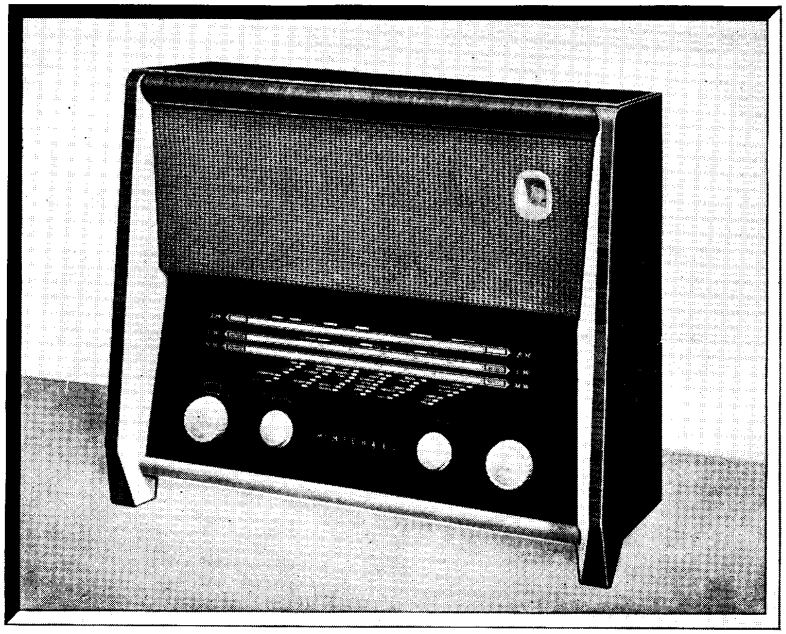
McMichael

SERVICE INFORMATION

Radio Receiver Model FM55



This is a table model Radio Receiver for reception of F.M. signals on V.H.F. and normal A.M. signals on Medium and Long waves.

SPECIFICATION

Circuit	Superhet on F.M. and A.M.
Waveband Coverage	Long, 900–2000 metres ; Medium, 190–540 metres ; F.M., 88–95 Mc/s.
Valves	ECC85, ECH81, EF85, EABC80, EL84, EZ80, EM80
Internal Aerials	A.M., Ferrite Rods; F.M., 300 ohm folded dipole balanced
External Aerial Provisions	A.M., Normal; F.M., 300 ohm folded dipole balanced or 75 ohm dipole unbalanced
Operating Voltage	190–260v. A.C. 40–100 c/s.
Gramophone Pick-up Sockets	High impedance
Loudspeaker	Permanent Magnet elliptical 10″x6″ 3 ohms Provision for external 3 ohm speaker
I.F. Frequency	F.M., 10·7 Mc/s.; A.M., 470 Kc/s.

CIRCUIT DESCRIPTION

F.M.

The front end is mounted on a separate sub chassis. One section ECC85 is used as RF amplifier with combination grounded grid, grounded cathode input. The other section ECC85 is used as self-oscillating additive mixer. The oscillator frequency is lower than the signal frequency. The RF signal is injected into the oscillator circuit by means of a bridge network 1C7 1C8 1C5 and Ca-k the valve capacitance. 1C5 is variable to balance for minimum oscillator voltage across the RF circuit. This method of connection, together with method of connecting input to RF amplifier, ensures low oscillator radiation. 1L3 and 1C11 is an IF trap to give extra rejection of IF signals from the aerial.

Valve damping of 1L7 is compensated by IF feedback through 1C7 1C8 and 1L5 to the grid of the mixer. The amount of compensation depends on the values of 1C6 1C9 and 1C12. The presence of 1C6 tends to stabilise the performance of the oscillator and the position of this condenser must not be moved considerably. Core tuning of RF and oscillator circuits is employed, the cores being operated by a cam attached to the main tuning spindle. The position of this cam on the spindle must not be altered.

Further IF amplification is provided by ECH81 (triode section not used) and EF85 to the ratio detector.

Two frequency conscious voltages are supplied by T3 to two diodes of the EABC80. These diodes are so connected that the sum of the rectified voltages appears across the diode load R23. This voltage is stabilised against AM by C43 and is available for A.V.C. In addition a voltage appears across C36 proportional to the difference between these two voltages, the current flowing through the tertiary winding and diodes in opposition. At centre frequency the voltage across C36 is one half that across R23, and varies at AF above and below this value as the frequency deviates either side of centre frequency. De-emphasis is obtained by R10 C32 which also filters IF frequencies.

