provides grid current bias to **V2** and **V3** control grids. To improve control, the voltage across stabilising capacitor **C54** of the ratio detector circuit is also applied to **V1A** via **R6, V2** injector grid (pin 7) through **R15** and direct to **V3** suppressor grid (pin 9). A fraction of this voltage is also applied to **V2** and **V3** control grids by **R23**.

AM—Conventional system from diode load **R32** (volume control) through **R14, R27**.

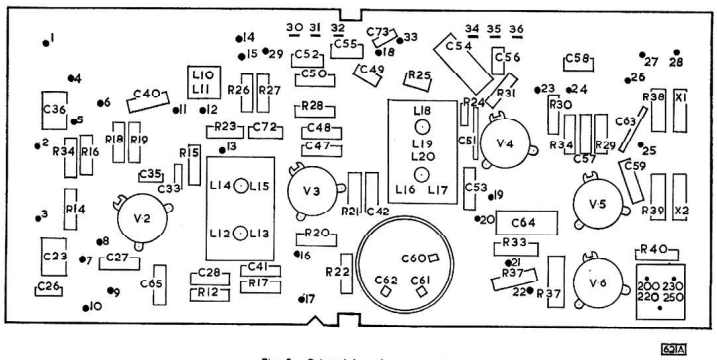

Fig. 3. Printed board components.

SERVICE NOTES

ACCESS TO THE CHASSIS

1. Remove cabinet back (two screws) and pull off control knobs.

   Note the spring fitted to each control knob ensures a tight fit to eliminate the possibility of a live spindle accidentally becoming accessible to the user. Each knob may be removed with the aid of a length of stout cord placed round the knob boss. Ensure that the knob is a tight fit when re-assembling.

2. Unscrew two chassis fixing nuts from front edge of chassis.

3. Disconnect mains supply leads from gram deck at terminal block and unplug leads from pick-up.

4. Unplug FM aerial and remove aerial panel (two screws.)

5. Unplug output transformer leads and note arrangement for re-assembly.

6. The chassis is now free and may be removed complete with glass tuning scale and aerial input panel.

PRINTED PANEL SERVICING

When servicing the printed circuit panel, it must be remembered that excessive heat can loosen the bond between the copper conducting circuits and the insulating board. Special care must be exercised when soldering connections to the " wiring " side of the panel. When replacing a resistor or capacitor, cut out the faulty component so that as much as possible of the original lead-out wires remain so that these may be used as connections to the new component, thus avoiding whenever possible, soldering to the printed conductors. Use a small low-consumption iron and do not apply the bit for longer than is necessary to produce a sound joint.

The electrolytic C60/C61/C62 is secured on the panel by means of clip lugs which also make electrical connections to the printed circuit. Use a heavier type iron to remove this component, applying heat and pressure to the lugs and not to the printed circuit so that when the solder melts, the lugs are pressed clear of their connecting points. A small stiff-haired brush will sometimes assist in breaking these connections.

If a section of the printed conductor becomes damaged or fused, scrape off the damaged portion and restore the connection with a jumper wire on the component side of the panel. Whenever the necessity arises, however, to solder directly to a printed conductor, use a 60 : 40 resin-cored solder and make the joint as quickly as possible to avoid overheating. **Do not use a corrosive type flux.**

DRIVE CORD REPLACEMENT

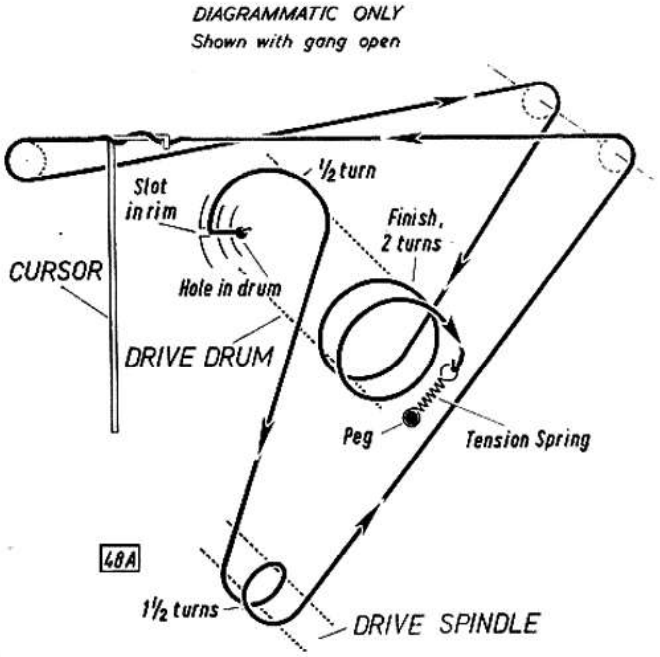

Fig. 4. The arrangement of the Tuning Drive Cord.

