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EKCO SERVICE DATA

MODEL A355

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MODEL A355 is an A.C. mains operated AM/FM radio receiver employing five valves plus an electronic tuning indicator and metal rectifier. The receiver offers free tuning of A.M. signals on the Long and Medium wavebands, and of F.M. signals on band II. Piano key type press buttons provide waveband, On-Off and Gram switching facilities.

A directional Ferrite rod aerial is used for Long and Medium wavebands, with provision for the connection of an external aerial. For the F.M. band, an internal aerial provides good reception in suitable localities, whilst an external dipole may be connected to the sockets provided.

The receiver incorporates a dual loud-speaker system, with sockets for the connection of a tape recorder, gramophone pick-up, or an extension loud-speaker. The A355 may also be used as an amplifier for one channel of a stereophonic record-player.

MAINS SUPPLY : 200-250 volts A.C. 50 c/s.

MAINS CONSUMPTION : Approximately 50 watts.

WARNING : The tappings of the mains transformer primary must be set to the correct positions as indicated, according to the voltage of the local mains supply, before the receiver is connected.

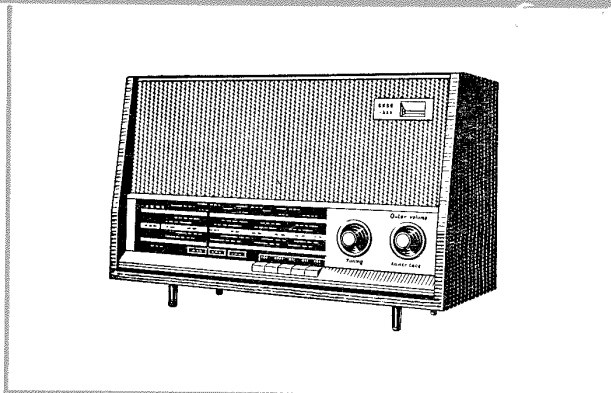
CONTROLS : The controls, situated at the right hand end of the scale are :—

Left Hand —Tuning
Right Hand (outer) —Volume
Right Hand (inner) —Tone

The five piano key buttons, from left to right are :—
Off, Gram, V.H.F., M.W. and L.W.

A muting switch for the internal loud-speakers is positioned at the rear of the chassis.

PILOT LAMPS : 6.5 volts 0.3 amp. M.E.S.

**VALVES :**

V1	F.M. R.F. Amplifier and Frequency Changer	ECC85
V2	F.M. I.F. Amplifier, A.M. Frequency Changer	ECH81
V3	I.F. Amplifier, F.M. and A.M.	EF89
V4	F.M. Detector, A.G.C. Diode, A.F. Amplifier, A.M. Detector.	EABC80
V5	Audio Output	EL84
V6	Tuning Indicator	EM84

METAL RECTIFIER : Westinghouse ECI, bridge type, contact-cooled.

WAVEBAND COVERAGE :

F.M. : 86—100 Mc/s.
M.W. : 545—182 metres, 550—1650 Kc/s.
L.W. : 2000—1200 metres, 150—250 Kc/s.

LOUD-SPEAKERS : One 8" x 5" elliptical, impedance 3 ohms at 400 c/s., and one 4" diameter high-frequency unit. The extension loud-speaker sockets provide a low-impedance output.

OUTPUT : 4 watts, approximately.

