'TRADER' SERVICE SHEET

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G.E.C. A.C. ALL-WAVE SUPER 6

OCTAL based valves are employed in all but one stage of the G.E.C. A.C. All-Wave Super 6 3-band superhet, the short-wave range being 16.5-51 metres. Model BC3860 is for mains of 190-250 V, 40-100 C/S, and the BC3860L is for 110-130 and 210-230 V, 40-100 C/S, but this *Service Sheet* was prepared on one of the former.

A very similar chassis is fitted in the BC3868 A.C. All-Wave Super 6 Radiogram, and the differences are explained in "General Notes." This model is for 190-250 V, 50-60 C/S.

It should be noted that there are two further models bearing the name A.C. All-Wave Super 6, the catalogue numbers being BC3862 and BC3862L, but these tune over two short-wave ranges and the medium waves, but not long. These are not covered by this *Service Sheet*.

CIRCUIT DESCRIPTION

Aerial input via **C1** to coupling coil **L1** and condenser **C2**, which forms a common coupling impedance, to single tuned circuits comprising coils **L2** (S.W.), plus **L3** (M.W.), plus **L4** (L.W.), tuned by **C37**, which precede variable-mu pentode R.F. amplifier (**V1, Osram W63**).

Tuned-secondary R.F. transformer coupling by **L5** (primary) and secondaries **L6** (S.W.), plus **L7** (M.W.), plus **L8** (L.W.), tuned by **C41**, assisted by condensers **C5, C6** and **C7**, between **V1** and triode hexode valve (**V2, Osram X41**) which operates as frequency changer with internal coupling. Triode oscillator grid coils **L9** (S.W.), plus **L10** (M.W.), plus **L11** (L.W.) are tuned by **C42**; parallel trimming by **C43** (S.W.), **C44** (M.W.) and **C45** (L.W.); series tracking by **C15** (S.W.), **C47** (M.W.) and **C46** (L.W.). Reaction by coil **L12** and **R15, C16, C17.**

Third valve (**V3, Osram W63**) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned primary tuned-secondary transformer couplings **C48, L13, L14, C49** and **C50, L15, L16, C51.**

Intermediate frequency 456 KC/S.

Diode second detector is part of double diode triode valve (**V4, Osram DH63**). Audio frequency component in rectified output is developed across load resistance **R21** and passed via I.F. stopper **R18**, A.F. coupling condenser **C21** and manual volume control **R19** to C.G. of triode section which operates as A.F. amplifier. Provision for connection of gramophone pick-up by terminals across **R19.**

Second diode of **V4**, fed from **L16** via **C24**, provides D.C. potentials which are developed across load resistances **R25, R26**, and fed back through decoupling circuits as G.B. to R.F., F.C. and I.F. valves, giving automatic volume control.

The cathode ray tuning indicator (**T.I., G.E.C. Tuneray Y63**) is controlled by potential developed at junction of **R25, R26.**

Resistance-capacity coupling by **R24, C26** and **R28** between **V4** triode and tetrode output valve (**V5, Osram KT63**). Coupling is modified for tone control purposes by **C27, R29** and **C28.**

