EKCO SERVICE DATA

MODEL U243

See also Service News Sheets Nos :

MODEL U243 is a seven-valve (including rectifier and tuning indicator), superheterodyne receiver designed for the reception of F.M. signals on Band II in addition to A.M. signals on the Medium and Long wavebands, and for operation from either A.C. or D.C. mains.

Features include, an electronic tuning indicator, a waveband indicator, and built-in aerials for both F.M. and A.M. reception. Sockets are provided for the connection of an external aerial, earth and dipole, and an extension loud-speaker. The receiver is housed in a walnut veneered cabinet with a plastics grille and a two-colour scale escutcheon.

WARNING: As is customary with AC/DC receivers, the chassis connects to one side of the mains, and due care must be taken when handling an exposed chassis connected to the supply.

When operating on A.C. the chassis should be connected to the " earthed " side of the mains. Check with a neon lamp and insulated leads between chassis and earth, if the lamp glows, reverse the mains input plug.

MAINS SUPPLY : 200-250 volts, 40-100 c/s. A.C. or 200-250 volts D.C.

MAINS CONSUMPTION: F.M. Range 63 watts. A.M. range 60 watts.

Note.—The figures quoted for both ranges are taken with the pilot lamp in circuit.

CONTROLS: Front left, VOLUME ON/OFF. Front right, TUNING.

Side, WAVEBAND SELECTOR. Rear, Pre-set TONE and L.S. switch.

VALVES:

V1	UCC85	R.F. Amplifier and F.M. Mixer.
V2	UCH81	A.M. Freq. Changer, F.M. I.F. Ampl.
V3	UF85	I.F. Amplifier.
V4	UABC80	F.M. Ratio Det., A.M. Demodulator, A.F. Ampl.
V5	UL41	A.F. Output.
V6	UY41	Half-wave Rectifier.
V7	DM70	Electronic Tuning Indicator.

All valves are Mullard, V1.2.3.4. have B9A bases, V5.6 have B8A bases, V7 has a B8D base.

WAVEBAND COVERAGE:

Position 1	F.M. Band II	87-100 Mc/s.	3 -3.45 metres.
2	M.W. Band	545-1560 Kc/s.	192-550 metres.
3	L.W. Band	148-305 Kc/s.	983.6-2027 metres.

INTERMEDIATE FREQUENCY: F.M. 10.7 Mc/s. A.M. 470 Kc/s.

PILOT LAMP: 250 volts, 15 watts, Pygmy lamp.

LOUD-SPEAKER IMPEDANCE: 3 ohms at 400 c/s. An external loud-speaker, when fitted should have a similar impedance.

CIRCUIT SUMMARY

F.M./A.M. SWITCHING: The waveband selector comprises two widely spaced wafers which contain respectively all four sections of SW1 and the three sections of SW2.

SW1.A and SW1.B control the signal input to the A.M. frequency changer, and on position 1 (F.M.) short-circuit the M.W./L.W. input coils and the A.M. signal feed. On positions 2 and 3, the signal short-circuit is removed and the appropriate M.W./L.W. coil(s) made operative.

SW1.C and SW1.D control the grid and anode circuits respectively of the A.M. triode oscillator, rendering this section of V2 inoperative on position 1, and connecting in the M.W. and L.W. oscillator circuits on positions 2 and 3.

SW2.A connects the H.T. feed to V1 for F.M. operation, and breaks it to render the valve inoperative on the A.M. positions 2 and 3.

