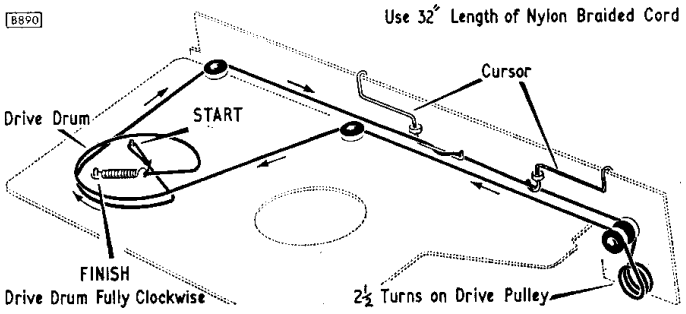
ACCESS FOR SERVICE

Slide open battery cover, then disconnect and take out batteries. Complete access to the printed board may be gained by removing the cabinet back cover which is retained by three countersunk screws in the cabinet base.

For access to the drive cord and the copper side of the printed board, pull off control knobs and unsolder lead on telescopic aerial. Take out five screws and washers securing printed board, then unsolder leads on loudspeaker tag panel. The printed board may then be lifted out without further disconnection.



SERVICING NOTES

To check oscillator operation, use an oscilloscope to measure the peak-to-peak voltage across R10, and compare with the voltage indicated in the Circuit Diagram for a correctly functioning oscillator. An alternative method is to connect a DC voltmeter across R10. If the oscillator is working properly, the voltage should drop slightly when the oscillator section of the tuning gang is short-circuited.

To avoid the risk of short-circuiting resistor R34, in series with the negative supply line, all earthed output connections of test equipment should be suitably isolated from the receiver chassis.

The tuning gang is of special construction and no attempt should be made to clean or repair it. A faulty gang under guarantee should be returned to the nearest Service Depot.

Printed Board Tag Connections

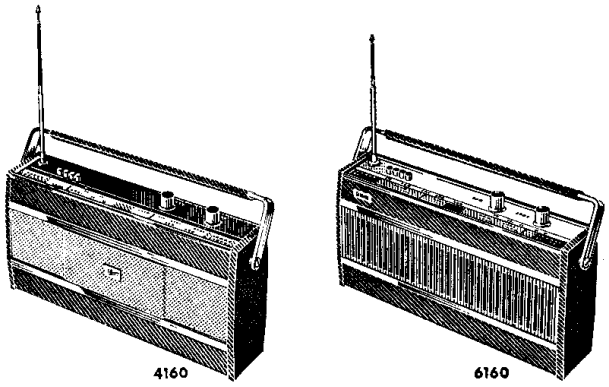
1. To SKT1 'live' contact.
2. To telescopic aerial.
3. To L1.
4. To C17.
5. To L7.
6. To S4A contact 2.
7. To L7.
8. To S4A contact 5.
9. To S4A contact 4.
10. To frame of loudspeaker.
11. To C55.
12. To J1 contact 'c', and C63.
13. To J1 contact 'a'.
14. To C20, C23 and S3a contact 1.
15. To C6 and upper connection of L2
16. To C6 and lower connection of L2.
17. To C10 and upper connection of L4
18. To C10 and lower connection of L4.
19. To C31 and S3A contact 4.
20. To C63.

BRC

SERVICE MANUAL

Price: One Shilling and Sixpence

MARCONIPHONE 4160 & ULTRA 6160



SPECIFICATION

Batteries: Two 9v. Drydex DT7, Ever Ready PP7, Vidor VT7 or equivalents.

Waveranges:

Medium Wave:	190–566 metres (1579–530 kHz)
Bandspread:	185–216 metres (1621–1389 kHz)
Long Wave:	1120–2025 metres (268–148 kHz)
VHF/FM:	87·7–101 MHz

Aerials:

MW and LW:	7" long × ⅜" dia. ferrite rod.
VHF:	8-section telescopic aerial.

External Sockets: Car aerial or VHF aerial. Earphone (15-100 Ω) or tape recorder socket.

Loudspeaker: 4" round, 35 ohm impedance, PM moving coil.

Power Output: 600mW.

