Operator's Handbook

for

TELERADIO

SS70 and SS70A

HANDBOOK 1-62570R

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

Engineering Products Division

OPERATOR'S HANDBOOK

SINGLE SIDEBAND TELERADIO SS70 AND SS70A

Type 1N62570

160370

Handbook 1-62570R

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

Engineering Product Division

422 LANE COVE ROAD, NORTH RYDE, N.S.W.

PREFACE

The AWA Teleradio SS70 Series N62570 provides instant and reliable 2-way long-distance communication in radio-telephone services using single sideband.

The transceiver fully meets Australian Post Office Specification RB209 and fulfils the need created by the international agreement for the cessation of amplitude-modulated (double sideband) transmission in radiotelephone services. However the SS70 can provide "compatible a.m." operation with existing double sideband systems.

Solid state devices are used throughout the transceiver and because of the low voltages used with these devices personnel and property are in no way endangered.

The transceiver does not require shock-mounting when installed in a land vehicle or small ship.

This Operator's Handbook deals with the installation and operation of a complete station comprising a transceiver, an aerial, and a battery. For more details concerning the alignment and testing of the transceiver it is necessary to consult the Service Manual (Handbook 62570R).

The latest developments in electronics are incorporated in the circuitry of the Teleradio SS70 and servicing should be entrusted only to persons having a thorough understanding of the circuits involved.

A list of AWA Service Departments appears overlead.

SERVICE FACILITIES

The moulded foam plastic container in which the Teleradio SS70 is packed should be carefully preserved in case it should become necessary to send the transceiver to a service shop.

When packing the transceiver the plastic container should be wrapped in cardboard or several layers of stout paper and then securely tied with string or cord.

Service facilities are available at the AWA Service Departments listed below.

NEW SOUTH WALES

Sydney: 67 Lords Road, Leichhardt, 2040
Telephone: 560-8644

VICTORIA

Melbourne: 470 Queensberry Street, North Melbourne, 3051
Telephone: 30-4185

Sale: 108 York Street, Sale, 3850
Telephone: 2874

QUEENSLAND

Brisbane: 70 Merivale Street, South Brisbane, 4101
Telephone: 41-1631
Telex: 40607
Postal: Box 98, South Brisbane, 4101

Townsville: 23 The Market, Keane Street, Currajong, 4812
Telephone: 79-6155
Telex: AA77008

SOUTH AUSTRALIA

Adelaide: 48 King William Street, Goodwood, 5034
Telephone: 72-2366
Telegraphic: Expanse Adelaide

WESTERN AUSTRALIA

Perth: 231 Bulwer Street, Perth, 6000
Telephone: 28-6400
Telex: 92121
Postal: Box H525, Perth, 6001

Port Hedland: 555 Morgan Street, Port Hedland, 6721
Telephone: 3-1384
Postal: Box 327, Port Hedland, 6721

TASMANIA

Launceston: 42 Frederick Street, Launceston, 7250
Telephone: 2-1804
Telegraphic: Expanse Launceston
Postal: Box 738H, Launceston, 7250

Hobart: 123 Murray Street, Hobart, 7000
Telephone: 34-3836
Postal: Box 303C, Hobart, 7001

Further information regarding service facilities is available from Royal Flying Doctor Service bases.

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PART 1

THE TRANSCEIVER

1. INTRODUCTION

The AWA Teleradio SS70 transceiver meets the requirements of the Australian Post Office for medium-frequency and high-frequency single sideband suppressed carrier radiotelephone equipment for the Royal Flying Doctor Service and fixed and mobile radiotelephone land services.

The transceiver is fully transistorised and requires an input of 12 volts d.c. (nominal); this input can be from either a battery or a regulated power supply operated from a.c. mains.

The full range of accessory items which permit the basic transceiver to perform as a fixed, mobile, or portable installation is listed in Section 3 below.

2. ABRIDGED SPECIFICATION

The performance of the transceiver as quoted below is maintained under the following climatic conditions:

Temperature:	+32 °F to +131 °F (0 °C to 55 °C)
Humidity:	Up to 95% at +104 °F (40 °C)
Altitude:	Up to 30 000 feet

Frequency Range:	2 MHz to 10 MHz
Mode of Operation:	Single-channel simplex on up to six channels
Aerial Impedance:	50 ohms (unbalanced)
Transmission Modes:	Single sideband suppressed carrier (A3j) and single sideband with carrier 6 dB or less below peak envelope power (A3h)
Reception Modes:	Single sideband suppressed carrier (A3j). An optional a.m. compatibility kit permits normal reception of double sideband amplitude modulation (A3).
Operative Sideband:	Upper sideband. Lower sideband operation on any or all channels can be provided upon request.

Transmitter Output:	Nominal 25 watts p.e.p. (2-tone rating); 30 watts is typical.
Transmitter Duty Cycle:	Capable of continuous speech operation (A3j or A3h).
Receiver Sensitivity:	Signal-to-noise ratio of better than 10dB for an input signal of 1 microvolt; 16dB is typical.
Receiver Output:	1 watt into 8-ohm internal speaker.
Receiver A.G.C.:	Less than 6 dB variation in output for inputs between 5 microvolts and 100 millivolts.
Supply Voltage:	Nominal 12 V d.c. with negative earth.
Current Drain:	
Receive (SSB):	60 mA in absence of audio output rising to 180 mA at rated audio output.
Receive (AM):	100 mA in absence of audio output rising to 200 mA at rated audio output.
Transmit:	4 A for 25 W p.e.p. output with 2-tone input; the current drain fluctuates during speech transmissions.
Dimensions:	
Width:	10.5/8 inches (270 mm)
Depth:	10.1/2 inches (267 mm)
Height:	3 inches (76 mm)
Weight:	7 pounds (3.2 kg)
Crystal Frequency:	455 kHz above the suppressed carrier frequency (for upper sideband operation).

3. ACCESSORY ITEMS

Half-Wave Dipole Aerial (AWA Type 2Y64985) consisting of balun transformer, wire, insulators, and 100 feet of coaxial cable fitted with appropriate connectors. Wire requires cutting to length according to chart packed with the kit and the fitting of end insulator assemblies.

Chassis-mounting Coaxial Connectors (Type BNC Style UG-625B/U) which permit the use of up to six separate aerials. Dummy buttons in the rear panel of the transceiver case permit easy fitting of these connectors. (The AWA Stock Code Number of the connectors is 234665.)

Service Manual (AWA Handbook 62570R) containing full specification, circuit description, performance tests, alignment, component schedule, and diagrams.

Mobile Installation Kit (AWA Type 1R62571) containing mounting cradle, aerial cable, and hardware for installation in a vehicle.