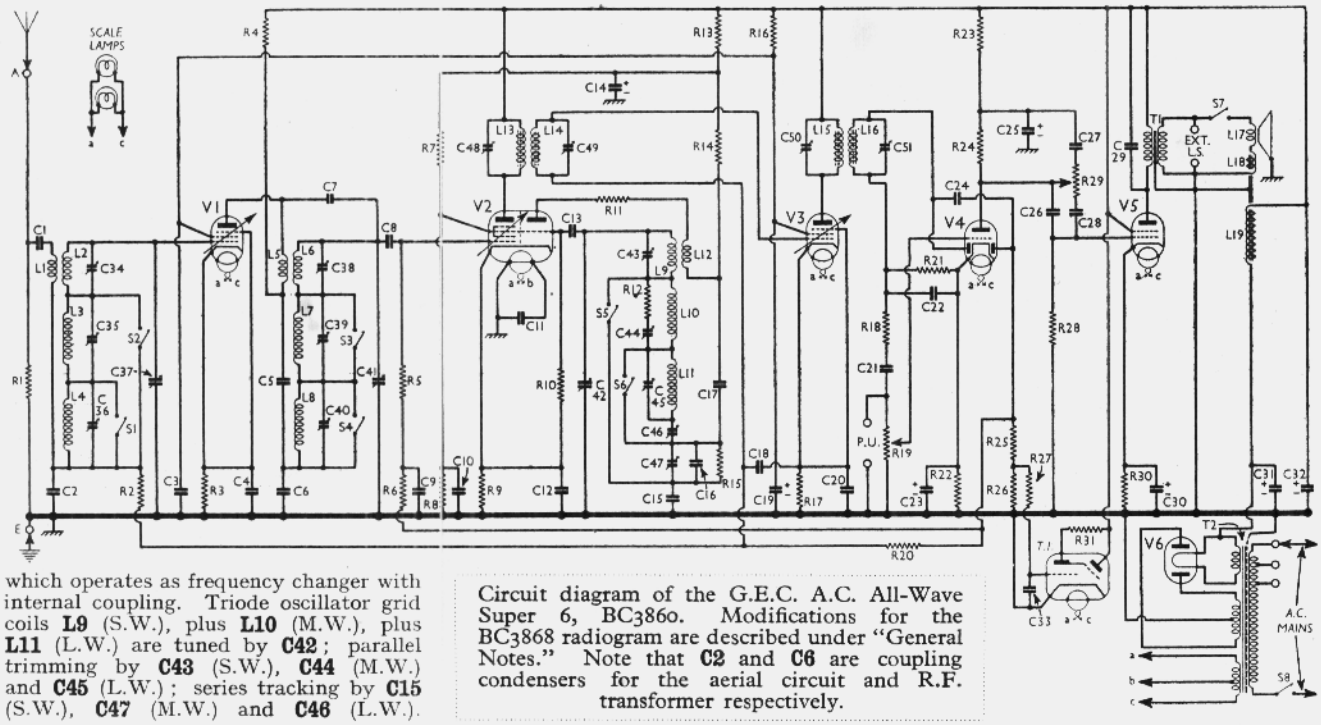
Fixed tone correction in anode circuit of **V5** by condenser **C29.** Provision for connection of low impedance external speaker across secondary of **T1.**

H.T. current is supplied by full-wave rectifying valve (**V6, Osram U50**). Smoothing by speaker field **L19** and dry electrolytic condensers **C31, C32.**

