INSTRUCTION MANUAL

for

WIRELESS SET No. 208

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WIRELESS SET No. 208.

PROVISIONAL PAMPHLET.

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CHAPTER 1.

GENERAL DESCRIPTION.

1. GENERAL FEATURES.

Wireless Set No. 208 has been designed as a low-power portable equipment to provide C.W. Wireless Telegraphy (W/T) communication only within an infantry battalion or similar unit. It is capable of being carried in a pack or ruck-sack for transport and operated on the ground by one man.

It is combined sender and receiver and has a frequency coverage of 2.5 to 3.5 Mc/s (120 to 85.7 metres).

The Set is equipped with six valves, four for the receiver and two for the sender. Provision is made for the reception of Radio Telephony (R/T) signals.

2. EQUIPMENT.

The complete station comprises briefly the following equipment:—

(a) Combined Sender/Receiver unit in lightweight metal case.

(b) Dry battery.

(c) Accessories Bag, carrying cases, spare valves, key and plug assembly, Receiver's headgear, battery connectors and aerial equipment.

A list of stores included in the complete station appears in Appendix II.

3. POWER SUPPLY.

3.1 Batteries:

For power supply, the Wireless Set No. 208 is provided with a dry battery comprising in one block the following:—

Low Tension	1.5 volts
High Tension	99 volts

The voltages are obtained by means of a battery connector plugged into the four-point plug-socket in the battery block. An extension battery lead is included in the complete station so that the set may also be operated from separate L.T. and H.T. batteries as in Wireless Set No. 108. Low tension supply should be 1.5 volts and High Tensions between 90 and 105 volts.

3.2 Current Consumption:

The approximate current consumption at full voltage is shown in Table 1.

TABLE 1.—Current Consumption.

	Sending (Key Down)	Receiving
Low Tension	200 mA.	250 mA.
High Tension	18 mA.	8.5 mA.

The power input to the final valve of the sender varies between .5 and .6 watts (approx.) depending on frequency and length of aerial.

4. WEIGHTS AND DIMENSIONS.

TABLE II.—WEIGHTS AND DIMENSIONS.

	Weight lbs.	Length ins.	Width ins.	Height ins.
(1)	(2)	(3)	(4)	(5)
Sender/Receiver Unit	8¾	9½	8	7
Bag, Accessories (filled)	4½	8	7	5
Battery (1.5/99V)	5	6¾	3½	5¼
Complete Station	18¼			

5. CONNECTIONS.

The sender and receiver are assembled as one unit which is contained in a light weight metal case. The battery is carried separately and when required for operation is connected by means of CONNECTORS, BATTERY, to the 6-point plug at the rear of the Sender/Receiver Unit. When separate battery for L.T. and H.T. are used the CONNECTORS, EXTENSION is joined to the CONNECTORS, BATTERY by means of the plug and socket and connections are made to the individual battery units according to the labelled tags.

Jacks for one pair of headphones and the morse key are provided on the front panel of the set.

6. AERIALS AND COMMUNICATION DETAILS.

6. 1 Aerials:

The sender-receiver is arranged to operate with a Marconi type aerial in conjunction with a counterpoise. The sender will efficiently load into aerials having lengths up to 70 feet. Different lengths of aerial are loaded by adjusting the aerial tap switch. The aerial equipment provided with the Wireless Set No. 208 is carried in the accessories bag and consists of 70 feet of rubber cover flex, a 12 feet star network counterpoise and two cords with insulators. The aerial and counterpoise are connected to the appropriate terminals on the front panel of the Sender/Receiver unit by means of phone tips.

The cords and insulators are used for slinging the aerial between two trees or buildings or other convenient objects. The set may be operated with the aerial laid along the ground or with a person holding it if no convenient means of support is available with, of course, the consequent decrease in effective range.

6.2 Factors affecting range:

Certain general conditions tend adversely to affect the range of communication, but under normal operating conditions range of 30 to 40 miles (or greater) will be obtained. Range may be expected to be curtailed if one or both sets are operated in any of the following positions:—

(i) Against a bank or hill which lies on the line of communication.

(ii) Against a wood, or brush, whose trees are considerably taller than the aerial.

(iii) Under overhead power or telephone lines.

(iv) Near steel structures, or buildings having steel frameworks.

(v) On dry or sandy ground.

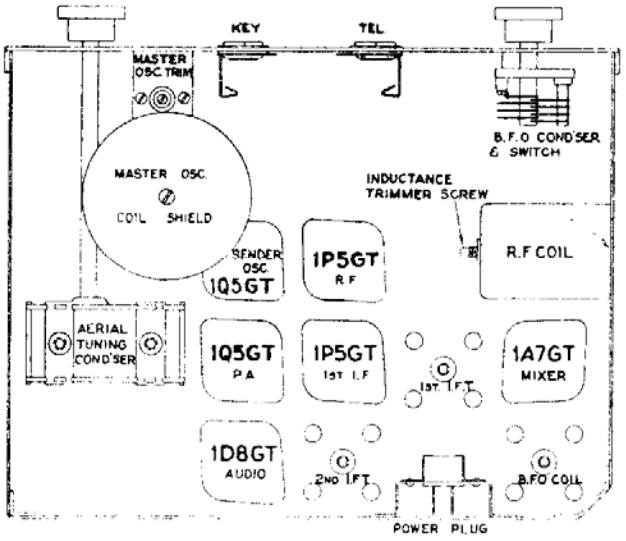
It is preferable for the site of the station to be 50 yards from such positions, to minimize their effects on range.

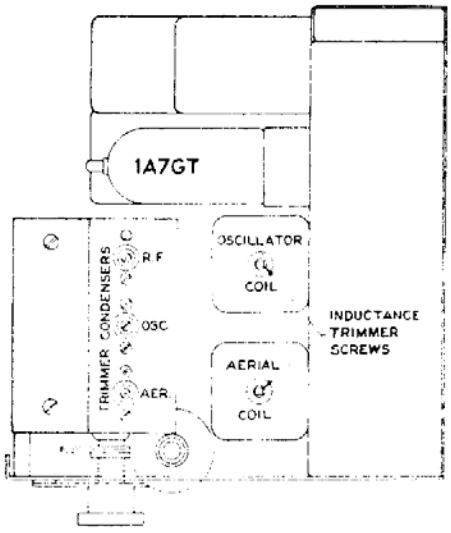
6.3 Interference:

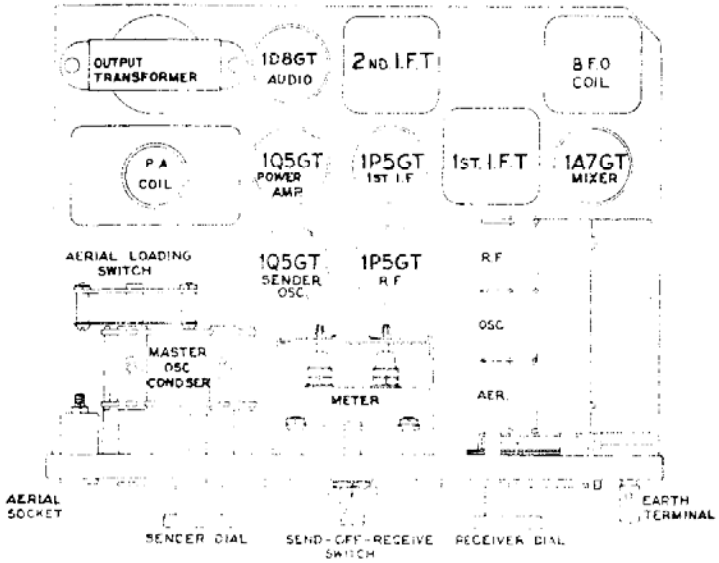
Range is also affected adversely if the sets are situated where the receivers can pick up electrical interference. Severe interference of this nature may be expected from overhead high tension power lines, petrol engines with unsuppressed ignition (either stationary or vehicles), and hospital apparatus — such as diathermy, X-ray, or ultra violet ray equipment. Interference may also be experienced from overhead and underground power and telephone lines, commutating motors and dynamos (such as battery charging sets). The extent to which interference is radiated from such sources varies considerably and prediction as to its exact effects is not possible.

—PLACEMENT DIAGRAM—

FIELD WIRELESS SET Nº 208.







CHAPTER II.

WORKING INSTRUCTIONS.

7. VALVES.

Six valves are required for the set. These valves are given in Table III. Valve socket connections are shown on Fig. 1 (b).

TABLE III.—VALVES.

Type	Position	Quantity	Function
1P5GT	V1A-B	2	R.F. Amp. I.F. Amp.
1A7GT	V2A	1	Mixer-oscillator.
1D8GT	V3A	1	2nd Det., B.F.O. and Audio Amp.
1Q5GT	V4A-B	2	Master Oscillator, Power Amplifier.

Inserting the Valves:

(i) Unscrew the two oxidised cheese head screws from the top front edge and the lower rear edge of the cabinet.

(ii) Remove the chassis by gently pulling on the knob marked "AER."

(iii) See that the 1Q5GT (V4B) 1D8GT (V3A) and the 1P5GT (V1B) valves are fitted with valve shields and that the earthing lugs for the shields are affixed to the centre key and pin No. 1 of the valve base and clamped inside the valve shield so as to make good contact with it.

(iv) Plug the valves into their respective sockets in accordance with the disposition shown in Fig 1(a).

(v) Firmly fit on the grid contact caps on all valves except V4A and V4B.

(vi) Replace chassis in case; screw up the two cheese head screws.

8. SETTING UP.

8.1 **Preliminary:**

To place the set into operation proceed as follows:

(i) Place the set on its final site having due regard to the position of the aerial.

(ii) Erect the aerial. Use the insulators where possible and attach them by means of the cords to convenient trees, posts or buildings. Where this is impossible get the aerial as high as possible by throwing the end over a bough or wall. If the insulators are not used reliance is placed on the rubber insulation of the aerial wire so the contact area with earthed objects should be as small as possible. Failing everything else the set will operate with the aerial lying along the ground.

(iii) Connect the aerial and the counterpoise to the appropriate terminals. Spread the counterpoise out on the ground to its full extent. Best results will be obtained if the counterpoise is laid in a symmetrical layout under the aerial.

(iv) Open the lid of the Sender/Receiver unit and hinge it backwards so that it is resting on the cabinet top and can be used as a firm base for operating the key.

(v) Plug the Receivers, headgear and the Key and Plug assembly into the appropriate jacks on the front panel of the set, marked "TELS" and "KEY" respectively. Place the key in the guides on the inside of the lid.

(vi) The four-point plug on one end of CONNECTORS, BATTERY, is plugged into the socket on the 1.5/99 volts battery. The six-point plug-socket on the other end is plugged into the receptacle on the rear of the cabinet.

The set should now be capable of sending and receiving after correct operation of the controls.

8.2 Preliminary Adjustments:

(i) Set the RECEIVER and SENDER tuning controls to the frequency which has been allocated for use. The RECEIVER tuning dial may be turned by operating its main knob or the thumb control vernier. The lock nut holding the SENDER dial must be loosened before the dial is turned.

(ii) Check that the AER and BFO knobs turn easily and smoothly. The BFO control is a combined beat note control and BFO on/off switch, and should move through half a full turn; the AER knob should move through two full turns.

9. OPERATING INSTRUCTIONS.

9.1 Reception:

To adjust the set for reception:—

(i) Turn the SEND-OFF-RECEIVE switch to the RECEIVE position.

(ii) Turn BFO control in anti-clockwise direction and set in central position. If reception of Radio Telephony (R/T) signals is desired this should be in the off position, i.e., fully clockwise.

(iii) Search on the RECEIVER tuning dial around the allocated frequency until the desired station is heard. Searching should be done by means of the thumb vernier control. The tuning control should be set to the centre of the received signal.

(iv) Adjust the B.F.O. control to give the desired note.

9.2 Sending:

To adjust the set for sending:—

(i) Set the sender to the frequency allocated for use by setting and locking the "SEND" tuning dial in the required position.

(ii) After adjustment to the correct frequency, press the key and with the SEND-OFF-RECEIVE switch in the SEND position, turn the AER tuning knob until the current shown on the milliameter dips to its lowest value. Turn the AERIAL TAPS switch to the different taps until the greatest dip in current reading on the meter is obtained by rotating the AER control. Slight "hand capacity" effects on this adjustment may be noticed. If the position or length of the aerial or the sender frequency is altered the AER tuning knob requires readjustment. Correct setting of this control is essential for good output from the sender.

(iii) Operate the morse key. Do not keep the key pressed for longer than is necessary.

(iv) To change to the receiver turn the SEND-OFF-RECEIVE switch to the RECEIVE position.

(v) When communication is completed and if it is not required to stand by for further calls, always return the SEND-OFF-RECEIVE switch to the OFF position. For long periods of waiting switch to OFF position to conserve battery power.