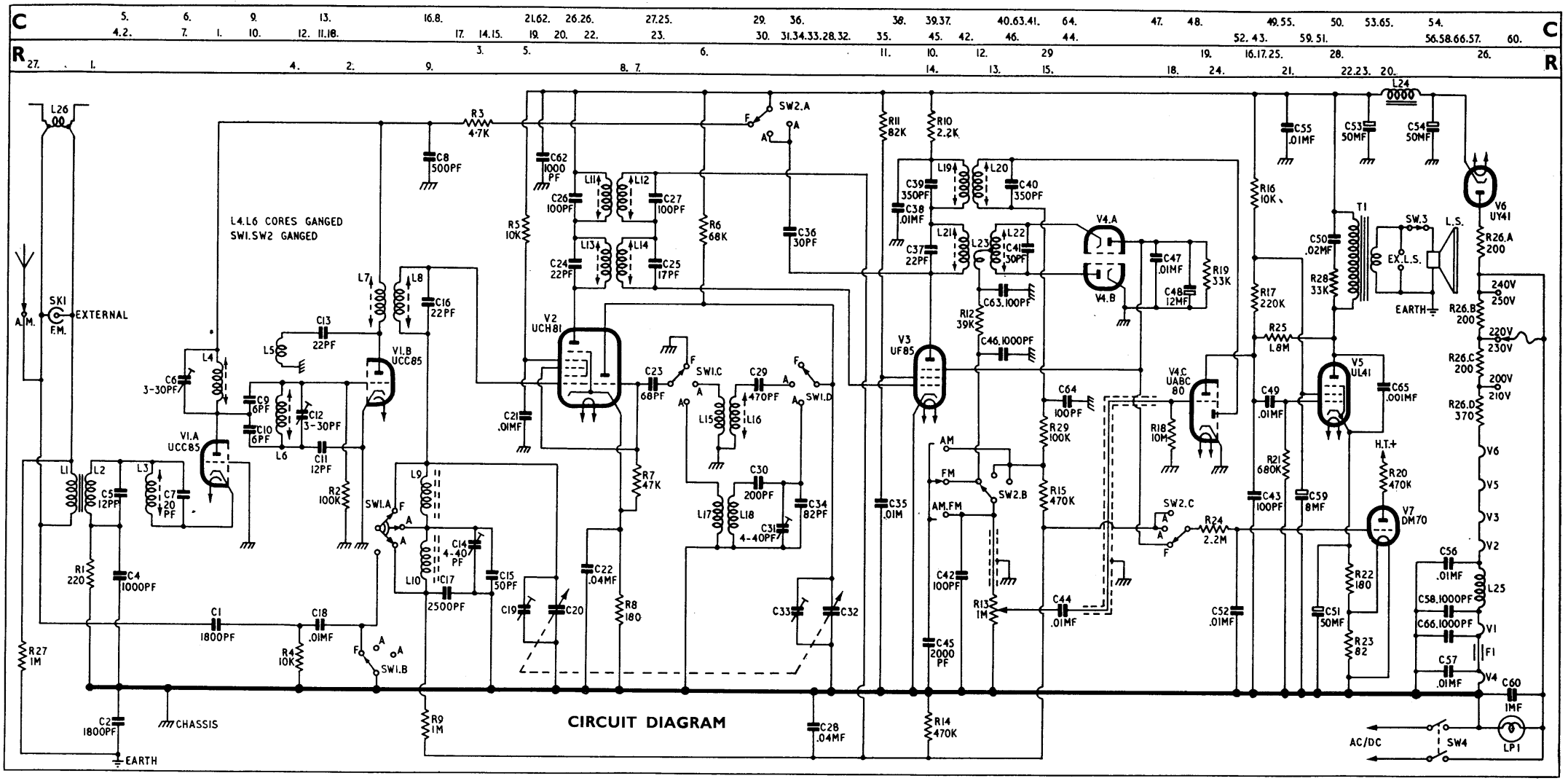
On the latter positions C36 is connected from V3 anode to the H.T. line to shunt, and therefore detune, the F.M. I.F. transformer primary during A.M. reception.

SW2.B selects the F.M. audio on position 1, or the A.M. audio on positions 2 and 3 for application to the succeeding A.F. amplifying circuits.

SW2.C selects F.M. or A.M. drive for the tuning indicator.

F.M. R.F. and I.F. CIRCUITS: From the built-in dipole loading coil, the output is matched into the input coupling coil

(Continued on page 3)



Correction : L18 should have iron dust core.

L1, across which is connected the socket for an external dipole. The signal is coupled to the cathode of an earthed grid triode V1.A via L2.C5 and an I.F. filter L3.C7 ; the output at R.F. appearing at the tuned anode being coupled to the oscillator grid.

V1.B, together with L6.C9.C10.C12 and the feedback coil L5, is a free-running oscillator which beats with the incoming R.F. signal to produce an I.F. output at 10.7 Mc/s. at the tuned anode circuit.