High-Frequency Helical Whip Aerial (Belling and Lee Type HFW1/6) for single-frequency operation of a mobile installation.

Helical Whip Sections (Belling and Lee Type HFW1/6T) for additional operating frequencies. A section is required for each frequency.

Transportable Kit (AWA Type 1R62574) consisting of a carrying frame and canvas case which render the transceiver suitable for portable service.

Man-Pack Helical Whip (Belling and Lee Type HFW1/P) for single-frequency operation of a portable transceiver.

Set of Batteries consisting of 11 nickel-cadmium cells (Eveready Type R4.5) for use with the Transportable Kit.

Battery Charger BC-1 for recharging and nickel-cadmium battery bank from 240 V a.c. mains. The charger is rated at 450 mA.

A.M. Compatibility Kit (AWA Type 6R62572) containing all components necessary for compatible a.m. operation.

Regulated Power Supply (AWA Type 1H63848) provides a regulated output of 12 V d.c. from 200-280 V a.c. mains.

4. CIRCUIT THEORY

Refer to Block Diagram (Drg 62570G1).

4.1 Transmitting Mode

When the press-to-talk button on the microphone is pressed, the "transmit" circuits are activated and produce the radio-frequency output signal in the following manner.

The audio signal from the microphone (or the tone oscillator) is amplified in two stages (3VT12, 3VT13) before being fed to a balanced modulator (5MR1-5MR4). An automatic compression circuit consisting of 3VT14, 3VT16-3VT18, 3VT11, and 3VT9 maintains a reasonably constant audio level into the balanced modulator regardless of fluctuations in the input level at the microphone caused by changes in the loudness of the operator's voice and variations in the distance of the operator's mouth from the microphone.

A 455 kHz carrier signal is generated by 5VT1 and then fed via 5VT2 to the balanced modulator. The carrier and the audio signal combine in the balanced modulator and two sidebands resulting from the addition and subtraction of the two signals appear in the output of transformer 5TR1. The carrier is suppressed in the balanced modulator.

The double sideband suppressed carrier signal from the balanced modulator is then coupled to the sideband filter which suppresses the "sum" sideband and permits only the "difference" sideband to pass into the intermediate-frequency amplifier (3VT1). The single sideband suppressed carrier signal from the intermediate-frequency amplifier is then fed into another balanced modulator (2MR1-2MR4). where it combines with a signal derived from the "channel" oscillator (2VT1). The "difference" frequency signal from the balanced modulator is the upper sideband relative to the channel frequency and is amplified in two radio-frequency stages (1VT1, 1VT2), the driver (8VT1), and the power amplifier (15VT1). The signal then passes through a selector to the appropriate aerial.

The gain of the intermediate-frequency amplifier and the two radio-frequency amplifiers is controlled by an automatic load control (a.l.c.) circuit to maintain the output of the power amplifier at the rated level. Variations in the output level are sensed by 8MR1 and amplified in 3VT4, 3VT6, and 3VT7 to provide a controlling voltage for the intermediate-frequency amplifier and the two radio-frequency amplifiers.

For a.m. compatible transmissions, a prescribed amount of the 455 kHz carrier is re-inserted at the input of the intermediate-frequency amplifier.

4.2 Receiving Mode

The receive functions are almost the reverse of the transmit functions and, with the exception of the driver and power amplifier, all the stages used in transmitting are used in receiving. The changeover is made by several relays which are energised for transmitting and de-energised for receiving.

The appropriate receiving aerial is connected via the aerial selector and channel filter to the radio-frequency amplifiers (1VT1, 1VT2). The output

from 1VT2 passes to the balanced modulator (2MR1-2MR4) where the signal from the "channel" oscillator translates the received signal from the channel frequency down to the intermediate frequency of 455 kHz. This intermediate-frequency signal then passes through the sideband filter (or the a.m. filter and amplifier) to the intermediate-frequency amplifiers (3VT1, 3VT2, 3VT3).

For the reception of single sideband signals, the output from the third intermediate-frequency amplifier is fed to the balanced modulator (5MR1-5MR4) where it combines with the 455 kHz signal from the carrier oscillator to recover the modulating signal. This audio signal is then applied via the VOLUME control (15RV1) to the audio amplifiers.

For the reception of a.m. signals (double sideband with full carrier), the signal from the third intermediate-frequency amplifier is demodulated in the envelope detector (3MR2) and then fed to the VOLUME control.

From the VOLUME control the audio signal passes to the audio amplifier section which consists of 3VT12-3VT14 and 3VT16-3VT18. Whereas in the transmit mode the output from the last stage is used to control the compressor, in the receive mode the output is fed to the loudspeaker.

In both modes of reception the gain of the radio-frequency amplifiers and the first two intermediate- frequency amplifiers (3VT1. 3VT2l is controlled by an automatic gain control circuit which is fed from the envelope detector. The a.g.c. circuit includes the amplifier stages 3VT4, 3VT6, and 3VT7; the SENSITIVITY control (15RV2); and the switching transistor 3VT8. The switching transistor completes the earth return circuit of the SENSITIVITY control during reception thus permitting adjustment of the sensitivity; in the transmit mode the switching transistor is non-conducting and renders the transmitter a.l.c. circuit immune from the setting of the SENSITIVITY control.

4.3 Power Supply and Power Control

All circuits with the exception of the transmitter power amplifier are supplied from the +12 V input line. For some circuits this voltage is reduced to +9 V by a Zener regulator.

A regulated +28 V supply for the transmitter power amplifier is derived by adding the output of a d.c./d.c. converter to the input voltage and then regulating the whole in a series regulator.

Series diodes in all +12 V branches provide protection against reverse polarity of the power source.

5. INSTALLATION IN A BUILDING

The transceiver should be located away from direct sunlight in a position that affords protection against mechanical damage, a wall shelf being considered ideal. In such locations the microphone clip can be mounted at a convenient height on the wall near the shelf.

Where a wall shelf conflicts with the room furnishings a telephone table or desk can be used with the microphone clip secured to the furniture piece within easy reach of the operator.

Because of the comparative lightness of the transceiver it is recommended that some means be employed to prevent accidental dragging on to the floor.

For details concerning batteries and battery cables refer to PART 3 of this handbook.

6. INSTALLATION IN A VEHICLE

All hardware items and the aerial cable for the installation of the transceiver in a land vehicle are contained in Mobile Installation Kit Type 1R62571. A list of the items in this kit appears in PART 4 of this handbook.