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

BRITISH RADIO CORPORATION LIMITED

SERVICE DEPOTS

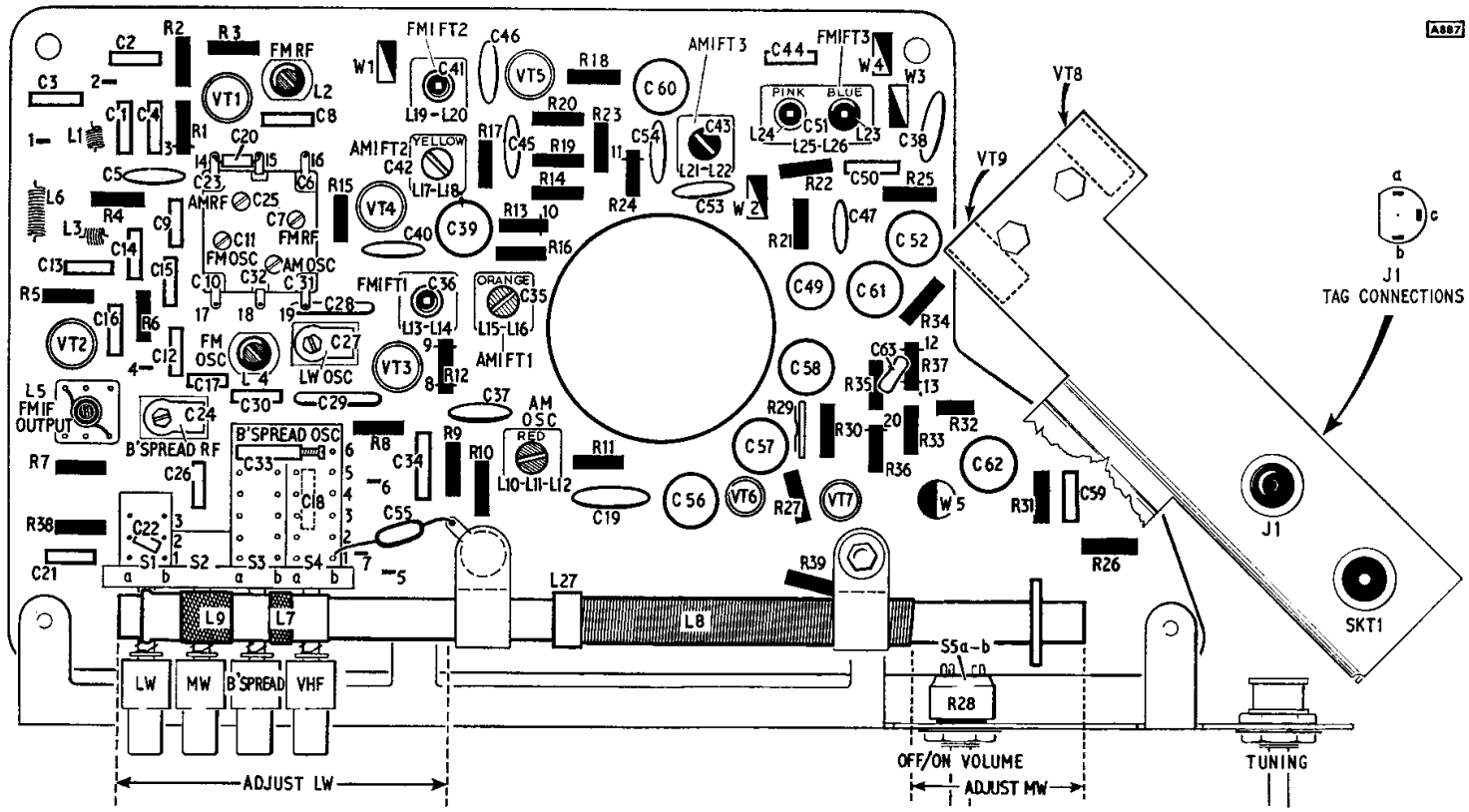
LONDON
PO Box No. 121, Eley's Estate, Angel Road, Edmonton, N.18.
Tel. 01-807 3060 *Ansafone Spares: Tel. 01-807 6332*

BIRMINGHAM
25 Sheepcote Street, 15 *Tel. 021-643 9988*

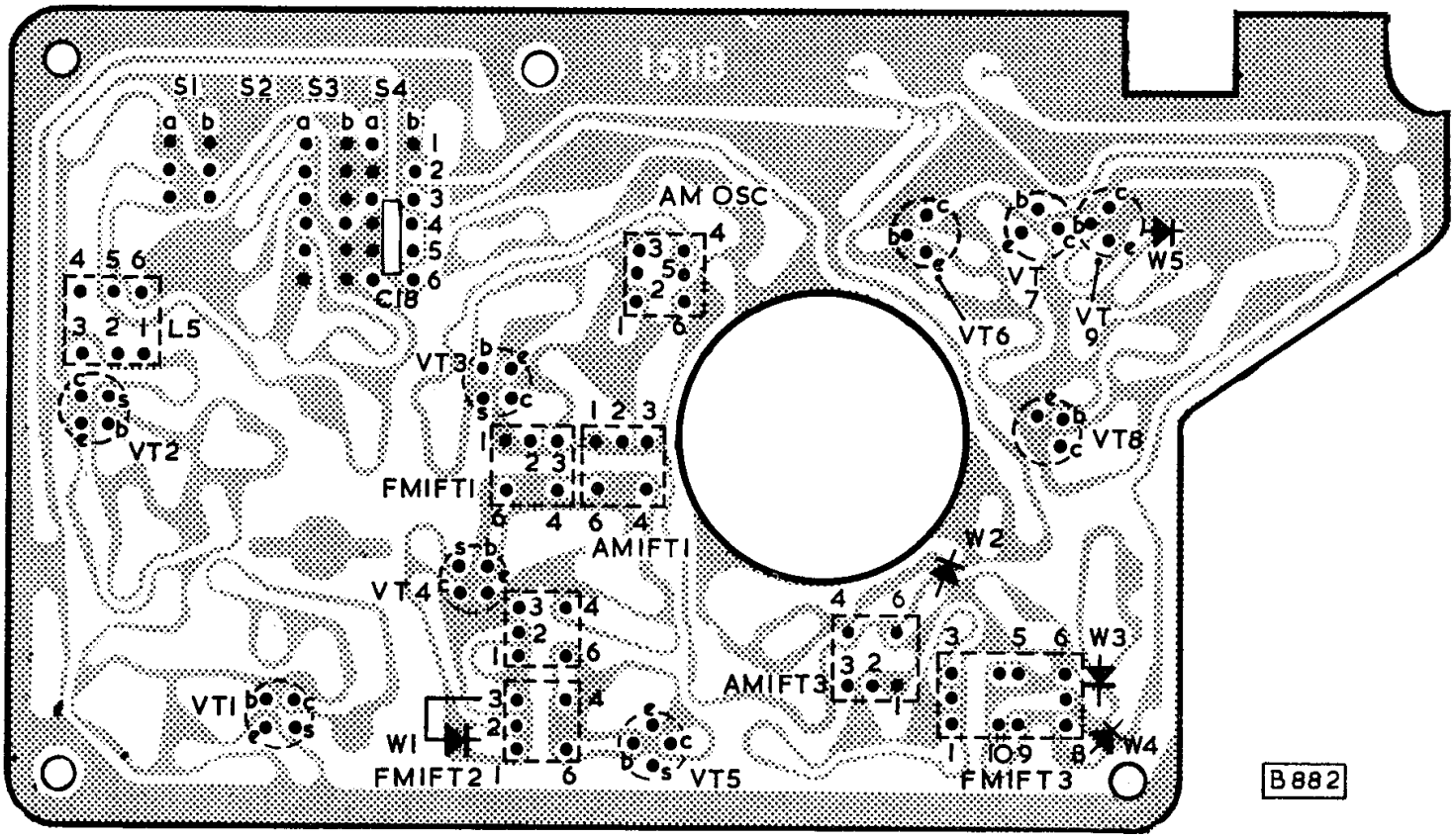
GLASGOW
160/162 Battlefield Road, S.2
Tel. Langside 9251/2/3/4

