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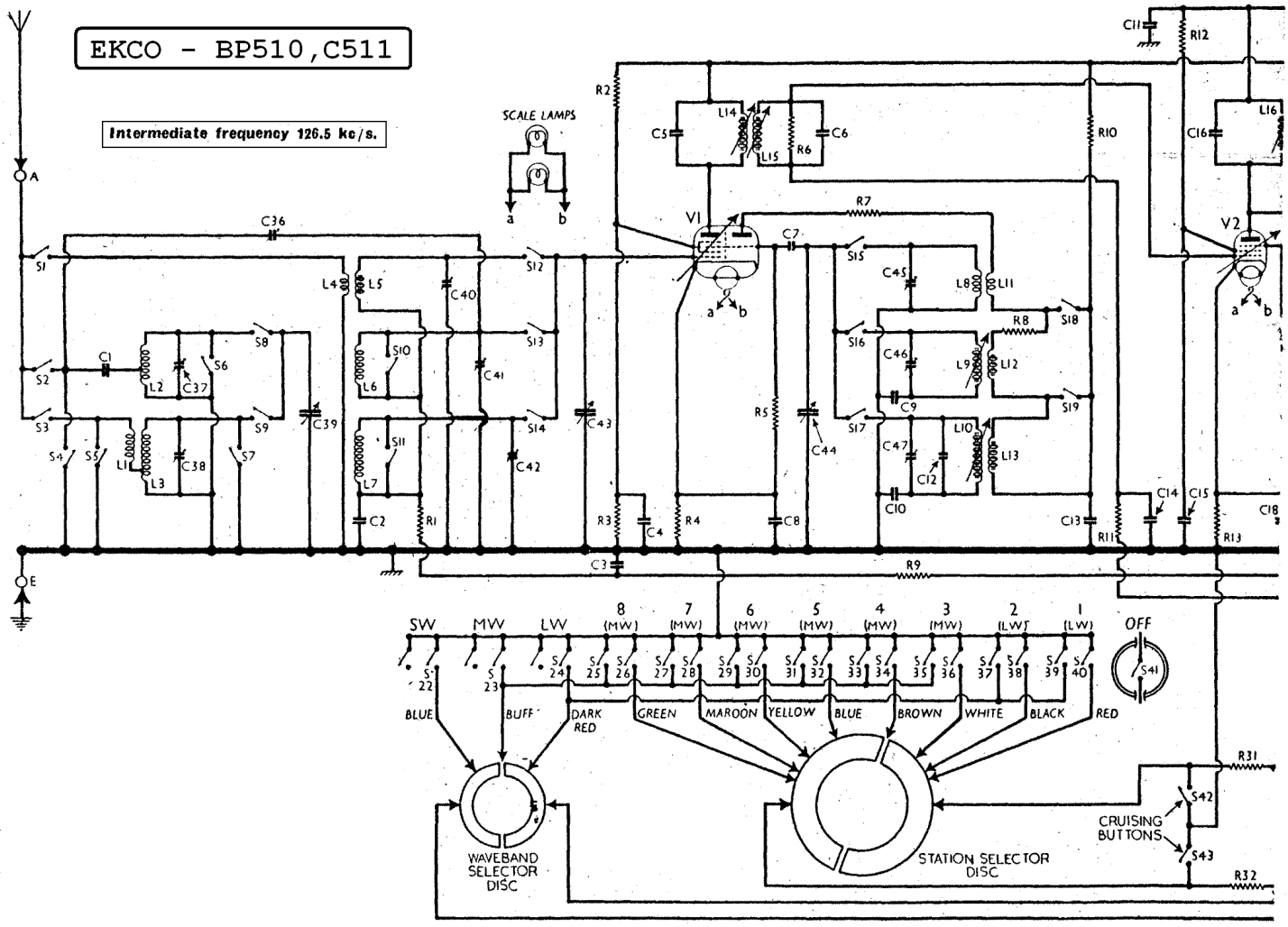
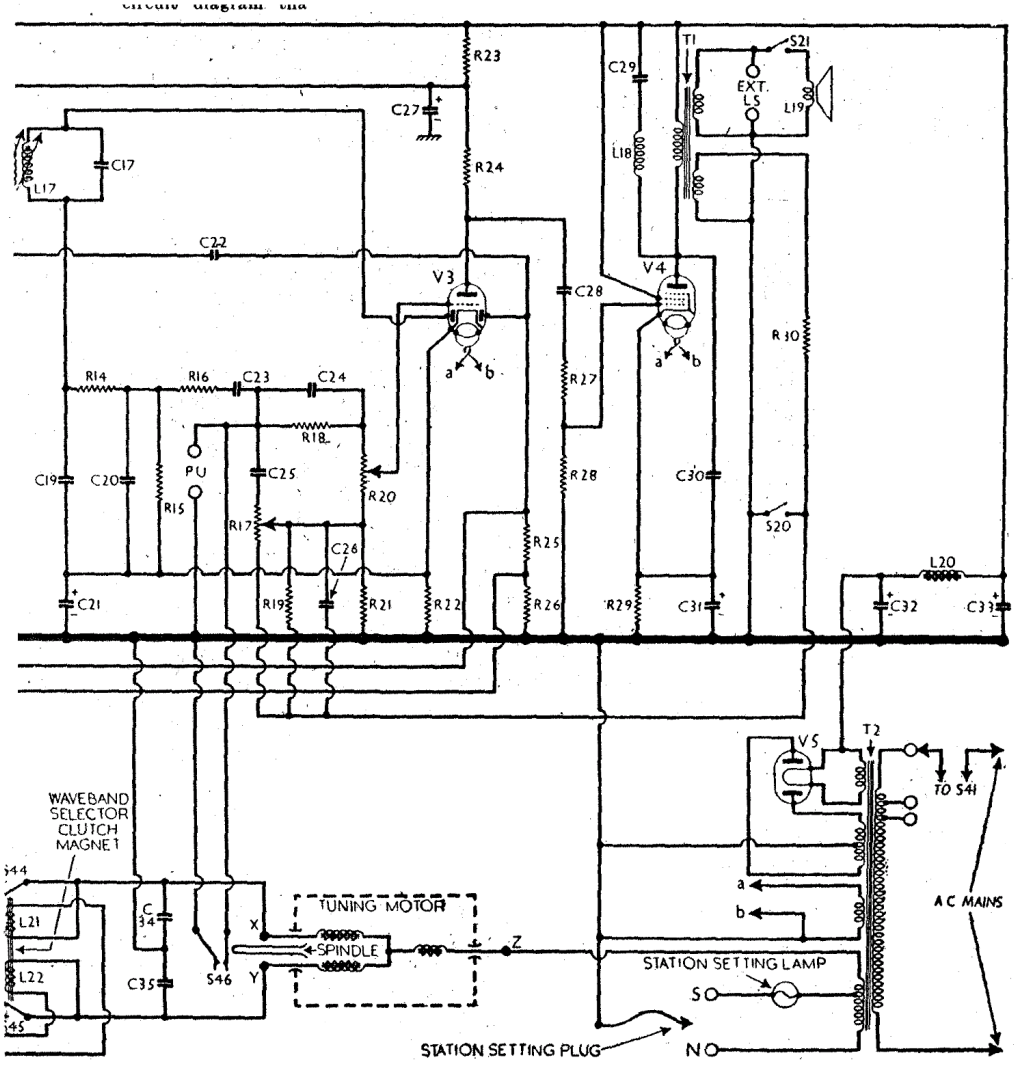
Intermediate frequency 126.5 kc/s.





