"His Master's Voice"

SERVICE DATA SHEET

"His Master's Voice" products are made to a standard of design and quality approved by The Gramophone Co. Ltd., registered proprietor of the trade mark.

AM-FM TRANSISTOR RADIO RECEIVER MODEL 1421

DESCRIPTION

AM/FM table radio receiver employing nine transistors and four crystal diodes in a superhetrodyne circuit incorporating a push-pull output stage. Rotary type waverange switching is provided and the receiver is capacitance tuned for both AM and FM ranges. Inbuilt aerials are provided with sockets for external aerials and earth to be connected if required. The receiver is housed in a wooden cabinet 17¼in. wide x 11½in. high x 7in. deep.

An 8 in. x 5 in. elliptical permanent magnet type loudspeaker is incorporated and extension loudspeaker sockets are also provided. The on-off switch is combined with a continuously variable tone control and a power output of one watt is obtained from a 9 volt battery supply.

Power Supply

A battery of any of the following types, or their equivalent, is suitable.

Every Ready	PP10
GEC	BB30
Vidor	T6010

SERVICING NOTES

Output Measurement

It is essential that output leads to internal speaker be loaded by the loudspeaker or by an alternative load of 35Ω. For alignment purposes the internal speaker may be left connected and output measured across speaker terminals by means of Model 8 Avometer on 2·5V AC range, (1·8 volts across speaker will then represent 100mW, the recommended output for aligning purposes). Should an output meter be used it should be of 35Ω impedance and any speaker used for aural identification of alignment signal should be 'stood-off' by a resistor so that total impedance presented to output leads is not appreciably reduced.

As there is no direct chassis connection to loudspeaker, care must be taken when connecting test equipment, i.e. earth on input signal device and earth on output measuring equipment will short out certain components. Output meter can usually be isolated from common earth but should an oscilloscope be connected to check output waveform this should be between chassis and collector of VT8 or VT9.

Audio Checks

These are made by applying input signal between battery positive and junction of R29–C57. Output meter should be isolated or if oscilloscope or any other earthed device be used it should be connected in this case between battery positive and VT8 or VT9 collector (i.e. battery positive is common earth).

DC Measurements should be confined to voltages and total current drain. This will vary between 20–28mA for zero output and will rise to 200–220mA at 800 mW output.

Chassis Removal

1. Take off cabinet back.
2. Pull off front control knobs.
3. Disconnect loudspeaker leads.
4. Remove cleats securing mains lead and wires to external loudspeaker sockets.
5. Remove external loudspeaker socket.
6. Slacken off nuts securing clamping strips at each side of chassis.
7. Slide out chassis.

DRIVE CORD REPLACEMENT

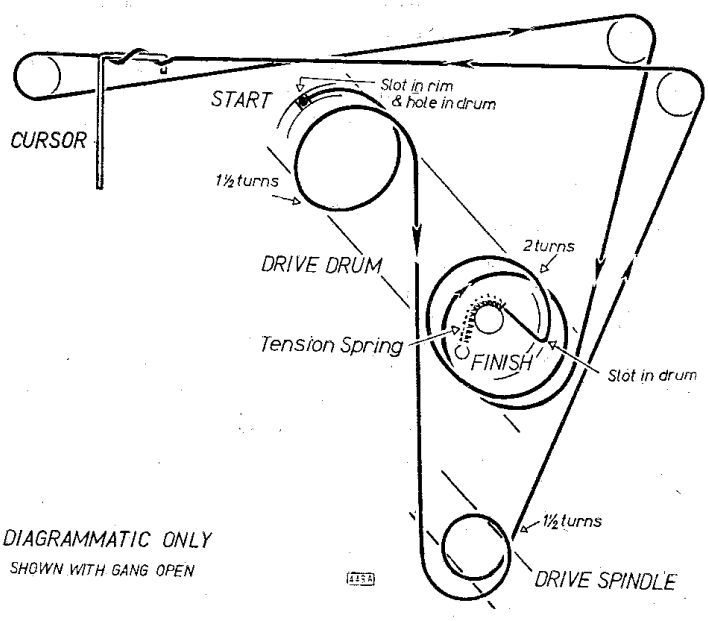


Fig. 1. The arrangement of the tuning drive cord. Approximately 66 inches of nylon braided cord required.