THORN

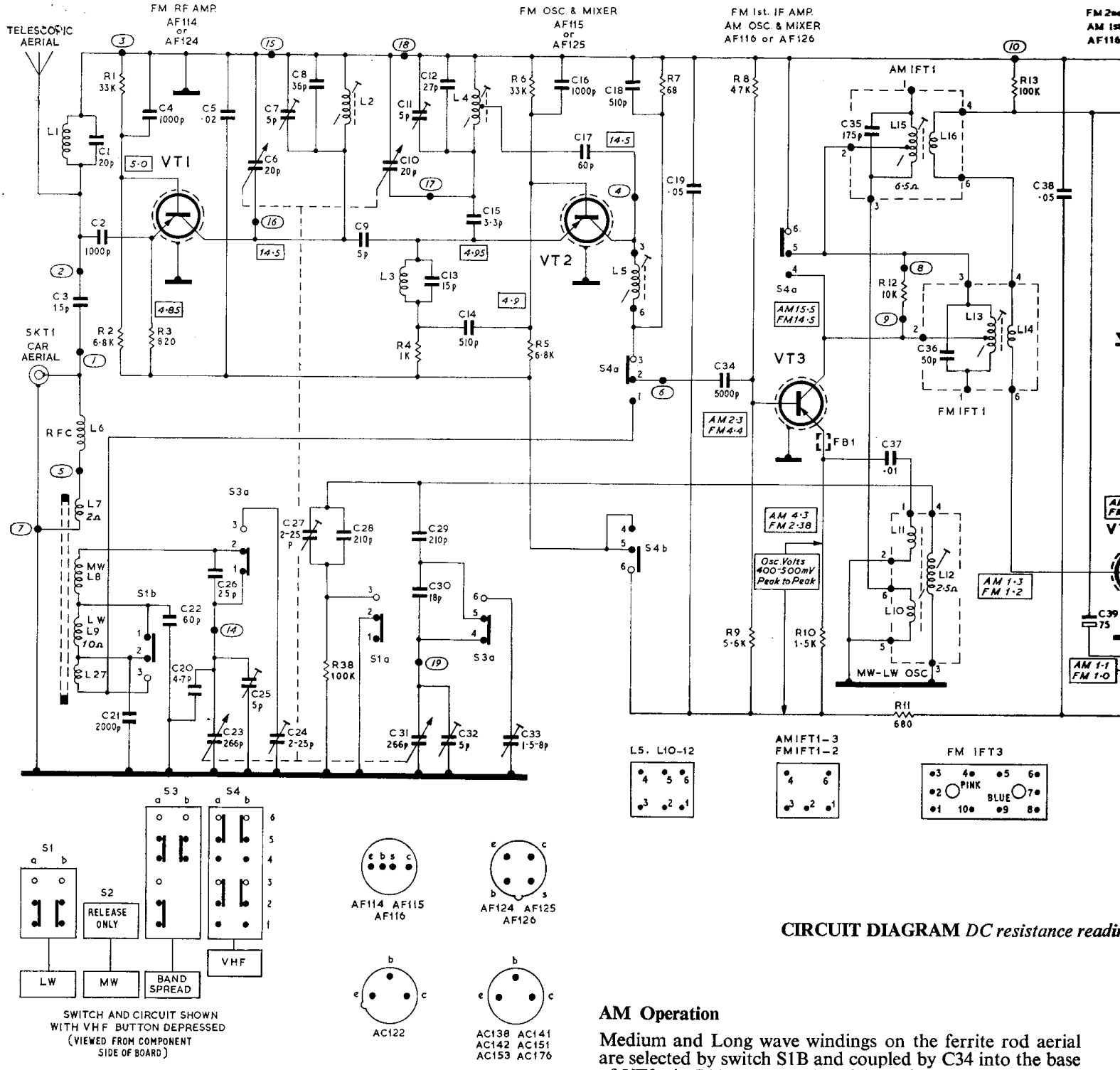
British Radio Corporation Limited is a Member of The Thorn Group



Component Location Diagram



Copper Side of Printed Board (showing transistor and coil connections)



CIRCUIT DIAGRAM *DC resistance readi*

CIRCUIT NOTES

FM Operation

The signal is applied via the coupling capacitor C2 from the VHF/FM tuned circuit L1/C1.