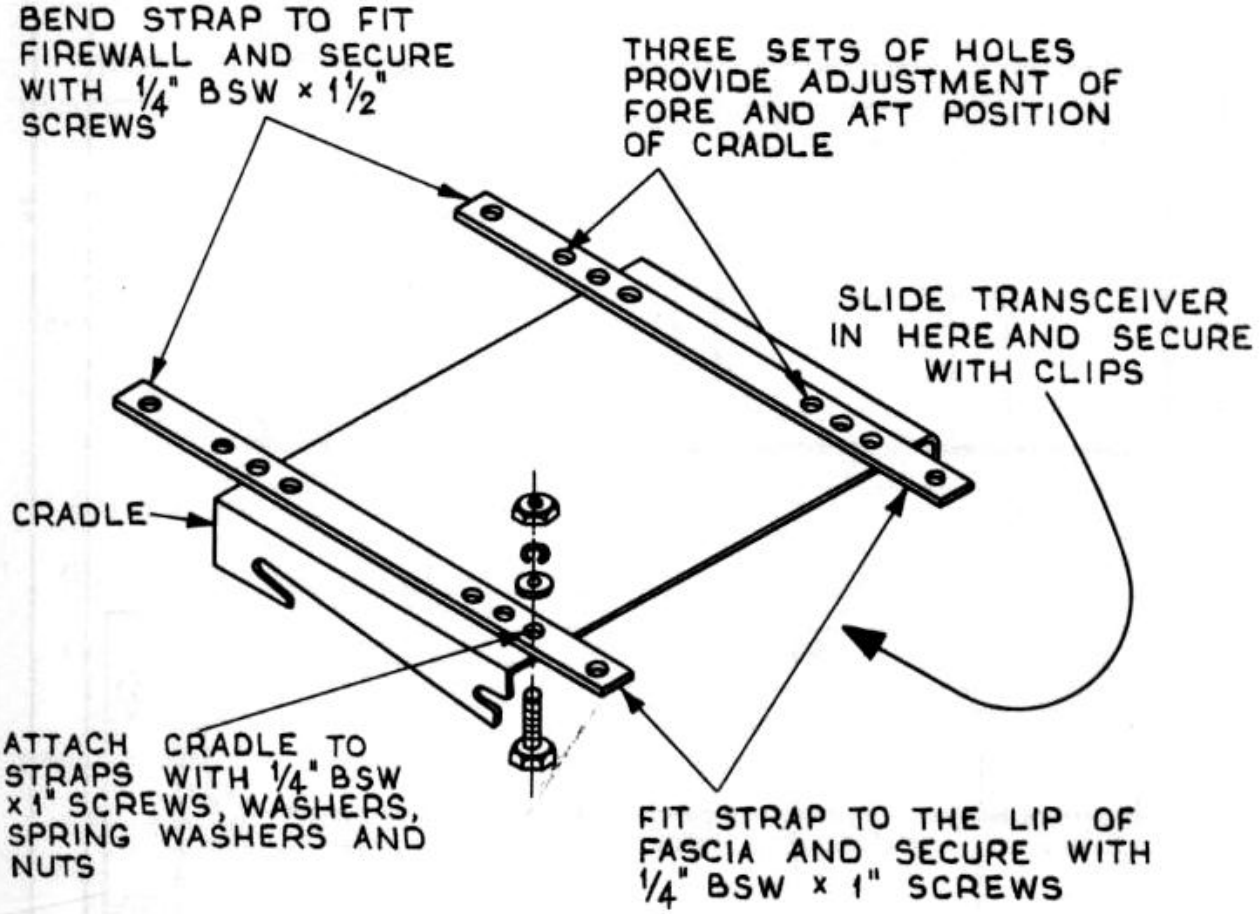
IMPORTANT: *The transceiver is designed for operation from NEGATIVE EARTH electrical systems. If the vehicle has a POSITIVE EARTH system a separate battery must be used to supply the transceiver; this battery must not be connected in any way to the electrical wiring in the vehicle.*

The location of the transceiver in the vehicle will depend upon the type of vehicle and the personal comfort of the operator, but the recommended arrangement is to fit the mounting cradle horizontally below the fascia panel in a position which gives easy access to the operating controls. The microphone clip is then mounted conveniently close to the operator's position.

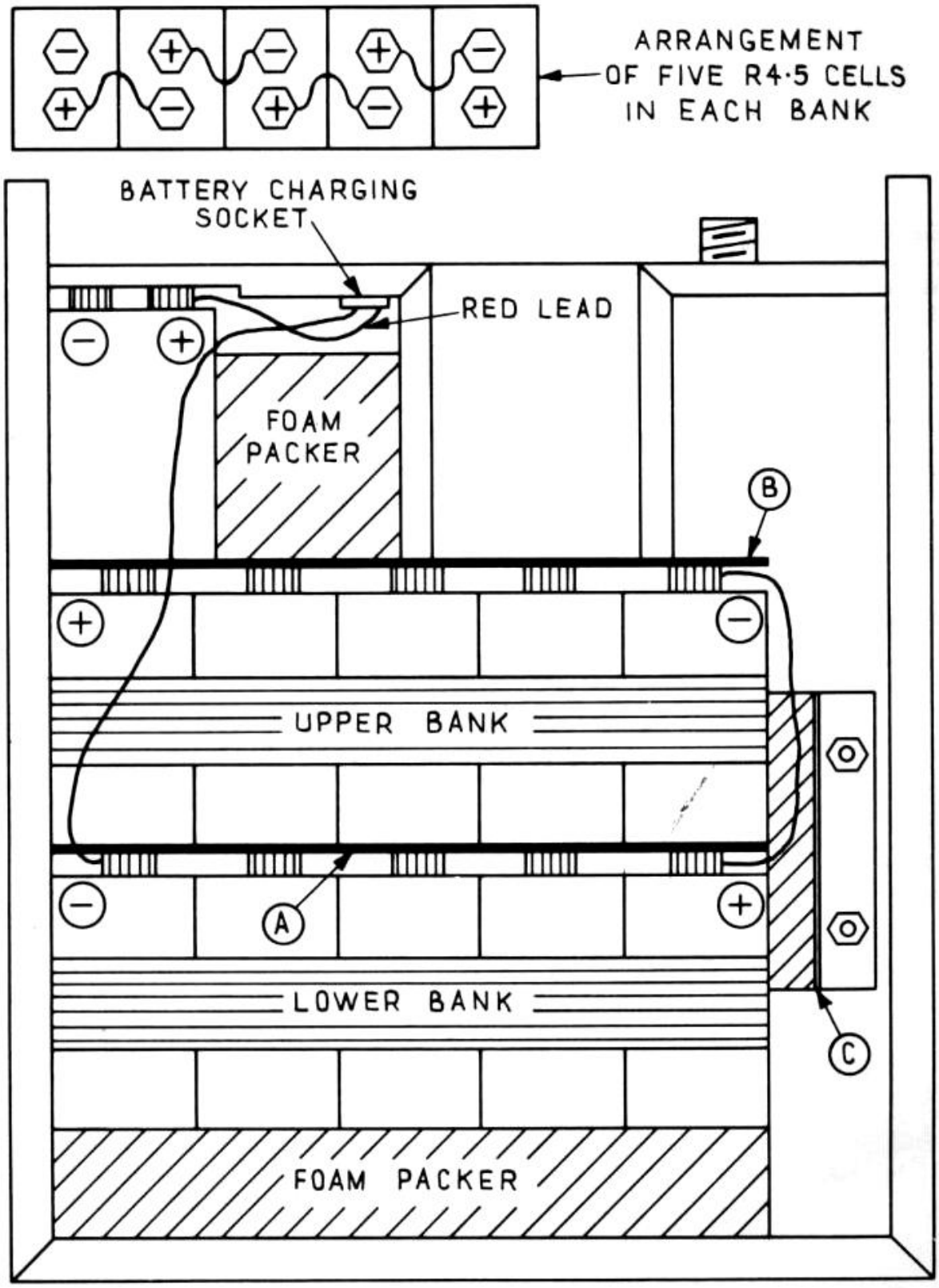
Fitting details for the mounting cradle are shown in the drawing facing this page.

