

OPERATING INSTRUCTIONS

Suitcase Set. Type 3. Mark II.

Set Serial No.....42796.....

Equipment:—

Suitcase containing: ✓

- (a) Transmitter. ✓
- (b) Receiver. ✓
- (c) Combination Power Pack for A.C. Mains and 6v. Battery operation. ✓
- (d) Instruction Manual. ✓
- (e) Spares box containing: ✓
 - (i) ~~100~~ ft. aerial wire. ^{I.E.S.B.C. ADAPTOR} 60 ft ✓
 - (ii) 10-ft. earth wire. ✓
 - (iii) Transmitting key. ✓
 - (iv) Telephone headset. ✓
 - (v) 10 fuses (two types). + 2.1 AMP fuses ✓
 - (vi) 1 Receiving valve 7Q7. ✓
 - (vii) 1 Receiving valve 7R7. ✓
 - (viii) 1 Transmitting valve EL32. ✓
 - (ix) 1 Transmitting valve 6L6G. ✓
 - (x) Screwdriver. ✓
 - (xi) Two brass pins to convert mains plug to Continental fittings. ✓
 - (xii) 4 tank coils: ✓

L1 — 3 — 5.5 Mc/Second. ✓

L2 — 4.5 — 7.5 " " ✓

L3 — 6.5 — 10.0 " " ✓

L4 — 9.0 — 16 " " ✓

(xiii) 4 Crystals:

1

2

3

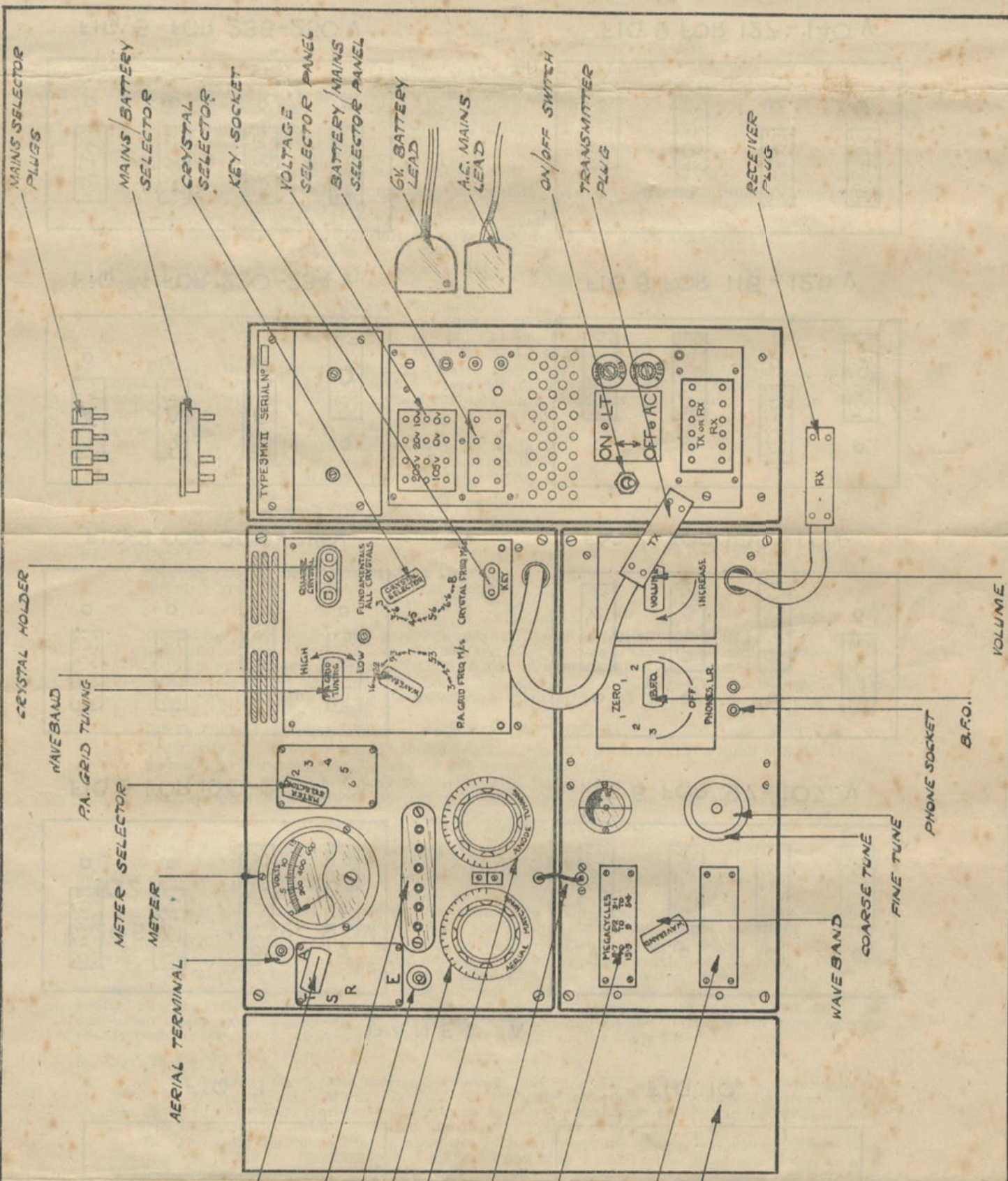
4

Total Weight: 34 lbs.



13 JUL 1942





VOLUME

B.F.O.

TUNE/SEND/RECEIVE SWITCH

COIL HOLDER

EARTH TERMINAL

AERIAL MATCHING

ANODE TUNING

AERIAL LINK

AERIAL TRIMMERS

OSC. TRIMMERS

SPARES BOX.

CONTENTS:-

4 TRANSMITTER COILS

1 6L6G VALVE

1 EL32 "

1 797 "

5 FUSES, 10 AMP

5 " 500 M.A. + 2.1-AMP FUSES

1 TELEGRAPH KEY

1 PAIR HEADPHONES

1 MAINS LEAD

1 BATTERY LEAD

2 CONTINENTAL PLUG-PINS

1 ADAPTOR. 2PIN/BAYONET CAP

1 " EDISWAN SCREW/B.C.

1 AERIAL WIRE (100 FT)

1 EARTH " (10 FT)

1 SCREWDRIVER

1 OPERATING CHART (IN COVER)

CRYSTAL HOLDER

WAVEBAND

PA. GRID TUNING

METER SELECTOR

METER

AERIAL TERMINAL

CRISTAL HOLDER

WAVEBAND

PA. GRID TUNING

METER SELECTOR

METER

AERIAL TERMINAL

CRISTAL HOLDER

WAVEBAND

PA. GRID TUNING

METER SELECTOR

METER

AERIAL TERMINAL

CRISTAL HOLDER

WAVEBAND

PA. GRID TUNING

METER SELECTOR

METER

AERIAL TERMINAL

CRISTAL HOLDER

WAVEBAND

PA. GRID TUNING

METER SELECTOR

METER

AERIAL TERMINAL

CRISTAL HOLDER

WAVEBAND

PA. GRID TUNING

VOLTAGE

SELECTOR

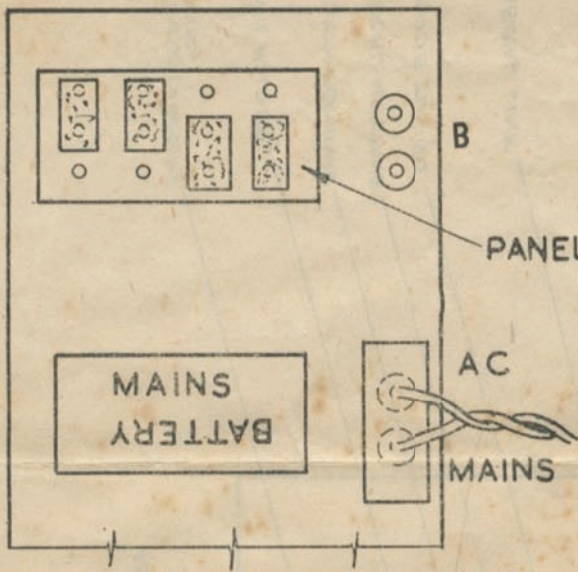


FIG. 1.

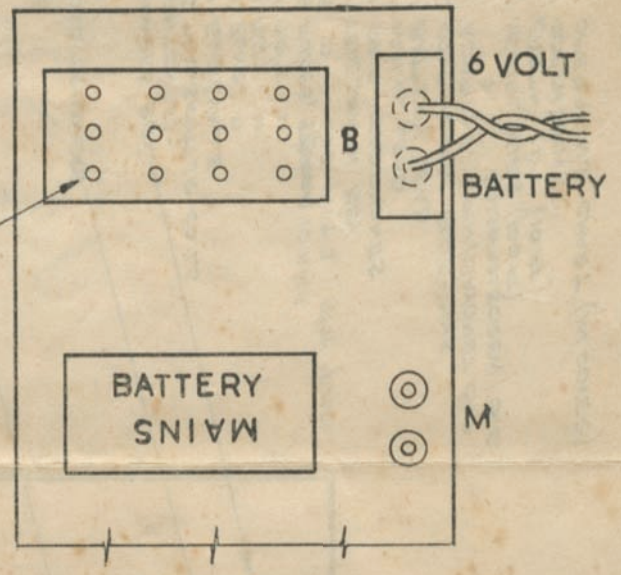


FIG. 10.