10. MAINTENANCE BY THE OPERATOR.

10.1 Valves:

Cases of suspected valve failure can be checked by replacing the suspected valve with a spare. In any case, spare valves should be tested weekly when the set is in regular use, by actual operation in the set. It is desirable, however, to retain the same set of valves in the set for normal working as long as possible, and if it is necessary to change a valve, the set should be returned for checking by the Bde. Sig. Sec. or Technical Maintenance Section as soon as possible after the change, as different valves occasionally make slight realignment of the set necessary.

10.2 Batteries:

Failing batteries are indicated by gradual falling-off of receiver performance, and decrease in the amount of "dip" in the meter reading when tuning the aerial at "SEND." Batteries can be checked by replacement with fresh blocks.

10.3 Other Faults:

Should replacing of valves and batteries not restore the set to proper working condition, the set should be returned to Brigade Sig. Section or Technical Maintenance Section for repair.

10.4 Tuning Controls, etc.:

The operator should report as soon as possible any faults he may notice while using the set, such as:—

(i) Tuning knobs, etc., becoming hard to turn.

(ii) Faulty operation of locking screws. The tuning knob should be firmly held by the locking screw when the latter is screwed up tight.

(iii) Faulty or intermittent action of switches.

(iv) Backlash or failure of slow motion controls.

(v) Meter "sticking."

(vi) Morse key not operating.

(vii) Any other unusual symptom.

10.5 Leads and Plugs:

Battery leads and the leads and plugs of the operating key and receivers, headgear, should be examined regularly at frequent intervals for signs of damage, and in any case should be examined and cleaned before the sets are returned to store at the end of each period of use.

10.6 Aerial:

Great care should be taken to avoid rough handling or misuse of the aerial wire. If the rubber insulation becomes worn or the wire becomes frayed the range of the set may be reduced because of the inefficient radiating system. The wire should be replaced as soon as possible.

CHAPTER III.

TECHNICAL DESCRIPTION.

11. INTRODUCTION.

The receiver is of the superheterodyne type, using an intermediate frequency of 455 kc/s. One tuned R.F. stage, a frequency changer and one I.F. stage are followed by a diode detector, triode and pentode audio stages. The frequency changer employs a pentagrid type valve.

The sender circuit is a conventional Master-oscillator Power-Amplifier arrangement, using similar valves in both stages.

Fig. 2 is a circuit diagram of the combined Sender/Receiver Unit.

12. RECEIVER CIRCUITS.

12.1 R.F. Amplifier:

One of the disadvantages of superheterodyne receivers is that a signal, whose frequency is higher instead of lower than that of the local oscillator by the amount of the I.F., if allowed to reach the grid of the frequency changer, will produce the same difference frequency as the wanted signal, and will cause interference. In order to reject these "Images," two preselector circuits are employed in conjunction with a pentode V1A. This gives a much greater image rejection ratio, and also increases the signal/noise ratio.

The input circuit comprises the inductance L2A and the tuning condenser C2A (11-75 uuF) which forms part of the 3-gang assembly operated by the RECEIVER tuning dial, the aerial feed being taken via the series condenser C1A (15 uuF). The input circuit is trimmed by the condenser C3A (3-25 uuF). The anode of V1A is connected to the opened circuit, L2A, C2B. This circuit is trimmed by the condenser C5A (2-12 uuF), and fed via the condenser C7A. (.0001 uF) to the control grid of the frequency changer valve, the grid lead of which is R2A (1 megohm).

12.2 Frequency Changer:

The output of the R.F. amplifier is applied as in the preceding sub-section to the control grid of the frequency changer valve V2A, and the local oscillations are provided by the triode portions of V2A. The oscillator operates in a tuned grid feed-back circuit. The tuned circuit comprises the coil L3A, one section of the 3-gang assembly C2C, the shunt trimmer condensers C3B (3-25 uuF) and C1B (15 uuF). The oscillator anode is coupled to the feed back portion of L3A by condenser C8A (.001 uuF). H.T. is applied to the oscillator anode via resistor R4A (20,000 ohms). R3A is the oscillator grid leak and C7B (.0001 uF) the grid blocking condenser. The screen grid of V2A is decoupled by R5A (50,000 ohms) and C10A (.05 uF).

The anode impedance of V2A is formed by the primary coil of the first I.F. transformer T1A which is permeability tuned.

12.3 Ganging:

To ensure that the local oscillator frequency is always higher than of the unwanted signal by the amount of the I.F. the condenser C2A, C2B and C2C are ganged, and tracking is accomplished by the trimmer condensers and the permeability trimmer screws in the oscillator tuned circuit.

12.4 I.F. Amplifier:

The function of the I.F. Amplifier is to give sufficient amplification to meet all requirements and at the same time to provide the necessary selectivity. The grid of the I.F. valve (V1B) is returned via the permeability-tuned secondary of T1A to earth. The anode load of V1B is the permeability-tuned primary of the second I.F. transformer T2A. Full high tension voltage is applied to the screen grid of V1B.

12.5 Second Detector:

This detector is the diode portion of V3A which is a diode-triode-pentode valve. It is fed from the permeability-tuned secondary of T2A. The A.F. component of the detector output is developed across R2B (1 megohm) and fed via C8B (.001 uF) and R5B (50,000 ohms) to the grid of the triode portion of V3A, R29 (1 megohm) is the grid leak for the triode portion of V3A. The purpose of R5B is to slightly reduce the audio input to the grid as there is no volume control on this receiver.

12.6 A.F. and Output Stages:

The triode portion of V3A acts as an A.F. amplifier stage, the anode load being R2D (1 megohm). The output from the triode portion is fed from the anode via C6B (.005 uF) to the grid of the pentode portion of V3A which acts as AF output stage. High Tension negative from the battery is fed (when the set is on Receive) to the junction of grid leak R9A (1.75 megohm) and R8A (500 ohms) to give a negative bias potential of 12 volts on the A.F. output stage. H.T. voltage is fed to the screen of V3A direct and to the anode of the pentode portion through the primary of transformer T4A, which is shunted by condenser C12A (.002 uF).

The headphones are connected to the low impedance secondary of transformer T4A and when referred to the primary of T4A constitute the load impedance of V3A.

12.7 Beat Frequency Oscillator:

The triode portion of V3A is utilized as a beat frequency oscillator in addition to being an A.F. amplifier. The oscillator is of the shunt-fed Hartley type and consists of a fixed reasonance circuit permeability-tuned coil T3A, C9F and C9G and a variable trimmer C11A (3-12 uuF). The condensers C9E and C9H have the combined function of blocking and coupling condensers. The switch S2A is part of the trimmer condenser C11A and is closed when the C11A is rotated fully clockwise causing oscillations to cease.