The aerial cable is fitted with a coaxial connector at the transceiver end and should be cut to the shortest practical length after routing from the transceiver to the aerial.

When the transceiver is supplied from the vehicle battery, the battery cables should be connected to the BATTERY TERMINALS and any surplus length should be doubled back along the cable or formed into a neat coil and



INSTALLATION OF CRADLE



FITTING OF BATTERIES

then secured to the firewall behind the fascia panel. Solderless lugs should be fitted; cable fracture adjacent to the lugs may result from the use of soldered fittings.

Before connecting the battery cables to the transceiver check that the cable polarity is correct – RED IS POSITIVE. A 10 A fuse must be fitted in each fuse holder.

Refer to PART 2 of this handbook for details concerning the whip aerials used in mobile installations.

7. PREPARATION FOR PORTABLE SERVICE

Four steps are required to prepare a transceiver for portable service. These steps are:

(i) Fitting of eleven nickel-cadmium cells into the battery compartment of the carrying frame.

(ii) Fitting of the transceiver into the carrying frame.

(iii) Initial charging of the nickel-cadmium battery bank.

(iv) Connection of an aerial.

The procedure for fitting the nickel-cadmium cells into the battery compartment follows. (See also the diagrams facing this page.)

1. Arrange two banks each of five cells as shown in the diagram and bind each bank with adhesive tape.

2. Make the series connections between the cells in each bank.

3. Solder a lead about four inches long to the +ve terminal of each bank.

4. Place the lower bank in the position shown in the diagram and solder the black lead from the battery charging socket to the -ve terminal of the bank.

5. Fit insulating strip A over the terminals of the cells in the lower bank.

6. Place insulating strip B in position and partially insert the upper bank being careful to avoid short-circuiting of any cell. Complete the series connection from the +ve terminal of the lower bank to the -ve terminal of the upper bank. Push the upper bank into position.

7. Partially insert the single cell. Complete the series connection from the +ve terminal of the upper bank to the -ve terminal of the cell. Connect the red lead from the battery charging socket to the +ve terminal of the cell. Push the cell into position.

8. Clamp the upper and lower banks with bracket C.

Before securing the transceiver in the frame, connect the aerial lead to the appropriate connector at the rear of the transceiver and then connect the battery leads making sure that a 5 A ANTI-SURGE fuse is fitted in each fuse holder. Then engage the rear bollards of the transceiver in the sloping notches in the sides of the frame and clip the spring fasteners on the frame over the front bollards of the transceiver.

The battery bank must be charged for TWELVE HOURS at 450 mA. Battery charger BC-1 produces the correct charging rate and is fitted with a plug which engages with the 5-way socket on the frame.

The preparation for portable service is completed by attaching an aerial. Turn to Part 2, Section 5 for further details.

Refer to Part 3, Sub-Section 5.3 for information concerning discharge and recharging periods of the battery bank.

8. THE CONTROLS AND THEIR USE

AM/SSB Switch

The AM/SSB switch changes the mode of operation of the transceiver to permit communication with stations using either amplitude modulation (AM) or single sideband (SSB).

Most of the old systems employ amplitude modulation; the newer systems employ single sideband. This switch must be set to suit the station you are working.

FINE TUNE Control (SS70 only)

The FINE TUNE control is used during reception of a single sideband signal to make the speech sound natural. At the same time the control adjusts the transceiver precisely to the frequency of the other station. This precise adjustment of frequency is known as "netting".

In an incorrectly adjusted transceiver the speech is either unintelligible or unnaturally high pitched. In either case careful adjustment of the control

restores the speech to normal.

If the station being worked is an AWA SS70 or an AWA SS220, netting can be adjusted while receiving a tone transmission from the station. If the tone has a bubbling sound the FINE TUNE control should be adjusted until the burble disappears. This method is extremely accurate and best results are obtained when the volume is at a high level. It may require patience and experience before the operator can readily distinguish the burble and its disappearance when the control reaches the correct setting.

SPEECH/TONE Control

The SPEECH/TONE control must be set at the SPEECH position for normal operation of the transceiver. The TONE position provides an intentionally distorted tone from the transmitter when the press-to-talk button is operated. This tone is used when netting with another station and is audible in the loudspeaker as a reminder to the operator that the transceiver is not capable of speech transmission until the switch is returned to the SPEECH position.

SENS - VOL ON/OFF Control

The SENS - VOL ON/OFF control is a combination of three controls.

The large knob close to the front panel adjusts the sensitivity of the receiver and is correctly set when a low background or "frying" noise is heard from the loudspeaker in the absence of signals. Setting the control too far clockwise will result in excessive background noise and impair the intelligibility of speech signals.

The small knob combines the on/off switch and volume control. When the control is advanced from the fully anti-clockwise position a click that can be felt and heard indicates operation of the on/off switch. Care must be taken when switching off to rotate the control anti-clockwise until it clicks.

CHANNEL Selector

The CHANNEL selector changes the operating frequency of the transceiver.

9. OPERATING INSTRUCTIONS

9.1 Receiving

1. Set the CHANNEL selector to the number corresponding to the desired channel.

2. Set the AM/SSB switch to the mode used by the station you intend working.

3. Set the SPEECH/TONE switch to SPEECH.

4. Switch on the transceiver by turning the small knob of the SENS - VOL ON/OFF control clockwise until a click is felt or heard. Advance the control (i.e. the volume control) clockwise to about mid-position.