PANEL A

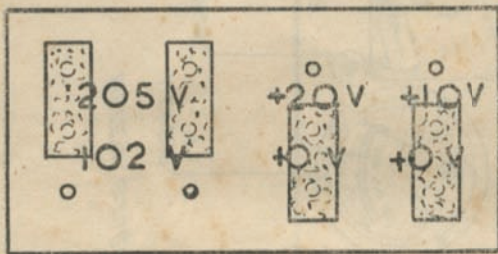


FIG 2 FOR 190-207 V

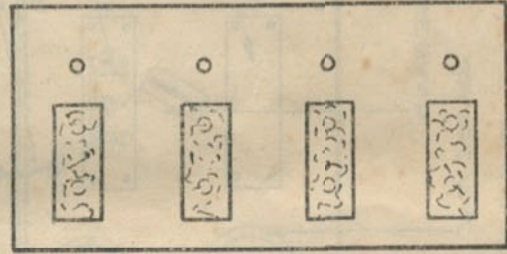


FIG 6 FOR 97-107 V

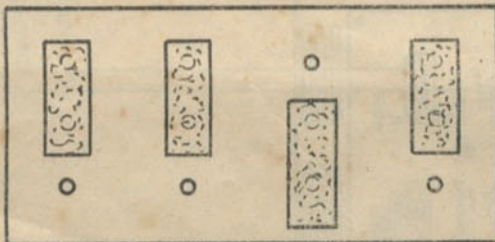


FIG 3 FOR 208-219V

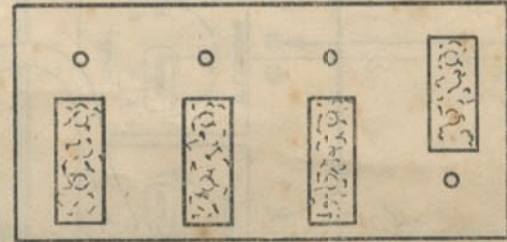


FIG 7 FOR 108-117V

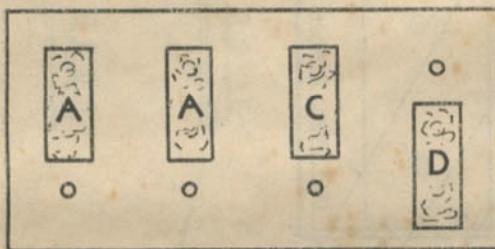


FIG 4 FOR 220-234 V



FIG 8 FOR 118-126 V



FIG 5 FOR 235-250 V

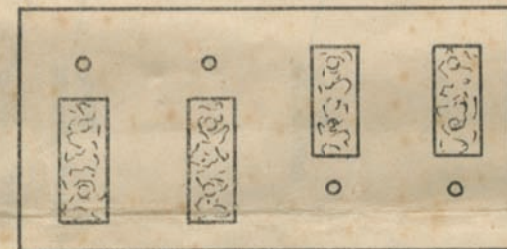


FIG 9 FOR 127-140 V

SPECIFICATIONS.

I. COMBINATION POWER PACK for A.C. and Battery Operation.

Size: $10\frac{3}{4}$ " x $4\frac{1}{8}$ " x 5". Weight: 12lbs. 8ozs.

A. **Mains Supply:** A.C. only. 97-140 volts, 190-250 volts.
40-60 c/s.

Consumption: (a) Transmit 57 watts.
(b) Receive 25 watts.

B. **Battery Supply.** 6 volt accumulator, automobile type of largest available ampere-hour capacity.

Maximum drain 10 amps. This battery is not provided.

Consumption: (a) Transmit $9\frac{1}{2}$ amps. (key down) 3.5 amps. (key up).
(b) Receive $4\frac{1}{2}$ amps.

A spare vibrator, 6-volt non-synchronous, is fixed inside.

II. TRANSMITTER.

Size: $9\frac{1}{2}$ " x $6\frac{1}{4}$ " x $4\frac{3}{4}$ ". Weight: 7lbs. 8ozs.

Supply: From the Power Pack—(a) 500v. at 60 mA.
(b) 230v. at 18 mA.
(c) 6.3v. at 1.1 amps.

Circuit: Oscillator-doubler driving Class C amplifier, crystal controlled. Provision for frequency doubling. Plug-in tank coils to cover 3.0 to 16 Mc/sec. "Tune-Send-Receive" switch. Multi-range meter to read voltages and currents on transmitter and receiver. Plug in Transmitting Key.

Power Output. A. On A.C. Mains.

(a) Average fundamental power is 20 watts.
(b) The second harmonic power is 20 watts.
(c) The third harmonic power is 16-20 watts.

B. On Batteries.

(a) Average fundamental power is 20 watts.
(b) The second harmonic power is 18-20 watts.
(c) The third harmonic power is 15-18 watts.

III. RECEIVER.

Size: $9\frac{1}{2}$ " x $4\frac{1}{8}$ " x $4\frac{3}{4}$ ". Weight: 6lbs. 12ozs.

Supply: From Power Pack—230v. at 28mA.
6.3v. at 1.2 amps.
—12½v. to —14v. bias.

Circuit: 4 valve seven stage superheterodyne receiver essentially designed for CW reception. 3 wave band switch selector 3.1 to 15.5 Mc/sec. total coverage. 50-1 slow motion vernier dial. B.F.O. pitch control incorporating ON/OFF switch. Volume control and 'phone jack.

Valves: Frequency changer.—7Q7 Loctal pentagrid. IF Amplifier.—7R7 Loctal double diode pentode. 2nd IF Amplifier & B.F.O.—7Q7 Loctal pentagrid. 2nd Detector & L.F. amplifier.—7R7 Loctal double diode pentode.

Intermediate Frequency: 470 Kc/sec. B.F.O. 470 Kc±3 Kc.

Sensitivity: 1—3 microvolts for 10 milliwatts output at 1000 c.p.s. (C.W. input and B.F.O. on).

Selectivity: Bandwidth. 1 Kc/sec. 3 DB down from peak.
9 Kc/sec. 20 DB down from peak.

Max. Output: 50 milliwatts into 120 ohm telephones. (Impedance 800 ohm at 800 c.p.s.).

INSTALLATION INSTRUCTIONS.

Before setting up to establish communication, the proposed site should be examined as to its suitability for the installation of an efficient Aerial and Earth system, and the question of a power supply considered. Where possible A.C. Mains should be used and a 6-volt large capacity accumulator obtained for emergency use.

The operator should study Appendix A on Aerials and make himself familiar with the method of adjusting the voltage selector on the Power Pack and Tuning the Receiver and Transmitter.

Aerials: 100 ft. of aerial wire is provided, as much of which as possible should be suspended as high as possible and not too close to earthed objects, in order to obtain maximum efficiency. One end will, when operating, be connected to the Aerial terminal on the Transmitter. See Appendix A.

Earth: A good electrical connection must be made to an existing earth tube, a main water pipe or central heating system. If these are not available a wire of the same length as the aerial should be suspended underneath it, preferably two or three feet above the ground. The earth wire or this counterpoise earth will be connected to the Earth terminal on the transmitter.

I. POWER PACK.

A. If mains are available ascertain whether they are A.C. or D.C. This apparatus must NOT be used on D.C. Mains. If A.C. is available ascertain the voltage by reference to the electric light meter, electrical apparatus in use, or the markings on electric light bulbs. Note the type of plug or connection required and prepare your lead for future use.

B. **To adjust the Power Plug to a known Voltage:** Insert the "Mains—Battery" plug to read "Mains" as in Fig. 1. The selection is made by inserting 4 small 2-pin plugs into the holes provided on PANEL A. (See Fig. 1.) The plugs must be pushed well in and cover the numbers which add together to the voltage required. Two plugs must always cover either the "205v" or "102v." The other two plugs are used to cover "+Ov.", "+10v" or "+20v." (See Figs. 1 to 9). Thus in Fig. 4, plugs (A) and (A) cover "205v," plug (C) covers "+20v" and plug (D) covers "+Ov." The Power Pack is now adjusted for a mains voltage of $205 + 20 + 0 = 225$ volts. In practice this setting is used for any voltage between 220 and 234 volts. Similarly in Fig. 9, the voltage is $102 + 20 + 10 = 132$ volts. This setting is used for any voltage between 127v and 140 volts.

C. **To adjust the Power Pack when the Mains voltage is not known.** If the mains are known to be A.C. but the voltage is not known, proceed as follows:—

- (a) See that the "RX" 6-pin plug is not connected to the Power Pack.
- (b) Plug the "TX" 6-pin plug into the Power Pack and set the "T.S.R." (Tune-Send-Receive) switch to "R" and the "Meter Selector" to Position 2.
- (c) Set the "Battery-Mains" plug to "Mains" and adjust the voltage selector to the highest setting (235-250) Fig. 5.
- (d) Switch on and the meter will give a reading.
- (e) If this reading is less than $\frac{1}{2}$ scale (300) switch off and reset the voltage selector to the next lower setting,—Fig. 4 and recheck the meter reading.
- (f) Proceed thus until a voltage setting is found in which the meter reads as nearly $\frac{1}{2}$ scale (300) as possible.
- (g) Always use this voltage setting when working on these mains.

NOTE: If the first meter reading (c) is only about 150 the mains are in the 100 volt range, in this case, replace the 500 m/amp fuse by a 1 amp fuse, then, adjust the selector to 127-140 volts, Fig. 9, and make checks progressively as above.