13. SENDER CIRCUITS.

13.1 Master Oscillator:

The Master Oscillator is the beam-power tetrode V4B. The M.O. tuned circuit consist of L7A, C16A, C3C and C9I. The primary L7A together with the portion of secondary L7A between the filament tap and earth corresponds to that portion of the coil between cathode tap and earth in the more common type of circuit, using an indirectly heated valve. The tuned circuit capacity is provided by the shunt trimmer C3C (3-25 uuF), the fixed condenser C91 (100 uuF) and the variable condenser, "SENDER" tuning, C16A (10-185 uuF). C7D (.0001 uF) is the grid-blocking condenser while R7B (25,000 ohms) is the grid leak which is returned to earth via the operating key. Filament decoupling is provided by C6D (.005 uF). The screen is supplied through R6B (10,000 ohms) which is decoupled by C12C (.002 uF).

H.T. is applied to the anode via L6A (R.F. Choke) and the output is coupled to the grid of V4A via condenser C8E (.001 uF).

13.2 Power Amplifier:

The power amplifier valve V4A is of the same type as V4B. The grid leak is R7A (25,000 ohms). H.T. Voltage is supplied direct to the screen grid of V4A and to the anode via the 0 - 15 mA meter M1A, the R.F. Choke L5A and part of the inductance L4A. The output of V4A is fed via the tuned circuit L4A, C6C (.005 uF), C15A (12-390 uuF) through the "AERIAL TAPS" switch S3A and coupling condenser C8D (.001 uF) to the aerial. The "AER" control is C15A.

13.3 Keying:

When the key is pressed and with the SEND-OFF-RECEIVE Switch in the SEND position, the following takes place:—

(i) H.T. negative is connected to earth.

(ii) The Master Oscillator grid leak R7B (25,000 ohms) is connected to earth.

(iii) The Power Amplifier grid leak R7A (25,000 ohms) is connected to earth.

13.4 SEND-OFF-RECEIVE SWITCH:

The functions of the SEND-OFF-RECEIVE switch S1A-C which consists of three single pole 3-position sections are as follows:—

(i) It switches the aerial to the appropriate circuit.

(ii) It switches the L.T. positive circuit to the filaments of Sender or Receiver, or to the OFF position as required.

(iii) It switches the H.T. negative to the Sender (keying circuit), the Receiver or OFF as required.

CHAPTER IV.

FIELD MAINTENANCE.

14. INTRODUCTION.

This chapter deals only with items of maintenance and repair that can be undertaken by Regimental Signals Personnel and Signals Units in the field, using a minimum of test equipment. Repairs, servicing and alignment that can be carried out by both Signals Units and Ordnance Workshops is given in Chapter V.

The occurrence of serious defects when the set is in use will be minimised if the daily and weekly routine given below are carried out, and if symptoms of trouble are reported immediately they are discovered.

15. DAILY MAINTENANCE.

15.1 Batteries:

The dry battery (or batteries) used for L.T. and H.T. supply should be tested daily on load with the set at "RECEIVE." If the L.T. reading is below 1.1 volts or if H.T. reading is below 70 volts the battery should be replaced. If no voltmeter is available, a comparison should be made of receiver performance and tuning "dip" at "SEND" with fresh battery. A large discrepancy indicates that replacement is required.

A note should be taken of the tuning "dip" at the beginning and end of each period of work. A gradual decrease of the amount of the "dip," other conditions such as aerial length, frequency and location being unchanged, is a general indication that batteries require replacement.

15.2 General:

Turn "SEND-OFF-RECEIVE" switch to "RECEIVE." Check that the character and volume of the background noise and any known regular signals are normal, and that there are no intermittent noises. If intermittent noises exist but cease on removal of the aerial, they are probably due to extraneous causes and not to any fault in the set.

If such noises persist after removal of the aerial, examine headphone cords and terminals for looseness or signs of wear, battery terminals and valve grid clips and socket seating for looseness or bad seating. Switch to SEND, tune aerial and see that meter needle kicks when the key is pressed.

When satisfied that the set is in good working order, thoroughly clean and dry all exposed parts before putting the set away in store. Every opportunity should be taken to remove all traces of dust, dirt and water, otherwise these will cause serious damage later.

16 WEEKLY MAINTENANCE.

16.1 Removal of Set from Case:

To remove the set from the case, unscrew the two oxidised cheese head screws from the top front edge and the lower rear edge of the cabinet and withdraw the chassis by pulling gently on the knob marked "AER."

16.2 Miscellaneous:

See that all components are mechanically tight, and examine all electrical connections and switches, but do not disturb the wiring.

Make sure that the milliammeter is firmly bound and making good contact.

See that all valve shields are secure, and that the valve grid clips and earthing clips are making good contact to the valves, caps and shields respectively. Examine the battery plug and socket on the chassis and case for continuity and damage.

16.3 Tuning Drives:

Examine the "SEND" and "RECEIVE" and "AER" tuning drives for binding and backlash. Examine the worm drive of the "RECEIVE" dial and the split half-cogs on each spindle. If the anti-backlash spring is properly tensioned one of the half-cogs will be slightly in advance of the other — which one is immaterial; see that all grub screws are tight.

If backlash is excessive or if the drive jumps on fine tuning the set should be returned to store for repair by Signals or Ordnance Workshops. See that the locking nut on the "SEND" dial rotates freely on the screw and that it is not bent or twisted.

16.4 Locating Faults:

Table IV gives a list of faults which might occur under service conditions, and which may be detected and corrected in the field. Faults of a more obscure nature must be investigated by the Brigade Signal Section or Technical Maintenance Section.

TABLE IV.—Location of Faults.

Symptom	Possible Fault.	Correction.
Noise in Receiver.	Loose connections in aerial, headphone circuits.	Examine all connections and tighten.
	Faulty battery connection.	Check.
	Loose grid clips or valves loose in sockets.	Check.
	Interference from local sources.	Check for noise with aerial disconnected.
Receiver dead Filaments not alight.	Battery flat.	Try spare battery.
	Valve burnt out.	Try replacing valves in turn.
	Faulty battery connections.	Examine and check.
Transmitter dead.	Battery flat.	Try spare battery.
No H.T. when key closed.	Valve burnt out.	Try replacing valves in turn.
Filaments not alight.	Faulty battery connections.	Examine and check.
Set dead but supplies apparently present.	Open circuit in antenna connections.	Examine and check.
Sender will not load.	Faulty Valve.	Try spares.
	Aerial and earth connections.	Examine and check.

CHAPTER V.

WORKSHOP MAINTENANCE.

17. INTRODUCTION.

This chapter deals with maintenance and repair that can be carried out by Signals and R.A.O.S. personnel in workshops. It must be realised that the procedure laid down in this chapter must be used only as a guide because methods will vary according to the equipment available.