Take approximately 60 inches of nylon braided cord and knot one end. Thread cord through hole in rear of drive drum, feeding through from front until the knot anchors. Take end through slot in rear rim and wind as shown in diagram.

To finish: wind two turns clockwise round drum and take cord through slot. Slip cord round one end of the tension spring and peg the other end of spring to the drum. Ensure that the spring is exerting tension before knotting cord. Finally, fit cursor as shown in diagram.

CAPACITORS

All 350 Volt working, 20% tolerance unless otherwise stated.

Ref.	Value	Rating	Function and Part No.
C1	470pF	400V AC	FM aerial isolating
C2	470pF	400V AC	
C3	47pF 5%		L1A tuning
C4	220pF		V1 grid coupling
C5	15pF 5%		L1B tuning and part V1 neutralizing
C6	47pF 5%		
C7	7pF ±½pF		Part V1 neutralizing—C070H35
C8	47pF 5%		VHF amplifier padder
C9	Variable		VHF amplifier tuning *
C10	18·5pF ±½pF		Oscillator feedback coupling—C185XH35
C11	5pF ±½pF		Oscillator/mixer signal injection—C050H35
C12	5pF ±½pF		
C13	12pF 2½%		V1 IF/mixer feedback
C14	88pF 2½%		
C15	11·5pF 2½%		Part oscillator tuning
C16	50pF 5%		Oscillator padder
C17	Variable		Oscillator tuning *
C18	1500pF		V1 HT decoupling
C19	40pF 5%		Part L7 tuning
C20	1000pF +80—20%	500V	V1 heater decoupling
C21	1000pF +80—20%	500V	
C22	100pF		AM aerial isolating
C23	4-40pF Pre-set		MW aerial tuning—25547
C24	Variable		Aerial tuning *
C25	30pF 5%		Part L7 tuning
C26	96pF 2%		LW aerial tuning
C27	3900pF	500V	V2 SG decoupling
C28	5000pF	500V	V2 heptode neutralizing
C29	12pF 5%		L12 tuning
C30	12pF 5%		L13 tuning
C31	220pF 2%		L14 tuning
C32	220pF 2%		L15 tuning
C33	220pF		V2 oscillator anode coupling
C34	56pF	500V	V2 oscillator grid coupling
C35	220pF		V2 oscillator output coupling
C36	4-40pF Pre-set		MW oscillator trimmer—25547
C37	Variable		AM oscillator tuning *
C38	3-30pF Pre-set		LW oscillator trimmer—13937
C39	265pF 2%		LW oscillator tuning
C40	5000pF 500V		V2 triode output coupling
C41	5000pF	500V	V1, V2 HT decoupling
C42	1000pF	500V	V3 neutralizing
C43	220pF 2%		L16 tuning
C44	220pF 2%		L17 tuning
C45	15pF 5%		L18 tuning
C46	56pF 5%		L19 tuning
C47	6000pF	500V	V3 SG decoupling
C48	5000pF	500V	V3 suppressor grid decoupling
C49	500pF		FM IF by-pass and de-emphasis
C50	·02μF	150V	Audio coupling to V2 (FM)
C51	3000pF 5%		FM IF bypass
C52	100pF	500V	AM IF filter
C53	100pF	500V	
C54	4μF Elec	100V	Ratio detector stabilizing—13210
C55	·02μF	150V	V4 grid coupling
C56	220pF		Part tone control
C57	3900pF	500V	V5 grid coupling
C58	500pF		FM IF bypass
C59	1000pF	400V AC	Tone correction and RF bypass
C60	32μF		HT smoothing†
C61	40μF Elec	275V	HT smoothing†
C62	40μF		HT reservoir†
C63	·02μF	350V AC	Mains RF bypass
C64	10μF Elec	25V	V5 cathode bypass—13222/6
C65	5000pF	500V	Heater RF bypass
C66	1000pF +80—20%	500V	
C67	·02μF	350V AC	PU isolating
C68	·01μF	400V AC	PU isolating
C69	1000pF		PU correction
C70	·02μF	350V AC	Earth isolating
C71	·02μF	350V AC	Motor earth isolating
C72	·04μF	150V	AM AGC decoupling FM limiting
C73	100pF		

* Tuning Gang Part No. 25703.
† Part No. 13237/8.