N.B. 1 amp fuse must be used in A.C. Fuse Holder when mains volts are in 97 - 140 range. 500 ma. Fuse when mains volts are 190 - 250 volts.

D. **To adjust Power Pack for Battery Operation.** If mains are not available or are unsuitable, a 6-volt accumulator must be procured. It is essential for satisfactory working that, in view of the heavy drain on the battery—up to 10 amps. when transmitting and 4 amps. when receiving—this should be of the automobile type, fully charged and in good condition. Two such batteries may, with advantage, be used in parallel.

- (a) With the "ON-OFF" switch on the Power Pack in the "OFF" position connect the lead provided to the battery terminals—polarity will not affect performance—and plug on to the large pins marked "B" Fig. 10.
- (b) Set the "Battery-Mains" plug to "Battery" Fig. 10.
- (c) Switch to "ON." A voltage will be shown on the transmitter meter, in Position 2, and a faint hum heard in the Pack.

NOTE: The position of the voltage selector plugs on Panel A is quite immaterial and has no effect when "Battery Mains" plug is set to "Battery."

When the Power Pack is set for Battery operation, do not leave the switch in the "ON" position when not operating or the battery will be discharged unnecessarily.

E. **To Change from Battery to Mains operation and vice-versa.** If a rapid change-over from Mains to Battery operation is likely to be required, it is advisable to connect up as specified in sections D and B—both battery and mains leads being connected to the Power Pack. Assuming A.C. mains are in use—should they fail, then

- (a) Move Power Pack switch to "OFF."
- (b) Reverse "Battery-Mains" plug to read "Battery."
- (c) Switch to "ON."

NOTE: (i) If the apparatus is to be used with the battery still connected up to the electrical system of a car, the BLACK battery clip should be connected to the terminal which is earthed to the car chassis—irrespective of whether it is Positive or Negative.

It is absolutely essential that the voltage of the accumulator used should not exceed 6.3 volts, since otherwise the set may be damaged. The accumulator must not be charged whilst connected to the set.

If, when on battery operation, no hum is heard from the Power Pack and the battery and fuse are in order, the vibrator may be faulty. Disconnect and withdraw the Power Pack from the suitcase. Take out the 2 screws in each side of the metal case and remove the lid. Insert the spare vibrator into the red clip in place of the faulty vibrator.

F. **Transmitter and Receiver Connections:** Normally the 6-pin "TX" cable plug is fitted in the upper row of sockets on the Power Pack, marked "TX" or "RX." The 6-pin "RX" cable plug is fitted in the lower sockets marked "RX only." In this position the receiver is automatically switched off when the Transmitter "T.S.R." switch is at "S" (send). If it is required to operate the Receiver alone, its cable plug must be fitted in the upper sockets, "TX or RX."

The Aerial and Earth terminals are on the Transmitter panel. The plug on the short yellow lead on the Transmitter should be inserted in the Aerial socket on the Receiver. If the Receiver alone is to be used, the Aerial wire may be removed from the transmitter aerial terminal and used in the receiver aerial socket.

II. TRANSMITTER.

The operator should make himself familiar with the function of the following controls.

A. **"Crystal Selector."** This switch adjusts the transmitter to suit different crystal frequencies and not the operating frequency. One position of the switch is for use on fundamental operation irrespective of crystal frequency.

B. **"Wave Band."** This switch sets the frequency of the oscillator valve to the band required. This will usually be the transmitting frequency, e.g. Using a 6.0 mc/s crystal on fundamental set the "Wave Band" to "5-7" and the transmission is on 6.0 mc/s. With the "Crystal Selector" set to "Harmonic 5.2-6," and the same crystal, the "Wave Band" would be set to 9-12 m/cs and the transmitted frequency would be 12.0 mc/s.

C. **"T.S.R."** This "Tune-send-receive" switch performs the following functions.

- (i) **Position "T."** In this position the transmitter is ready for tuning. The key is short circuited. The power to P.A. (Power Amplifier) is reduced to protect the valve. The aerial is disconnected so that no signal is transmitted until required. The receiver H.T. is switched off. Receiver heaters are still on.
- (ii) **Position "S."** The Receiver H.T. is still switched OFF. The aerial is in circuit. When the key is depressed, the P.A. valve will transmit at full power. This is the operating position.
- (iii) **Position "R."** The Transmitter HT is now off and Receiver H.T. on. The Aerial is now connected to the receiver. No other transmitter controls should be altered in going from "Send to Receive."

NOTE: So long as the "TX" and "RX" plugs are in the Power Pack sockets and the Power Pack switch on, the heaters of both transmitter and receiver are on.

D. **"Meter Selector."** This switches the moving coil meter into different circuits of the transmitter or receiver to measure either voltage or current. The positions of the switch are as tabulated on page 6.

E. **"P.A. Grid Tuning."** This knob controls a variable condenser which is a fine adjustment to the setting of the "Wave Band" switch. With the "Meter Selector" in Position 3 tuning is accomplished by observing the deflection given by the P.A. Grid Current.

F. **"Anode Tuning."** This controls the tuning condenser for the P.A. valve. It is always adjusted for minimum P.A. Total current.

G. **"Aerial Matching."** This knob controls a variable condenser and is used to adjust or match the transmitter to suit any particular aerial. It may be considered as a "load-increasing" control.

The two sockets above the "Crystal Selector" are for 2-pin quartz crystals (3,000-8,000 mc/s) and those below, for the 2-pin plug on the key lead. The Aerial terminal is above the "T.S.R." switch and the Earth below it. See illustration.

NB.
Fuse Holder marked
H.T. needs 10 amp.
fuse.
Fuse Holder marked
A.C. needs 500 m.a.
fuse.

Meter Selector. "T.S.R." switch in "T" or "S."

Position.	Circuit Measured.	Full Scale Meter Reading.	Normal Reading.
1.	Oscillator voltage.	600 volts.	230 volts.
2.	P.A. Voltage.	600(x2) volts.	230(x2) volts.
3.	P.A. Grid current.	6 m/a.	1 to 3 m/a.
4.	Osc. Grid current.	1.5 m/a.	.25 to .75 m/a.
5.	None.	—	—
6.	P.A. Total current.	120 m/a. 600 on scale.	65-70 m/a. 325-350 on scale.

"T.S.R." switch on "R."

Position.	Circuit Measured.	Full Scale Meter Reading.	Normal Reading.
1.	Receiver voltage.	600 volts.	230 volts.
2.	P.A. voltage.	600(x2) volts.	260(x2) volts.
3.	None.	—	—
4.	Receiver current.	15 m/a (x2)	12.5 m/a(x2).
5.	None.	—	—
6.	None.	—	—

NOTE: (i) Normal readings are for the transmitter tuned up and working and for the receiver working at almost full volume.

(ii) At Position 2. Full scale indicates 1200 volts, i.e. 600(x2).

H. The Meter. Unless other readings are required, as when testing the apparatus, or tuning the Transmitter, it is advisable to make a habit of leaving the "Meter Selector Switch" in Position 2 reading Anode volts. In this Position, the Meter is an indication that the set is "ON" and that the Power Supply is in order. Should the mains fail, the meter will register this, an immediate change-over to battery operation should then be effected, when the meter will again read approximately half scale if all is in order.

Tank Coils. To obtain the highest efficiency over the wide wave band covered, each of the 4 coils can be plugged in in two ways, A and B. The particular coil and its position will depend upon the installation—Aerial-Earth, etc., but the following table will serve as a guide under average conditions with 40-50 ft. (13-17 metres) of aerial wire. The "A" position is that in which the letter A on the coil base faces the operator in the usual position.

Coil.	Position.	FREQUENCY (Mc/s)	
		Minimum.	Maximum.
L1	A	3.0	4.0
L1	B	3.75	5.25
L2	A	4.5	6.25
L2	B	5.5	7.5
L3	A	6.5	9.0
L3	B	7.0	10.0
L4	A	9.0	13.0
L4	B	12.0	16.0

If the setting of either knob reaches "O" whilst tuning the transmitter a smaller coil is required, e.g. L2B instead of L2A or L4A instead of L3B. Similarly if either knob reaches "10" then a larger coil is required.

OPERATING INSTRUCTIONS.

With an A.C. power supply, aerial and earth system installed, and, if possible, a 6v. accumulator for emergency use available, proceed as follows:—

I. PRELIMINARIES.

- Open the suitcase, and examine the apparatus.
- Plug the 6-pin plugs marked "TX" and "RX," which will be found lying on the panel into the sockets on the Power Pack marked "TX and RX" and "RX only" respectively (Page 5 Sect. F).
- Open the spares box, remove the mains and battery leads, plug them on to their appropriate pins (See Figs I and II). See that the "ON-OFF" switch on the Power Pack is to "OFF," then connect the Battery clips to the Battery terminals and plug in and switch on the mains.
- Plug the key into the transmitter and the telephones into the receiver.
- Attach the Aerial and Earth wires to the appropriate terminals (see illustration).
- Adjust the Power Pack voltage selector to the voltage of the mains (previously determined) and set the "Battery-Mains" plug to "Mains."
- Insert the Aerial plug on the Transmitter into the socket on the Receiver (see illustration).
- The "Meter-Selector" switch should be in Position 2.
- Select your crystal and the appropriate coil. Plug them in.
- Set the "Crystal Selector" and "Wave Band" switches to the correct frequency.