Alignment and calibration is very important in a wireless set of this kind as no provision is made on the set for "netting." The ease with which a signal will be found on the dial depends wholly on the calibration accuracy of the sending and receiving stations. Recalibration should take place regularly, and in the case of a group of stations a standard should be set to which all sets in the group should be calibrated.

18. SERVICING PROCEDURE.

There is need for a definite servicing procedure:—

(a) When the set is received with an unknown fault, and

(b) Before the set is returned for service in the field.

The procedure to be adopted should be as follows:—

(i) Remove and test all valves, also all the spare valves in the spare valves case.

(ii) Measure H.T. and L.T. voltages at input plug-socket. Replace battery if necessary. Trace H.T. and L.T. voltages throughout the set by use of a voltmeter or an analyzer and by following the circuit diagram.

(iii) Measure voltages at all valve sockets and check with those shown in Section 21. Table V. If any of these voltages vary to a great extent, suspicion should be placed on decoupling and load resistors and condensers. These should be examined and tested for resistance or capacity. By now the fault (if any) should be located and the new component replaced.

(iv) Align the set according to the procedure laid down in Section 19.

(v) Check the calibration of the Sender and Receiver; re-calibrate if necessary according to the procedure laid down in Section 20.

19. ALIGNMENT.

19.1 Equipment:

The equipment necessary for the correct alignment of Wireless Sets No. 208 consists of:—

(a) Signal Generator covering a frequency range of 2.5 to 3.5 Mc/s. and a frequency of 455 Kc/s for I.F. alignment.

(b) An output meter with an impedance of 500 ohms.

(c) A dummy aerial comprising a 400 ohm. non-inductive resistor (for overall alignment).

19.2 I.F. Alignment:

With the set removed from its cabinet and connected to its battery the signal generator is connected between the grid of the 1A7GT valve V2A

(see placement diagram attached to inside rear of cabinet for valve location) and earth. With the output meter plugged into the telephone jack and the generator set on 455 kilocycles the adjusting screws on the intermediate frequency transformers are adjusted for maximum output. There are two of these screws on each I.F. transformer, one projecting through the top of the can and accessible from the top of the chassis, the other projecting through the bottom of the can and accessible from underneath the chassis. With these adjustments made to indicate maximum output on the output meter and the generator now reduced to indicate an output of 6 milliwatts the I.F. sensitivity on the receiver in normal operating conditions would be approximately 800 microvolts.

19.3 B.F.O. Adjustment:

With the receiver and generator connected as above and modulation removed from the generator the BFO control knob is rotated 90° in an anti-clockwise direction thus switching the BFO on. The adjusting screw projecting through the top of the BFO transformer is then adjusted until zero beat is heard in the telephones.

19.4 Overall Alignment:

With the generator connected between the aerial and earth terminals with the dummy antenna of 400 ohms in series with the aerial lead the aerial and RF stages may be aligned. With the generator set to 3.5 megacycles and the Receiver tuned to receive this signal the parallel trimmers mounted along the side of the gang units are adjusted to maximum output. With the generator set to 2.5 megacycles and the receiver tuned to receive this signal, the inductance trimming screws projecting from the tops of the coil cans are adjusted for maximum output. The adjusting screw for the aerial coil is located on the right-hand side of the set underneath the gang unit and is the adjusting screw nearest the front panel. The adjustment for the RF stage projects through the RF coil underneath the chassis.

20. CALIBRATION.

20.1 Receiver Calibration:

Should it become necessary to recalibrate the receiver the adjustment of the oscillator inductance screw at 2.5 megacycles and the parallel trimmer C3B at 3.5 megacycles against a reliable signal source of these frequencies will bring the dial calibrations back to their correct settings. Successive adjustment of the screws and the trimmers are necessary as a certain degree of coupling exists between the two adjustments.

20.2 Sender Calibration:

The calibration of the Sender (Master Oscillator) at the high frequency end, 3.5 megacycles, is adjusted by means of the parallel trimmer C3C located underneath the chassis and mounted on the front panel adjacent to the master oscillator coil. The setting of this frequency is best done by beating the transmitted signal against a known frequency source in a heterodyne detector. Should the low frequency end calibrations be inaccurate after the high frequency end is adjusted correctly correction may be made by slightly bending the master oscillator tuning condenser plates to increase or decrease capacity as required. Should this adjustment be necessary re-adjustment of the high frequency end is desirable.

21. TEST VOLTAGES.

TABLE V.—VOLTAGE CHART. **Refer Fig. 1(b).**

Valve	Type	Voltage at Socket Contact Number							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RECEIVER									
V1A	1P5GT	—	1.5	73	84	84	—	—	—
V2A	1A7GT	—	1.5	84	35	—	55	—	84
V1B	1P5GT	—	1.5	84	84	—	—	—	—
V3A	1D8GT	—	1.5	84	84	—	15	—	—
SENDER									
V4A	1Q5GT	—	1.5	95	60	—	—	—	—
V4B	1Q5GT	—	—	95	95	—	—	1.5	1.5

APPENDIX I.

WIRELESS SET, No. 208

List of Main Components —

V.A.O.S. Cat. No.	Nomenclature	Symbol	Description (R) Receiver (S) Sender	Associate with Valve	Valve	Type rating and Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
ZAA	**Section Z.1**					
284	Condensers fixed Y.15 (Aust.)	C1A	Aerial Series	V1A	15 uuF	Silvered, mica, wax dipped
284	" " " " "	C1B	Oscillator Trimmer (R)	V2A	"	" "
329	Condensers variable No. 15 (Aust.)	C2A	"RECEIVER" tuning, input	V1A	11-75 uuF	11 plate 3 gang air variable
329	" " " " "	C2B	" " anode	V1A		
329	" " " " "	C2C	" " oscillator	V2A		
331	Condensers variable No. 19 (Aust.)	C3A	Input Trimmer (R)	V1A	3-25 uuF	7 plate, air trimmer
331	" " " " "	C3B	Oscillator Trimmer (R)	V2A	"	" "
331	" " " " "	C3C	M.O. Trimmer (S)	V4B	"	" "
217	Condensers fixed P.5.C. (Aust.)	C4A	Filament Bypass (R)	V1A	0.5 uF	Paper, 200 V. wkg.
333	Condensers variable No. 17 (Aust.)	C5A	Anode Trimmer (R)	V1A	2-12 uuF	4 plate, air trimmer
252	Condensers fixed R.5 (Aust.)	C6A	" Decoupling (R)	V1A	.005 uF	Mica, moulded case
252	" " " " "	C6B	B.F.O. Coupling (R)	V3A	"	" " "
252	" " " " "	C6C	P.A. Anode (S)	V4A	"	" " "
252	" " " " "	C6D	Filament Decoupling (S)	V4B	"	" " "
258	Condensers fixed X.1.B (Aust.)	C7A	Grid Coupling (R)	V2A	100 uuF	" " "
258	" " " " "	C7B	Osc. Grid Blocking (R)	V2A	"	" " "
258	" " " " "	C7C	Diode R.F. Filter (R)	V3A	"	" " "
258	" " " " "	C7D	M.O. Grid Blocking (S)	V4B	"	" " "
255	Condensers fixed R.1, B (Aust.)	C8A	Osc. Coupling (R)	V2A	.001 uF	" " "
255	" " " " "	C8B	A.F. Grid Coupling (R)	V2A	.001 uF	" " "
255	" " " " "	C8C	P.A. Anode Decoupling (S)	V4A	"	" " "
255	" " " " "	C8D	Aerial Coupling (S)	V4A	"	" " "