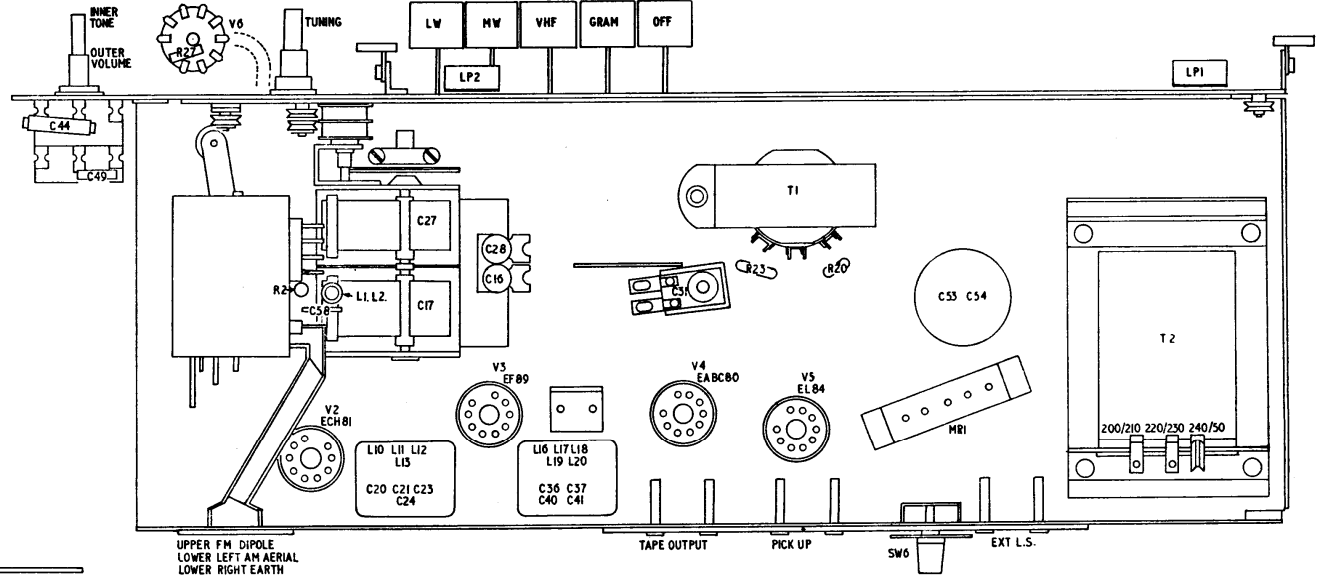
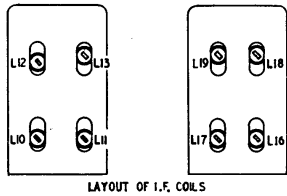
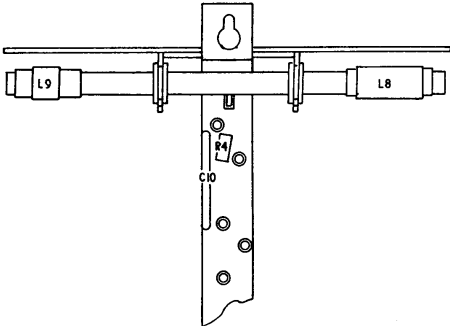
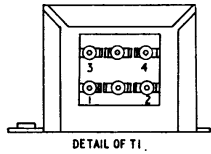
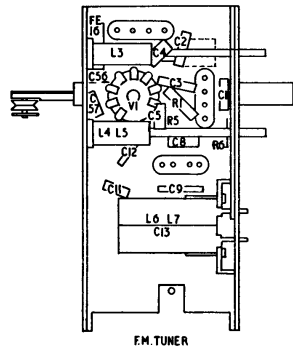
INTERMEDIATE FREQUENCIES : A.M. 470 Kc/s.
F.M. 10.7 Mc/s.

CIRCUIT DETAILS : F.M. OPERATION :