After the initial setting of the trimmers C6.C12, these circuits are tuned by the ganged cores of L4.L6, which are spring-loaded and cam driven from the main tuning drive.

V1.B output is coupled via L7.L8 to V2 which, on F.M., functions as a pentode amplifier, the triode being inoperative, and in turn V2 output is coupled via L13.L14 to V3 for final amplification at 10.7 Mc/s.

F.M. RATIO DETECTOR: The third F.M. I.F. transformer has three windings with phase controlled coupling, so that the signal voltages in the primary L21 and the tertiary L23 are always in phase with each other, while the secondary L22 voltage will be out of phase by varying degrees.

The voltages at each end of L22, however, are always anti-phase with each other and, when rectified by the opposed diodes, produce a D.C. voltage across R19 which is controlled against any rapid variation by the reservoir action of the large capacity C48.

This means that R19 voltage will vary only with the relatively slow variations of signal strength but will remain unaffected by any audio content, so that any noise and A.M. audio will be suppressed.

The conversion of the modulation of the F.M. signal to A.F. is solely the result of phase inequalities across the transformer. At the centre frequency, 10.7 Mc/s., the voltage developed at each end of L22 will be $\pm$ 90 deg. out of phase with L21 voltage, while L23 voltage remains constantly in phase with L21. The voltage of L23 is injected to the centre point of L22 and is used as a reference for the voltages at each end of L22 the effective value of which is the algebraic sum of an end voltage and the reference voltage.

At 10.7 Mc/s., each end voltage plus the reference voltage is equal to but anti-phase with its counterpart, and the current set up in each half circuit is equal and opposite, to result in a null or D.C. condition at the centre of L22, and therefore no audio output.

As the primary signal is deviated from the centre frequency by its frequency modulation, the phase of L22 voltages will vary in equal but opposite degrees, which means that the phase of one end will approach that of L21, and that of the other end will recede, so that when each end voltage phase is then added algebraically to the reference voltage phase, the effective end voltages will no longer be equal, and unequal currents will therefore result in each half circuit.

A difference current will then appear at the centre point of L22 and will flow via L23 to set up a voltage across the external load, C63. This difference current will vary in direct sympathy with the phase differences of L22.L23, which vary with the modulation deviation of the primary signal. Hence the voltage across the external load will vary with the audio content of the F.M. signal.

LIMITING: This is carried out as an automatic function of the ratio detector reservoir circuit, and no separate limiter is therefore required.

DE-EMPHASIS: To assist in countering the effects of noise modulation upon the signal, the higher frequencies of the audio range are deliberately emphasised at the transmitter. Within the receiver, the signal is brought back to normal by de-emphasising these same frequencies to a like degree, by a 50 μS filter, comprising R12.C46 and stray capacities, connected across the audio load, C63.

F.M. A.G.C. AND TUNING INDICATOR: As mentioned under the heading " Ratio Detector ", a D.C. voltage that is relative to signal strength is developed across R19. A feed from the negative side of this resistor applies the voltage to G3 of the final I.F. amplifier V3 as an A.G.C.

A similar negative feed is taken via the filter R24.C52 to the tuning indicator V7 as grid drive.

A.M. R.F. AND I.F. CIRCUITS: A.M. signals may be received by using the internal Ferrite rod aerial, by utilising the down lead of an F.M. dipole (if available), or by a separate external aerial.

With the internal aerial, signals are induced direct into the grip coils of V2 heptode. With either external aerials, the signal is " bottom " coupled to the coil in use via a mains isolating capacitor C1, and a D.C. blocking capacitor for the A.G.C. line C18. R4 is fitted to minimise modulation hum.

For the triode oscillator, conventional anode tuned circuits are used.

The I.F. output at V2 heptode anode is coupled by L11.L12 to V3 for amplification, and from V3 anode is coupled by L19.L20 to a single diode of V4 for demodulation.