	CONDENSERS	Values (μF)
C1	Aerial MW coupling ...	0·001
C2	V1 hex. CG decoupling ...	0·1
C3	AVC line decoupling ...	0·02
C4	V1 SG decoupling ...	0·1
C5	1st IF transformer tuning condensers	0·00014
C6		0·00014
C7	V1 osc. CG condenser ...	0·000025
C8	V1 cathode by-pass ...	0·1
C9	Osc. circ. MW tracker ...	0·001505
C10	Osc. circ. LW tracker ...	0·000425
C11	HT circuit RF by-pass ...	0·1
C12	Osc. LW fixed trimmer ...	0·00002
C13	V1 osc. anode decoupling	0·1
C14	V2 CG decoupling ...	0·01
C15	V2 SG decoupling ...	0·1
C16	2nd IF transformer tuning condensers ...	0·00014
C17		0·00014
C18	V2 cathode by-pass ...	0·1
C19	IF by-pass condensers ...	0·0002
C20		0·0002
C21*	V3 cathode by-pass ...	25·0
C22	AVC diode coupling ...	0·000015
C23	Coupling to V3 triode ...	0·01
C24	Parts of tone corrector circuit	0·0003
C25		0·0025
C26		0·08
C27*	V1 and V3 triode anode decoupling	4·0
C28	AF coupling to V4 ...	0·1
C29	Whistle filter tuning ...	0·005
C30	Fixed tone corrector ...	0·0025
C31*	V4 cathode by-pass ...	50·0
C32	HT smoothing condensers	8·0
C33		14·0
C34	Tuning motor shunt condensers	0·02
C35		0·02
C36‡	Image suppressor ...	—
C37‡	B-P pri. MW trimmer ...	—
C38‡	B-P pri. LW trimmer ...	—
C39†	Band-pass pri. tuning ...	—
C40‡	Aerial circ. SW trimmer	—
C41‡	B-P sec. MW trimmer ...	—
C42‡	B-P sec. LW trimmer ...	—
C43†	B-P sec. and SW tuning	—
C44†	Oscillator circuit tuning	—
C45‡	Osc. circ. SW trimmer ...	—
C46‡	Osc. circ. MW trimmer ...	—
C47†	Osc. circ. LW trimmer ...	—