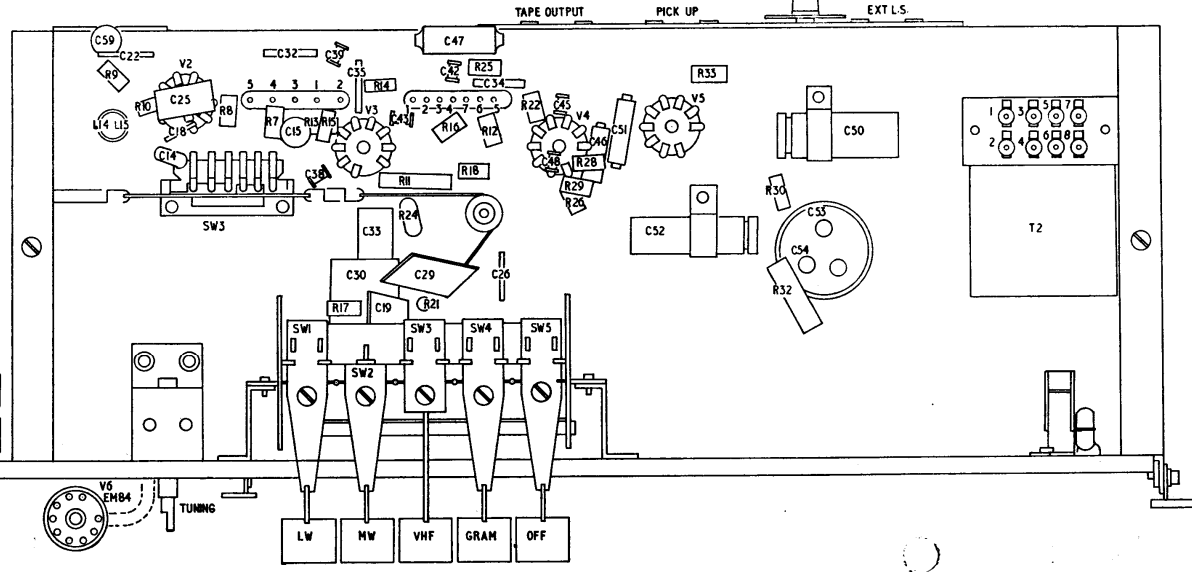
R.F. AND MIXER STAGES : F.M. signals from the dipole are passed via the V.H.F. aerial socket to the aerial coils, L1, L2, and then to the cathode of V1A, operating as a grounded grid R.F. triode. Amplified signal voltages are developed across the tuned circuit L3, C4 and fed via C7 to the grid circuit of V1B. R.F. tuning is by L3 core. V1B operates as a parallel fed oscillator, L5 core, which is ganged to L3 core, forming the variable tuning element. H.T. is fed to V1A via SW3.B.

INTERMEDIATE FREQUENCY STAGES : I.F. signals at the anode of V1B are transformer coupled by L6, L7 to the grid of V2 which operates as the first I.F. amplifier on F.M. The triode section of V2 is rendered inoperative on F.M. by the switch SW3.B which disconnects the H.T. supply from the anode. Amplified signals at the heptode anode are transformer coupled by L10, L12 to the grid of V3. The primary of the first A.M. I.F. transformer, L11, is short-circuited by SW3.C on F.M. to avoid interference from 470 Kc/s. signals. I.F. signals amplified by V3 are applied to the ratio detector V4A by the discriminator coil assembly L17, L19, L20.

RATIO DETECTOR : V4A operates as a conventional ratio detector in which the signal voltage across L19 is 90 degrees out of phase with the primary voltage when the F.M. signal is at mean frequency, and the sum total of signal voltages at the ends of L19 are equal and opposite. L20 applies a signal voltage to the centre of L19, which is in constant phase relation with the primary voltage. The voltage across L19 is applied to the opposed diodes of V4A which at the mean intermediate frequency produces a constant output. When the signal voltage in L17 deviates above or below the mean frequency, the phase in L19 changes relative to the degree of deviation. The total voltage applied to one diode, i.e. $\frac{1}{2} L19 \pm L20$, will increase while the other will decrease. The resultant output from the diodes will vary in direct relation to the deviation of the F.M. signal, i.e. in accordance with the audio content, and is fed through the I.F. filter R14, C39, R15, C38 and SW3.D, SW4, C44 to the Volume control R19.