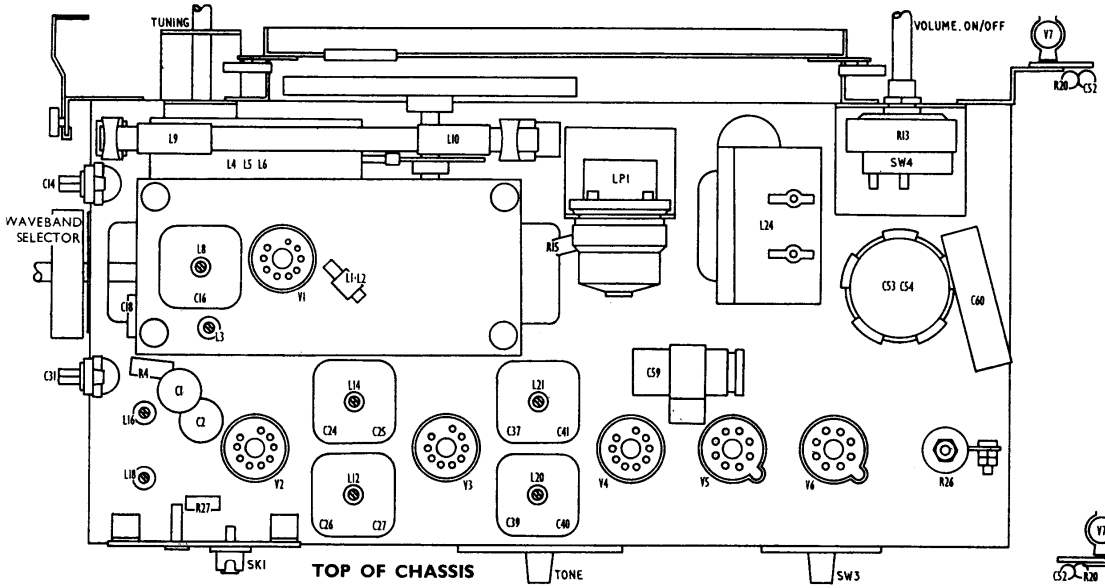
A.F. CIRCUITS: The F.M. audio output from the de-emphasis network R12.C46 is selected on position 1 of SW2.B and applied to the volume control R13.

The A.M. audio is developed across the diode load potentiometer R29.R15.R14 from which it is tapped off by SW2.B and applied, on positions 2 and 3, to the volume control.

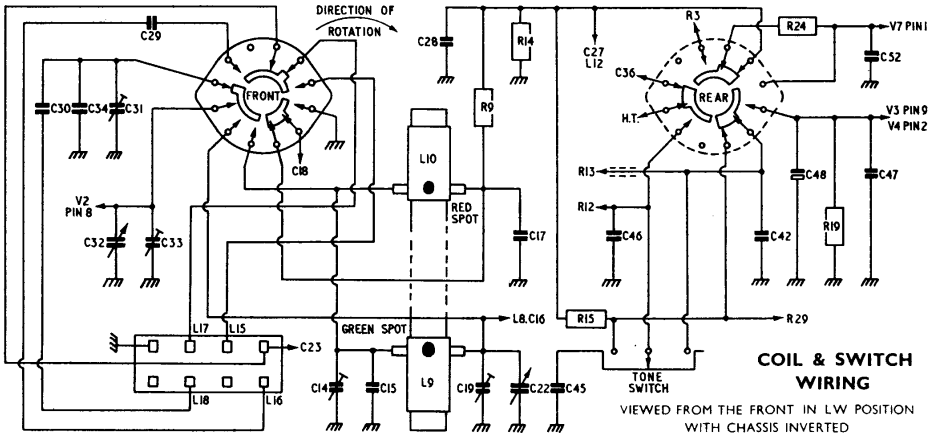
C45 provides optional top cut and can be selected for A.M. only, F.M. only or both.

From the volume control, the signal is fed to the triode of V4, amplified, and then coupled by C49 to V5 for final amplification, with V5 output transformer coupled to the loud-speaker. Negative feedback is applied across V5 anode and grid via R25 and C49.