COMPONENTS AND VALUES

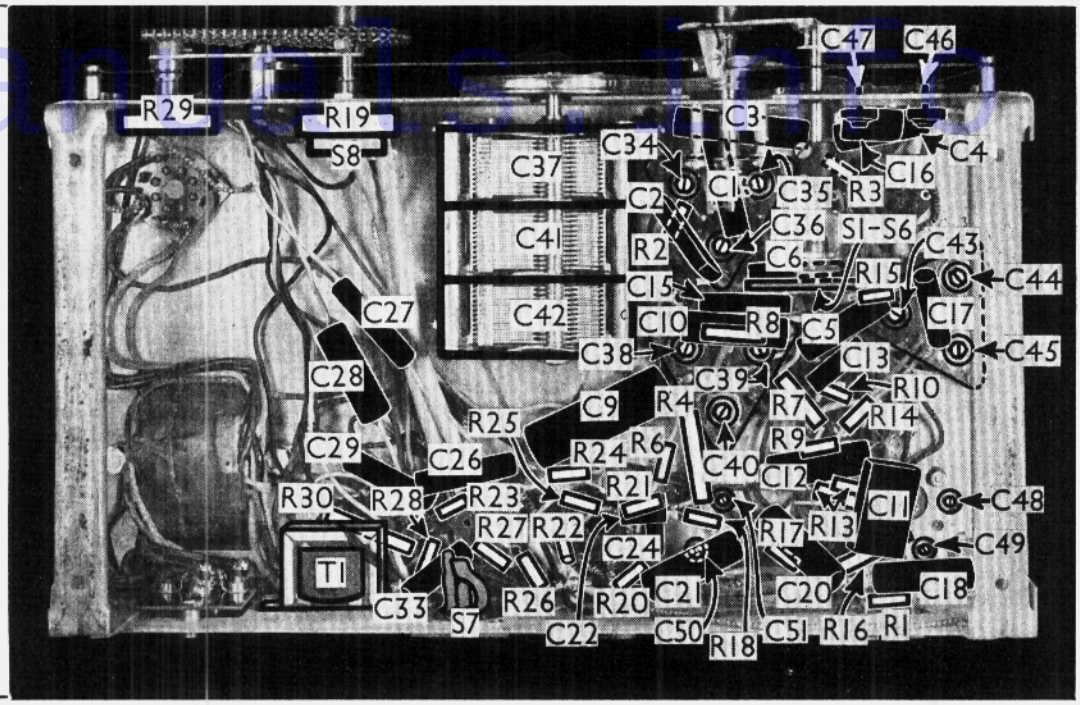
	RESISTANCES	Values (ohms)
R1	Aerial circuit shunt	9,900
R2	V1 C.G. decoupling	99,000
R3	V1 fixed G.B. resistance	300
R4	V1 anode H.T. feed	9,900
R5	V2 hex. C.G. resistance	99,000
R6	V2 hex. C.G. decoupling	2,000,000
R7	V2 S.G. H.T. feed potential divider	9,900
R8		33,000
R9	V2 hex. fixed G.B. resistance	200
R10	V2 osc. C.G. resistance	55,000
R11	Oscillator reaction stabiliser	150
R12	Osc. circuit M.W. damping	150
R13	V2 S.G. and osc. anode H.T. feed	14,666*
R14	V2 osc. anode decoupling	9,900
R15	Part V2 osc. anode coupling	2,200
R16	V1, V3 S.G. H.T. feed	44,000
R17	V3 fixed G.B. resistance	300
R18	I.F. stopper	99,000
R19	Manual volume control	1,000,000
R20	A.V.C. line decoupling	660,000
R21	V4 signal diode load	220,000
R22	V4 triode G.B. and A.V.C. delay voltage resistance	3,300
R23	V4 triode anode decoupling	22,000
R24	V4 triode anode load	99,000
R25, R26	V4 A.V.C. diode load resistances	99,000 330,000
R27	T.I. C.G. feed resistance	2,000,000
R28	V5 C.G. resistance	440,000
R29	Variable tone control	1,000,000
R30	V5 G.B. resistance	400
R31	T.I. anode H.T. feed	1,000,000

* 22,000 Ω and 44,000 Ω connected in parallel.



Circuit diagram of the G.E.C. A.C. All-Wave Super 6, BC3860. Modifications for the BC3868 radiogram are described under "General Notes." Note that **C2** and **C6** are coupling condensers for the aerial circuit and R.F. transformer respectively.

All the trimmers are indicated in this under-chassis view, **C50** and **C51** being towards the right of the chassis, near the rear member. The aerial, R.F. and oscillator coil units each contain three trimmers.