UPPER FM DIPOLE
LOWER LEFT AM AERIAL
LOWER RIGHT EARTH



VOLUME TONE

TUNING

LW MW VHF GRAM OFF

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The capacitor C47 operates as a reservoir across the two diodes, and assists in removing any A.M. content from the output.

A.G.C. : A D.C. voltage, developed across R25,C47, has an amplitude which varies in direct relation to the input signal amplitude. This voltage is applied to the suppressor grid of V3 as A.G.C.

A.M. R.F. MIXER STAGE : The directional aerial for M.W. and L.W. reception consists of coils L9 and L8, which are located near the ends of a Ferrite rod. Provision is made for coupling an external aerial into the 'bottom end' of the aerial coils, if required. Aerial circuit waveband selection is by SW3.A, SW1.A and SW1.B, and tuning is effected by C17, with C16 as a pre-set trimmer. R.F. signals are fed through L7 to the control grid of V2 heptode. The triode section of V2 operates as a conventional parallel fed oscillator in which waveband selection is by SW1.C, and tuning by C27. The pre-set trimmers are C28 and C31. Mixing is by electronic coupling in the valve.

I.F. AMPLIFIER AND DEMODULATOR : I.F. signals at the anode of V2 are transformer coupled by L11,L13 to the grid of V3, which operates as a conventional I.F. amplifier. SW3.C short circuits the primary of the second F.M. I.F. transformer during A.M. operation.

Amplified I.F. voltages at the anode of V3 are fed to the diode demodulator V4B by the coils L16,L18. The diode load consists of R17 and R16. A.F. voltages are fed through SW3.D and SW4 to C44 and the Volume control.

A.G.C. : The rectified signal voltages developed across R17 are fed via R18 and R7 as bias to the control grids of V3 and V2 respectively.

GRAM OPERATION : Sockets for connecting to an external gramophone pick-up are coupled to the Volume control by SW4 and C44.

A.F. AMPLIFIER AND AUDIO OUTPUT STAGES : The A.F. amplifier and audio output stages are common to A.M., F.M. or gramophone operation. A.F. voltages at the Volume control are fed through C46 to the grid of V4B triode and, after amplification, are coupled by C51 to

the grid of the output valve V5. The circuit comprising R31,C49 provides variable tone correction. Negative feedback from the output transformer secondary is applied to V4B.

The loud-speakers are fed from the secondary of the output transformer T1, with SW6 operating as the internal loud-speaker muting switch.

POWER SUPPLIES : A.C. mains are applied through the On/Off switch SW5, to the tapped primary of the mains transformer T2. Two separate secondary windings on T2 provide heater current for valves and pilot lamps respectively.

MRI operates as a full-wave bridge rectifier fed from the H.T. secondary of the mains transformer. The D.C. output is smoothed by C54,C53,R32,R30 and C50.

CHASSIS REMOVAL : Disconnect the receiver from the mains supply, and remove the back cover, which is secured by five screws. Pull off the three control knobs (one two-piece and one concentric pair) and remove four screws from the underside of the cabinet, securing the chassis to the cabinet. Remove the woodscrew securing the bracing bracket to the lower centre of the baffle. Slacken the woodscrew holding the ferrite rod assembly bracket and spring the slot over the screwhead. Remove the valveholder from the tuning indicator. The chassis may now be withdrawn to the extent of the loud-speaker leads.

DRIVE CORD DETAILS :

POINTER DRIVE : A length of nylon cord of approximately 47", having a small loop at one end, is required. Check that with the gang fully meshed, the slots in the drive pulley are at the top. Attach the cord loop to the spring, and anchor the spring temporarily to any convenient point, such as the output transformer tags. Pass the cord round the pulley 'A' in an anti-clockwise direction, and across to the outer section of pulley 'B', passing over this pulley in a clockwise direction. Now make $1\frac{1}{2}$ turns round the drive spindle 'D' in a clockwise direction. Pass the cord clockwise round the inner pulley 'B' and, after passing round 'C' anti-clockwise, the cord should make four turns anti-clockwise round the inner section of the drive pulley.