The collector of VT2 is loaded by L5 and tuned by C17. C17 also provides coupling into the oscillator tuned circuit (L4, C10, C11 and C12). C15 provides feedback into the emitter and L3 and C14 form a 10·7 MHz FM IF rejector with C13 acting as an input phase corrector at oscillator frequencies. The 10·7 MHz IF output developed across L5 is fed via S4A, contacts 2 and 3 and C34 to the base of VT3 which operates as an IF amplifier.

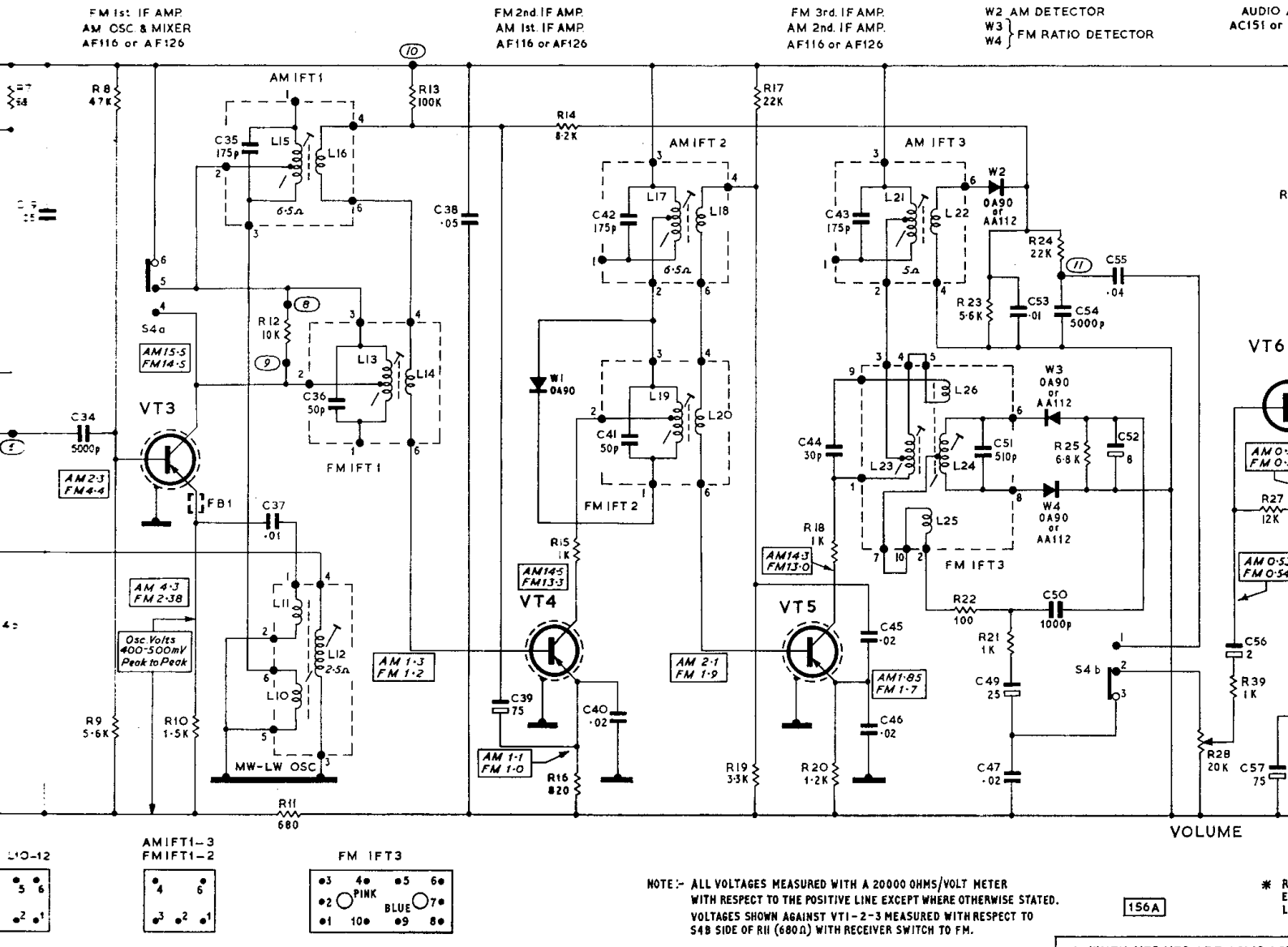
AM Operation

Medium and Long wave windings on the ferrite rod aerial are selected by switch S1B and coupled by C34 into the base of VT3 via S4A, contacts 1 and 2. VT3 operates as an AM oscillator and mixer and VT1 and VT2 are rendered inoperative when S4B disconnects their emitter and bias voltages from the battery positive rail.

Complementary Power Output Stage

PNP and NPN type transistors are used in conjunction with a stabilizing diode to provide a transformerless power output stage giving an audio output of 600 mW.