* Electrolytic. † Variable. ‡ Pre-set

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	RESISTORS	Values (ohms)
R1	V1 hex. CG decoupling...	1,000,000
R2	V1 SG HT feed potential	47,000
R3	divider	68,000
R4	V1 fixed GB resistor ...	200
R5	V1 osc. CG resistor ...	100,000
R6	1st IF trans. sec. shunt...	470,000
R7	Oscillator reaction cir-	220
R8	cuit damping resistors	1,000
R9	AVC line decoupling ...	150,000
R10	V1 osc. anode HT feed...	47,000
R11	V2 CG decoupling ...	680,000
R12	V2 SG HT feed	91,000
R13	V2 fixed GB resistor ...	510
R14	IF stopper	270,000
R15	V3 signal diode load ...	100,000
R16	AF feed resistor... ...	56,000
R17	Variable tone control ...	500,000
R18	Parts of tone corrector	220,000
R19	circuit	47,000
R20	Manual volume control	1,000,000
R21	Part feed-back coupling	820
R22	V3 GB resistor	1,000
R23	V3 triode anode decoupling	3,300
R24	V3 triode anode load ...	56,000
R25	V3 AVC diode load	470,000
R26	resistors	470,000
R27	V4 CG potential divider	100,000
R28		270,000
R29	V4 GB resistor	120
R30	Feed-back coupling ...	15,000
R31	Tuning motor ballast re-	5
R32	sistors	5

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial LW coupling coil ...	28·0†
L2	Band-pass primary coils	3·0
L3		28·0
L4	Aerial SW coupling coil ...	0·2
L5	Aerial SW tuning coil ...	Very low
L6	Band-pass secondary coils	3·0
L7		29·0
L8	Osc. SW tuning coil ...	Very low
L9	Osc. MW tuning coil ...	3·0
L10	Osc. LW tuning coil ...	10·0
L11	Osc. SW reaction coil ...	0·5
L12	Osc. MW reaction coil ...	0·5
L13	Osc. LW reaction coil ...	0·7
L14	1st IF trans. Pri. ...	43·0
L15	Sec. ...	46·0
L16	2nd IF trans. Pri. ...	43·0
L17	Sec. ...	46·0
L18	Whistle filter coil ...	85·0
L19	Speaker speech coil ...	2·4
L20	HT smoothing choke ...	650·0
L21	Clutch magnet windings...	5·5
L22		5·5
T1	Output trans. Pri.	360·0
	Speech Sec. ...	0·4
	FB sec. ...	45·0
T2	Mains mains Pri., total ...	33·0
	Heater sec. ...	0·2
	Rect. heat sec.	0·2
	Motor sec., total	2·0
	HT sec., total...	540·0
TM	Tuning motor windings ...	5·0*
S1-S20	Waveband switches ...	—
S21	Int. speaker switch ...	—
S22-S40	Press-button switches ...	—
S41	Mains switch	—
S42, S43	PB cruising switches ...	—
S44, S45	Wavechange clutch switches	—

† Including the lower end of L3.
* Either winding. Measured between X and Z or Y and Z.

VALVE ANALYSIS

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH3	218	1·65	65	2·2
	Oscillator			
	82	2·7		
V2 EF9	250	4·8	110	1·4
V3 EBC3	100	2·2	—	—
V4 EL3	235	43·0	250	4·8
V5 AZ1	275†	—	—	—

† Each anode, AC.

CIRCUIT ALIGNMENT

IF Stages.—Switch set to LW, and turn the gang to maximum. Connect signal generator via a 0.01 μF condenser to CG (top cap) of **V1** and chassis, turn the gain control to maximum, feed in a 126.5 kc/s (2,372 m) signal and, using a fully insulated tool with a flat blade, adjust the cores of **L17** (upper coil), **L16** (lower coil) and **L15** (upper coil), **L14** (lower coil) for maximum output, keeping input low. These adjustments will not peak sharply.