Now pass the cord through the slot between the two sections of the drive pulley and across to the spring, where it should be secured so as to maintain a slight tension. Attach the pointer to the cord between the pulleys 'A' and 'B' so that, with the gang fully meshed, it coincides with the datum mark at the right hand end of the scale. Seal both knots with adhesive.

V.H.F. SWITCH DRIVE : A length of approximately 6 inches of nylon cord is required. Attach one end of the cord to the top of the lever at the front of the V.H.F. press button unit, then pass the cord round the pulley and tie off at the actuating spring so that, with the button released, the cord is taut and the slide switch is released. Seal knots in the cord with adhesive.

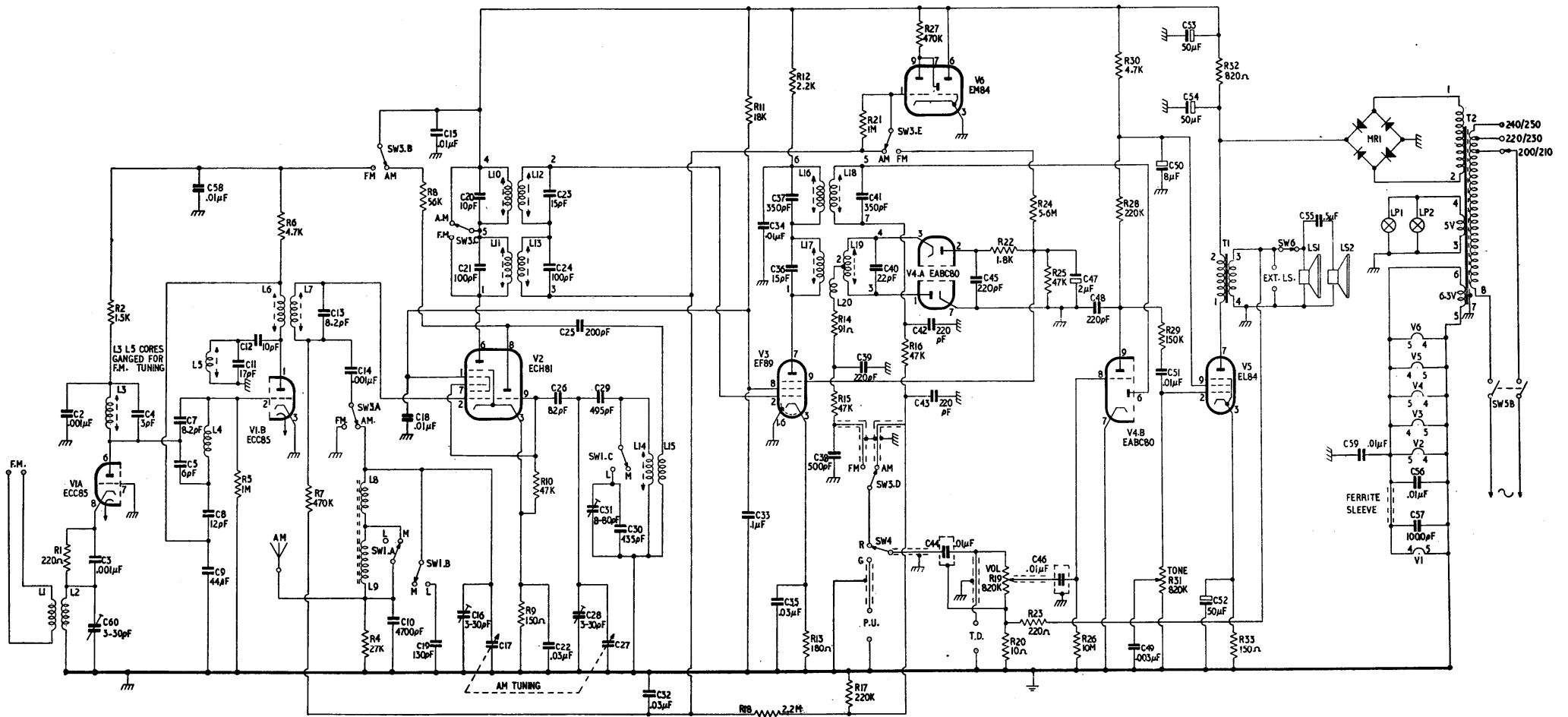
V.H.F. UNIT DRIVE : A length of nylon cord approximately $8\frac{1}{2}$ " long is required. Attach the cord to the end of the tuner unit carriage, and pass it over the pulley mounted on the tuner unit. Now take one turn anti-clockwise round the tuning gang shaft, and with the gang fully meshed, pass the cord round the rear of the right-hand screw on the drive collar and secure it firmly to the left-hand screw. The cord should be adjusted so that, with the gang fully meshed, the tuner unit carriage is $\frac{1}{32}$ " from the fully returned position. This cord can also be adjusted by rotating the tuning collar on the condenser shaft.