(Continued on page 5)

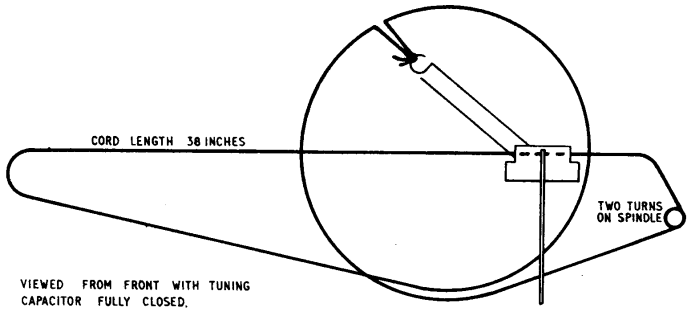


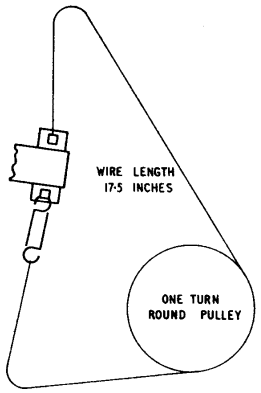
TOP OF CHASSIS



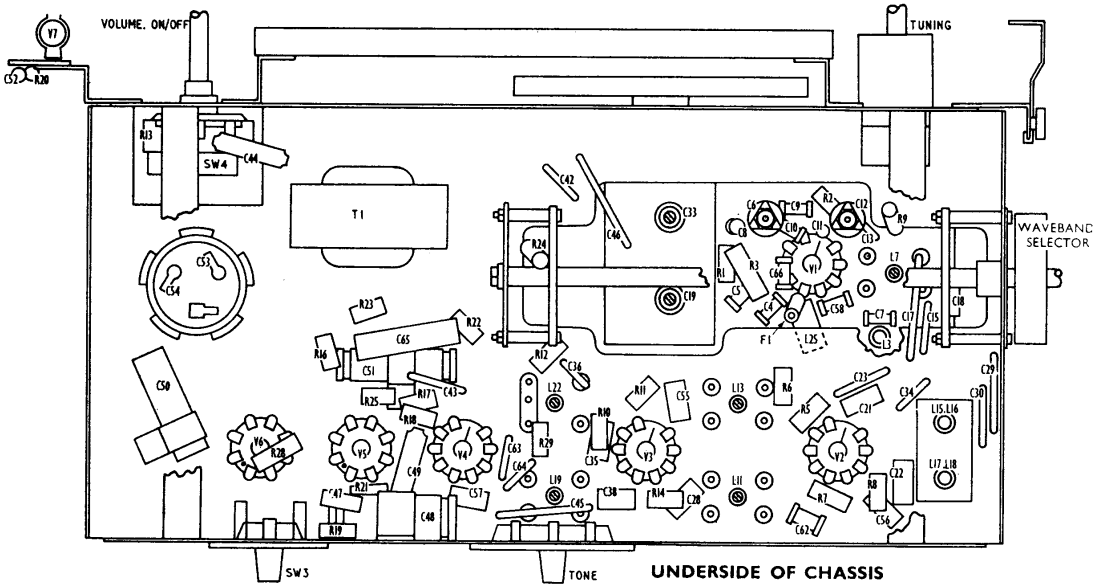
COIL & SWITCH WIRING

VIEWED FROM THE FRONT IN LW POSITION WITH CHASSIS INVERTED





DRIVE CORD & WIRE DETAILS



UNDERSIDE OF CHASSIS

A.M. A.G.C. AND TUNING INDICATOR: From the diode load potentiometer, the rectified voltage is tapped off, filtered and applied as A G.C. voltage to the grids of V2 and V3. From the same tapping, a feed is taken, on positions 2 and 3 of SW2.C, to the grid of the tuning indicator.

POWER SUPPLIES: After double pole switching, one side of the mains input is connected to chassis, and the other side via a surge limiter R26.A. to the anode of the half-wave rectifier V6. The D.C. output is smoothed by a conventional C.L.C. filter and fed to the H.T. line.

Across the mains, the six valve heaters are connected in series with the resistor R26.B.C.D., which is adjustable for the control of heater current with different input voltages.

Note.—V7 filament is supplied from V5 cathode circuit.

Also across the mains is the Pygmy lamp LP1 shunted by C60.