5. Set the large knob of the SENS - VOL ON/OFF control (i.e. the sensitivity control) fully clockwise.

6. When the station is heard adjust the volume control to the desired level.

7. Turn the sensitivity control anti-clockwise until the background noise is just audible in the absence of signals.

8. If the received speech sounds unnatural carefully adjust the FINE TUNE control (SS70 only) until the speech is normal.

9.2 Transmitting

1. Set up the transceiver as for receiving.

2. Take up the microphone and press the button.

3. Speak into the microphone in a normal tone of voice keeping the microphone case about an inch away from the lips.

4. Observe the RF OUTPUT lamp while speaking. An intermittent blinking of the lamp indicates that the transmitter is radiating.

5. Release the microphone button when finished speaking otherwise the reply will not be heard.

10. SIMPLE TROUBLE SHOOTING

The circuitry of the transceiver embodies recent developments in electronics; therefore servicing or maintenance should not be attempted by persons not having a thorough understanding of such developments.

However it is important that the operator be able to determine whether an apparently faulty transceiver requires the attention of a qualified technician. To assist the operator in making such a decision trouble-shooting diagrams for two basic symptoms are included at the rear of this handbook.

In these diagrams references are made to the battery, the fuses, and the RF OUTPUT lamp. The following notes will assist in the checking of those items.

(i) Lead-acid batteries can be checked by a hydrometer. A fully charged battery will give a reading of 1.280; a reading of 1.225 indicates that the battery requires recharging.

(ii) The state of charge of the nickel-cadmium battery bank used with a portable transceiver cannot be determined because of the flat discharge characteristic of the cells. When the battery bank is suspected of being less than fully charged it should be charged for 12 hours at 450 mA.

(iii) The state of a fuse can usually be determined by visual inspection, but the best method is by the substitution of a fuse that is known to be intact.

(iv) The RF OUTPUT lamp has soldered connections and is easily withdrawn from its mounting hole after removal of the top cover of the transceiver. Checking is best performed by substitution of a spare of known quality.

End of Part

PART 2

THE AERIAL SYSTEM

1. USE OF CORRECT AERIAL

The aerial system is as important as the transceiver in the performance of an installation and the full capability of the Teleradio SS70 cannot be realised without an efficient aerial system.

The Teleradio SS70 is designed for operation with the aerials listed in Part 1, Section 3 of this handbook under the heading "Accessory Items". These aerials are electrically matched to the transceiver and produce excellent results.

Other aerials, particularly those used in older installations, may prove unsatisfactory *and can cause costly internal damage to the transceiver.* The use of such aerials may also invalidate any guarantees on the transceiver

In addition to the aerials for fixed, mobile, and portable installations as listed in Part 1, AWA can supply aerials for special applications such as in ships and ocean platforms. It is essential that the aerial suit the requirements of an installation and AWA will be pleased to advise on the aerial requirements for any special application.

Remember! A 25-watt transmitter with an efficient aerial can outperform a 200-watt transmitter with an unsuitable aerial.

2. AERIAL IMPEDANCE

All of the recommended aerials are designed to present an impedance of 50 ohms to the transceiver; however minor variations can be produced by location, ground effect, and nearby objects. These variations are of small magnitude and will have little effect on the performance of the transceiver.

If possible a check of the voltage standing wave ratio at the transceiver end of the aerial feeder cable should be made before using an aerial. Suitable instruments are:

Kyoritsu Model K-109 Standing Wave Ratio Indicator
Bird "Thruline" Model 43 Directional Wattmeter

An aerial having a v.s.w.r. of greater than 1.5 to 1 must not be used for transmitting.

3. AERIALS FOR FIXED INSTALLATIONS

The recommended aerial for a fixed installation is a half-wave dipole fed at the centre via a 1:1 balun transformer and 50-ohm coaxial cable. The AWA Half-Wave Dipole Aerial Type 2Y64985 is such an aerial.

A separate aerial should be erected for each channel.

3.1 Half-Wave Dipole Aerial

The aerial is supplied as a kit and requires only the cutting to length of the two arms and the fitting of the end insulator assemblies. Information necessary for the determination of length is supplied with the kit.

The following points must be borne in mind when completing the aerial:

(i) The calculated length is the distance between the outer ends of the two arms.

(ii) The arms must be of equal length. Each arm should be measured from the middle of the centre assembly outwards to HALF the calculated length.

(iii) About six inches extra length must be allowed in each arm for attaching the end insulator assemblies.

3.2 Height of the Aerial

The characteristic impedance of a half-wave dipole aerial varies with height above ground. The angle of radiation also varies with height above ground.

When the aerial is about one-quarter wavelength high the characteristic impedance closely matches that of the transceiver and the angle of radiation is favourable for distances up to approximately 500 miles; therefore every effort should be made to place the centre of the aerial at that height. The length of each arm of the half-wave dipole aerial is very nearly equal to one-quarter wavelength and can be considered as being the recommended height for the aerial.

When the communication path exceeds 500 miles the height of the aerial must be increased to obtain a favourable angle of radiation, the height

becoming critical as the distance increases. The height should be increased in proportion to the distance; for example, for a path of 750 miles the aerial height should be increased by a half. The following formula can be used to calculate the height.

$$\text{Required Height} = \frac{\text{Distance in Miles} \times \text{Length of Each Arm.}}{500}$$

3.3 Direction of the Aerial

A half-wave dipole aerial exhibits a directional radiation pattern, the direction of maximum gain being at right angles (broadside) to the axis of the aerial. However the pattern is reasonably broad and little loss occurs within the first forty-five degrees either side of the line of maximum radiation.

When locating the aerial supporting poles or towers an effort should be made to place the most important communication path within this 90-degree arc. In cases where two or three aerials are required the supports should form a flat triangle with the preferred direction of communication at right angles to the base of the triangle. A typical arrangement is shown in the diagram on the next page.

In all installations the aerials should be kept clear of obstructions, e.g. trees and power lines, otherwise the directivity and efficiency of the aerial will suffer.