CIRCUIT DESCRIPTION

AM Operation

On AM the two transistors VT.1 and VT.2 are inoperative, the battery supply being disconnected by S1c.

An internal aerial facility is provided on medium waves and long waves by L9 and L10 wound on a ferrite-rod and coupled to VT.3 by L12 and L13.

An external aerial may be coupled into the ferrite-rod by L11 loaded by L8. Coupling to VT.3 being effected by L12 and L13 switched through S1b.

VT.3 is an RF amplifier loaded by R9 and resistance capacitance coupled to the self-oscillating mixer VT.4 by C28, R14.

The collector of VT.4 is coupled to the oscillator circuit through the primary of a double tuned 470 Kc/s transformer IFT.2 and the 10·7 Mc/s transformer IFT.3. The oscillator operates in grounded base configuration, neutralization of oscillator voltage on the base being effected by C33, whilst S1d provides oscillator switching.

The secondary of IFT.2 is coupled to the base of the IF amplifier VT.5 via a capacitative potentiometer C38 and C39 in series with the secondary of the IFT.3. The collector of VT.5 is loaded by a double-tuned transformer IFT.4, the secondary being matched into a diode detector W2. The audio output is switched through to the volume control via S1e.

The diode provides an AGC voltage which acts in opposition to a bias voltage derived from potentiometer R20 and R21, the resultant of which is used to control the gain of the RF amplifier VT.3 via R24 and the base coupling coils. De-coupling to the emitter is effected by C25. The additional resistor R10 compensates for the input bias current of VT.3. In order to stabilise gain with varying battery voltage the bias for both VT.4 and VT.5 is derived via R14 and R17 respectively from a line stabilised at 1·2 volts by a forward current flowing through selenium diodes W5A and W5B.

FM Operation

An internal aerial facility is provided by a shortened dipole which is coupled into the emitter of the RF amplifier VT.1 via a double-tuned transformer L1–L2.

The collector of VT.1 is loaded by a tuneable circuit L3, C6, C7 and C8 coupled into the emitter of self-oscillating mixer VT.2 via C9.

The collector of VT.2 is loaded by the primary of the first IFT L6, tuned by C13. C13 also provides coupling into the oscillator tuned circuit L5, C14, C15 and C16. Feedback into the emitter is provided by C10. Oscillatory and RF voltages at the emitter of VT.2 are developed across L4 whilst L4 in series with C12 effectively grounds the emitter at the IF frequency of 10·7 Mc/s. The secondary of the IF transformer L7 is matched into the first IF amplifier VT.3 by capacitative potentiometer C17, C18 and switched through S1b. The output from VT.3 is developed into the primary of a single tuned transformer L14, L15 and L16, the AM load R9 now being shorted to the chassis. At high signal strengths the IF voltage developed in L16 is rectified by W1 and provides an AGC voltage to the RF amplifier VT.1. L15 matches this transformer into the base of the second IF stage VT.4, the polarity of L15 being such that neutralization of VT.3 is effected through C36.

The collector of VT.4 is loaded by the primary of IFT.3, the AM oscillator now being shorted to earth through S1d. A winding L17 in IFT.3 provides a neutralizing voltage through C34. The secondary of IFT.3 is inductively matched into the base of the third IF amplifier VT.5, the collector of which is loaded by the primary of the ratio detector L25. The output from the secondary L26 and tertiary L27 are rectified by W3 and W4 stabilised by C52, and the audio output is derived from the centre tap of load resistors R26, R27. RF currents in the output from the ratio detector are decoupled to chassis by R28 and C56. All three IF stages are supplied with bias from the stabilised source.