RF and Oscillator Stages.—Transfer signal generator leads to **A** and **E** sockets, via a suitable dummy aerial. With the gang at maximum, the pointer should cover the 50 m calibration mark on the scale.

SW.—Press the SW button, and tune to 14 m on scale. Feed in a 14 m (21.4 Mc/s) signal, and adjust **C45** for maximum output, using the peak involving the lesser trimmer capacity if two are found. Tune to 15 m on scale, feed in a 15 m (20 Mc/s) signal, and adjust **C40** for maximum output. The calibration should now be correct at both ends of the scale. If it is not, check that the **C45** has been set to the correct peak.

MW.—Press the MW button, tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust the core of **L9** for maximum output. Tune to 190 m on scale, feed in a 190 m (1,579 kc/s) signal, and adjust **C46** for maximum output, using the peak involving the lesser trimmer capacity. Tune to 250 m on scale, feed in a 250 m (1,200 kc/s) signal, and adjust **C37** and **C41** for maximum output. Readjust **L9** at 500 m, and if any adjustment is necessary to secure correct calibration, return afterwards to the 190 m and 250 m adjustments and repeat the MW procedure.

LW.—Press the LW button, tune to 1,700 m on scale, feed in a 1,700 m (176.6 kc/s) signal, and adjust **L10** for maximum output. Tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C47** for maximum output, using the peak involving the lesser trimmer capacity if two are found.

Tune to 1,300 m on scale, feed in a 1,300 m (231 kc/s) signal, and adjust **C38** and **C42** for maximum output. Readjust **L10** at 1,700 m, and if any adjustment is required to secure correct calibration, return to 1,000 m and 1,300 m and repeat the LW procedure.

Image Suppressor.—Press the MW button, feed in a strong 300 m (1,000 kc/s) signal, and locate the image signal at about 406.5 m on scale. Then adjust **C36** for minimum output.

Automatic Tuning Control.

The mains transformer **T2** has a fourth secondary winding to energise the tuning motor, and one end of it is normally connected via the station setting plug and socket **N** to chassis. The tuning motor windings are connected via tag **Z** to the free end of this secondary, so that the motor will run if either of the terminals **X, Y** at the opposite end is connected to chassis, clockwise or anti-clockwise according to which of the two alternative connections is used. It is in these leads to chassis that the press-button station and waveband selection mechanism are inserted.

Station Selection.—Considering first the station selection alone, it will be seen from the circuit diagram that the common bus-bar of the press-button switch unit is connected to chassis. When any of the buttons, which are numbered 1 to 8, is pressed, connection is thus made between one of the station selector disc plates and chassis. If No. 5 button is pressed, for instance, **S31** and **S32** close, and all the other switches on the bank remain open, and the blue lead contacts a disc plate via its clip, which also is numbered 5, like its button. An unnumbered clip contacts the same plate (the left-hand one in our diagram) and thus permits current to flow from that plate via **R32** and **S45** (which is closed) to the **Y** connection of the motor winding, so that the motor will run, in a given direction.

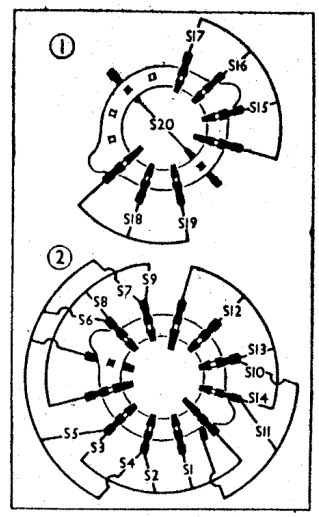
The selector disc is mechanically coupled to the tuning motor through a chain of gears, and the condenser gang is directly coupled to the disc. When the motor runs, the direction of disc rotation is such that the insulated gap (the upper one in our diagram) travels towards the contact clip. In our case, the disc would now travel anti-clockwise.

When the gap reaches clip No. 5, therefore, in our example, the current is cut off. In practice, the gap over-runs the clip, owing to momentum, and the clip contacts the opposite plate. Current then flows via the second unnumbered clip, **R31** and **S44** to motor contact **X**; the motor reverses, and the gap comes back again to clip No. 5.

Owing to the "slow-motion" action of the condenser drive, however, reversal of direction of travel introduces a 5 to 1 reduction ratio in speed, so that the gap returns at one-fifth of its original speed, and the disc stops without over-running, and the station is tuned.