A.M.

This is a standard 4+1 superhet. Medium and Long Wave aerial coils are mounted on ferrite rods acting as internal aerials. External aerial is bottom capacity coupled C12 via IF trap L1 C2. A.V.C. is supplied by signal diode.

GENERAL

F.M. and A.M. IF transformers are connected in series to their respective valves each acting as negligible impedance to the other. The primary of T1 is shorted on A.M. to prevent amplification of interfering voltages, notably harmonics of oscillator triode ECH81. AF, A.V.C. and tuning indicator are switched FM-AM by same contacts, C39 C41 being blocking condensers.

Audio section is normal. EABC80 is self biased by R21 C42.

Tone control is by selective negative feedback via C45.

H.T. flows through a hum-bucking tap on the primary output transformer to minimise residual hum.

The F.M. built-in aerial consists of a 300 ohm folded dipole mounted on the cabinet interior. If this is insufficient try a similar aerial fixed to (say) a picture rail. 300 ohm feeder line may be used, constructed similar to the built-in aerial, mounted horizontal and with the total length of the horizontal section 60″. In bad reception areas an outdoor aerial should be used. Provision is made for a 300 ohm balanced feeder line from a folded dipole or 75 ohm co-axial feeder from a standard dipole. If an external aerial is used, stow the internal aerial in the " dummy " sockets.

ALIGNMENT INSTRUCTIONS

As the normal tuning scale is mounted in the cabinet, reference is made to calibration marks on the drive drum, in conjunction with the auxiliary pointer. These marks are as follows:—

A—Medium Wave	190 metres
Long Wave	900 metres
F.M.	95 Mc/s.
B—Medium Wave	500 metres
C—Long Wave	2000 metres
D—Datum mark	
E—F.M.	88 Mc/s.
F—F.M.	91 Mc/s.

Before alignment, check mains tapping plug, check that auxiliary pointer coincides with mark D with gang condenser fully closed.

A.M. Alignment

Disconnect loudspeaker and substitute 3 ohms output meter.

Turn volume and tone controls maximum clockwise.

Details given are for an accurately tuned signal generator, modulated 400 c/s. 30%. Output 200MW.

For IF alignment connect signal generator direct to junction C6/switch and chassis. IF sensitivity is measured with oscillator stopped (short circuit C8b).

For RF and IF trap alignment connect signal generator via dummy aerial to aerial and earth sockets.

Sensitivity figures given are design centre figures and allow a production tolerance ±3 db.

Tune for maximum output in all cases except IF trap which is tuned for minimum output.

Operation	*Frequency*	*Receiver Setting*	*Tune*	*Sensitivity*
IF	470 Kc/s	M.W. Medial	T2 T4	20μV (2 mV at G1 EF85)
IF trap	470 Kc/s	M.W. Medial	L1	8 mV
M.W.	1580 Kc/s 600 Kc/s	A B	C17 C4 L4 L2	60μV 45μV
L.W.	333 Kc/s 150 Kc/s	A C	C18 C5 L5 L3	70μV 100μV

A.V.C. Measurement

Inject 1 Mc/s via dummy aerial, tune receiver. Adjust volume control for 2·5 W output with input 100 mV and subsequently 10 mV and 1 mV.

Input reduction	*Output reduction*
100 mV to 10 mV	4 db
10 mV to 1 mV	6 db
1 mV to 100 μV	16 db
Total 60 db	Total 26 db

NOTE

Oscillator grid current measured with microammeter in series with R4 (chassis end).

M.W. 210μA to 230μA
L.W. 190μA to 240μA

F.M. Alignment

I.F. Adjustment

Connect signal generator direct to junction C6/switch and chassis.

Connect meter (e.g. Taylor "Windsor" meter model 77A) across R.23 (positive to chassis) as output indication. Using accurately tuned signal generator inject 10·7 Mc/s. unmodulated.

Carefully tune T.1 and T.3 primary for maximum output, keep output indication at approximately 3 volts.

Check band width by swinging signal generator frequency either side of 10·7 Mc/s until output drops 3 db (3v to 2·1v). Band width should be $\pm$100 Kc/s. Retune IF's if necessary. Obtain two accurately matched resistors about 100K each and connect in series across R.23. Connect meter from junction of these two resistors and junction R.10/C.32. Tune secondary T.3 for zero output.