The audio signal developed across volume control R28 is applied via coupling capacitor C56 to the base of audio amplifier VT6. The amplified signal appearing at the collector of VT6 is directly coupled to the base of driver transistor VT7. The output from VT7 simultaneously drives the bases of both output transistors VT8 and VT9. During positive half-cycles of the signal, NPN transistor (VT9) conducts, resulting in a fall in collector/emitter voltage



CIRCUIT DIAGRAM *DC resistance readings are shown against inductors where these are 0·5Ω or greater. Ringed figures ind*

peration

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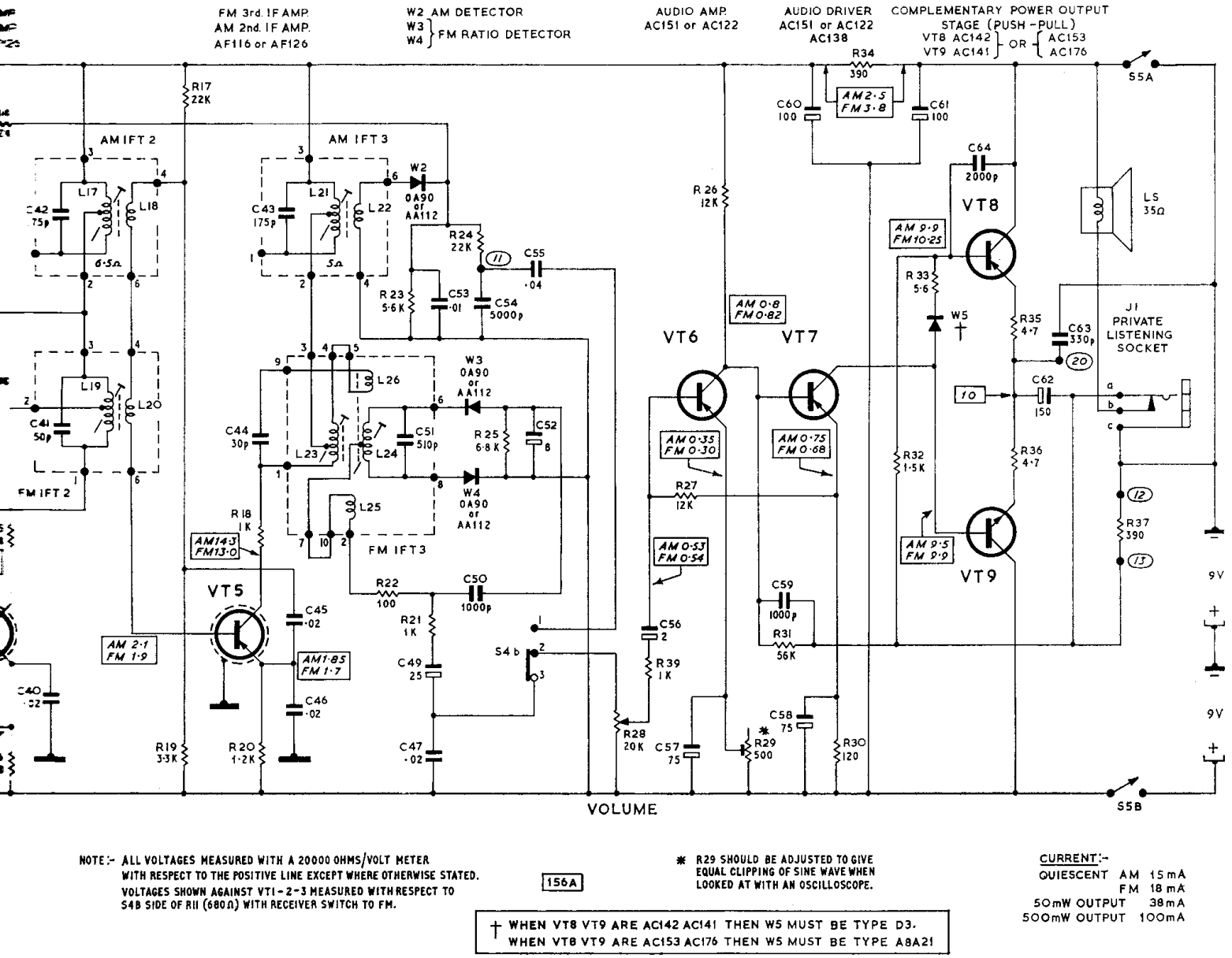
VT7 collector load R32 is returned to the " live " side of the loudspeaker and, as this point is coupled to the emitters of VT8 and VT9 through C62, the input signal to the output stage is virtually applied between base and emitter of both VT8 and VT9.

Diode W5 is biased by VT7 collector current and acts as a variable resistance which is sensitive to voltage and temperature variations. The resistance value of W5 is small compared with R32 and the voltage developed across W5 equals the sum of the nominal output transistor (VT8 and VT9) base/emitter voltages and so determines the correct quiescent operating conditions. During low ambient temperature conditions the resistance of W5 increases thus compensating for falling current of the output transistors. This effect also takes place in the event of falling battery voltage. The diode W5 also assists thermal stability at high temperatures and opposes high current drain from the battery.

Balance

Output the 18 voltage emitter emitter will, th directly potenti VT8 an of VT8 line. due to determi bottom

An alt VT8 an output should at high



NOTE:- ALL VOLTAGES MEASURED WITH A 20000 OHMS/VOLT METER WITH RESPECT TO THE POSITIVE LINE EXCEPT WHERE OTHERWISE STATED. VOLTAGES SHOWN AGAINST VT1-2-3 MEASURED WITH RESPECT TO S4B SIDE OF R11 (680Ω) WITH RECEIVER SWITCH TO FM.

156A

* R29 SHOULD BE ADJUSTED TO GIVE EQUAL CLIPPING OF SINE WAVE WHEN LOOKED AT WITH AN OSCILLOSCOPE.