CHASSIS REMOVAL: Remove two control knobs on the front of the cabinet and the waveband control knob at the side. The screw for the latter is accessible from inside the cabinet.

Next remove two plastic cover plates screwed to the cabinet base and then remove the four 2BA chassis bolts thus exposed.

Finally withdraw chassis to the extent of the speaker leads.

POINTER ADJUSTMENT: With the tuning capacitors fully closed, control fully clockwise, the pointer should coincide with the small datum marks at the right hand end of the upper and lower scale. If in error, slide the pointer carriage along the drive cord until correct.

ALIGNMENT

REQUIREMENTS: A general purpose Signal Generator. An A.F. output meter. A 0-10 volt D.C. voltmeter (20,000 ohms/volt). A 0-100μA D.C. microammeter. Two 220K resistors. Trimming tools.

F.M. I.F. SECTION: Set the Volume Control for maximum output. Set the Waveband Selector to F.M. and tune the receiver to 87 Mc/s. Disconnect the lead to the F.M. internal aerial. Connect the 0-10 voltmeter across R19(C48).

Procedure: Inject a 10.7 Mc/s. signal to the grid, pin 2, of V3 via a suitable series isolating capacitor. If an A.M. generator is used, the signal should be unmodulated. If an F.M. type is used the signal should be deviated $\pm$25 Kc/s. at 400 c/s.

Tune L21 core for maximum output on the voltmeter. Disconnect this meter.

Connect the two 220K resistors in series across R19(C48), and the μAmeter from the junction of these resistors to the junction of R12.C63 and L23. With the same signal input tune L22 core for zero μAmeter reading. Check that L22 core adjustment produces a change of current polarity about the zero point, then leave the core set at zero reading. Remove the meter and resistors. Replace the 0-10 voltmeter across R19(C48).

Inject the 10.7 Mc/s. signal to the grid, pin 2, of V2 then tune L13 and L14 cores for maximum meter reading. Check that the I.F. is symmetrical at $\pm$100 Kc/s. off tune ; if in error, retune L21.

Inject the 10.7 Mc/s. signal to the cathode, pin 8, of V1, and tune the cores of L7 and L8 for maximum reading.

Inject the 10.7 Mc/s. signal to the F.M. dipole socket, SK1, and tune L3 core for minimum meter reading. Check sensitivity and bandwidth.

Sensitivity: Input to V3 grid, deviation $\pm$25 Kc/s. at 400 c/s. 70mV input for 500 mW output.

Input to V2 grid, 5.5mV for 500mW. Input to V1 cathode, 2mV for 500mW.

Bandwidth: Input to V3 grid, $\pm$250 Kc/s. for 6dB. Input to V2 grid, $\pm$100 Kc/s. for 6dB. Input to V1 cathode, $\pm$90Kc/s. for 6dB.

A.M. I.F. SECTION: Set the Volume Control for maximum output. Set the Waveband Selector to M.W. and tune the receiver to 545 Kc/s. Connect the output meter across the loudspeaker tags.

Procedure: Inject a 470 Kc/s. signal, mod. 30 per cent at 400 c/s., to the grid, pin 2, of V2, then adjust the cores of L20.L19.L12.L11. in that order for maximum output.

F.M. R.F. SECTION: Alignment of this section may be carried out by either of the following methods :

(1) By using an unmodulated signal input and tuning for peak D.C. volts across R19(C48), or,

(2) By using a frequency modulated signal input and tuning for maximum audio output.

It is recommended that the first method be used, as the second can give erroneous results if the I.F. amplifier and radio detector are not perfectly symmetrical.

Set the Waveband Selector to F.M. and tune the receiver to 94 Mc/s.

Set the Volume Control for maximum output. Connect the 0-10 volt meter across R19(C48). Set trimmers C6 for approximate mid-capacity and C12 for maximum capacity.

Procedure: Inject an unmodulated 94 Mc/s. signal from a 75 ohms source to the F.M. dipole socket. Reduce C12 capacity until a second peak is tuned. (The first response corresponds to the image with the oscillator on the L.F. side of the input signal.) Adjust C6 for maximum meter reading, re-adjust C12 as necessary.