Note:—The core position on tune is approximately level with the base of former. Starting with core well out, a peak occurs in one direction. On screwing core in, the output goes through zero to a peak in the opposite direction. The tune position is for zero output. A centre zero meter is of assistance here, but the operation is best performed on a wobbulator. (See later.)

Connect signal generator leads direct to aerial input terminals. Short circuit I.F. Trap 1L3 (two tags near 1L9). Tune 1L8 and 1L7 for maximum output. Input from signal generator will have to be increased to force I.F. signal through R.F. circuits. Remove short circuit and tune 1L3 for minimum output.

Minimum Oscillator Radiation

Set receiver to minimum frequency. Set 1C3 and 1C4 to centre position. Connect valve voltmeter to junction 1C7/1C8 and chassis. Tune 1C5 for minimum reading. If two minimum positions are found, the correct one is for minimum capacity.

To Check R.F. Adjustment

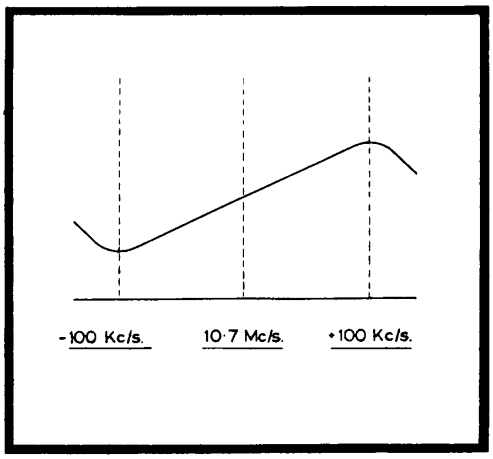
Set receiver to position E on drive drum. Connect output meter across R.23. Inject 88 Mc/s. and adjust 1C4 then 1C3 for maximum output. Check that 95 Mc/s. coincides with position A on drive drum, and if necessary correct by separating or closing 1C7/1C8.

This should be only adjustment necessary. If, however, further correction is needed, proceed as follows:—Set receiver to position F on drive drum, inject 91 Mc/s. and tune 1C4 for maximum output. Check that 88 Mc/s. coincides with position E and 95 Mc/s. with position A. If 95 Mc/s. position only is inaccurate, correct by separating or closing 1C7/1C8.

If both 88 Mc/s. and 95 Mc/s. positions are incorrect, adjust core of oscillator coil 1L5 by rotating screw which is sealed by lacquer. One turn on oscillator core equals approximately 150 kc/s. of adjustment. If oscillator core is altered, recheck IF coils 1L7 and 1L8.

To Check Setting of Ratio Detector by Wobbulator

Inject R.F. signal from frequency modulated signal generator to aerial sockets. Connect oscilloscope input leads across volume control and output meter across R.23. Modulate signal generator $\pm$150 kc/s. and tune receiver for maximum reading on output meter. Adjust input to give 3v on output meter. Tune secondary of T.3 for linear output as viewed on oscilloscope.



Sensitivity

The overall sensitivity for 200 mW. output is 15μV $\pm$3 db measured by injecting R.F. signal into 300 ohms aerial sockets from signal generator frequency modulated $\pm$25 kc/s at 1000 c/s output into 3 ohm output meter; speaker disconnected, volume and tone controls at maximum. Required input at 10·7 Mc/s into modulating grid EF85 to give 3v. across R.23 is 50 mV. Into modulating grid ECH81, required input is 5 mV. In both cases measurements are taken with signal generator unmodulated and A.V.C. shorted out.

To Check A.V.C.

Inject 91 Mc/s into 300 ohm aerial socket. Modulate signal generator $\pm$25 kc/s at 1000 c/s. Adjust signal generator to give 50 mV input and volume control to give 2·5 W output as measured on 3 ohm output meter substituted for speaker. Input is reduced to 10 mV and subsequently to 1 mV and 100μV. Output reduction reference to 2·5 W output is as follows:—

Input reduction	*Output reduction*
50 mV to 10 mV	2 db
10 mV to 1 mV	6 db
1 mV to 100μV	8 db
Total 54 db	Total 16 db

ELECTRICAL TEST VALUES

Measured with Avometer Model 7.
Supply 235 V.A.C. voltage tapping 225–250.
Band Switch M.W. no signal.
Volume control to maximum, tone control to maximum top.
Higher readings on the 400v. range, lower on 10v.