CONDENSERS		Values (μF)
C1	Aerial coupling condensers	0·005
C2	Aerial coupling condensers	0·0028
C3	V1, V3 S.G.'s R.F. by-pass	0·05
C4	V1 cathode by-pass	0·05
C5	V1 to V2 coupling condensers	0·005
C6	V1 to V2 coupling condensers	0·003
C7	V1 to V2 coupling condensers	0·000004
C8	V2 hexode C.G. condenser	0·0001
C9	V2 hexode C.G. decoupling	0·25
C10	V2 S.G. R.F. by-pass	0·05
C11	V2 heater R.F. by-pass	0·002
C12	V2 cathode by-pass	0·05
C13	V2 osc. C.G. condenser	0·0001
C14*	V2 S.G. and osc. anode de-coupling	7·0
C15	Osc. circuit S.W. tracker	0·0016
C16	Parts V2 osc. anode coupling	0·0003
C17	Parts V2 osc. anode coupling	0·005
C18	V3 C.G. decoupling	0·05
C19*	V1, V3 S.G.'s decoupling	3·0
C20	V3 cathode by-pass	0·05
C21	A.F. coupling to V4 triode	0·02
C22	I.F. by-pass	0·0001
C23*	V4 cathode by-pass	10·0
C24	Coupling to V4 A.V.C. diode	0·0001
C25*	V4 triode anode decoupling	3·0
C26	V4 triode to V5 coupling	0·005
C27	Parts variable tone control	0·005
C28	Parts variable tone control	0·02
C29	Fixed tone corrector	0·005
C30*	V5 cathode by-pass	20·0
C31*	H.T. smoothing	14·0
C32*	H.T. smoothing	7·0
C33	T.I. C.G. decoupling	0·01
C34‡	Aerial S.W. trimmer	—
C35‡	Aerial M.W. trimmer	—
C36‡	Aerial L.W. trimmer	—
C37†	Aerial circuit tuning	—
C38‡	R.F. trans. S.W. trimmer	—
C39‡	R.F. trans. M.W. trimmer	—
C40‡	R.F. trans. L.W. trimmer	—
C41†	R.F. trans. sec. tuning	—
C42†	Oscillator circuit tuning	—
C43‡	Osc. circuit S.W. trimmer	—
C44‡	Osc. circuit M.W. trimmer	—
C45‡	Osc. circuit L.W. trimmer	—
C46‡	Osc. circuit L.W. tracker	—
C47‡	Osc. circuit M.W. tracker	—
C48‡	1st I.F. trans. pri. tuning	—
C49‡	1st I.F. trans. sec. tuning	—
C50‡	2nd I.F. trans. pri. tuning	—
C51‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial S.W. coupling coil	0·2
L2	Aerial S.W. tuning coil	0·02
L3	Aerial M.W. tuning coil	4·0
L4	Aerial L.W. tuning coil	31·0
L5	R.F. transformer pri.	2·3
L6	R.F. trans. S.W. sec.	0·02
L7	R.F. trans. M.W. sec.	4·0
L8	R.F. trans. L.W. sec.	31·0
L9	Oscillator S.W. tuning coil	0·04
L10	Oscillator M.W. tuning coil	2·8
L11	Oscillator L.W. tuning coil	13·6
L12	Osc. anode reaction coil	0·4
L13	1st I.F. trans. Pri.	7·0
L14	1st I.F. trans. Sec.	7·0
L15	2nd I.F. trans. Pri.	4·0
L16	2nd I.F. trans. Sec.	4·0
L17	Speaker speech coil	2·3
L18	Hum neutralising coil	0·1
L19	Speaker field coil	1,200·0
T1	Output trans. Pri.	850·0
T1	Output trans. Sec.	0·32
T2	Mains trans. Pri., total	20·1
T2	Mains trans. Heater sec., total	0·15
T2	Mains trans. Rect. heat. sec.	0·16
T2	Mains trans. H.T. sec., total	455·0
S1-S6	Waveband switches	—
S7	Internal speaker switch	—
S8	Mains switch, ganged R19	—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, remove the control knobs and levers (pull off) and the bracing batten across the back of the cabinet (two countersunk-head wood screws). Then remove the two round-head wood screws (with washers) holding the scale assembly to the top of the cabinet, and the four bolts (with washers and rubber washers) holding the chassis to the bottom of the cabinet.

By tilting the back upwards, the chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes. *When replacing*, make sure that there are rubber washers between the chassis and the bottom of the cabinet.

To free the chassis entirely unsolder the speaker leads and *when replacing*, connect them as follows, numbering the tags from left to right:— Bottom row, 1, red/white; 2, red. Middle row, 1 and 4, blank; 2, white; 3, black. The black earthing lead goes to a soldering tag on the top right-hand speaker fixing screw.

Removing Speaker.—To remove the speaker, remove the four screws (with washers and spring washers) holding it to the sub-baffle and *when replacing*, see that the terminal panel is at the top and do not forget to replace the earthing tag on the top right-hand screw.

VALVE ANALYSIS

Valve voltages and currents given in table below are those measured in our receiver when it was operating on mains of 225 V, using the 220 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium band and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 W63	180	7·0	96	1·8
V2 X41	255	4·6	86	1·8
V2 X41	Oscillator			
V2 X41	86	4·2		
V3 W63	255	6·5	96	1·7
V4 DH63	122	0·7	—	—
V5 KT63	222	34·0	255	5·6
V6 U50	336†	—	—	—
T.I. Y63	18	0·3	—	—
T.I. Y63	Target	Anode		
T.I. Y63	255	1·1*		

† Each anode, A.C.
* May vary appreciably.