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Inject a 98 Mc/s. signal and tune the receiver to the same frequency, then check calibration and sensitivity. Repeat at 90 Mc/s. If the coverage is not correct it may be necessary to adjust the position of the operating cam on the tuning capacitor shaft. The cam has a "throw" greater than the 180 deg. required for full scale, and may be reset to cover the required range. Calibration tolerance is ±0.5 Mc/s.

A.M. R.F. SECTION: Set the Waveband Selector to M.W. and the Volume Control for maximum output. Connect the output meter to the loud-speaker tags. All signals are injected to the external A and E sockets via a standard 200pf dummy aerial.

Procedure: Tune to and inject a modulated 600 Kc/s. signal, then tune L16 core for maximum output.

Tune to and inject a 1400 Kc/s. signal, then adjust trimmer C33 for maximum output. Repeat the adjustments at 600 and 1400 Kc/s. until there is no further improvement.

At 600 Kc/s. tune L9 by sliding it along the Ferrite rod for maximum output. Tune to and inject 1400 Kc/s. then adjust trimmer C19 for maximum output. Repeat as necessary.

Check calibration and coverage, then seal L9.

Set the Waveband Selector to L.W. Tune to and inject a 150 Kc/s. signal, then tune L18 core for maximum output.

Tune to and inject a 300 Kc/s. signal, then adjust C31 for maximum output. Repeat the adjustments at 150 and 300 Kc/s. until there is no further improvement.

Tune to and inject 150 Kc/s. then tune L10 by sliding it along the Ferrite rod for maximum output. Tune to and inject 300 Kc/s. then tune C14 for maximum output. Repeat adjustments as necessary.

Check calibration and coverage, then seal L10.

SERVICE NOTES

HUM: This may be experienced if the mains supply is connected the wrong way round.

A.M. I.F. BREAKTHROUGH: In the rare event of this occurring, it can be cleared by connecting a coil type DP23313 in series with a 150pf capacitor across the A and E sockets. The coil should be tuned for minimum output with 470 Kc/s. input.

AERIALS: Where it is desired to use separate external aerials for A.M. and F.M. reception, the lead connecting the F.M. dipole socket and the A.M. aerial socket, should be removed to avoid A.M. overloading.

VOLTAGE AND CURRENT DATA

F.M. Range

VALVE		ANODE		SCREEN		CATHODE	
		V	mA	V	mA	V	mA
V1	A	125	5·4	—	—	1·2	5·4
	B	125	5·8	—	—	—	5·8
V2	A	177	6·3	106	5·3	2·5	13·7
	B	61	2·1	—	—		
V3		163	6·52	38	1·7	—	8·22
V4	A	—	—	—	—	—	—
	B	—	—	—	—	—	—
	C	54	—	—	—	—	—
V5		164	27·5	116	4·3	6·5	31·8
V6		205 RMS	65	—	—	203	65

VOLTAGE AND CURRENT DATA—*continued*

A.M. Range

VALVE		ANODE		SCREEN		CATHODE	
		V	mA	V	mA	V	mA
V2	A	190	2·8	106	7·2	2·0	11·6
	B	72·5	1·6	—	—		
V3		176	7	41	1·8	—	8·8
V4	C	55	—	—	—	—	—
V5		177	29·7	125	4·6	7·0	34·3
V6		210 RMS	52	—	—	212	52

Conditions of Test: Receiver tuned to 94 Mc/s. (F.M.), 1,000 Kc/s. (A.M.). No signal input. 225 volts, 50 c/s. mains input to 220-230 volts tap.

Voltages taken with 20,000 ohms/voltmeter, chassis as negative.

RESISTANCE OF WINDINGS

WINDING	OHMS
L1	*
L2	*
L3	*
L4	*
L5	*
L6	*
L7	*
L8	*
L9	1·3
L10	8·4

WINDING	OHMS
L11	11·3
L12	11·3
L13	*
L14	*
L15	1
L16	2·3
L17	3
L18	7·5
L19	12
L20	10·5

WINDING	OHMS
L21	*
L22	*
L23	*
L24	360
L25	*
L26	*
T1 PRI.	380
T1 SEC.	*

* Less than 1 ohm.

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