At large signal inputs limiting takes place by successive ' bottoming ' of the IF amplifiers and in order to control the output characteristics of the transistors in the ' bottomed ' state, resistors R13, R16 and R19 are incorporated.

Audio Stages

Input to the first audio amplifier VT.6 is controlled by R29. DC feedback through R30 stabilises the current in this transistor and selective feedback through R31 and C58 provides variable tone control. The output voltage developed across R32 is coupled by C59 to the base of driver transistor VT.7 which is transformer coupled to the push-pull output pair VT.8 and VT.9 via T1. The output from these transistors is matched into the internal loudspeaker having 35Ω impedance voice coil and external speaker sockets for 3Ω voice coil by an auto transformer T2. De-coupling of the output stage from earlier stages is effected by R36 and C63. The bias to VT.7 and the current to W5A and W5B is derived from the potentiometer R35 and R37 whilst the bias for the output transistors VT.8 and VT.9 is derived by potentiometer R39, R40 across W5A. In order to compensate for the current drain through R39 and R40 a compensating current is derived from the emitter of VT.7 through R38 to the common junction of W5A and W5B.

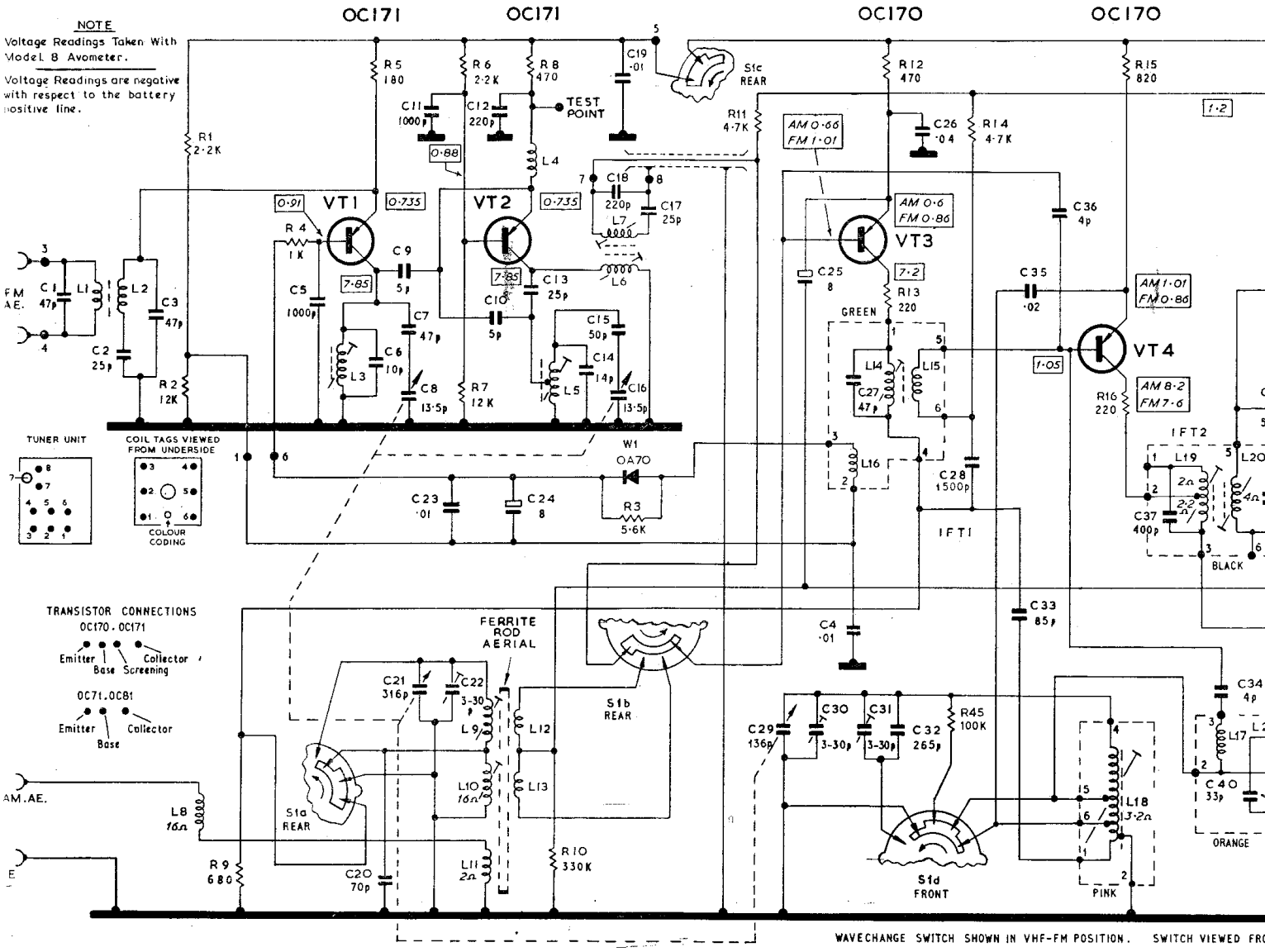


Fig. 2. Figures in rectangles indicate voltages measured with a 20,000 Ω/volt meter. DC res

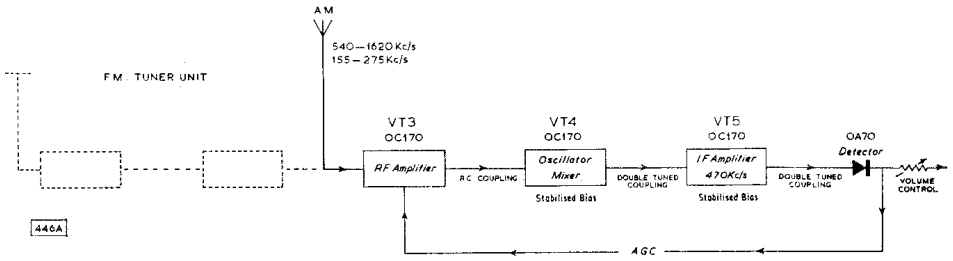


Fig. 3. Block schematic of AM circuits.