II. TO TUNE THE RECEIVER.

- (a) Turn the "T.S.R." switch to "R" and switch on the Power Pack. There should be a deflection of about half scale on the meter (indicating anode volts) and in a few moments a faint hum heard in the telephones).
- (b) Set the "Wave Band" switch to the desired band.
- (c) If CW is to be received, set the B.F.O. knob to the "ON" position at "O."
- (d) Consult the chart or graph relating to frequency and dial settings and move the tuning control over the setting indicated for the frequency desired and advance the volume control towards maximum until a comfortable volume is reached.
- (e) Should the station not be received at once, check the "T.S.R.," "Wave Band" switch and Graph reading and then again search around the setting indicated by moving the tuning control slowly to and fro on either side of the number given on the chart.
- (f) **Beat Frequency Control.** Attention to the following points will ensure best reception. The beat oscillator is provided with a control for varying the pitch of the note received. This control is normally set to "O." When a station is received, the main tuning knob should be adjusted to give the lowest pitch possible and then the "B.F.O." control set to give the desired note for Morse reception. Setting the "B.F.O." control on either side of zero will provide the required note. If interference from another station is experienced, setting the control to the same number on the other side of the zero should be tried. This will give the same pitched note for the wanted station but a different note for the interfering station, thus permitting the operator to recognise easily his own station. When searching for a station, the B.F.O. control should always be at "O." The receiver is designed to give maximum volume for a note of 1000 cycles per second and the B.F.O. control should always be adjusted for this frequency.

III. TO TUNE THE TRANSMITTER.

(a) Transmitting on Fundamental.

For the purpose of this example, it is assumed that a crystal of a frequency of 3.755 mc/s is to be used.

- (i) Connect up the Aerial, Earth, Key, Telephones and Power Pack as already described.
- (ii) Take Coil L1 and plug it into its socket with the figures L1A to the front.
- (iii) Plug the crystal into its socket and set the "Crystal Selector" knob to "Fundamental all Crystals."
- (iv) Set "Wave Band" knob to Position "3-4."
- (v) Set "Meter Selector" to Position 2—P.A. Voltage.
- (vi) Set the "T.S.R." switch to "T" (Tune).
- (vii) Set "Anode Tuning" and "Aerial Matching" knobs to "10."
- (viii) Switch on the power pack. The meter should read about 300.
- (ix) Switch "Meter Selector" to 3. Adjust "PA Grid Tuning" for maximum meter reading.
- (x) Switch Meter Selector to 6. (PA total current, meter reads about half scale).
- (xi) Turn the Anode Tuning knob until the meter reading dips to a minimum value, this is usually about 100 with the Anode Tuning knob at about 2. The Transmitter is now in tune and ready to be matched to the aerial.
- (xii) Turn the "T.S.R." switch to "S." The meter will now cease to read until the key is pressed.
- (xiii) Press the Key. The meter reading is now greater (about 200) as the aerial is beginning to take power from the transmitter.

Matching the Aerial. The Key must be held down whilst matching.

- (xiv) Turn the Aerial matching knob one division to "9." The reading increases because the load on the transmitter is increased. The Anode Tuning knob is now slightly adjusted to the dip as before—which, however, is now higher perhaps up to 300.
- (xv) Turn the Aerial matching knob to "8" and again adjust "Anode Tuning" to dip of the needle. This may be just over 350. This is a little too much, as the Transmitter delivers Maximum Power for a reading of 325-350 (i.e. 65/70 m/a) so bring back the "Aerial Matching" knob a little to between "8" and "9" and readjust "Anode Tuning" and the dip should be between 325 and 350. In this position the transmitter is putting out the full power of 20 watts into the aerial. The "Anode Tuning" knob may now be between 2 and 3. Transmission may now commence.

NOTES. The meter MUST DIP to the final reading. This is proof that the transmitter is tuning. The valve will take more current when off tune but give out much less power.

With a bad earth or a too short aerial, it may not be possible to fully load up the transmitter. In this case the "dip" will be below 325 on the scale (65 m/a).

(b) Transmitting on Harmonic.

It is assumed that the same crystal (3.755mc/s) is to be used (in daylight) and that the signal is to be sent out on 7.510 mc/s which is the 2nd harmonic or double the crystal frequency. The transmitter is set up exactly as before except for the following details.

- (i) The tank coil used will now be L3A as given in the coil table.
- (ii) The "Crystal Selector" knob is now set to "Harmonic 3.6—4.6" since the crystal frequency falls between these two numbers.
- (iii) The "Wave Band" knob is now set to "7-9" since the harmonic (7.510) is between 7 and 9 mc/s.
- (iv) Everything else is done in the same order and the meter readings will be the same. The aerial is matched in the same way and the Anode tuning control adjusted to give the dip at between 325 and 350. The power radiated is the same on harmonic as on fundamental frequency.

With the "Meter Selector" switch at Position 4, the meter measures the oscillator grid current, and proves whether or not the crystal is working. It need only be used if there is any doubt that the transmitter is working properly. It normally reads $2\frac{1}{2}$ — $7\frac{1}{2}$ on the 15 scale—that is .25 to .75 m/a.

AERIALS.

APPENDIX A.

The most usual type of aerial is the so called Marconi aerial which consists of a length of

AERIALS.

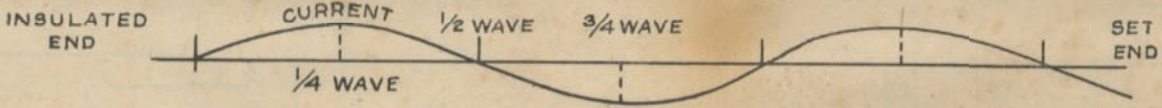
APPENDIX A.

The most usual type of aerial is the so called Marconi aerial which consists of a length of wire, one end insulated and the other end attached to the aerial terminal of the transmitter. A second length of wire joins the earth terminal of the transmitter to a conductor entering the ground. In this type of aerial the main losses are due to the resistance of the earth connection and every effort must be made to obtain as good an earth connection as possible.

The rated power of a transmitter is the power it will deliver to a suitable aerial but the power delivered to the aerial is **not** the power radiated by the aerial, which is always less and unless the aerial-earth system is efficient may be very considerably less. The remainder of the power is dissipated as heat in neighbouring objects such as walls, etc., and in the ground.

CURRENT DISTRIBUTION IN AERIALS.

If a long wire, insulated at one end, has the other end attached to the aerial terminal of the transmitter, an alternating current is produced in the wire, the amplitude of which varies along the wire. For a long wire the current reaches a maximum at a distance of a $\frac{1}{4}$ wavelength along the wire and then decreases. See Fig. 1.



Since the power radiated is proportional to the square of the current, it is clearly desirable to have at least one current maximum occur somewhere along the aerial. The shortest aerial which can be considered reasonably efficient is a quarter-wave aerial.

FREQUENCY	3 Mc/S	6 Mc/S	12 Mc/S	16 Mc/S
WAVE LENGTH	100 metres	50 metres	25 metres	20 metres
$\frac{1}{4}$ WAVE LENGTH	25 "	12 $\frac{1}{2}$ "	6 $\frac{1}{4}$ "	5 "

EARTH RESISTANCE.

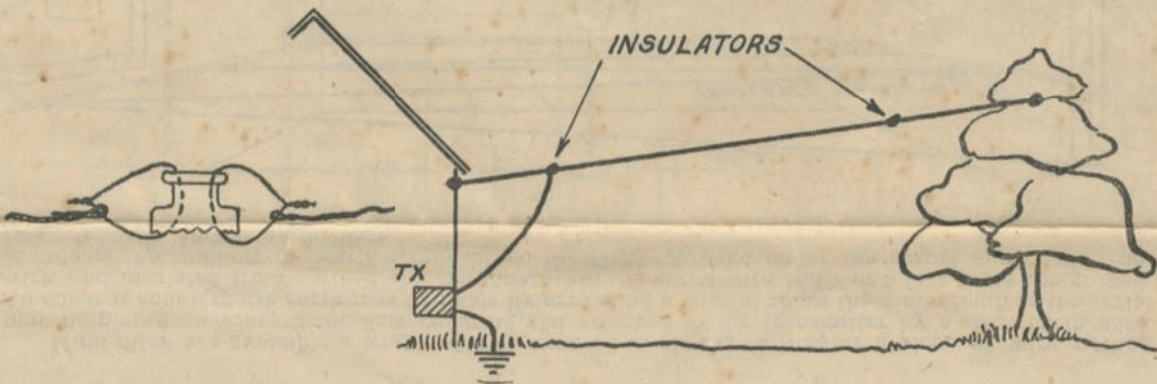
The resistance of the earth connection usually varies from about 10 ohms, obtained when the earth wire is soldered to a main water pipe near to the ground to about 100 ohms, obtained from a moderate earth connection.

Earth Resistance in ohms.		10	50	100
Radiated power as a percentage of the power in the aerial	$\frac{1}{4}$ wave	80%	44%	29%
	$\frac{1}{2}$ wave	50%	16%	9%
	$\frac{3}{4}$ wave	20%	5%	2 $\frac{1}{2}$ %

The amount of power that can be afforded to be wasted when using suitcase sets is small, it is therefore never any use trying to use a shorter aerial than $\frac{1}{4}$ wave and this only in conjunction with a very good earth.