Continued overleaf

G.E.C.—*Continued*

GENERAL NOTES

Switches.—**S1-S6** are the waveband switches, in a single rotary unit beneath the chassis. The unit is indicated in our under-chassis view, and shown in detail in the diagram on this page, where it is seen looking from the rear of the underside of the chassis.

The table below gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

Switch	M.W.	L.W.	S.W.
S1	C	—	—
S2	—	—	C
S3	—	—	C
S4	C	—	C
S5	—	—	C
S6	C	—	C

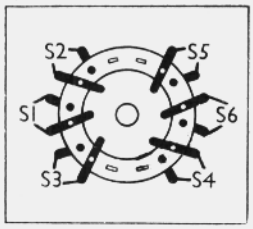


Diagram of the switch unit, as seen when looking from the rear of the underside of the chassis.

S7 is the internal speaker jack switch, combined with the external speaker sockets at the rear of the chassis. On pushing the external speaker plug fully home, **S7** opens and mutes the internal speaker.

S8 is the Q.M.B. mains switch, ganged with the volume control **R19.**

Coils.—All the coils are in five screened units on the chassis deck. **L1-L4, L5-L8** and **L9-L12** are in the three tubular units, and the I.F. transformers **L13, L14** and **L15, L16** are in the two rectangular units. Two of the tubular units contain certain extra components, indicated in our plan chassis view. All the trimmers are beneath the chassis.

Scale Lamps.—These are two Osram M.E.S. types, rated at 6·5 V, 0·3 A, and having small bulbs.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2-4 Ω) external speaker. **S7** mutes the internal speaker when required.

Condenser Block.—The rectangular metal-cased dry electrolytic condenser block mounted on the chassis deck contains seven condensers, **C14, C19, C23, C25** and **C30-C32.** It is a Dubilier Type 3223. The brown and red leads are the negative and positive respectively of **C31** (14 μF). The remaining condensers have a common negative (black) lead. The blue lead to **V3** valveholder is the positive of **C19** (3 μF); the blue lead to **R23, R24** is the positive of **C25** (3 μF); the yellow lead is the positive of **C32** (7 μF); the green lead is the positive of **C14** (7 μF); the slate lead is the positive of **C23** (10 μF); and the purple lead is the positive of **C30** (20 μF).

Resistance R13.—This consists of two resistors in parallel.

Trimmers and Trackers.—These are all beneath chassis or coil units. The trackers **C46** and **C47** are adjusted through holes in the front chassis member. The I.F. trimmers are adjusted through holes in the chassis deck beneath their respective transformer units. The other nine trimmers are in groups of three on triangular paxolin plates beneath the three R.F. and oscillator coil units. All are indicated in our under-chassis view.

Valve Bases.—All the valves except **V2** have International octal bases. The connections were given on page I of *Radio Maintenance* for November 13, 1937. **V2** is fitted with a normal 7-pin base, and has a 4 V heater. It is run from a tapping on the heater secondary of **T2.**

Radiogram Modifications.—The radiogram BC3868 has a similar chassis, but **R19** and **S8** are removed from the chassis and mounted for operation from the front of the cabinet. Their place in the chassis is taken by the radio-gram switch unit, containing four switches. One of these is between **R13, R7** and **R14,** and opens on gram., thus muting radio. The junction between **C21** and **R19** is broken, and a common connection from two further switches (say X and Y), goes to the lower end of **C21.** The other side of switch X goes to the top of **R19,** and to one side of the fourth switch, say Z.

The top pick-up socket is disconnected from **R19** and taken to the other side of switch Z. The remaining side of switch Y goes to chassis.

On radio, switch X is closed, and Y and Z are open, thus connecting **C21** to **R19,** as in the table model, and leaving the pick-up circuit disconnected. On gram., X is open and Y and Z closed, thus taking the bottom of **C21** to chassis (muting radio) and connecting the pick-up to the top of **R19.** A resistance of 55,000 Ω across the pick-up terminals is the only additional component.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set on five minutes before making adjustments. Set range switch to M.W. and tuning control to maximum. Volume control should be at maximum and quality control to "mellow." Short **C42** temporarily by connecting stator to chassis. Connect signal generator via a 0·1 μF condenser to control grid (top cap) of **V2** and chassis, leaving existing top connection in place.