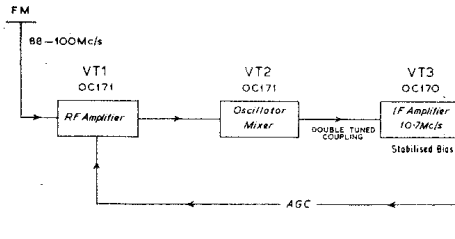
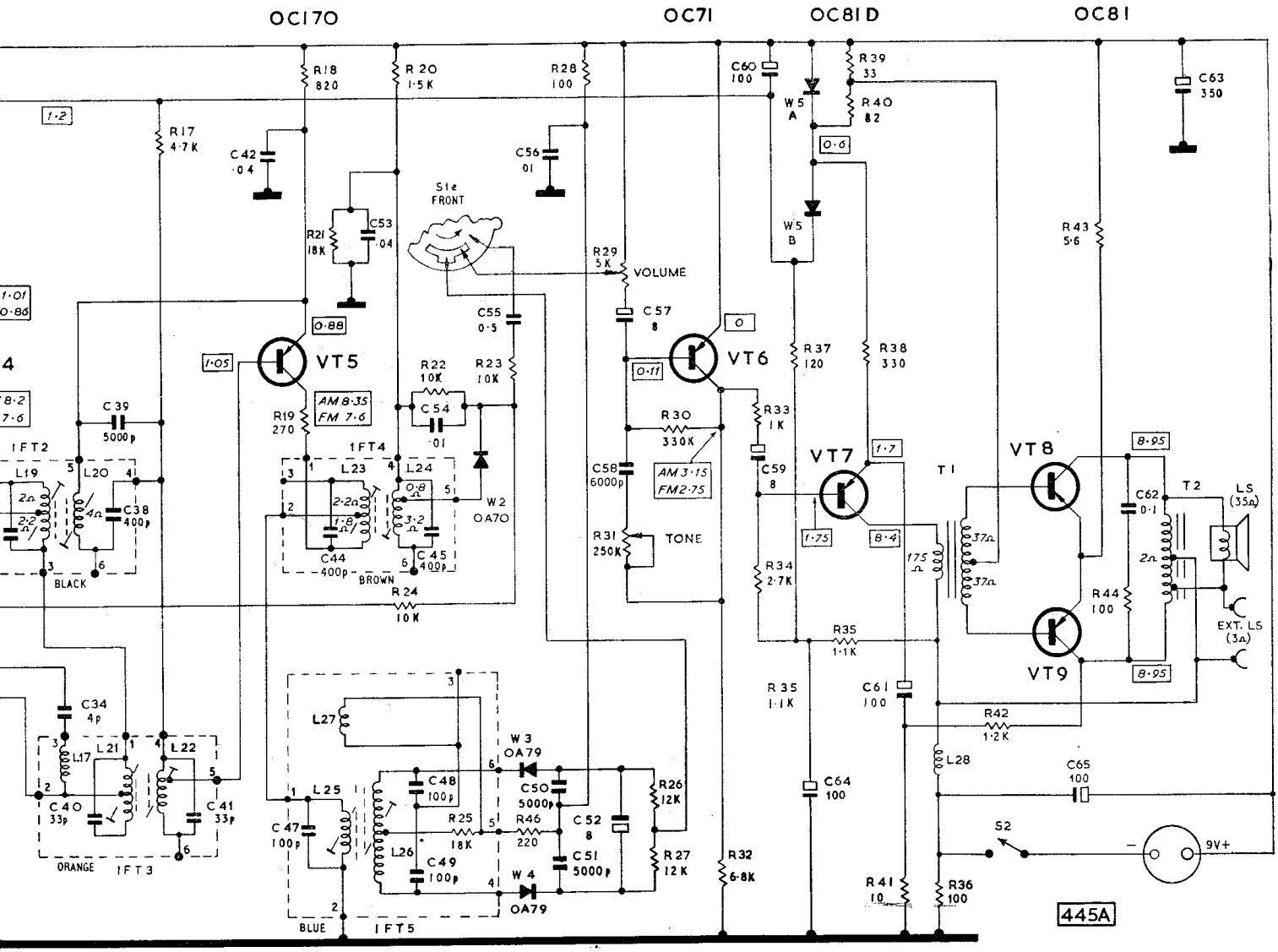


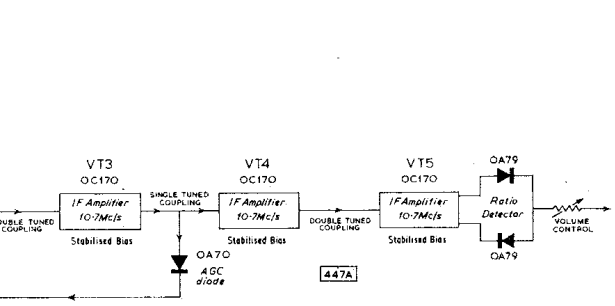
Fig. 4. Block schematic o

T DIAGRAM



SWITCH VIEWED FROM FRONT OF INVERTED CHASSIS.

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



k schematic of VHF/FM circuits.

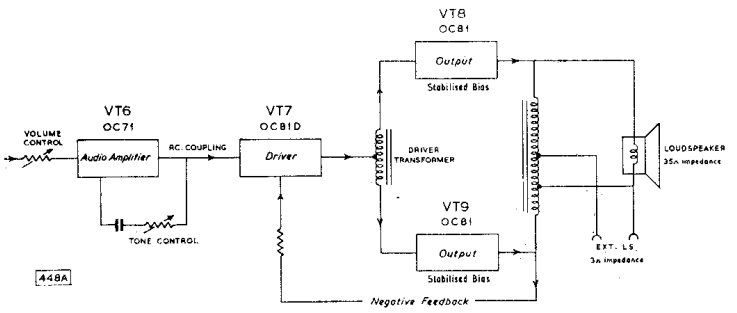


Fig. 5. Block schematic of audio amplifier.