The motor bearings are permitted a certain amount of intentional end-play, and when at rest, a spring pushes the armature spindle towards one end bearing. When the motor runs, the armature is pulled magnetically against the spring, towards the opposite end-bearing, so that one end of the armature spindle projects further out of the motor casing and the other end recedes. The projecting end presses the blades of switch **S46**, so that it closes and short-circuits the pick-up sockets, muting the receiver as long as the motor is running; the receding end draws in the lugs of a dog-clutch attached to it, engaging the condenser drive mechanism. This clutch is introduced to permit the motor to expend its momentum freely after the current has been cut off, disengaging it from the drive.

The two "cruising" buttons are provided to permit manual control of the electrical drive system when tuning manually.



Above : Diagrams of the waveband switch units.
Below : The associated switch table.

Switch	SW	MW	LW
S1	C	—	—
S2	—	C	—
S3	—	—	C
S4	C	—	—
S5	C	C	—
S6	C	—	—
S7	C	C	—
S8	—	C	—
S9	—	—	C
S10	C	—	—
S11	C	C	—
S12	C	—	—
S13	—	C	—
S14	—	—	C
S15	C	—	—
S16	—	C	—
S17	—	—	C
S18	C	—	—
S19	—	C	—
S20	C	—	—

Station Setting.—For setting up the system to receive the desired stations, a station setting lamp replaces the motor drive and acts as an indicator. The station setting plug is transferred from its normal socket **N** to the setting socket **S**, so that only a small portion of the motor secondary winding on **T2** is in circuit between the motor connection **Z** and chassis, and the lamp is in series with it.

If a press-button that would normally cause the motor to run were now pressed, the lamp would light; the motor, although still in circuit, would not run at the low voltage now available.

When the appropriate clip has been moved along its carrier rail to a position where its contact lies on the insulated gap between the two plates, the light will go out, and the gang will in future return to the same position when that button is pressed and the setting plug is at **N**. Prior to this operation the operator, of course, has tuned the set manually to the desired station.

Waveband Selection.—No purely manual or mechanical control is provided for waveband switching. Instead, three press-buttons are used, one for each band, and they are associated with switches **S22, S23** and **S24** on the press-button unit.

The principle of waveband selection is the same as that just described for station selection, but it involves the use of another selector disc and a relay. If, for instance, matters were arranged as shown in our diagram, with the set switched to MW, and the LW button were pressed, connection would be made between chassis and the **Y** motor contact, but now the current would flow via the LW clip (dark red lead), the right-hand plate on the waveband selector disc and the magnet winding **L22**.

The magnet forms part of a relay, and has two windings **L21, L22**. When either winding energises the magnet, the armature, or latch-bar, is attracted; but the latch-bar engages with a geared dog-clutch, and when the relay is energised the clutch closes and engages with the tuning drive to the condenser gang, so that it becomes motor-driven with the gang, and as its gear teeth are engaged with those of the waveband selector disc, this rotates until the gap between the plates reaches the LW contact clip, when the motor current is cut off. The set is then switched to the LW band.

The latch-bar, however, also performs a second function. When the relay closes, two insulated prods on the latch-bar press against the blades of switches **S44** and **S45**, so that they open and disconnect the station selector disc and its associated circuit from the motor altogether until the wave-changing operation is completed, when the relay relaxes, disengaging the dog-clutch and permitting **S44, S45** to close again.

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Owing to the presence of **L21, L22,** the voltage of the motor secondary on **T2** is higher than is required by the motor in order to compensate for the drop along these windings when they are in use. For station selection only, the voltage would consequently be too high, so **R31** and **R32** are inserted in the station selector leads to drop the same voltage.

Combined Action.—If the receiver is switched to one band, say MW, and a button of the other band (say No. 2 button, LW) is pressed, the "Radio Brain" system automatically selects first the correct waveband and then the desired wavelength.

All the MW buttons control a duplicate of switch **S23** for waveband control, and the two LW buttons control a duplicate of **S24,** in addition to their station selector switches. When No. 2 button is pressed, therefore, **S37** and **S38** close, bringing in circuit station selector clip No. 2 (black lead) and the LW clip on the waveband selector. Obviously, both systems will try to work, but the waveband selector magnet will open **S44, S45** and the station selector will be cut out of circuit until the waveband has been selected as described under "Waveband Selection."

Immediately this is completed **S44, S45** close, and the procedure described under "Station Selection" is performed.