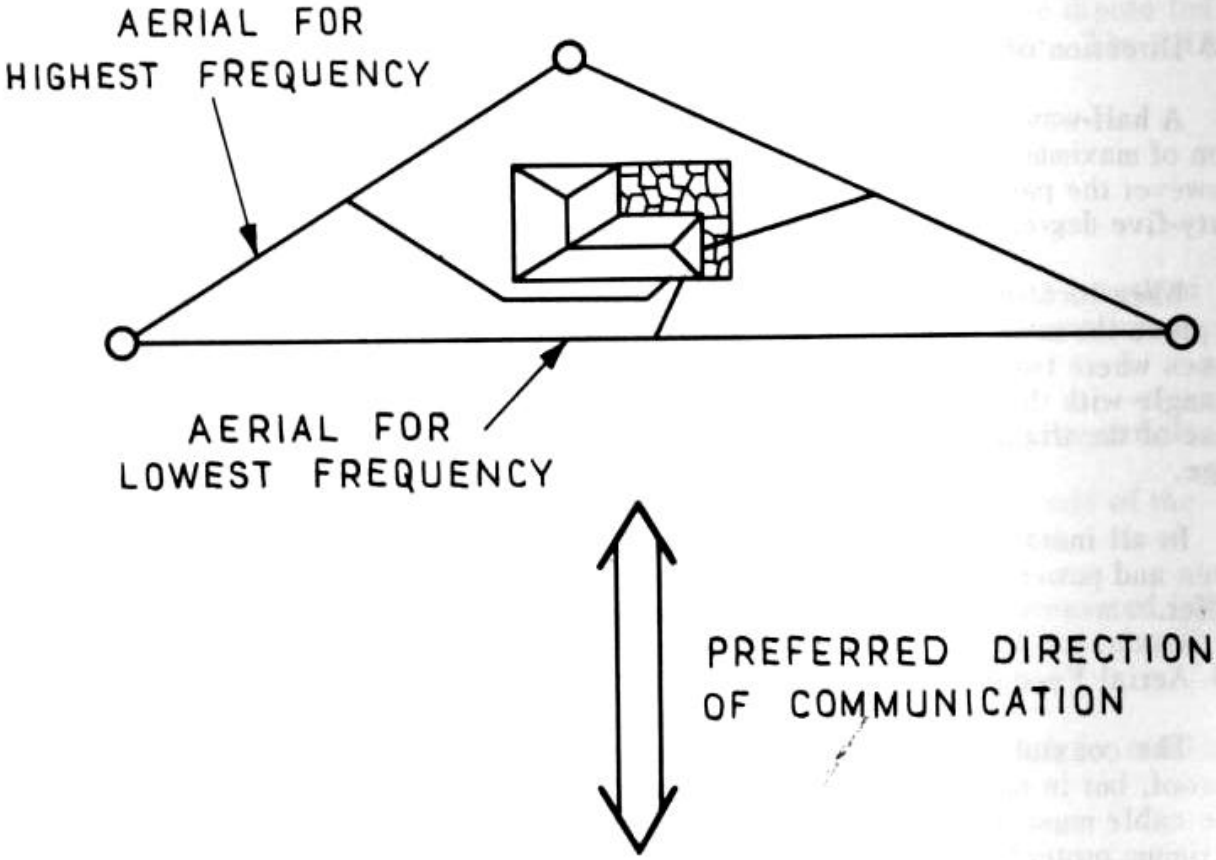
3.4 Aerial Feeder Cable

The coaxial feeder cable in the aerial kit is extremely efficient and weatherproof, but is susceptible to mechanical damage by pressure, strain, and heat. The cable must be handled carefully and installed in a manner that affords maximum protection against damage.

Sharp bends must be avoided and the cable must be supported to prevent movement and strain. Where an air span is longer than 10 feet the cable should be supported by a wire catenary or a rigid support such as a metal pipe. Electrician's cable clips are recommended for securing the cable to walls and so on inside a building.

Although the cable is weatherproof it can be damaged by excessive heat. The cable should be kept clear of sources of heat such as fireplaces, hot water systems, and exhaust fans.

Sufficient slack must be allowed at the transceiver end to prevent strain being placed on either the cable or the connectors.



TYPICAL ARRANGEMENT FOR THREE AERIALS

4. AERIALS FOR MOBILE INSTALLATIONS

The recommended aerial for land vehicles is Belling and Lee Type HFW1/6. This aerial consists of a base assembly and a helically wound fibreglass whip, a separate whip section (HFW1/6T) being required for each frequency

The whip sections exhibit a narrow bandpass characteristic; that is, the whip will operate satisfactorily over a very small band of frequencies. Because of this characteristic it becomes necessary after installation to tune the whip to the channel frequency by clipping the straight wire section at the top of the whip.

Because the field strength reaches maximum intensity when the whip is resonant the correct length for the top wire can be accurately determined by using a field strength indicator. A simple field strength indicator can be constructed by shunting a 0-1 mA meter with a r.f. diode and attaching a stiff wire about 12 inches long to each of the meter terminals. This instrument should then be set up about 15 feet away from the vehicle with the stiff wires forming a straight vertical line.

The top wire of the whip should be shortened about one-quarter of an inch at a time until the meter reading ceases to increase or just begins to decrease.

If a suitable instrument is available the voltage standing wave ratio of the aerial should be checked. This ratio should not exceed 1.5 to 1.

5. AERIALS FOR PORTABLE INSTALLATIONS

Three types of aerials are available for use with portable stations. These types are:

(i) Helically wound single-frequency whips

(ii) Collapsible vertical aerials

(iii) End-fed wire aerials.

5.1 Helically Wound Single-Frequency Whips

The recommended aerial is Belling and Lee Type HFW1/P, and is similar to the whip sections used in mobile installations. The whip sections are shorter than the equivalent mobile whips and are fitted with a connector which mates with the coaxial connector on the portable carrying frame.

A separate whip is required for each frequency and each whip must be tuned for maximum field strength as described in Section 4 above.

5.2 Collapsible Vertical Aerials

The collapsible vertical aerial has an assembled height of 36 feet and consists of a number of fibreglass sections that plug together.

The aerial can be lashed against the side of a vehicle or a short post and does not require guys. It is intended for use in field operations where the communication path is long and the absence of trees or suitable supporting structures prevents the erection of a halfwave dipole aerial.

An earth system is required with this aerial. The vehicle against which the aerial is lashed can be used as an "earth"; alternatively a wire equal in length to the aerial can be laid on the ground. In either case the "earth" must be connected to the earth terminal on the portable carrying frame.

An aerial tuning unit must be used with the aerial to present the correct impedance of 50 ohms at the aerial connector of the transceiver. Details of suitable aerial tuning units can be supplied on request.

5.3 End-Fed Wire Aerials

For operation on a single frequency, a quarter wavelength of wire can be connected directly to the aerial terminal on the portable carrying frame. The free end of the aerial should be raised to about twenty feet using any convenient support, e.g. a tree or building. Insulation of the free end is necessary and can be provided by a porcelain "egg" insulator.

An earth system must be used with this aerial. A vehicle or ground wire can be used as described in Sub-Section 5.2 above.

For multi-channel operation an end-fed aerial can be used in conjunction with an aerial tuning unit. In such installations the aerial should be 36 feet long.

6. AERIALS FOR SPECIAL APPLICATIONS

In some installations tne length and location of the aerial are determined by other than radio considerations. Such conditions are encountered in ships, ocean platforms, and large buildings.