Feed in a 456 KC/S signal, and adjust **C48, C49, C50** and **C51** (beneath chassis, under I.F. units) for maximum output, reducing input progressively as circuits come into line.

R.F. and Oscillator Stages.—Check that scale is central in clips. Check pointer for straightness and that it is in line with the extreme left-hand end of the horizontal calibration base lines of the scale when gang is at minimum.

S.W.—Switch to S.W., and tune to 16.7 m. on scale. Connect signal generator, via S.W. dummy aerial, to **A** and **E** terminals, and feed in a 16.7 m. (18 MC/S) signal. Adjust **C43,** then **C38** and **C34,** for maximum output. In the case of **C43,** use the peak requiring the *least* trimmer capacity. When adjusting **C38** and **C34,** rock the gang slightly to reduce the "pulling" effects between the circuits.

M.W.—Switch set to M.W. and tune to 214 m. on scale. Feed in a 214 m. (1,400 KC/S) signal using a standard dummy aerial. Adjust **C44, C39** and **C35** for maximum output.

Disconnect **C42** (by unsoldering stator lead), and connect an external variable condenser between the disconnected lead and chassis.

Feed in a 500 m. (600 KC/S) signal, and tune it in accurately with the gang condenser and the external variable condenser simultaneously. Disconnect external condenser and re-connect **C42.** Without altering tuning of gang, adjust **C47** for maximum output.

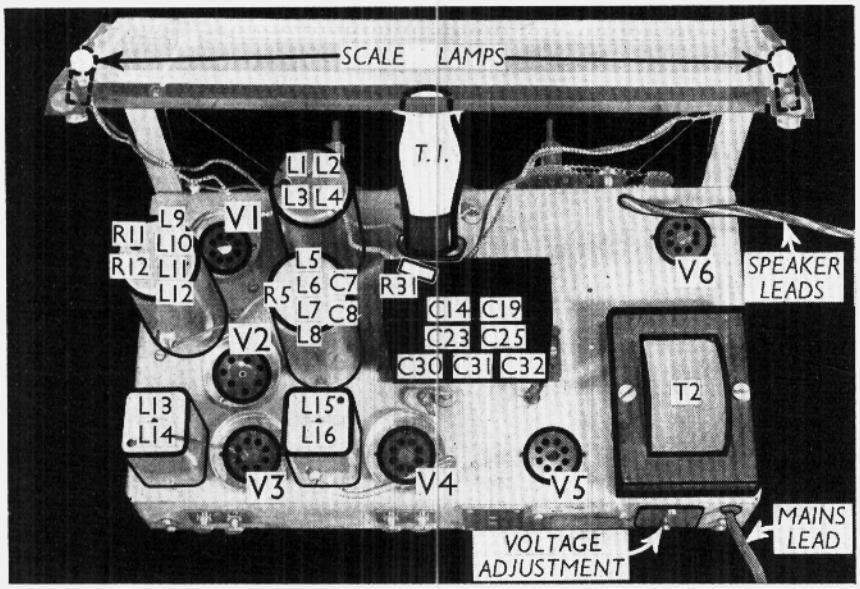
Repeat previous adjustments at 214 m.

L.W.—Switch set to L.W., and tune to 1,000 m. on scale. Feed in a 1,000 m. (300 KC/S) signal, and adjust **C45, C40** and **C36** for maximum output.

Disconnect **C42** as before and connect external variable condenser. Feed in a 1,818 m. (165 KC/S) signal, and tune it in accurately on gang and external condenser as before. Disconnect external condenser and re-connect **C42.** Without altering tuning of gang, adjust **C46** for maximum output.

Repeat 1,000 m. adjustments, and if the alteration is appreciable, repeat also 1,818 m. adjustments and finally re-check at 1,000 m.

Do not forget to re-seal trimmers and re-solder lead to **C42.**



Plan view of the chassis. Note the electrolytic condenser block and the fact that there are no trimmers on the top of the chassis.

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