(1)	(2)	(3)	(4)	(5)	(6)	(7)
255	Condensers fixed R.1,B (Aust.)	C8E	P.A. Grid Coupling (S)	V4A	.001 uF	Mica moulded case
272	Condensers fixed X.1 (Aust.)	C9A	1st I.F. Transformer Pri. (R)	V2A	100 uuF	Silvered mica
272	" " " " "	C9B	1st I.F. " Sec. (R)	V1B	"	" "
272	" " " " "	C9C	2nd I.F. Transformer Pri. (R)	V1B	"	" "
272	" " " " "	C9D	" " " " Sec.	V3A	"	" "
272	" " " " "	C9E	Grid Blocking (R)	V3A	"	" "
272	" " " " "	C9F	B.F.O. Tuning (R)	V3A	"	" "
272	" " " " "	C9G	" " (R)	V3A	"	" "
272	" " " " "	C9H	Anode Blocking (R)	V3A	"	" "
272	" " " " "	C9I	M.O. Tuning (S)	V4B	"	" "
224	Condenser fixed Q.5 (Aust.)	C10A	Screen Bypass (R)	V2A	.05 uF	Paper 200V wkg.
336	Condenser variable No. 26 (Aust.)	C11A S2A	B.F.O. Tuning and B.F.O. OFF Switch (R)	V3A	4-12 uuF	8 plate air trimmer with ON OFF switch
253	Condenser fixed R.2 (Aust.)	C12A	A.F. Output Filter (R)	V3A	.002 uF	Mica moulded case
253	" " " " "	C12B	Screen By-pass (S)	V4A	"	" " "
253	" " " " "	C12C	" " (S)	V4B	"	" " "
208	Condenser fixed 25, C (Aust.)	C13A	Back Bias By-pass (R)	V3A	25 uF	Electrolytic 40V peak
219	Condenser, fixed P.25, B (Aust.)	C14A	H.T. By-pass		0.25 uF	Paper 200V wkg.
334	Condenser variable No. 24 (Aust.)	C15A	"AER" Tuning (S)	V4A	12-390 uF	Air variable
335	Condenser variable No. 26 (Aust.)	C16A	M.O. Tuning (S)	V4B	10-185 uF	Air variable
2088	Jack telephone (208)	J1A	Phone Jack	V3A		Mounted on panel
8858	Jack Microphone (108 Mk. 11)	J2A	Key Jack	V4A-B		" " "
4651	Inductance No. 34 (Aust.)	L1A	Input Tuning (R)	V1A		In shield can
474	" No. 35 (Aust.)	L2A	Output Tuning (R)	V1A		In shield can
4751	" No. 36 (Aust.)	L3A	Oscillator Tuning (R)	V2A		" " "
459	" No. 33 (Aust.)	L4A	P.A. Tuning (S)	V4A		

196	Chokes R.F. No. 12 (Aust.)	L5A	P.A. Anode Supply (S)	V4A		4 pies
197	„ „ No. 13 (Aust.)	L6A	M.O. „ „ (S)	V4B		„
1551	Inductance No. 32 (Aust.)	L7A	M.O. Tuning (S)	V4B		
076	Ammeters D.C. 15 mA (Aust.)	M1A	P.A. Anode Current (S)	V4A	0-15 mA	Plug-in type
694	Resistor ½ Watt No. 3 or No. 4, 5000 ohms	R1A	Anode Decoupling (R)	V1A	5000 ohms	Metallised or carbon
704	Resistor ½ watt No. 3 1 megohm	R2A	Grid Leak (R)	V2A	1 megohm	„ „ „
704	„ „ „ „ „	R2B	Diode Load (R)	V3A	1 „	„ „ „
704	„ „ „ „ „	R2C	1st A.F. Grid Leak (R)	V3A	1 „	„ „ „
704	„ „ „ „ „	R2D	1st A.F. Anode Decoupling (R)	V3A	1 „	„ „ „
701	Resistor ½ Watt No. 3 150,000 ohms	R3A	Osc. Grid Leak (R)	V2A	150,000 ohms	„ „ „
696	Resistor ½ Watt No. 3 20,000 ohms	R4A	Osc. Anode Decoupling (R)	V2A	20,000 „	„ „ „
698	Resistor ½ Watt No. 3 50,000 ohms	R5A	Mixer Screen Decoupling (R)	V2A	50,000 „	„ „ „
698	„ „ „ „ „	R5B	1st A.F. Series Grid (R)	V3A	„	„ „ „
695	Resistor ½ Watt No. 3 10,000 ohms	R6A	B.F. Oscillation, Blocking (R)	V3A	10,000 „	„ „ „
695	„ „ „ „ „	R6B	M.O. Screen Decoupling (S)	V4B	„ „	„ „ „
697	Resistor ½ Watt No. 3 25,000 ohms.	R7A	P.A. Grid Leak (S)	V4A	25,000 „	„ „ „
697	„ „ „ „ „	R7B	M.O. „ „ (S)	V4B	25,000 „	„ „ „
6810	Resistor ½ Watt No. 3 1,500 ohms	R8A	Back Bias (R)	V3A	1,500 „	„ „ „
706	Resistor ½ Watt No. 3 1.75 meghoms	R9A	A.F. Output Grid Leak	V3A	1.75 megohm	„ „ „
768	Switch 3 pole 2 way B (Aust.)	S1A	SEND-OFF-RECEIVE Switch			3 tank Oak
768	„ „ „ „ „	S1B	„ „ „ „			„ „ „
768	„ „ „ „ „	S1C	„ „ „ „			„ „ „
	Switch single pole on-off	S2A	B.F.O. Off Switch			Included with C11A
751	Switch 1 pole 5 way (Aust.)	S3A	P.A. Coil Tappings			
8081	Transformer I.F. N (Aust.)	T1A	1st Intermediate			In shield can
8082	„ „ O „	T2A	2nd „			„ „ „
183	Inductance No. 37 (Aust.)	T3A	B.F.O. Coil			„ „ „
825	Transformer telephone L (Aust.)	T4A	A.F. Output	V3A		9000/500 ohms

(1)	(2)	(3)	(4)	(5)	(6)	(7)
914	Valves, W.T., type 1P5GT	V1A	R.F. Amplifier (R)			
	" " " "	V1B	I.F. " (R)			Shielded
302	" " " 1A7GT	V2A	Mixer (R)			
945	" " " 1D8GT	V3A	2nd Det. A.F. & B.F.O. (R)			Shielded
315	" " " 1Q5GT	V4A	Power Amp. (S)			
	" " " "	V4B	Master Osc. (S)			Shielded

APPENDIX II.