ERECTING AN AERIAL.

It is not usually practicable to erect a vertical $\frac{1}{4}$ wave aerial although this would be very efficient, but at least this length of wire and more if possible should be erected with a long vertical or rising portion and the top bent in some way towards the horizontal as in an inverted L. The exact length of wire is not critical as the transmitter is matched to the aerial in use during the tuning operations. The whole should be left well away from earthed objects such as buildings, cliff sides, surrounding trees, etc., and the end not attached to the transmitter should be insulated. In dry weather the rubber covering of the wire will be sufficient insulation but in wet weather it would be better to use an insulator. An old bottle neck may be used for this purpose.



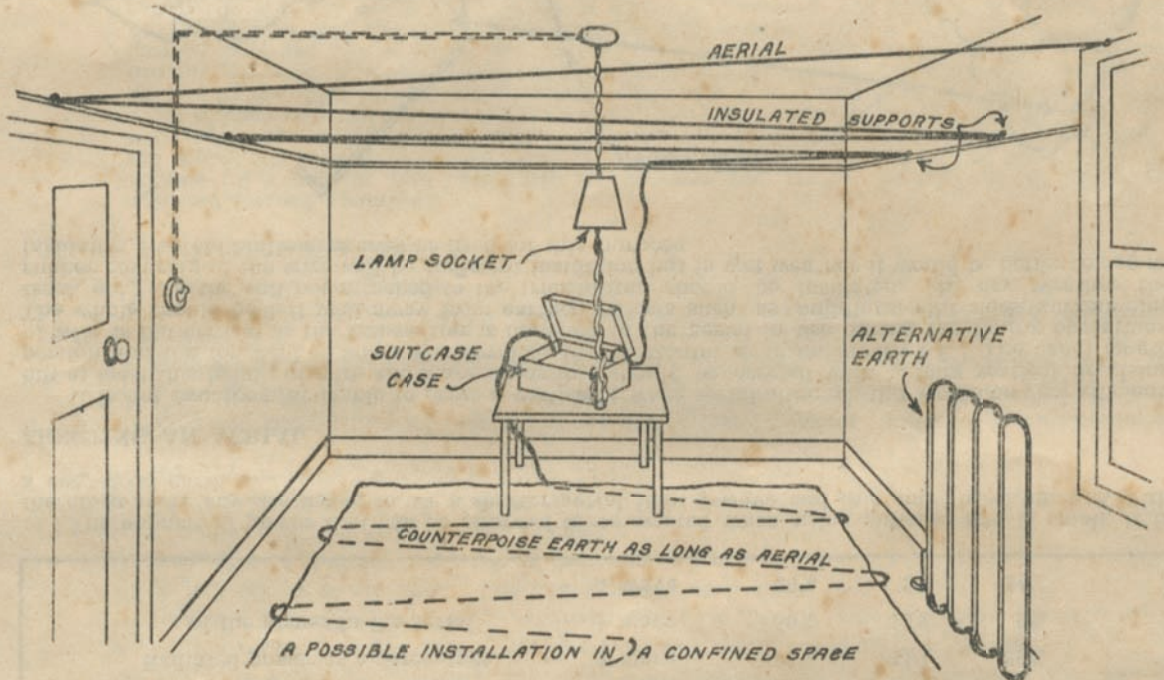
If it is impossible to use an outdoor aerial great care must be used to erect the most efficient indoor aerial possible. At least a $\frac{1}{4}$ wave length of wire should be used and this arranged high in the house—possibly in zig-zag fashion in the space amongst the rafters under the roof. Should circumstances restrict activities to one room the aerial wire should be arranged in zig-zag fashion across the room about a foot below the ceiling, spacing the wires as widely as possible, paying special attention to the fact that no part of the wire should run parallel to metal girders—electric wires, water pipes or spouting, nor should the wire be doubled back on itself at any point.

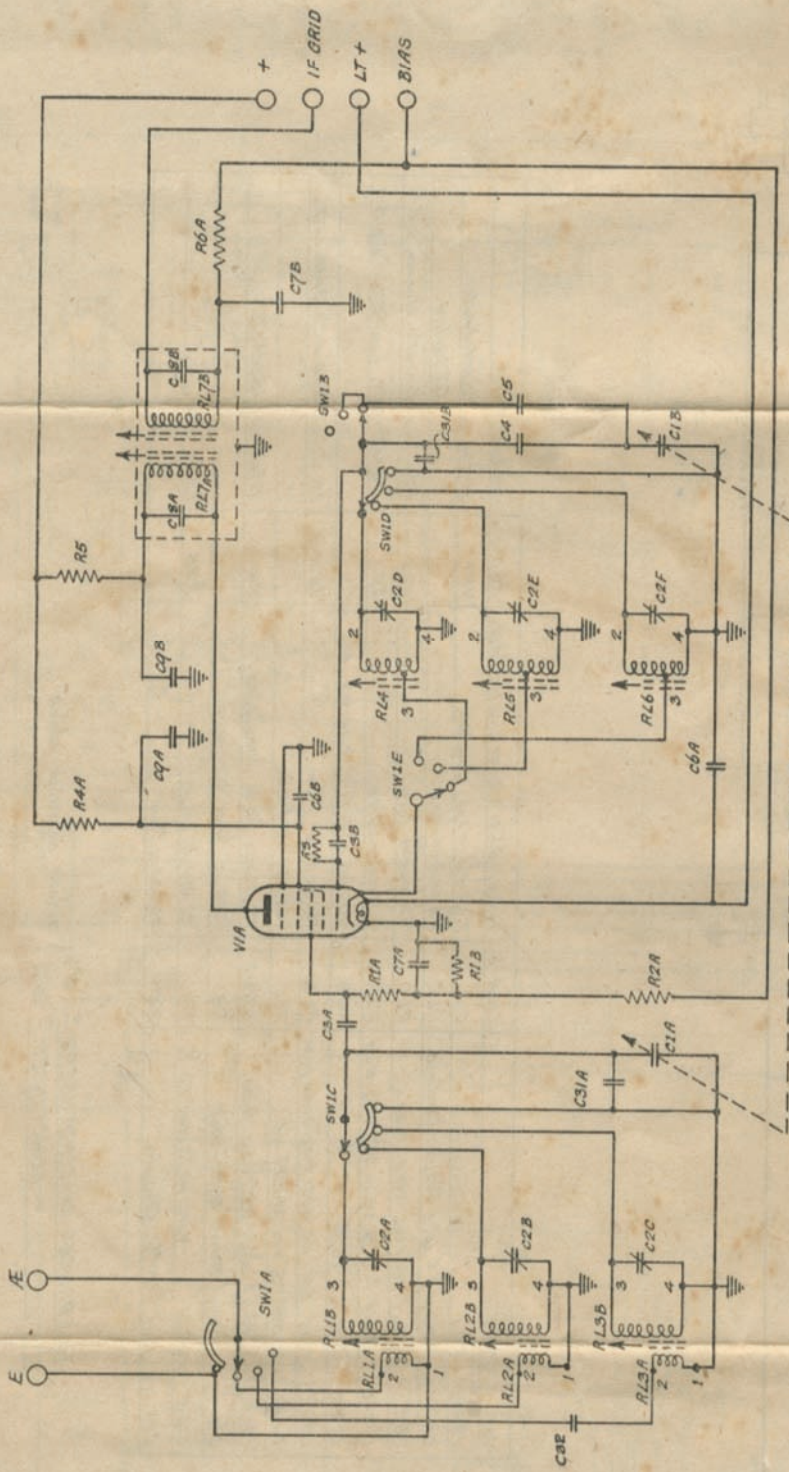
THE EARTH.

An efficient earth is most important. The ideal would be to solder a short length of wire to a large sheet of copper buried in moist earth near to the transmitter and to attach the free end of the wire to the earth terminal of the transmitter. Failing this, a copper earth tube, a large coil of barbed wire, an old oil drum well scraped, or some such metal receptacle could be buried instead, but it is most important that where it is attached to the earthwire should be clean metal, a good electrical contact, preferably soldered should be made and that the ground should be moist.

If indoors, a water pipe may be convenient. Choose a cold water pipe near to the ground if possible, rather than a hot pipe which may be loosely attached to dry walls in several places before finally making a good earth connection. Scrape the pipe clean before attaching the earth wire.