Reference	A.C. Volts	A.C. Amps.
Transformer primary		0·24
Rectifier anodes	260–0–260	
Valve heaters...	6·3	3·2
Rectifier heaters	6·3	0·63
Total power consumption	70 watts at 235 volts	

	Pin	D.C. Volts	D.C. mA.
Unsmoothed HT C48A ...		290	
Total HT consumption ...			65
1st smoothed HT C48C ...		260	
2nd smoothed HT C48B ...		210	
EL84 anode	7	253	36
screen	9	210	4·0
cathode	3	6	40

Reference		Pin	D.C. Volts	D.C. mA.
EABC80	anode	9	65	0·7
EM80	... ...	9	210	1·5
		7	30	0·4
EF85	anode	7	205	7·8
	screen	8	85	1·6
	cathode	1	1·0	9·0
ECH81	anode	6	205	2·0
	screen	1	62	4·4
	anode (osc.) ...	8	100	3·5
	anode (not osc.)...	8	50	5·2
ECC85	anode	6	140	6·0
	anode	1	135	5·5
	cathode	8	1·9	6·0

L.F. Sensitivity

Inject 1000 c/s between grid and chassis output into 3 ohms:

V.4 Pin 8 input required for 200 mW output 50 mV
V.5 Pin 2 input required for 200 mW output 1 V
V.4 Pin 8 input required for 3 watts output 0·2 V