† WHEN VT8 VT9 ARE AC142 AC141 THEN W5 MUST BE TYPE D3.
WHEN VT8 VT9 ARE AC153 AC176 THEN W5 MUST BE TYPE A8A21

CURRENT:-
QUIESCENT AM 15mA
FM 18mA
50mW OUTPUT 38mA
500mW OUTPUT 100mA

are shown against inductors where these are 0·5Ω or greater. Ringed figures indicate printed board tag connection points.

of VT9. During negative half-cycles of the signal PNP transistor (VT8) conducts, resulting in an increase in collector/emitter voltage of VT9. The loudspeaker is fed via C62.

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Balance Adjustment

Output transistors VT8 and VT9 are series connected across the 18V battery supply and to ensure a balanced supply voltage to each, an adjustment R29 is incorporated in the emitter circuit of VT6. Adjustment of this resistor sets emitter potential and hence collector potential of VT6. It will, therefore, determine the base potential of VT7 which is directly coupled to VT6. This bias decides collector potential of VT7 which in turn controls base voltages of VT8 and VT9. Correct balance is obtained when potential of VT8/VT9 emitter junction is 10V with respect to positive line. The discrepancy from half-battery voltage (9V) is due to the emitter bias voltage developed across R30, which determines the limit of negative signal excursion before bottoming of VT7 takes place.

An alternative method of balancing operating voltages of VT8 and VT9 is by visual observation on an oscilloscope of output waveform at maximum output, when adjustment should be made for symmetry of both waveform and clipping at high outputs.

ALIGNMENT DATA

Connect a 35 ohm output meter in place of loudspeaker, or a 20,000 ohm/volt meter set to a suitable AC range, across the internal loudspeaker terminals. With the volume control set to maximum, maintain audio output at 50mW throughout alignment, except where otherwise stated.

AM ADJUSTMENTS

IF Circuits

Select MW. Inject 475 kHz 30 per cent amplitude modulated signal, via 0.1 μF capacitor, across C23 (tags 14 and 15) the aerial section of the tuning gang.

Tune L21/L22, L17/L18 and L15/L16 for maximum output. Repeat until no further improvement results.

RF Circuits

Check that with the tuning gang fully closed the cursors coincide with the marker pips at the left-hand side of the LW and MW scales.

MW must be aligned first. Inject AM signals (30% amplitude modulated) via a loop loosely coupled to the ferrite rod aerial. Set cursor to 500 metres (600 kHz), inject 600 kHz signal and tune L12 and L8 (slide ring along ferrite rod) for maximum output.

Set cursor to 200 metres (1500 kHz), inject 1500 kHz signal and adjust C32 and C25 for maximum output. Repeat as necessary to obtain correct calibration and maximum output.

Select LW. Set cursor to 1500 metres (200 kHz), inject 200 kHz signal and adjust C27 and L9 (slide coil along ferrite rod) for maximum output.

Luxembourg Bandspread. Switch to "Bandspread" and set cursor at 200 metres. Inject, via loop, 1500 kHz signal and adjust C33 and C24 for maximum output.

Note: Always check Bandspread aerial trimmer (C24) after altering C25 or the tuning ring to L8. Also after reboxing, check that Luxembourg is receivable on Bandspread push-button range: if not readjust MW oscillator trimmer C32.

VHF/FM ADJUSTMENTS

IF Circuits

Select FM. Inject 10.7 MHz (25 kHz deviation) via 0.1 μF blocking capacitor to tag 6 on the printed circuit board.

Peak L24, L23, L19, L13 and L5 for maximum output. Increase signal level by 6db and reduce receiver volume control setting to maintain 50mW output. Switch signal generator to AM and tune L24 for minimum output (AM rejection). Switch signal generator to FM and check that FM output has not been reduced. Repeat above as necessary for maximum FM output and miminum AM output.

Note: L24 should be tuned to the outer peak, i.e. with the core protuding from the top of the can by approximately $\frac{1}{8}$ in. All other cores to be tuned to the inner peak.

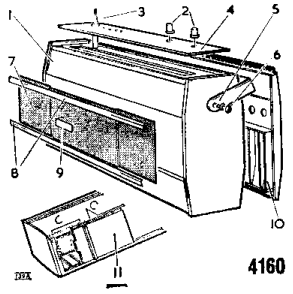
RF Circuits

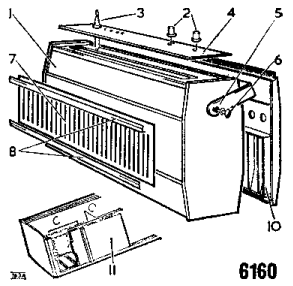
Check that gang is fully closed. Unsolder lead from tag on telescopic aerial and connect the signal generator between this lead and "earth" line. Adjust tuning control to set cursor at 96 MHz and inject 96 MHz signal. Adjust C11 and C7 for maximum output. Set cursor to 88 MHz and inject 88 MHz signal. Adjust L4 and L2 for maximum output. Repeat as necessary to obtain correct alignment.

Note: While tuned to an RF signal check tuning of L5 for maximum output.