VALVE VOLTAGE AND CURRENT DATA : F.M. OPERATION :

VALVES	ANODE			SCREEN			CATHODE		
	Pin	V	mA	Pin	V	mA	Pin	V	mA
V1A	6	227	8.2	—	—	—	8	1.9	8.2
V1B	1	215	4.3	—	—	—	3	—	—
V2(H)	6	240	7	1	110	4.5	3	2	13.3
V2(T)	8	—	—	—	—	—	3	—	—
V3	7	224	7.6	8	110	2.9	1 & 3	1.95	10.5
V4	9	85	0.64	—	—	—	7	—	—
V5	7	265	40	9	215	4.1	3	6.2	44.1
V6	6	235	0.83	—	—	—	3	—	—
V6	9 & 7	53	0.45	—	—	—	3	—	—

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C	3.	7.	8.	11.	12.	15.	14.	15.	20.	23.	24.	25.	29.	34.	37.	41.	39.	42.	45.	48.	50.	53.	56.	C														
R	2.	60.	4.	5.	9.	5.	6.	7.	4.	10.	19.	16.	21.	17.	22.	26.	28.	31.	27.	30.	49.	51.	54.	52.	R													
	1.									9.	10.				11.	18.	13.	15.	17.		20.	19.	23.	26.	28.	31.	33.	35.	38.	39.	40.	43.	44.	46.	47.	55.	57.	58.



A.M. OPERATION :

VALVES	ANODE			SCREEN			CATHODE		
	Pin	V	mA	Pin	V	mA	Pin	V	mA
V1A	6	0	—	—	—	—	8	—	—
V1B	1	0	—	—	—	—	3	—	—
V2(H)	6	250	6	1	100	6	3	2	13.3
V2(T)	8	69	3.3	—	—	—	3	2	13.3
V3	7	240	6.9	8	100	2.6	1 & 3	1.8	9.5
V4	9	87	0.7	—	—	—	7	—	—
V5	7	260	37	9	230	4.5	3	6.7	41.5
V6	6	255	0.83	—	—	—	3	—	—
V6	9 & 7	55	0.48	—	—	—	3	—	—

D.C. RESISTANCE OF WINDINGS :

Winding	Ohms
T1 Pri.	400
T2 Pri.	40
T2 H.T. Sec.	85
L9	7
L11	10

All other windings less than one ohm.