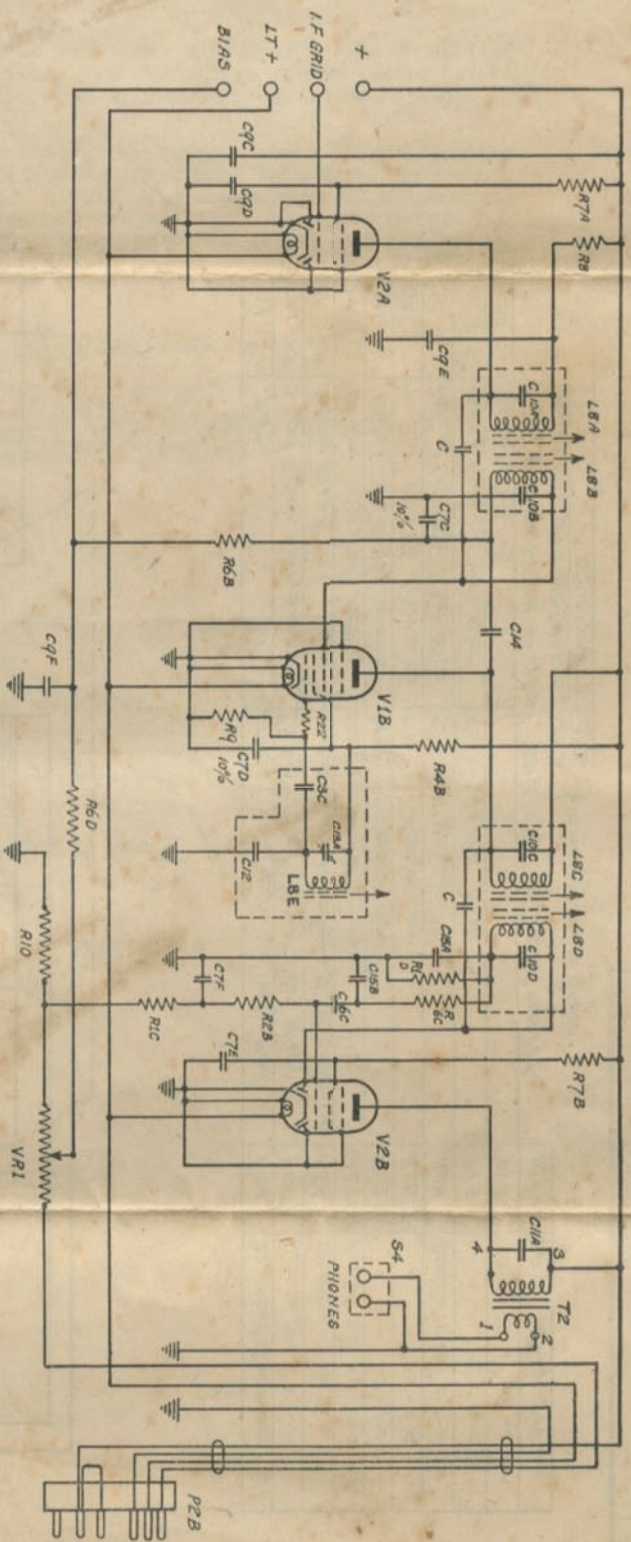
If no pipes are available a length of wire arrayed in zig-zag fashion or a piece of wire netting may be placed underneath the floor covering and attached to the transmitter by a short earth wire. An efficient counterpoise earth may be made by arranging a wire of about the same length as the aerial wire, and insulated from earthed objects underneath the aerial wire and 2 or 3 feet above the ground. If indoors the counterpoise earth should be on the floor—perhaps under the carpet and well separated from the indoor aerial wire.





V1A	707					
SW1A-F	3 Deck Rotary, 6 pole, 3 way					
C1A-B	2 gang 90 μ f.	CT A-B	.01 μ f 250V D.C. Wkg. Mica.	R4A	20,000 Ω \pm 5% wire wound. 6W	
C2A-F	Tyrimmer 2-9 μ f. Noz50q	CS A-B	110 μ f \pm 2 μ f. Silver Mica.	R5	5,000 Ω 1/2W "	
C3A-B	100 μ f \pm 10% tubular ceramic	CQ A-B	1 μ f A.M. 100/1021. Molex ceramic paper.	R6A	150,000 Ω 1/4W "	
C4	700 μ f \pm 2% + 1% Silver Mica	CS1A-B	6-8 pf ceramic.	RL1 (A-B)	Aerial coil 5.7-15.2 mcs	
C5	600 μ f \pm 0% + 3% Silver Mica	RI A	1 Megohm. 1/4W.	RL2 (A-B)	" " 5.2-9.04 "	
C6A-B	.001 μ f 250V D.C. Wkg. Mica.	RI B	1 Megohm 1/4W.	RL3 (A-B)	" " 3.1-5.4 "	
C32	50 μ f \pm 10%	R2A	4 Megohm. 1/4W	RL4	Oscillator coil 5.7-15.2 "	
		R3	20,000 1/4W	RL5	" " 5.2-9.04 "	
				RL6	" " 3.1-5.4 "	
				RL7A-B	I.F. Coil 470 kcs 1/45 Litz.	

NOTE: When C2A-F are 4-21 μ f, C31A-B (6-5 pf) are not required.
 TOLERANCES ON CONDENSERS \pm 25%
 " " RESISTANCES \pm 20% unless otherwise stated.

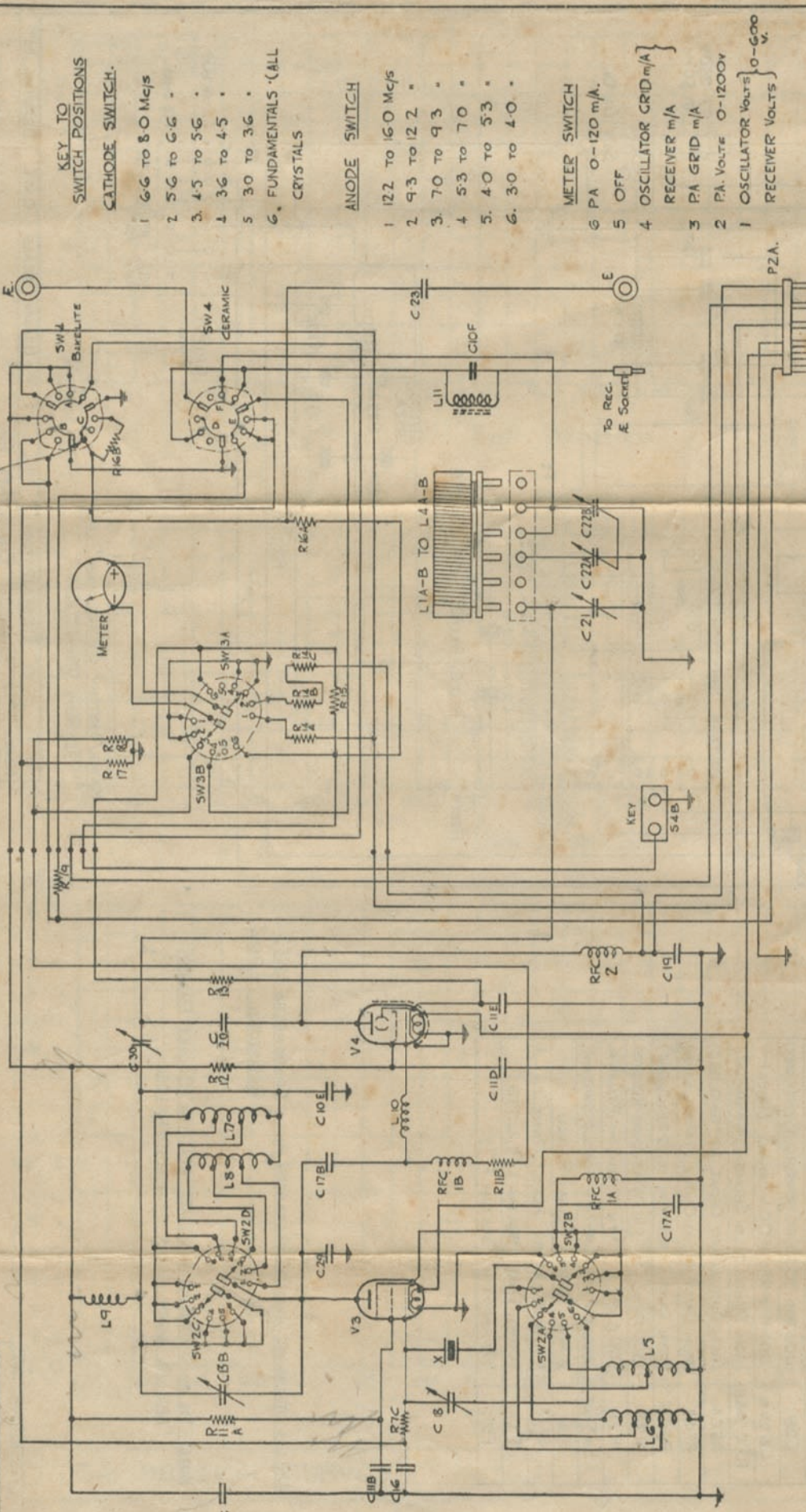


V1B	7A7	C15A-B	100 μ f $\pm 20\%$ Silver Mica moulded.	R6D	470,000 Ω $\frac{1}{2}$ w.
V2A-B	7R7	C	2pf ± 0 -1pf. Ceramic.	VR1	100,000 Ω Potentiometer.
C3C	100 μ f $\pm 10\%$ Tubular Ceramic	R1C	1 Megohm $\frac{1}{2}$ w.	C1A	CT lag law.
C6C	100 μ f 250V D.C. Wkg. Mica.	R1D	1 Megohm $\frac{1}{2}$ w.	R22	50 Ω $\frac{1}{2}$ w Parasitic stopper.
CTC-D	10 μ f $\pm 10\%$ 250V D.C. Wkg. Mica.	R2B	4 Megohms $\frac{1}{2}$ w.	T2	Transformer, Type 210. Ratio 15-1.
CTE-F	10 μ f $\pm 25\%$ " " "	R4B	20,000 Ω $\pm 5\%$ Wirewound. 6w.	L8A-E	470 kc/s Litz I.F. Coil.
C9C-F	1 μ f A.M. 100/4021 Metall. coated paper	R6B	150,000 Ω $\frac{1}{2}$ w.	L8A-E	470 kc/s Litz I.F. Coil.
C10A-D	220pf Silver Mica $\pm 4\%$	R6C	150,000 Ω $\frac{1}{2}$ w.	S4	Telephone Socket.
C11A	1002 μ f 350V D.C. Wkg. Mica.	R7A-B	100,000 Ω $\frac{1}{4}$ w. Insulated.		
C12	1000 pf Silver Mica $\pm 20\%$	R8	1000 Ω $\frac{1}{2}$ w. Wirewound		
C13A	25 pf Variable (3 point fix.)	R9	20,000 Ω $\frac{1}{2}$ w.	P2B	Case Pkg.
C14	6 pf $\pm 20\%$ Ceramic.	R10	40,000 Ω $\frac{1}{2}$ w.		