REPLACEMENT PARTS LIST

Cabinet Assembly





	4160	6160
1. Cabinet front including items 4-9 inclusive	3M4–838	3M4–829
2. Control knob (clip 3L3–100; felt washer 3L6–066)	3C0–141	3C0–141
3. Telescopic aerial	3F0–060	3F0–060
4. Scale (twinstick 3P8–012)	3A7–406	3A7–404
5. Handle	3A9–058	3A9–058
6. Handle fixing screw (spring washer 3L6–003; spacing washer WPMB00/BLC; plain washer WPLB04; shakeproof washer WPSB04; nut NFHB04)	3B3–086	3B3–086
7. Grille	3B4–195	3B4–122/2
8. Grille trim	3A2–172	3A2–172
9. Emblem	3A6–034/2	3A6–034/1
10. Cabinet back (clip 3L4–167; screw SZ06KP06/C)	3M4–837	3M4–828
11. Battery door	3C8–069	3C8–069/006

Chassis Assembly *(both models)*

Printed circuit board	0V6–151
Chassis retaining screw (washer WSPB04)	SB04TP06
Chassis retaining screw (washer WSPB04)	SB04TP20
Scale backing bracket (screw SZ06HP04)	3M1–092
Scale backing–Model 6160	3A7–355/005
Scale backing–Model 4160	3A7–355/001
Drive cord pulley–large (spindle 0B3–081/002; spacer 0L7–004/013)	3C8–001
Drive cord pulley–small (spindle 0B3–081/017)	3C8–006
Pillar fitted to scale bracket	3B3–084
Tuning drive shaft (circlip 3L3–004)	3B3–080
Tuning drive bush (nut 3L6 009; washer WSPB06)	3B3–005/004
Cursor (felt washer 0F7–014/001)	3B5–059
Drive drum	3F5–004
Drive cord tensioning spring	0B5–068
Car aerial and private listening socket bracket	3M4–525
Transistor heat sink (screw SZ06HH05; washer 3L6–077)	3C5–002/2
Wavechange push-button	3C0–142
Ferrite rod aerial cleat	3L3–084
Ferrite rod aerial mounting pillar (screw SB06HP04)	3L7–007/005
Battery connector	3F6–042

HEAT SINK COMPONENTS

Heat sink grease is applied to output transistors during production and it must always be reapplied by the engineer when replacing a transistor in its heat sink during servicing. Heat Sink Compound DP2623, or Anti-Tracking Grease MS4, is suitable and marketed by Midland Silicones Ltd.

COMPONENT DETAILS

CAPACITORS

Ref.	Value	Tol.	Rating	Function	Part No.
C1	20pF	5%	750V	L1 tuning	8M53
C2	1000pF	20%	500V	VT1 emitter coupling	4M15
C3	15pF	5%	750V	Car aerial coupling	4M28
C4	1000pF	20%	500V	VT1 base bias decoupling	4M15
C5	0·02μF	−20+80%	50V	Part supply line RF bypass	7A83
C6*	20pF			FM aerial tuning	
C7*	5pF			FM aerial trimmer	
C8	36pF	2½%	750V	Part FM aerial tuning	4M25
C9	5pF	±0·5pF	750V	VT2 emitter coupling	4M26
C10*	20pF			FM oscillator tuning	
C11*	5pF			FM oscillator trimmer	
C12	27pF	2½%	750V	Part FM osc. tuning	4M27
C13	15pF	5%	750V	L3 tuning (10·7 MHz rejector)	4M28
C14	510pF	10%	500V	Part IF rejector (10·7 MHz)	7M81
C15	3·3pF	0·25pF	750V	FM osc. feedback coupling	4M30
C16	1000pF	20%	500V	VT2 base bias decoupling	4M15
C17	60pF	2½%	120V	FM oscillator tuning and FM IF tuning	4M10
C18	510pF	20%	500V	Part FM RF filter	8M54
C19	0·05μF	−20+80%	50V	FM RF bypass	7M84
C20	4·7pF	±0·5pF	750V	AM bottom-end coupling	8M49
C21	2000pF	10%	500V	LW fixed aerial trimmer	7M25
C22	60pF	2½%	120V	LW fixed tuning	4M10
C23*	266pF			AM aerial tuning	
C24	2–25pF			Bandspread trimmer	3E4–015
C25*	5pF			AM aerial trimmer	
C26	25pF	2½%	750V	Bandspread aerial padding	4M11
C27	2–25pF			LW oscillator trimmer	3E4–015
C28	210pF	2%	350V	LW osc. fixed trimmer	7M60
C29	210pF	2%	350V	Fart bandspread osc. trimmer	7M60
C30	18pF	±0·5pF	750V	Part bandspread osc. trimmer	4M31
C31*	266pF			AM oscillator tuning	
C32*	5pF			AM oscillator trimmer	
C33	1·5–8pF			Bandspread osc. trimmer	3E4–033
C34	5000pF	20%	500V	VT3 base coupling	4M18
C35	175pF			L15 tuning	
C36	50pF			L13 tuning	
C37	0·01μF	20%	50V	VT3 emitter coupling	7M82
C38	0·05μF	−20+80%	50V	RF bypass	7M84
C39	75μF	Elec.	9V	VT4 AGC decoupling	0E0–228/04
C40	0·02μF	−20+50%	50V	VT4 emitter bypass	7M83
C41	50pF			L19 tuning	
C42	175pF			L17 tuning	
C43	175pF			L21 tuning	
C44	30pF	2½%	750V	L23 tuning	4M32
C45	0·02μF	−20+80%	50V	VT5 base bias decoupling	7M83
C46	0·02μF	−20+80%	50V	VT5 emitter bypass	7M83
C47	0·02μF	−20+80%	50V	Part FM IF filter	7M83
C49	25μF	Elec.	25V	Audio coupling (FM)	0E0–225/01
C50	1000pF	20%	500V	Part de-emphasis	4M15
C51	510pF			L24 tuning	
C52	8μF	Elec.	6V	Ratio detector stabilizing	0E0–222/02
C53	0·01μF	20%	50V	AGC decoupling	7M82
C54	5000pF	20%	500V	Part IF filter (AM)	2M27
C55	0·04μF	20%	250V	Audio coupling (AM)	4M33
C56	2μF	Elec.	25V	VT6 audio coupling	0E0–220/07
C57	75μF	Elec.	9V	VT6 emitter bypass	0E0–228/04
C58	75μF	Elec.	9V	VT7 emitter bypass	0E0–228/04
C59	1000pF	20%	500V	Negative feedback tone correction	4M15
C60	100μF	Elec.	25V	Supply decoupling	0E0–229/12
C61	100μF	Elec.	25V	Battery decoupling	0E0–229/12
C62	150μF	Elec.	9V	VT8/VT9 LS coupling	0E0–229/11
C63	330pF			VT8/VT9 RF bypass	8M55