ALIGNMENT DATA

Procedure : *Preferably connect a 35 ohm output meter in place of internal loudspeaker, or alternatively a 3 ohm output meter may be used across external speaker leads with the internal loudspeaker connected. Throughout alignment, signal input to the receiver should be adjusted to maintain an audio output of approximately 100mW with Volume and Tone controls set to maximum.*

AM CIRCUITS

IF Alignment

Inject 470 Kc/s 30% modulated signal to **C21** (aerial section of gang) via an 0·1μF capacitor. Peak **L24, L23, L20** and **L19** in that order for maximum output. Repeat until no further improvement results.

RF Alignment

MW must be aligned first. Signals to be injected via an 0·1μF capacitor to external aerial socket. With the tuning gang at maximum, set cursor to correspond with the Zero Marker. Pad and Trim Markers are provided on MW and a Calibration Check point on LW.

Range	Frequency	Cursor Position	Adjust
MW	1400 Kc/s	Trim Marker	C30, C22
	580 Kc/s	Pad Marker	L18, L9*
	* Adjust by sliding Ring along aerial rod.		
LW	220 Kc/s	Tune to Signal Check Calibration	C31, L10†
	† Adjust by sliding Coil Former along aerial rod.		

FM CIRCUITS

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 75 ohms.

IF Alignment

1. Inject 10·7 Mc/s **FM** signal via 30pF capacitor to FM Test Point on VHF tuner unit, and adjust **L26, L25, L22, L21** and **L14** for maximum output.
2. Inject 10·7 Mc/s **AM** signal, and adjust **L26** for minimum output.
3. Inject 10·7 Mc/s **FM** signal and adjust **L7** and **L6** for maximum output.
4. Repeat (1) to (3) until no further improvement results.

RF Alignment

1. Check that the cursor corresponds with Zero Marker with the tuning gang at maximum.
2. Rotate tuning control so that the cursor coincides with FM 91 Mc/s Marker.
3. 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 top end of the former must be chosen.
4. Inject 91 Mc/s **FM** signal to FM aerial socket and adjust L3 for maximum output.
5. Check calibration over range.