Winding	Ohms
L13	10
L14	2
L15	1
L16	5
L18	6

I.F. ALIGNMENT—F.M. :

(a) **Visual Method :** Disconnect 2 μ F stabilising condenser (C47) at the earthy end. Tune the receiver to the low frequency end of the band. Switch to F.M. position, and turn Volume control to minimum. Inject R.F. sweep input to control grid of V3 (EF89) and connect an oscilloscope across the ratio detector load (R25). Tune primary of discriminator transformer (L17) for peak response. Re-connect C47 and transfer oscilloscope to the tertiary output (junction R14/C39). Tune the secondary of the discriminator (L19) for best 'S' curve shape, re-adjusting the primary (L17) if necessary. If the alignment equipment has the facility to superimpose A.M. on the F.M. signal input, the adjustment of L19 should be made for the best compromise of A.M. rejection at 10.7 Mc/s. and 'S' curve shape, and the primary adjustment for 'S' curve shape only.

Transfer the input to the control grid of V2 (ECH81), preferably at the lead out from the F.M. tuner unit. Disconnect C47 and transfer the oscilloscope leads across R25. Tune the secondary (L12) and primary (L10) of the second I.F. transformer for peak output at 10.7 Mc/s., ensuring that the response curve is substantially flat (± 100 Kc/s. off 10.7 Mc/s.), and symmetrical. Transfer the input to the junction of R2/C2 on the F.M. tuner unit, these are 1.5K and .001 μ F respectively. Care should be taken, as this point is at H.T. potential. Tune the primary (L6) and secondary (L7) of the first I.F. transformer for peak output, ensuring that the response curve is symmetrical and substantially flat ± 75 Kc/s. (± 100 Kc/s. within 3 dB). Re-connect C47.

(b) **Generator Method :** Connect the output meter with 3 ohms load to the loud-speaker sockets. Turn Volume and Tone controls to maximum. Connect two matched 220K resistors in series across the ratio detector load R25. Tune the receiver to the low frequency end of the band. With a 0-50 micro-ammeter connected between the junction of the 220K resistors and chassis, inject 10.7 Mc/s. to the control grid of V3. When tuning the primary coils, shunt the secondary with a 4.7K resistor in series with a .001 μ F condenser, and vice versa. Tune the ratio detector primary (L17) for peak reading on the micro-ammeter. Connect the micro-ammeter between the junction of the 220K resistors and the tertiary winding of the discriminator transformer (Junction of R14/C39). Tune the secondary (L19) for zero current reading. This current must go from a maximum positive through zero, to a maximum negative. Transfer the micro-ammeter lead from the junction of R14/C39 to the chassis. Connect the I.F. input to pin 2 of V2. Tune the secondary (L12) and the primary (L10) of the second I.F. transformer for maximum meter reading. Modulate the I.F. signal (± 25 Kc/s. deviation at 400 c/s.) and, with the Volume and Tone controls at maximum, check that sensitivity and bandwidth are correct re-tuning if necessary.

Inject a 10.7 Mc/s. signal to the junction R2/C2 via a .001 μ F capacitor, taking care as this point is at H.T. potential. Tune primary (L6) and secondary (L7) of first I.F. transformer for peak meter reading. Re-check sensitivity and bandwidth as above. Remove test resistors.

I.F. ALIGNMENT—A.M. : Switch to Medium waves and turn the tuning gang to full mesh. Connect an output meter with a 3 ohms load, to the loud-speaker terminals.

Set the Volume and Tone controls to maximum.

Inject a 470 Kc/s. signal, modulated 30% at 400 c/s. via a 0.1 μ F capacitor to pin 2 of V2. Tune L18, L16, L13 and L11 in that order, for maximum output and symmetrical response.

R.F. ALIGNMENT—F.M. : Switch to the F.M. band with the Volume and Tone controls set to maximum. Check that with the tuning gang fully closed, the carriage of the tuner unit is $\frac{1}{32}$ " from fully open, and the pointer coincides with the datum mark at the right hand end of the scale. Adjust, if necessary, by rotating the drive collar on the gang shaft, and/or sliding the pointer along the drive cord. Set the pointer to 92 Mc/s. point on the scale, and inject a signal of that frequency to the aerial socket. Adjust the cores of the oscillator coil (L5) and R.F. coil (L3) for maximum output. Check the calibration at 87 Mc/s., 94 Mc/s. and 99 Mc/s., which should be within ± 0.3 Mc/s. at all points. Check that the oscillator is operating correctly on the low frequency side by tuning the receiver to 100 Mc/s., and identifying the image at 78.6 Mc/s.