WIRELESS SETS, No. 208, COMPLETE STATIONS.

List of Stores, which must be demanded and vouchered separately, comprised in one Wireless Set, No. 208, Complete Station.

Vocab. Cat. No.	Item	Minimum for work	Essential Spares	Total
	Section W.2.			
WBA 063	Batteries, dry, wireless, 1.5/99-V (Aust.)	1		1
	Section Z.1.			
ZAA 492	Insulators, W.T. (Aust.), No. 1B	1 (a)	1	2
A 4500	Key and plug assemblies, No. 2B	1 (a)		1
	Plugs, single, No. 9	1 (b)		1
ZAA 561	Receivers, Headgear, double L.R. (Aust.)	1 (a)		1
902	Valves, W.T., type 1A7GT	1 (c)	1 (d)	2
905	1D8GT	1 (c)	1 (d)	2
914	1P5GT	2 (c)	2 (d)	4
915	1Q5GT	2 (c)	2 (d)	4
2081	Wireless Sets, No. 208	1		1
2082	Aerials, 60-ft.	1 (a)		1
2083	Bags, accessories	1		1
2084	Cases, Spare valves	1 (a)		1
	Connectors			
2085	Battery	1 (a)		1
2086	Extension	1 (a)		1
2087	Leads, counterpoise, 208	1 (a)		1

(a) Carried in bags, accessories.

(b) Fitted on Receivers, headgear.

(c) Fitted in set.

(d) Carried in cases, spare valves.

BRIEF OPERATING INSTRUCTIONS.

WIRELESS SET No. 208 MARK III.

RADIO CORPORATION SERIES RC18B.

1. FUNCTION.

The 208 Mark III has been designed for use as a portable one man station for the transmission and reception of C.W. type radio emissions.

2. EQUIPMENT.

The transmitter, receiver, and battery are contained in the one case, Morse key, telephones and aerial equipment being carried separately.

3. RECEIVER.

The receiver employed in this unit is of the superheterodyne type and uses a radio frequency amplifying stage ahead of the converter stage. This is followed by one intermediate frequency amplifying stage operating on 455 Kc. Diode detection is employed, and is followed by a triode audio amplifier and a pentode output amplifier. These three functions are combined in the one valve, this being 1D8GT. The triode section of the 1D8GT valve is used to perform the function of beat frequency oscillator when the volume control is turned to its maximum position.

4. TRANSMITTER.

The transmitter uses two pentode valves, one being an electron coupled oscillator driving a final amplifier which is keyed in the screen circuit. Provision is made to permit the loading of a wide variety of aerials by the use of a 5-position switch which taps the aerial connection into the tank circuit. This switch used in conjunction with the aerial condenser permits the transmitter to be loaded up under practically any condition that would be met with in the field.

5. POWER SUPPLY.

The complete equipment is operated from a dry cell block combining both 1.5 volt "A" battery, and 90 volt "B" battery. This battery is carried in the main case with the transmitter receiver unit, and is readily removable by the disconnection of one 4-pin plug. The battery is a Diamond type AB1.

6. FREQUENCY RANGE.

The transmitter and receiver are suitable for operation over the band of frequencies from 2.5 Mc to 3.5 Mc, and both units are so designed that they may be set to any frequency within this band from direct dial calibration.

7. RECEIVER OPERATION AND CONTROLS.

(1) Send Receive Switch.

This switch is located at the top center of panel, and switches battery voltages from receiver to transmitter with the center position leaving batteries entirely disconnected.

(2) Volume Control.

This control is located at the bottom right hand corner of panel and operates in the grid circuit of the first audio amplifier, and is also used to control the oscillation in this tube for use as beat frequency oscillator. When this control is rotated in a clockwise direction to its maximum position, the first audio amplifier is caused to operate as an oscillator on

455 Kc, which is the IF channel, and therefore produces a heterodyne note when a signal is being received. Variation in heterodyne note pitch can be obtained by slightly detuning main receiver dial.

(3) Receiver Tuning Dial.

This is a dial calibrated directly in a frequency and is located in the top right hand corner of panel. This dial rotates the main tuning gang and can be set with good accuracy to a given frequency from the dial calibrations. A clutch fitted to the condenser spindle permits direct drive from this dial, or for more precise tuning, a vernier thumb wheel projects through the panel to the lower right of this dial. This vernier provides a tuning ratio of 60:1.

(4) Telephone Jack.

This jack is located at the bottom of the panel to the left of the volume control knob, and takes standard No. 9 telephone plug for the connection of a pair of low resistance telephones.

8. TRANSMITTER OPERATION AND CONTROLS.

(1) Sender Tuning Dial.

This dial is located in the top left hand corner of panel, and controls the frequency to which the oscillator is tuned. This dial may be set to a given frequency with good accuracy from the dial calibrations. A lock is provided which when screwed down prevents the sender dial from rotating, and thus hold transmitter frequency even when unit is operated in motion.

(2) Aerial Switch.

This switch is located directly below center tuning dial, and has five positions. The position best suited to a particular aerial system or location is found by trial. This switch selects the tapping on the tank coil, to which the aerial is connected, and is used in conjunction with the aerial tuning control.

(3) Aerial Tuning Control.

This control is located directly below the aerial switch, and tunes the output circuit of the final amplifier. The aerial tuning control is not provided with a calibrated dial as the correct setting of the control for any given frequency can best be located by the plate current meter indication. In adjusting the transmitter for operation the aerial switch and the aerial tuning control are used together and correct tuning is indicated on the plate current meter. For the majority of operating conditions, the plate current indication when correctly loaded will be between 5 and 6 milliamps, although this current is subject to considerable variations with aerials of different lengths and also whether a counterpoise or earth is being used. If the current indicated in the plate meter is below approximately 3 milliamps, the aerial tuning condition mismatches the aerial system used, and poor radiation obtains.