* Tuning gang—Part No. 3E4–048

INDUCTORS AND TRANSFORMERS

Ref.	Description	Part No.
L1	FM aerial coil	3D8–002
L2	FM RF tuning coil	3D1–059
L3	VT2 emitter loading coil and part 10·7 MHz rejector	3D8–002
L4	FM oscillator coil	3D1–058
L5	FM IF output coil	3D0–031
L6	RF choke	3D8–003
L7, L8, L9	Car aerial coupling coil, MW tuning coil, LW tuning coil — Ferrite rod assembly (including L27)	3F0–067
L10, L11, L12	AM oscillator coil	3D1–070
L13, L14	FM 1FT1	3D0–028
L15, L16	AM 1FT1	3D0–036
L17, L18	AM IFT2	3D0–037
L19, L20	FM IFT2	3D0–055
L21, L22	AM IFT3	3D0–038
L23, L24, L25, L26	FM IFT3	3D0–029
L27	AM aerial base coupling (with L7, L8 and L9)	

RESISTORS

All ¼ watt carbon ± 10% tolerance unless otherwise stated

Ref.	Value	Tol.	Function	Part No.
R1	33KΩ		VT1 base bias	8A33
R2	6·8KΩ		potential divider	8A08
R3	820Ω		VT1 emitter stabilizing	7A40
R4	1KΩ		VT2 emitter stabilizing	1A52
R5	6·8KΩ		VT2 base bias	8A08
R6	33KΩ		potential divider	8A22
R7	68Ω		Part FM RF filter	6A98
R8	47KΩ		VT3 base bias	7A57
R9	5·6KΩ		potential divider	1A65
R10	1·5KΩ		VT3 emitter stabilizing	8A06
R11	680Ω		FM unit supply decoupling	3A45
R12	10KΩ		L13 damping	8A35
R13	100KΩ		VT4 base bias feed	8A26
R14	8·2KΩ		VT4 AGC feed (AM)	7A42
R15	1KΩ		VT4 limiting control	1A52
R16	820Ω		VT4 emitter stabilizing	8A27
R17	22KΩ		Part VT5 base bias pot.	4A92
R18	1KΩ		VT5 limiting control	2A25
R19	3·3KΩ		Part VT5 base bias pot.	1B50
R20	1·2KΩ		VT5 emitter stabilizing	7A54
R21	1KΩ		Part de-emphasis network	1A52
R22	100Ω		AM limiting	8A36
R23	5·6KΩ		AM detector load	4A57
R24	22KΩ		Part IF filter (AM)	2B53
R25	6·8KΩ		Ratio detector load	8A08
R26	12KΩ		VT6–VT7 coupling	1A94
R27	12KΩ		VT6 base bias	1A89
R28	20KΩ	Log. pot.	Volume control	3E1–051
R29	500Ω	Preset	VT7 base bias adjustment	3E5–002/2
R30	120Ω		VT7 emitter stabilizing	8A24
R31	56KΩ		Negative feedback	8A10
R32	1·5KΩ		VT7 collector load	1B14
R33	5·6Ω		Bias stabilizing load	2A43
R34	390Ω		DC dropper and decoupling	7A84
R35	4·7Ω	±0·5Ω	VT8 bias stabilizing	1B77
R36	4·7Ω	±0·5Ω	VT9 bias stabilizing	1B83
R37	390Ω		Private listening socket load	7A84
R38	100KΩ		MW oscillator damping	2A28
R39	1KΩ		Part AF coupling	3A57

MISCELLANEOUS

Ref.	Description	Part No.
S1–S4	Push-button switch unit	3M4–526
S5A–B	ON-OFF switch	with R28
SKT1	Car aerial socket (push-on-fix 3L2–089)	3F6–025/002
J1	Private listening socket (15/100Ω impedance) (push-on-fix 3L2–001; plug 3F6–053)	3F6–037
LS	Loudspeaker, 35Ω impedance (clip 3L2–073)	3E3–033

TRANSISTORS AND DIODES

Ref.	Type
VT1	AF124
VT2	AF125
VT3–VT5	AF126
VT6	AC151 or AC122 or AC156
VT7	AC138 or AC151 or AC122 or AC113
VT8	AC142
VT9	AC141
W5	D3

VT8 or VT9 or W5: VT8 AC153, VT9 AC176, W5 A8A21 — or VT8 AC154, VT9 AC157, W5 AA120

When replacing transistors singly, whenever possible replace with type as originally fitted.

When ordering replacement components, please quote Model number and, where possible, include the description or function given with part number.

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