COMPONENTS LIST

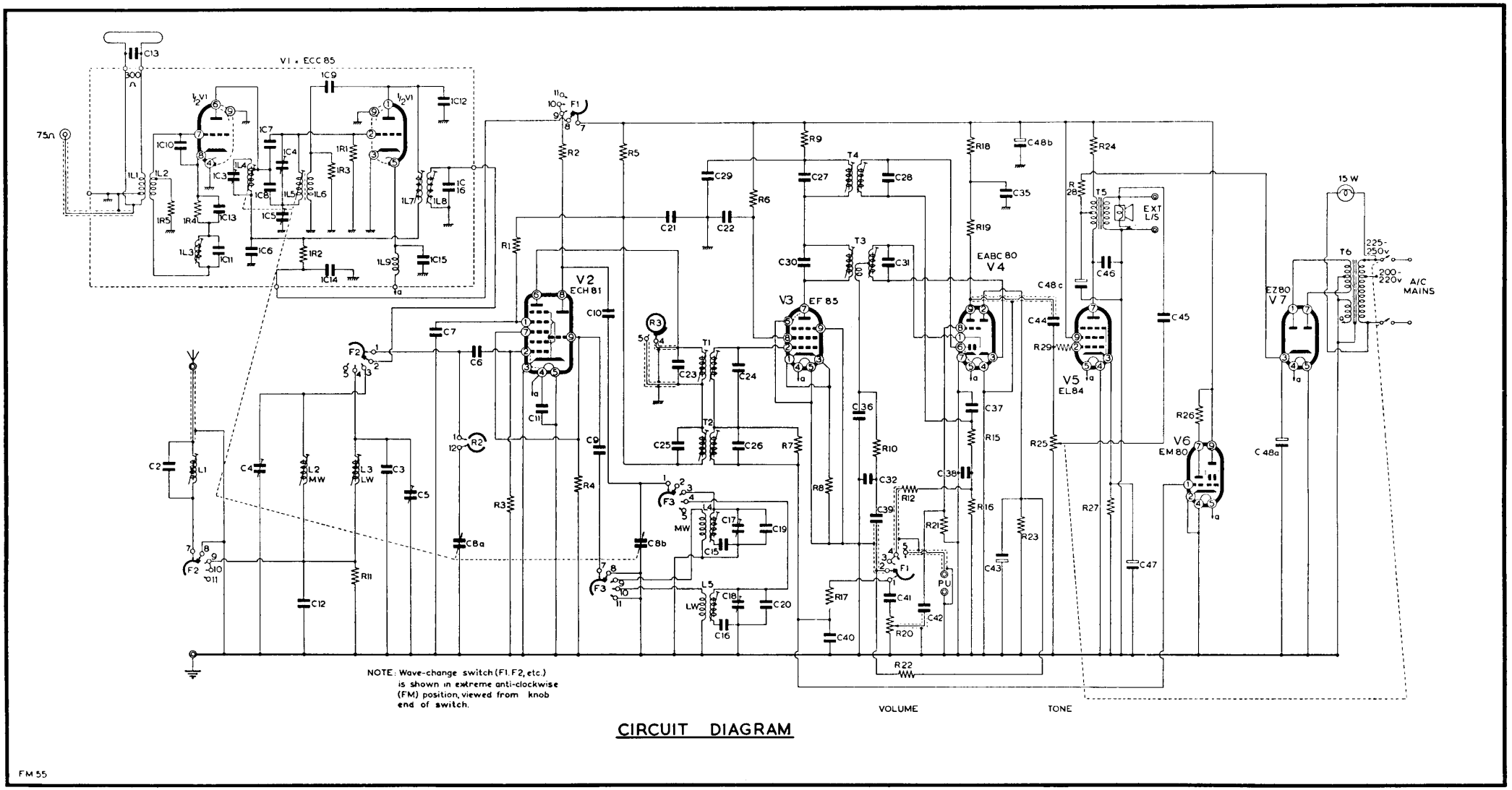
CONDENSERS

Ref. No.		Description
IC3	30pF	R.F. sub-chassis
IC4	30pF	R.F. sub-chassis
IC5	30pF	R.F. sub-chassis
IC6	570pF	R.F. sub-chassis
IC7	39pF	R.F. sub-chassis
IC8	39pF	R.F. sub-chassis
IC9	18pF	R.F. sub-chassis
IC10	8·2pF	R.F. sub-chassis
IC11	47pF	R.F. sub-chassis
IC12	12pF	R.F. sub-chassis
IC13	1000pF	R.F. sub-chassis
IC14	2200pF	R.F. sub-chassis
IC15	2200pF	R.F. sub-chassis
IC16	15pF	R.F. sub-chassis
C2	1500pF	10% S.M.
C3	30pF	10% S.M.
C4	3–30pF	2-bank Trimmer
C5	3–30pF	
C6	100pF	20% S.M.
C7	·005μF	Ceramic Disc
C8a, C8b	14·5–532pF	2-gang variable
C9	50pF	10% S.M.
C10	500pF	10% S.M.
C11	·001μF	Ceramic Disc
C12	·005μF	500 V.D.C.
C13	15pF	20% S.M. R.F. sub-chassis
C15	580pF	2% S.M.
C16	200pF	1% S.M.
C17	3–30pF	2-bank Trimmer
C18	3–30pF	
C19	20pF	10% S.M.
C20	100pF	10% S.M.
C21	·005μF	Ceramic Disc
C22	·005μF	Ceramic Disc
C23	50pF	5% S.M.
C24	50pF	5% S.M.
C25	60pF	2% S.M.
C26	100pF	2% S.M.
C27	100pF.	2% S.M.
C28	180pF	2% S.M.
C29	·005μF	Ceramic Disc
C30	10pF ±½pF	Tubular Ceramic
C31	30pF ±½pF	Tubular Ceramic
C32	·001μF	600 V.D.C.
C35	·1μF	350 V.D.C.
C36	300pF	20% S.M.
C37	100pF	20% S.M.
C38	100pF	20% S.M.

Ref. No.		Description
C39	·05μF	350 V.D.C.
C40	·05μF	350 V.D.C.
C41	·05μF	350 V.D.C.
C42	·02μF	350 V.D.C.
C43	5μF	50 V.D.C.
C44	·05μF	350 V.D.C.
C45	·01μF	500 V.D.C.
C46	·001μF	1000 V.D.C.
C47	50μF	12 V.D.C.
C48a	32μF (Reservoir)	350 V.D.C.
C48b	32μF	
C48c	16μF	