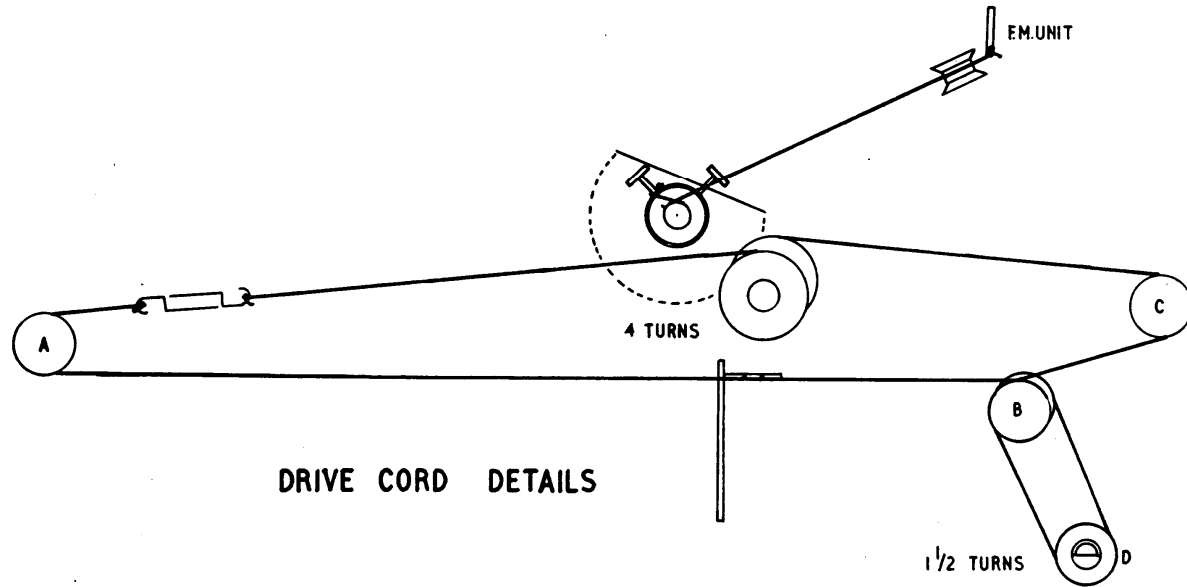
Finally, set the generator to 92 Mc/s., and adjust the aerial trimmer C60 for maximum output, with the internal aerial connected.

R.F. ALIGNMENT—A.M. : Switch to Medium waves and set the Volume and Tone controls to maximum. Tune the receiver to 600 Kc/s., and inject a 600 Kc/s. signal to the aerial socket.

Tune the oscillator coil (L14) until maximum output coincides with the 600 Kc/s. point on the scale.

Tune the receiver to 1,500 Kc/s., and inject 1,500 Kc/s. signal to the aerial socket. Tune the oscillator trimmer (C28) for maximum output. Tune the receiver to 666.6 Kc/s., and inject 666.6 Kc/s. to the aerial socket, adjusting aerial coil (L8) on the Ferrite rod for maximum output. With the receiver tuned to 1,400 Kc/s., and with a 1,400 Kc/s. input, tune the aerial trimmer (C16) for maximum output. Check tracking and calibration at 545 Kc/s., 857 Kc/s. and 1,600 Kc/s.

Switch to the Long wave band and tune to 214.3 Kc/s. Inject 214.3 Kc/s. to the aerial socket, and tune the oscillator trimmer (C31) for maximum output. Adjust the aerial coil on the Ferrite rod for maximum output. Check tracking and calibration at 150 Kc/s. and 250 Kc/s.



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