RESISTORS

All 20%, ¼ watt carbon unless otherwise stated.

Ref.	Value	Tol.	Watts	Function and Part No.
R1	1·8M Ω			FM aerial discharge
R2	1·8M Ω			
R3	1·8M Ω			AM aerial discharge
R4	68 Ω			FM aerial load
R5	680K Ω	10%		V1 grid leak
R6	1·5M Ω	10%		V1 AGC feed
R7	2·2K Ω			V1 HT feed
R8	6·8K Ω			
R9	680K Ω	10%		V1 grid leak
R10	100 Ω			RF damping
R11	22K Ω	10%		Part V2 triode anode load (FM)
R12	22K Ω	10%		V2 SG feed
R13	2·2M Ω	10%		V2 neg. feedback (FM only)
R14	1M Ω			V2 heptode grid leak
R15	6·8K Ω	10%		V2 heptode AGC feed (FM)
R16	47K Ω	10%		Oscillator grid leak (AM) and grid stopper (FM)
R17	2·7K Ω	10%		V2 neutralizing
R18	15K Ω	10%		V2 triode anode load
R19	220K Ω			V2 triode anode coupling (FM)
R20	470 Ω			V1/V2 HT feed
R21	47K Ω	10%		V3 SG feed
R22	3·3K Ω			V3 neutralizing
R23	2·7M Ω			V3 FM AGC feed
R24	220 Ω	10%		Ratio det. tertiary series
R25	100K Ω			FM IF filter
R26	4·7M Ω			Part FM AGC
R27	1M Ω			AM AGC feed
R28	100K Ω			AM IF filter
R29	120K Ω	10%		V4 triode anode load
R30	10M Ω			V4 grid leak
R31	27K Ω	10%		Ratio detector load
R32	1M Ω	Log. Pot.		Volume control—13125/1
R33	270 Ω	10%	½W	V5 cathode bias
R34	680K Ω			V5 grid leak
R35	1M Ω	Lin. Pot.		Tone control—13124/1
R36	680 Ω	10%	½W	HT smoothing
R37	500 Ω	5%	3W	
R38	100 Ω	5%	5W	HT surge limiter
R39	2·2K Ω	10%	½W	X2 shunt
R40	250 Ω	5%	3W	Mains dropper

INDUCTORS AND TRANSFORMERS

Ref.	Function	Part No.
L1A, L1B	VHF aerial input transformer	29232
L2	RF choke	29280
L3	VHF amplifier tuning	25835
L4, L5	VHF oscillator feedback, VHF oscillator tuning	29230
L6, L7	1st FM IF transformer	29233
L8, L9	MW, LW — Ferrite rod aerial	29276
L10, L11	MW and LW oscillator tuning, MW and LW oscillator feedback	25829
L12, L13	2nd FM IF transformer	25834
L14, L15	1st AM IF transformer	
L16, L17	2nd AM IF transformer	25810
L18, L19, L20	Ratio detector transformer	
L21	AM aerial coupling ferrite-rod aerial	29276
T1	Audio output transformer	25486

MISCELLANEOUS

Ref.	Description	Part No.
FL1/FL2	Ferrite beads	34759
LS	3 Ω impedance	16012/10
PL1/PL2	Pilot lamp 12V, 0·1A	33774
S1A-D	Wavechange switch	33983
S2/S3	Mains on/off switch	13124/1
S4	Loudspeaker muting switch	16509
X1/X2	Thermistor, Varite V1010	4558/7

The manufacturers reserve the right to vary specifications or use alternative materials as may be deemed necessary or desirable at any time.

SPARE PARTS LIST

Description	Part No.
Cabinet	33977
Control knobs:	
Tuning, Tone-on/off, Volume	32757/2
Wavechange	32757/3
Spring clips (for above)	45931
Cursor (felt pad 18450/1)	29814
Drive drum (spring clip 37309)	25147
Drive tension spring	10486
FM aerial plug	9291
Lampholder	13305/2
Mains voltage selector	25960
Mains voltage selector plug	25960/1
Scale (clips 25480/1)	33978
Scale diffuser	29813