TOLERANCES ON CONDENSERS $\pm 20\%$
 RESISTANCES $\pm 20\%$ unless otherwise stated

DESCRIPTION	DRAWN	DATE	DRG. NO.
RECEIVER I.F. UNIT. 3 MK II	L.M.W.	26 11 42	R5082

REVISION A: CONTACTS 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.



KEY TO SWITCH POSITIONS

CATHODE SWITCH.

- 1 6.6 TO 8.0 Mcfs
- 2 5.6 TO 6.6
- 3 4.5 TO 5.6
- 4 3.6 TO 4.5
- 5 3.0 TO 3.6
- 6 FUNDAMENTALS (ALL CRYSTALS)

ANODE SWITCH

- 1 12.2 TO 16.0 Mcfs
- 2 9.3 TO 12.2
- 3 7.0 TO 9.3
- 4 5.3 TO 7.0
- 5 4.0 TO 5.3
- 6 3.0 TO 4.0

METER SWITCH

- 6 PA 0-120 m/A.
- 5 OFF
- 4 OSCILLATOR GRID m/A
- 3 PA GRID m/A
- 2 PA VOLTS 0-1200V
- 1 OSCILLATOR VOLTS 0-600V
- RECEIVER VOLTS

NOTE: ALL SWITCHES VIEWED FROM REAR OF TRANSMITTER

TOLERANCES ON CONDENSERS ± 25% UNLESS OTHERWISE STATED
" " RESISTANCES ± 10%

DESCRIPTION	QTY	VALUE
OSC. CATHODE COIL	L5	LF
"	L6	"
"	L7	HF
"	L8	LF
"	L9	HF
NEUTRALISING COIL	L10	
ANTI-PARASITIC COIL	L11	
WAVE-TRAP COIL	P2A	
CABLE PLUG	METER	500Ω 0.5 m.A
CRYSTAL SOCKET	X	
KEY SOCKET	S4B	
2.5-9 pF. VARIABLE.	C30	
100,000Ω ± 5%	R7C	
20,000Ω ± 5%	R11A-B	
500Ω ± 5% W. WIREWOUND	R12	
200Ω ± 5%, 3 W. WIREWOUND.	R13	
1.7 MΩ ± 5%	R14 A-C	
2.08Ω ± 2% 1/2 W. WIREWOUND.	R15	
2.00Ω ± 10% 1/2 W. WIREWOUND.	R16 A-B	
250 pF. MICA.	C16	
100 pF ± 5%, 350V D.C. WKG. SILVERED	C17A-B	
TRIMMER 15-45 pF.	C18	
0.002 mF ± 20% 750V D.C. WKG.	C20	
300 pF. SINGLE SECTION.	C21	
300 pF. 2 GANG.	C22A-B	
1 mF. METAL CAGED PAPER	C23	
25 pF ± 1.25 pF. SILVERED MICA.	C24	
TANK COIL 3-4 MCS	L1A-B	3 1/2 - 5 1/2 MCS
"	L2A-B	4 1/2 - 6 1/2 MCS 5 1/2 - 7 1/2 MCS
"	L3A-B	6 1/2 - 8 MCS 7 - 10 MCS
"	L4A-B	9 - 15 MCS 12 - 16 MCS

MODEL 311

CIRCUIT DIAGRAM FOR MODEL 311 TRANSMITTER

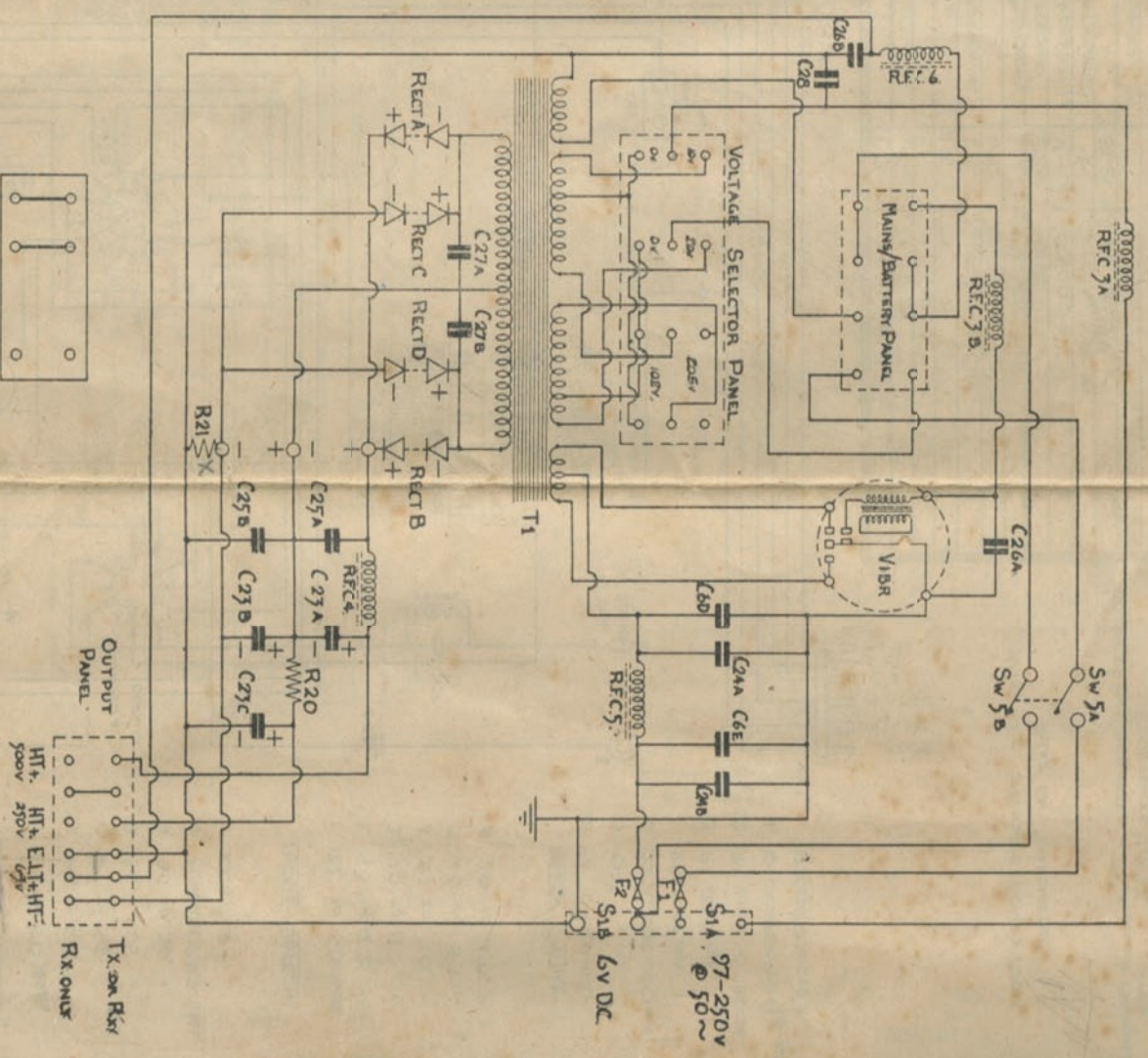
DRAWN SCALE DATE DRAWING NO.

ACG. 8-3-43 C.D 2038.

CODE	DESCRIPTION
T ₁	COMBINED TRANSFORMER.
VIBR	6 Volt Non Synchronous Vibrator.
RECTA-D	WESTALITE Selenium 30 Disc Rectifier.
C23A-C	16MFD 350V, WORKING, ELECTROLYTIC.
C24A&B	5MFD 50V, DC WORKING. (PAPER)
C25A&B	1MFD 450V, DC WORKING. (PAPER)
C26A&B	1MFD 350V, DC WORKING. (PAPER)
C27A&B	0.04 MFD 300V AC WORKING, 115C/B (PAPER)
C28	0.006 MFD 300V AC WORKING, 115C/B (PAPER)
C6 D&E	0.001 MFD 250V, DC WORKING (MICA)
RF.C.3A&B	IRON DUST CORED CHOKE (34 SWG. D.S.C.)
RF.C.4	IRON DUST CORED CHOKE (38 SWG. D.S.C.)
RF.C.5	IRON DUST CORED CHOKE (14 SWG. ENAM)
RF.C.6	IRON DUST CORED CHOKE (22 SWG. D.S.C.)
R20.	1300Ω ± 5% 3W WIREWOUND RESISTOR.
R21.	500Ω ± 5% 1½W WIREWOUND RESISTOR.
Sw5A&B	DOUBLE POLE ON-OFF TOGGLE SWITCH.
S1A	2 AMP MAINS PLUG PANEL
S1B	5 AMP BATTERY PLUG PANEL
F1	500MA FUSE. BELLING LEE. L. 738.
F2	7½ AMP FUSE. BULGIN F 75.