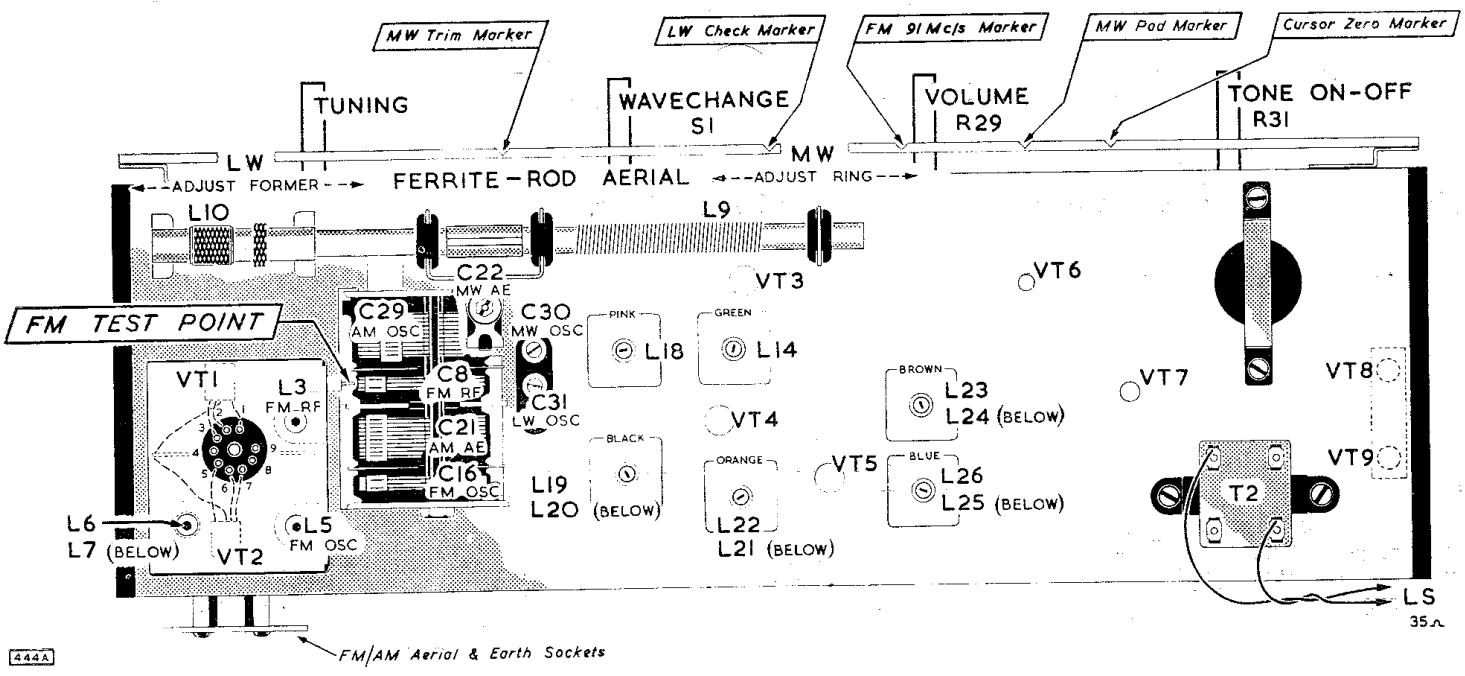


Fig. 9 Top view of chassis showing location of trimming adjustments required for Alignment and VHF transistors test socket

COMPONENTS LIST

CAPACITORS

All 350V DC working 20% tolerance unless otherwise stated.

Ref.	Value	Remarks	Part No.
C1	47pF	5%	
C2	25pF	5%	
C3	47pF	5%	
C4	·01μF		
C5	1000pF		
C6	10pF	±½pF	C100H35
C7	47pF	5%	
C8	13·5pF	Variable	Y25703
C9	5pF	±½pF	C050H35
C10	5pF	±½pF	
C11	1000pF		
C12	220pF	2½%	
C13	25pF	5%	
C14	14pF	5%	C140G35
C15	50pF	5%	
C16	13·5pF	Variable	Y25703
C17	25pF	5%	
C18	220pF	2½%	
C19	·01μF		
C20	70pF	5%	
C21	316pF	Variable	Y25703
C22	3-30pF	Trimmer	Z13937
C23	·01μF		
C24	8μF	Electro 6V	Y13222/8
C25	8μF	Electro 6V	
C26	·04μF		
C27	47pF	2½%	
C28	1500pF		
C29	136pF	Variable	Y25703
C30	3-30pF	Trimmer	Z13941
C31	3-30pF	Trimmer	
C32	265pF	2%	45775
C33	85pF	5%	
C34	4pF	±¼pF	C040035
C35	·02μF		
C36	4pF	±¼pF	
C37	400pF	2½%	
C38	400pF	2½%	
C39	5000pF	5%	
C40	33pF	2½%	
C41	33pF	2½%	
C42	·04μF		
C44	400pF	2½%	
C45	400pF	2½%	
C47	100pF	2½%	
C48	100pF	2½%	
C49	100pF	2½%	
C50	5000pF		
C51	5000pF		
C52	8μF	Electro 6V	Y13222/8
C53	·04μF		
C54	·01μF		
C55	0·5μF		
C56	·01μF		
C57	8μF	Electro 6V	Y13222/8
C58	6000pF		
C59	8μF	Electro 6V	Y13222/8
C60	100μF	Electro 6V	Y13229/3X
C61	100μF	Electro 12V	Y13229/2X
C62	0·1μF		
C63	350μF	Electro 12V	Y13229/23
C64	100μF	Electro 12V	
C65	100μF	Electro 12V	Y13229/2X

RESISTORS

All ½ Watt carbon unless otherwise stated.