(4) Key Jack.

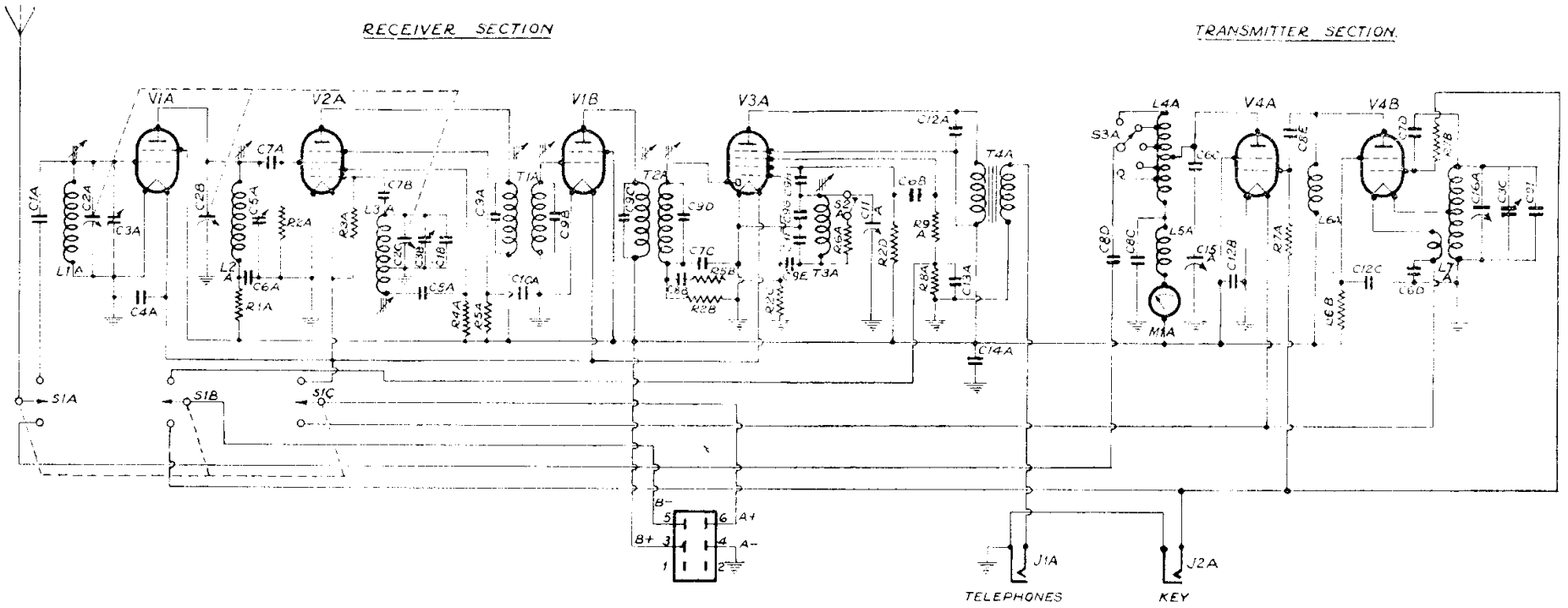
This jack is located at the bottom of the panel to the right of the aerial tuning knob, and takes standard No. 10 plug for the connection of telegraph key.

(5) Radiating System.

This set has been designed to operate satisfactorily with a wide variety of aerials. Satisfactory loading is readily obtained with lengths varying from 12 to 50 feet, also under certain field conditions, better results are obtained using a counterpoise, or earth spike. No particular aerial condition is stated, as this is governed by the conditions under which the set is used.

9. GENERAL.

The complete chassis is readily removable from the case, by removing three holding screws, one being located along the top of the case, and two along the lower back edge. When the chassis is removed, all components are readily accessible for service or inspection. The battery block is removed by disconnecting the 4-pin plug which permits this battery to slide forward and be removed for replacement.



LEGEND

CIRCUIT NO.	VALUE	CIRCUIT NO	VALUE	CIRCUIT NO.	VALUE	CIRCUIT NO	VALUE
C1A - B	15 μμF	C12A - C	.002 MICA COND.	R7A - B	25000 Ω ½ WATT RESISTOR	V3A	1D8 - GT
C2A - C	3 GANG CONDENSER.	C13A	25 μF ELECTROLYTIC COND.	R8A	15000 Ω ½ WATT RES.	V4A - B	1Q5 - GT
C3A - C	4 - 39 μμF TRIMMERS.	C14A	.25 μF PAPER COND.	R9A	1·75 MEG Ω ½ WATT RES.	T1A	455 KC. I.F. TRANSFORMER
C4A	0.5 μF PAPER COND.	C15A	12 - 390 μμF VARIABLE COND.	L1A	AERIAL COIL	T2A	455 KC. I.F. TRANSFORMER
C5A	4 - 20 μμF TRIMMER	C16A	10 - 185 μμF VARIABLE COND.	L2A	R.F. COIL	T3A	B.F.O. TRANS.
C6A - D	·005 μF MICA COND.	R1A	5000 Ω ½ WATT RESISTOR	L3A	OSCILLATOR COIL	T4A	OUTPUT TRANS.
C7A - D	.0001 μF MICA COND.	R2A - D	1.0 MEG Ω ½ WATT RES.	L4A	P.A. TANK COIL	S1A - C	SEND - OFF - RECEIVE SWITCH
C8A - E	.001 μF MICA COND.	R3A	150000 Ω ½ WATT RES.	L5A	P.A. R.F. CHOKE	S2A	B.F.O. ON - OFF SWITCH (ON C11A)
C9A - I	100 μμF SILVER MICA COND.	R4A	20000 Ω ½ WATT RES.	L6A	OSCILLATOR CHOKE.	S3A	AERIAL LOADING SWITCH.
C10A	.05 μF PAPER COND.	R5A - B	50000 Ω ½ WATT RES.	L7A	MASTER OSCILLATOR COIL	J1A	TELEPHONE JACK
C11A	3 - 12 μμF TRIMMER	R6A - B	10000 Ω ½ WATT RES.	V1A - B	1P5 - GT	J2A	KEY JACK.
				V2A	1A7 - GT	M1A	0 - 15 MA METER.

ISSUE

RADIO CORPORATION PTY. LTD.
MELBOURNE AUSTRALIA

SCHEMATIC

TRANSMITTER - RECEIVER

TYPE 208

FIELD WIRELESS SET.

DRAWN T.B.S. 19-9-41

APP'D

DRG. NO. 40

FILE 405