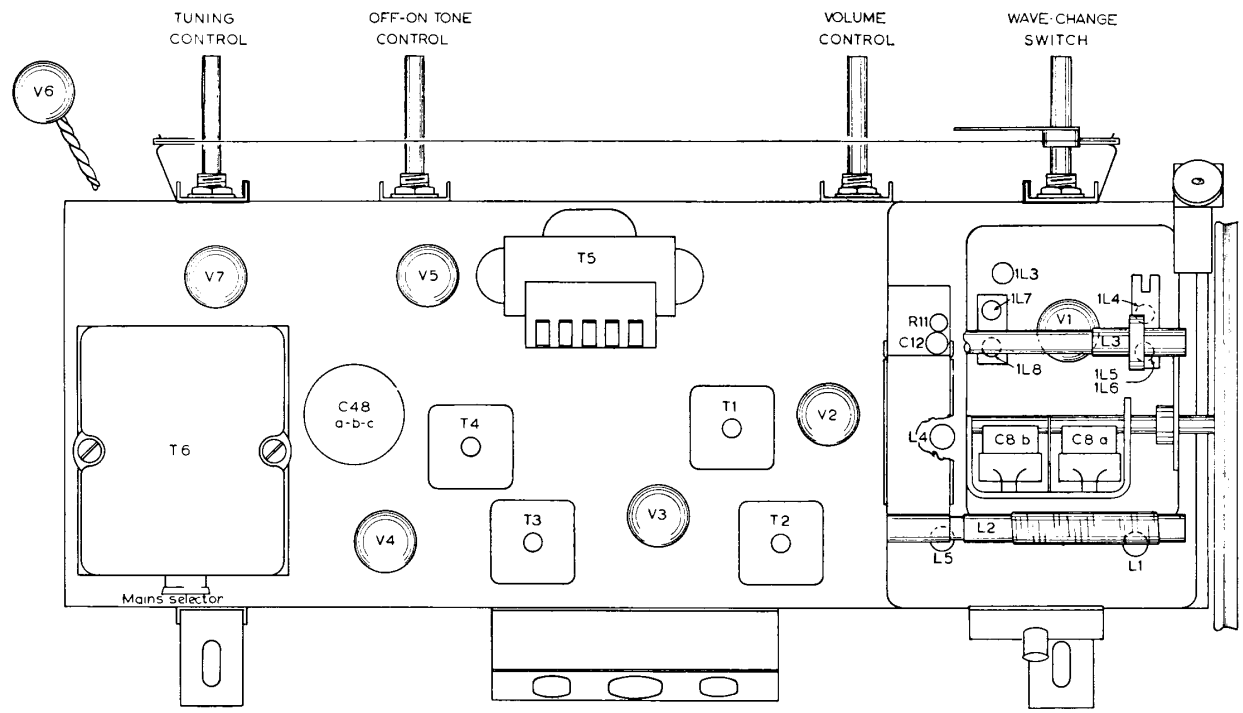
RESISTORS

Ref. No.		Description
IR1	1 megohm	R.F. sub-chassis
IR2	4·7K ohm	R.F. sub-chassis
IR3	2·2K ohm	R.F. sub-chassis
IR4	220 ohm	R.F. sub-chassis
IR5	120 ohm	R.F. sub-chassis
R1	33K	20% ½W
R2	33K	20% ½W
R3	1 megohm	20% ¼W
R4	47K	10% ¼W
R5	220 ohm	20% ¼W
R6	82K	20% ½W
R7	150K	10% ¼W
R8	100 ohm	20% ¼W
R9	220 ohm	20% ¼W
R10	47K	20% ¼W
R11	1K	10% ¼W
R12	1 megohm	20% ¼W
R15	47K	20% ¼W
R16	1 megohm	20% ¼W
R17	1 megohm	20% ¼W
R18	100K	20% ¼W
R19	100K	20% ¼W
R20	1 megohm	Pot. Log.
R21	10 megohms	20% ¼W
R22	2·2 megohms	20% ¼W
R23	33K	20% ¼W
R24	2K	10% W.W.
R25	250K	Pot. Lin.
R26	470K	20% ¼W
R27	150 ohm	10% ½W
R28	500 ohm	10% W.W.
R29	12K	20% ¼W