In these cases the aerial is usually a fixed length of wire or a vertical self-supporting rod. Because such aerials are not of the electrical length that

presents an impedance of 50 ohms to the transceiver it becomes necessary to install an aerial tuning unit to convert the impedance to 50 ohms.

The AWA Aerial Tuning Unit ATU-11 is designed for this purpose and can be remotely controlled for multi-channel operation from the channel selector of the transceiver. A power supple of 12 V d.c. or 24 V d.c. is required for the motor-driven switches in the unit.

End of Part

PART 3

THE BATTERY

1. AMPERE-HOUR RATING FOR FIXED INSTALLATIONS

The capacity (ampere-hours) will be dictated by the average current drain and the duration of usage. In cases where the transmitter duty cycle is low the average current drain will be about 150 milliamperes, whereas in cases with a higher duty cycle the average current drain will approach 2 amperes. (The rating of 2 amperes is based on continuous operation with equal transmit and receive times.)

The estimated current drain should then be multiplied by the probable daily usage (in hours) to give the daily drain in ampere-hours. If this figure is then multiplied by the desired number of days between battery recharging, the result gives the required ampere-hour rating of the battery. Conversely, if the ampere-hour rating of an available battery is known, the number of days of available service can be calculated by dividing the rating by the drain.

A reputable battery manufacturer should be consulted to determine the style of battery best suited to an installation.

2. LOCATION IN FIXED INSTALLATIONS

The most popular type of battery for fixed installations is the lead-acid accumulator.

When such batteries are used they should be housed in a ventilated closet preferably located outside the room in which the transceiver is located. The battery closet should be vented to outside air because of the injurious effect of battery fumes on metal, paintwork, and fabrics. The actual location of the battery closet should be consistent with the shortest practical length for the battery leads.

3. BATTERY CABLES AND FUSES

The battery cables are supplied without fittings at the battery end. Lugs or spring clamps should be fitted to the leads to permit connection to the battery terminals.

Any surplus cable should be doubled back along the cable or formed into

a neat coil, and then secured within the battery closet. Should it be necessary to extend the battery cables, the size of the additional cables should be such that the voltage drop in the "transmit" condition is less than 100 millivolts.

The transceiver ends of the cables are fitted with fust holders that mate with leads coming from the transceiver case. A 10 A fuse must be fitted in each fuse holder.

Before mating the battery cables check the battery connections - the RED lead must connect to the POSITIVE terminal of the battery.

4. MAINTENANCE OF LEAD-ACID BATTERIES

The battery should not be left in a discharged condition for any appreciable length of time. Recharging is required when the specific gravity falls to 1.225.

IMPORTANT: The transceiver must not be switched on while the battery is connected to a charger.

The battery terminals should be kept free from corrosion. Any corrosive accumulation may be removed by water to which some household ammonia or baking soda has been added, the solution being applied by a stiff-bristle brush. Care should be taken to prevent either the solution or the corrosive material from entering the cells. Cell caps should be rinsed in the same solution to clear the vent holes.

Battery terminals and clamps should be polished bright with a wire brush and coated with a high quality petroleum jelly such as "Vaseline".

Water is evaporated from the electrolyte, but the acid is not. Therefore water must be added from time to time so that the plates are completely covered. The level should be checked at least once per week especially during hot weather.

Distilled water is preferrable for replenishing but clear drinking water is an acceptable substitute. Bore water or water having a high mineral content must not be used. Too much water should not be added since the gassing that accompanies recharging may cause excessive splashing of the electrolyte on nearby objects.

A fully charged battery has a specific gravity of 1.280.

5 NICKEL - CADMIUM BATTERIES IN TRANSPORTABLE KIT

5.1 Characteristics

The characteristics of the nickel-cadmium cells used in the transportable kit differ considerably from those of the lead-acid batteries used with fixed or mobile installations; therefore a close study of the following notes is recommended.

When discharge is carried below one volt per cell a very rapid fall to zero volts occurs. Because of slight differences in cell capacity one cell may reach zero volts before another and this can result in cells reversing polarity. Polarity reversal causes no damage but should be avoided for maximum possible life.

Cycle life is at an optimum when over-discharge is avoided, recharging is performed regularly, and depth of discharge is kept as shallow as possible.

The self-discharge rate for unused cells is high for the first month, a remaining capacity of 70 per cent being normal. After the first month the capacity decreases only gradually, falling to about 60 per cent at the end of the fourth month.

Temperature is important to the life of nickel-cadmium cells particularly in regard to self-discharge which increases considerably at high temperatures. Permissible temperature ranges are as follows:

Charge:	+32 °F to +113 °F (0 °C to +45 °C)
Discharge:	-4 °F to +113 °F (-20 °C to +45 °C)
Storage:	-40 °F to +140 °F (-40 °C to +60 °C)

5.2 Storage

Before storage the cells should be given a normal charge. During storage the cells should be protected from dust accumulation across the terminals and from shorting terminals.

After storage for prolonged periods the cells will have lost some capacity because of self-discharge. Full capacity will be regained after two or three cycles of charge and discharge.

5.3 Service and Recharging Periods

The conditions of service can differ widely in portable applications; therefore it is not possible to lay down specific times of expected service for completely charged batteries. Because recharging depends upon the state of

charge of the batteries it is also impossible to lay down exact recharging times.

The following notes will be of assistance in avoiding complete discharge and overcharge, and their observance will result in reliable operation of the transceiver and long life for the cells.

(i) A fully charged battery will provide two and threequarter hours of CONTINUOUS 2-WAY COMMUNICATION assuming equal transmit and receive times.

(ii) A fully charged battery will provide 30 hours of receiving.

(iii) For every hour of continuous 2-way communication the battery requires 5 hours of recharging.

(iv) For every hour of receiving the battery requires one-half hour of recharging.

(v) The duration of any recharging period must not exceed 14 hours. (The apparent contradiction of Note (iv) is due to the rounding off of the recharging rate to one-half hour for every hour of operation.)

(vi) When the state of charge of a battery is unknown, the battery can be recharged for 12 hours.

(vii) The recharging rate is 450 mA and must not be exceeded. The AWA Battery Charger BC-1 produces the correct charging rate.

IMPORTANT: The transceiver must not be switched on while the battery charger is connected to the battery.

End of Part

PART 4

SCHEDULES

1 EXPLANATORY NOTES

Schedules for the various accessory kits are given in Sections 2 to 5 below.

Commonly used replacement parts are listed in Section 6.