Ref.	Value	Remarks	Part No.
R1	2·2KΩ	10%	
R2	12KΩ	10%	
R3	5·6KΩ	10%	
R4	1KΩ	10%	
R5	180Ω	10%	
R6	2·2KΩ	10%	
R7	12KΩ	10%	
R8	470Ω	10%	
R9	680Ω	10%	
R10	330KΩ	10%	
R11	4·7KΩ	10%	
R12	470Ω	10%	
R13	220Ω	10%	
R14	4·7KΩ	10%	
R15	820Ω	10%	
R16	220Ω	10%	
R17	4·7KΩ	10%	
R18	820Ω	10%	
R19	270Ω	10%	
R20	1·5KΩ	10%	
R21	18KΩ	10%	
R22	10KΩ	10%	
R23	10KΩ	10%	
R25	18KΩ	10%	
R26	12KΩ	10%	
R27	12KΩ	10%	
R28	100Ω	10%	
R29	5KΩ	Log. Pot.	Z13147/14
R30	330KΩ	10%	
R31	250KΩ	Anti-Log. Pot.	Z20200
R32	6·8KΩ	10%	
R33	1KΩ	10%	
R34	2·7KΩ	10%	
R35	1·1KΩ	5%	
R36	100Ω	10%	
R37	120Ω	5%	
R38	330Ω	5%	
R39	33Ω	5%	
R40	82Ω	5%	
R41	10Ω	10%	
R42	1·2KΩ	10%	
R43	5·6Ω	10%	
R44	100Ω	10%	
R45	100KΩ	20%	
R46	220Ω	20%	

INDUCTORS & TRANSFORMERS

Ref.	Description	Part No.
L1	FM aerial transformer	Y29323
L2		
L3	VHF amplifier tuning	Y25835
L4	Phase corrector	Y33202
L5	FM oscillator tuning	Y33200
L6	1st 10·7 Mc/s IFT	Y33201
L7		
L8	AM aerial loading	Y32010
L9	MW aerial	Y33189
L10	LW aerial	
L11	AM ext. aerial coupling	
L12	MW base coupling	
L13	LW base coupling	
L14	2nd 10·7 Mc/s IFT	Y33209
L15		
L16	AGC coil	
L17	Neutralizing	Y33210
L18	AM oscillator tuning	Y33208
L19	1st 470 Kc/s IFT	Y33212
L20		
L21	3rd 10·7 Mc/s IFT	Y33210
L22		
L23	2nd 470 Kc/s IFT	Y33213
L24		
L25	FM ratio detector	Y33211
L26		
L27		
L28	RF choke	Y33694
T1	Output driver transformer	Y33207
T2	Output transformer	Y32562

MISCELLANEOUS

Ref.	Description	Part No.
W1	OA70 FM AGC diode	
W2	OA70 AM detector diode	
W3	OA79 FM ratio detector diodes	
W4		
W5 A & B	D9-1-1 Voltage stabilising rectifier	
LS	Loudspeaker 35Ω impedance	Y16032/3
S1 a-e	Wavechange switch	Y33204
S2	On-Off switch	Z20200

SPARE PARTS

Description	Part No.
Battery plug	Z7553
Cabinet	V33371
Cabinet back	V33367
Control knobs:—	
Volume, Tone, Tuning	Y25493/4
Wavechange	Y25493/19
Control knob spring	45931
Cursor	Z29533/2
Drive drum	Z25147
Tuning scale	N33374

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 DIVISION)

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