UNLESS OTHERWISE STATED TOLERANCES ON:-
 CONDENSERS ± 25%
 RESISTORS ± 20%

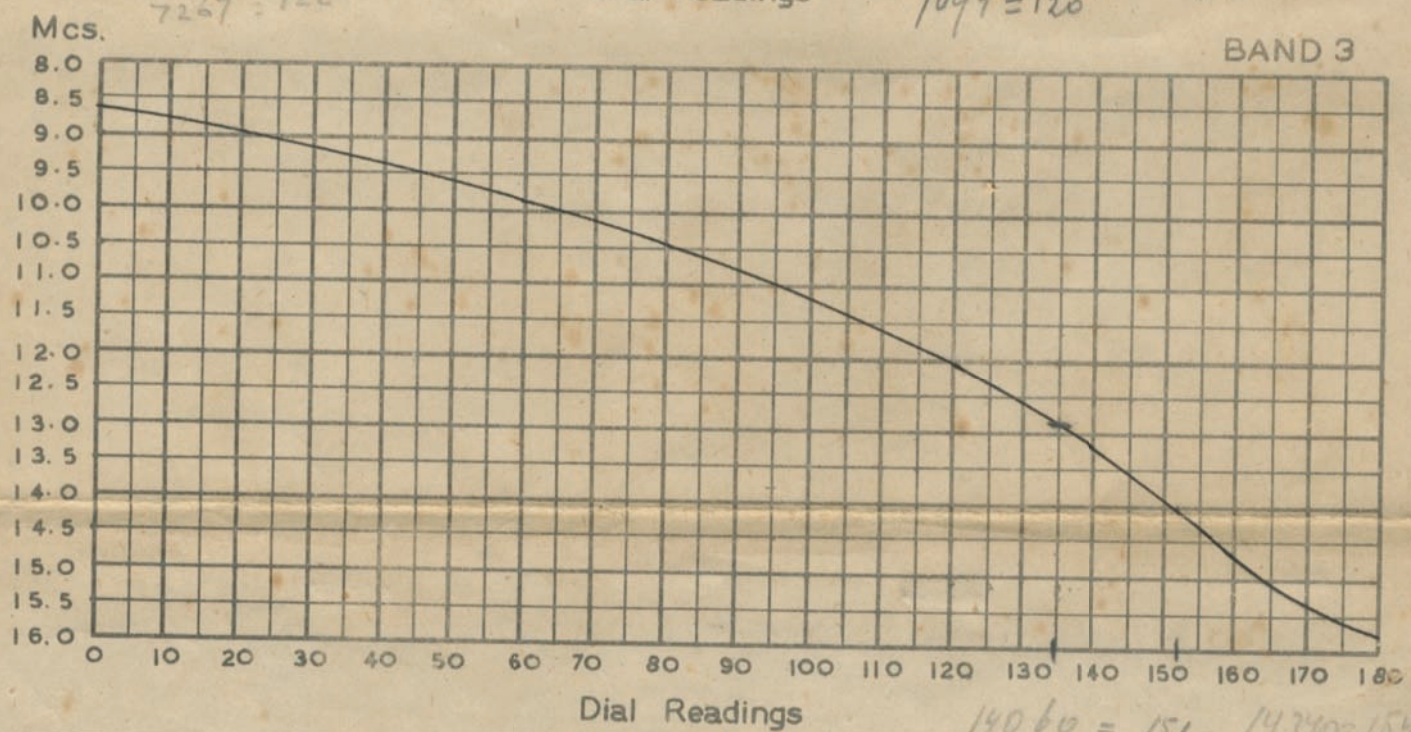
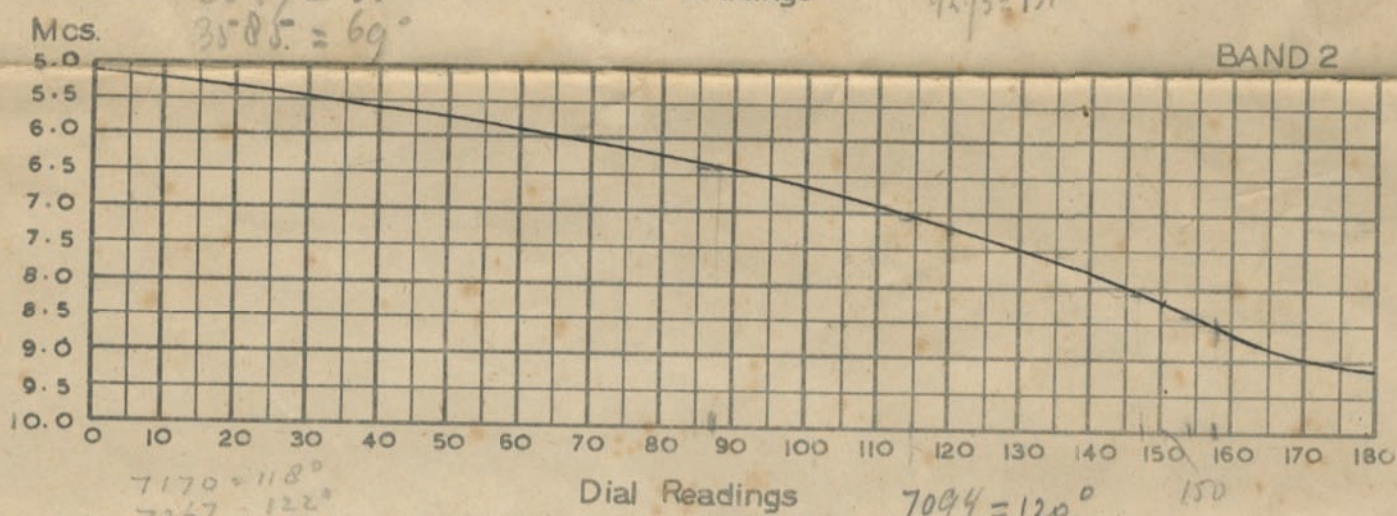
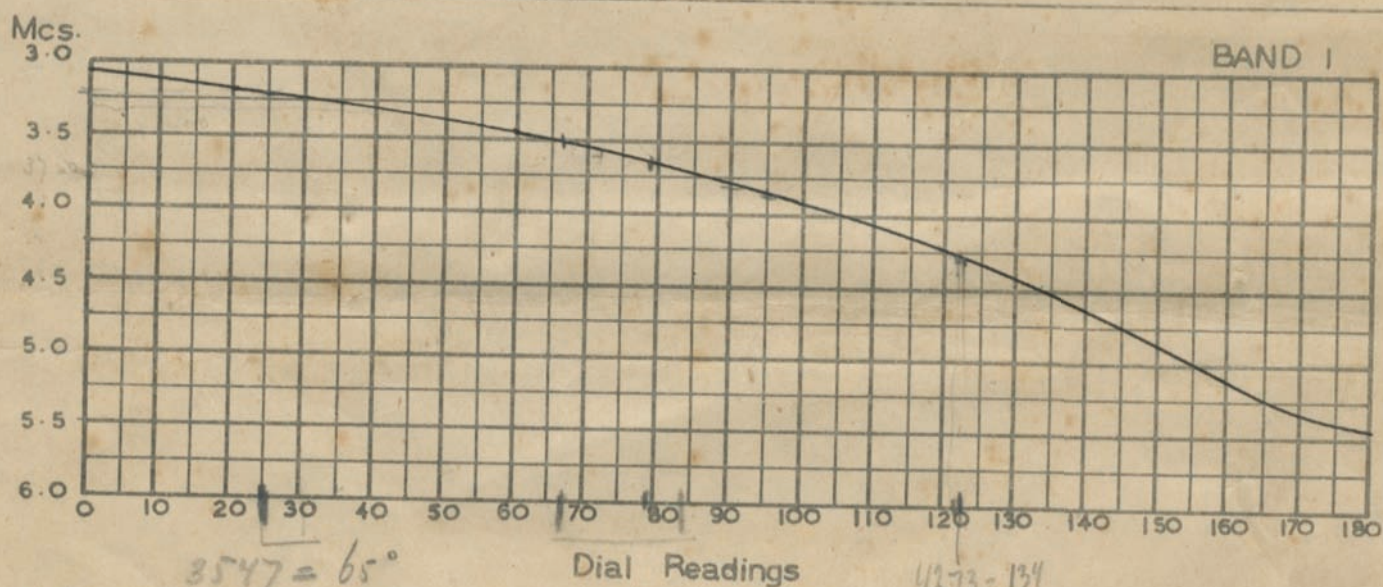
NOTE: IN THIS CIRCUIT DIAGRAM ALL THE SOCKET PANELS
 ARE AS SEEN FROM THE UNDERSIDE.



MAINS/BATTERY CHANGE OVER PLUG
 SHOWING CONNECTIONS.

REV. A. LEAD TO SW5B WAS
 TAKEN FROM POWER PACK
 SIDE OF FUSE. 11.6.43

DESCRIPTION	DRAWN	SCALE	DATE	DRAWING N°
Model 7/II CIRCUIT DIAGRAM FOR Model 7/II POWER PACK	G.H.R.	-	27/1/42	CD 2037.



CALIBRATION CURVES

SERIAL N° 42796