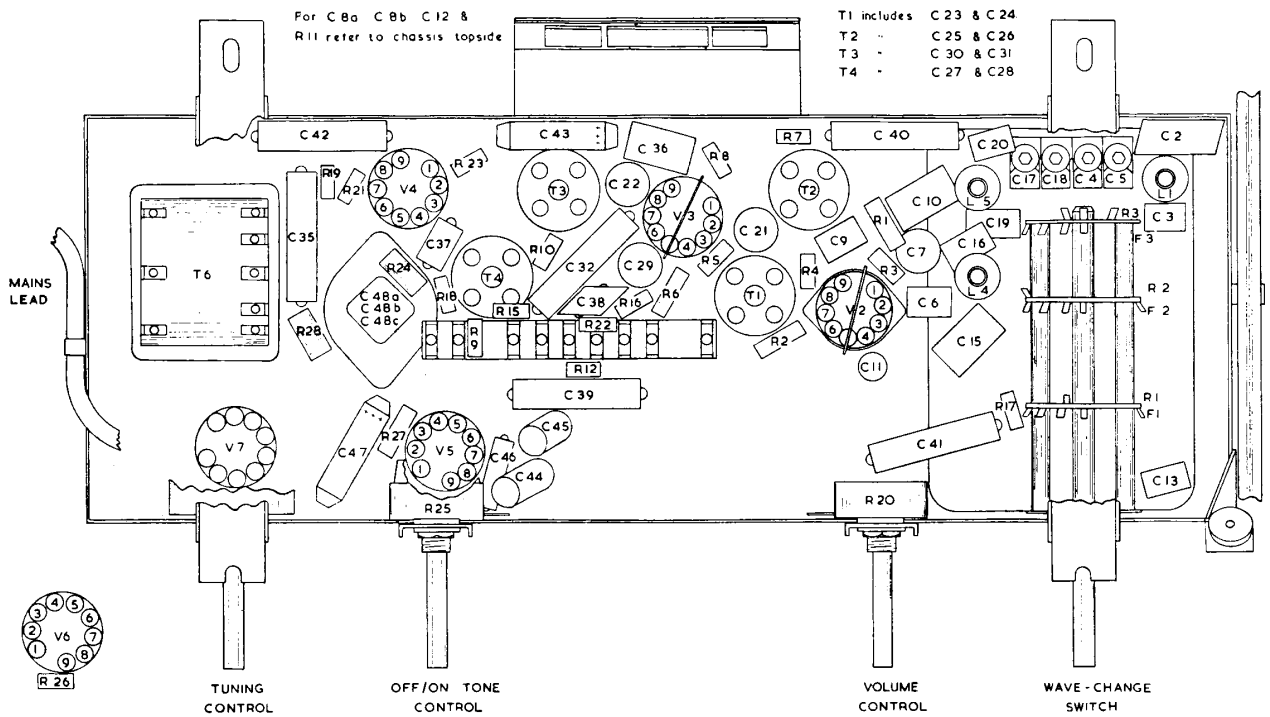
CIRCUIT DIAGRAM

FM 55



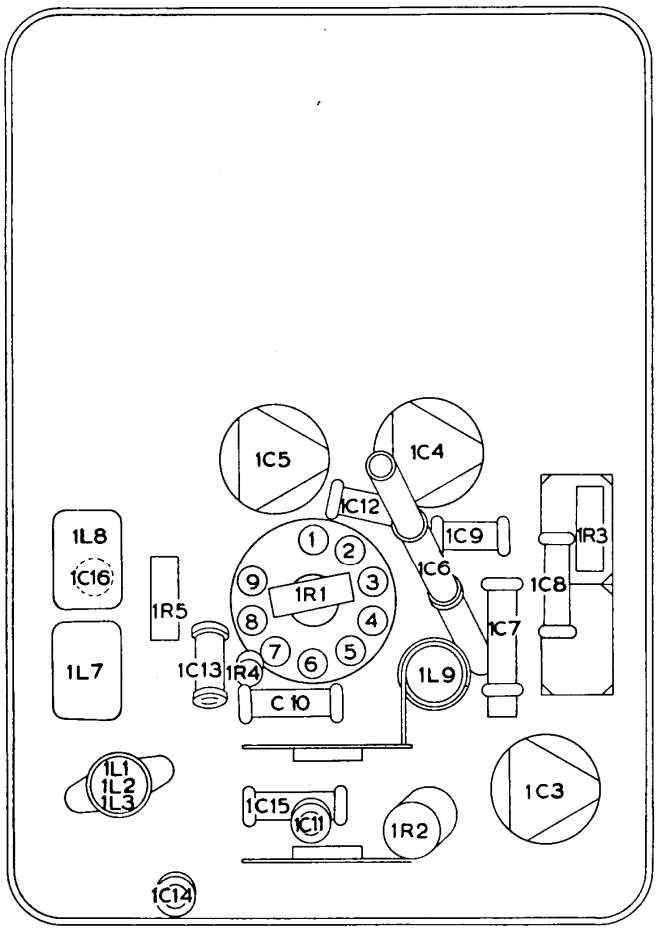
CHASSIS TOPSIDE.

FM55



CHASSIS UNDERSIDE.

FM.55.



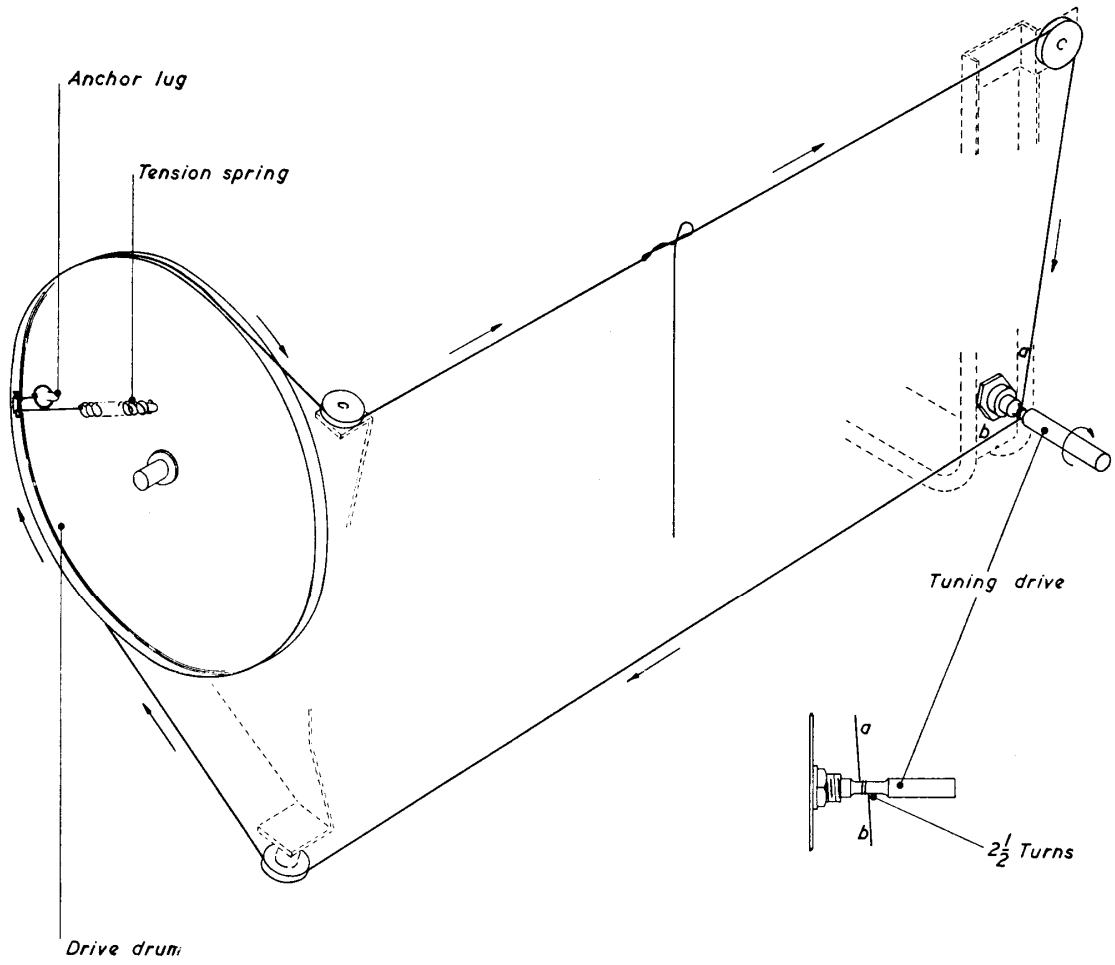
F.M. UNIT. UNDERSIDE.

F.M.55.

MECHANICAL DATA

REMOVAL OF CHASSIS FROM CABINET.—Unsolder loudspeaker leads. Remove control knobs and scale lamp assembly. Unscrew 2 fixing screws at rear of chassis.

DRIVE CORD REPLACEMENT.—Cut replacement cord to the length specified, attach one end to anchor-lug on drive pulley, and proceed as indicated in diagram. Knot free end to loop of tension spring and secure in position.



FM55

DRIVE CORD LAYOUT

SERVICE NOTES

McMICHAEL RADIO LTD.
WEXHAM ROAD, SLOUGH, BUCKS.
Telephone: SLOUGH 24541