2. HALF-WAVE DIPOLE AERIAL 2Y64985

Item	Qty	AWA Reference Number
Centre Assembly, including:	1	6398W10
Balun Transformer A & R 358B	1	
Coaxial Cable Assembly	1	64985V11
Porcelain Insulators	2	
Wire, 12 SWG, copper	2 x 120'	
Insulator Assembly including:	2	64985V4A
Porcelain Insulators	2	
Cutting Chart	1	64985D1

3. MOBILE INSTALLATION KIT 1R62571

Item	Qty	AWA Part or Code Number
Aerial Cable Assembly	1	62571V5
Clamp, Utilux H250	6	208942
Clamp, Utilux H962	6	208101
Cradle Strap	2	61968V14
Grommet Material, 3/8 inch	4''	591062
Mounting Cradle	1	63838X3
Nut, 10-32 UNF, steel	2	493490
Nut, 1/4 BSW, steel	8	493981
Screw, No. 6 x 3/8 inch, self-tapping	12	760374

Item	Qty	AWA Part or Code Number
Screw, 10-32 UNF x ¾ inch, pan head, steel	2	778452
Screw, ¼ BSW x 1 inch, hexagon, head, steel	6	746732
Screw, ¼ BSW x 1 1/2 inches, hexagon head, steel	2	746748
Washer, 2 BA, plain, large, brass	2	921002
Washer, 2 BA, lock, internal teeth	2	921212
Washer, ¼ inch, steel	8	921858
Washer, ¼ inch, spring	8	921658

4. TRANSPORTABLE KIT 1R62574

Item	Qty	AWA Reference Number
Carrying Bag, canvas	1	62574W8
Carrying Frame	1	62574W9
Miscellaneous Electrical Components (mounted on Carrying Frame)		

5. A.M. COMPATIBILITY KIT 6R62572

This kit consists of a printed wiring board complete with all components. The board reference is 6R62572.

6. COMMON REPLACEMENT PARTS

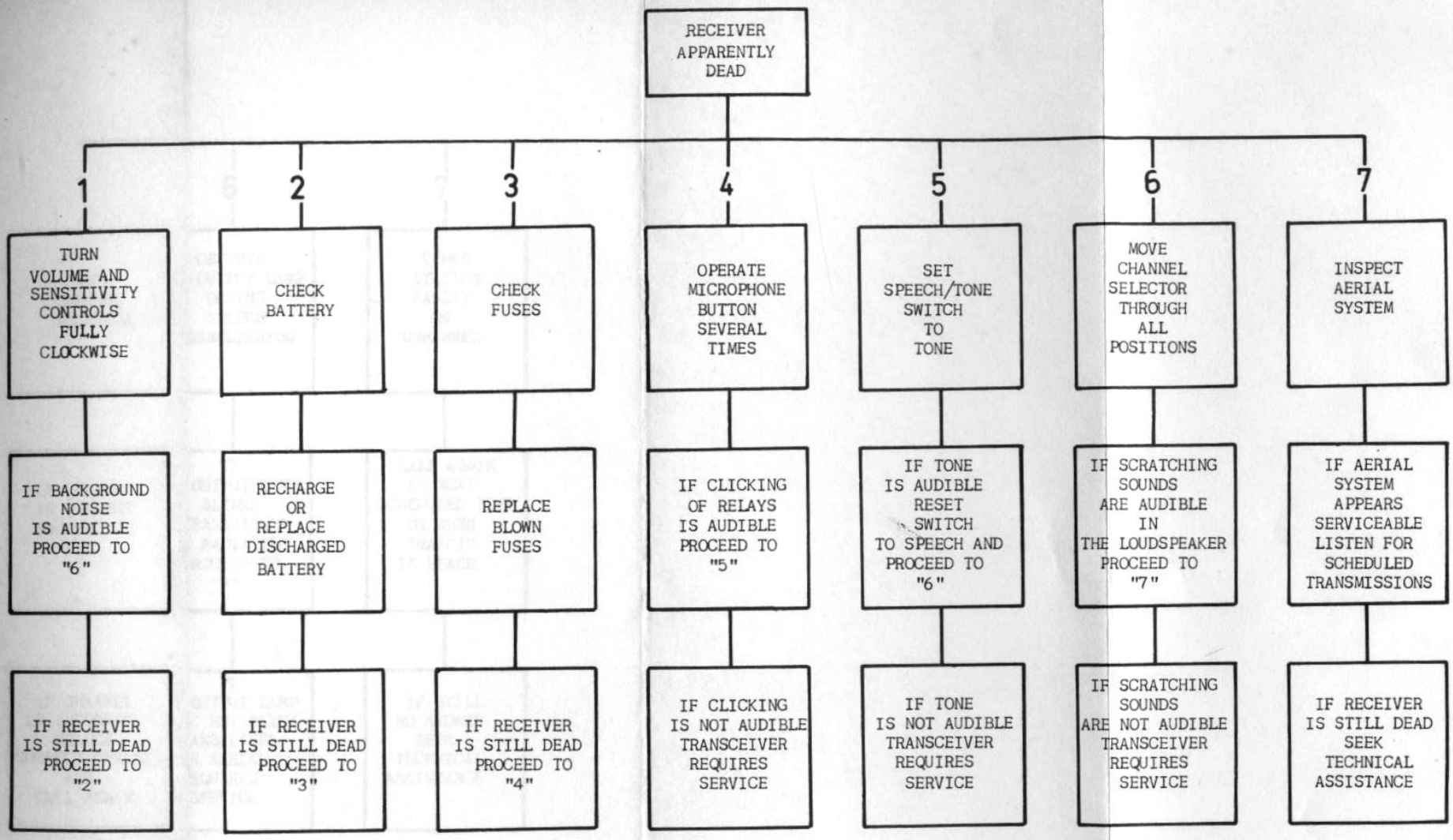
Item	AWA Part or Code Number
Connector, coaxial, plug, BNC, UG-88C/U (mates with aerial connectors on transceiver)	234630
Connector, coaxial, plug, right angle, BNC, UG-913/U (used in portable carrying frame)	

Item	AWA Part or Code Number
Connector, coaxial, receptacle, chassis mounting, SO-239 (used in portable carrying frame)	794305
Fuse holder, barrel section	790338
Fuse holder, cap section	188021
Fuse link, glass cartridge, 10 A (for use in fixed or mobile installations)	370074
Fuse link, glass cartridge, 5 A, anti-surge (for use with nickel-cadmium batteries in portable installations)	369967
Grub screw, 6-32 UNC x 3/8 inch, Allen head (used in SENSITIVITY control)	
Knob, black, Elma 70-14-1/8 (for VOLUME control)	
Knob. black, Elma 71-14-1/4 (for FINE TUNE control)	
Knob, black, Elma 73-21-1/4 (for CHANNEL selector)	
Knob cover, black, Elma 1450-14 (for VOLUME and FINE TUNE controls)	
Knob cover, black, Elma 1450-21 (for CHANNEL selector)	
Knob, metal, less grub screws (for SENSITIVITY control)	62570V137
Lamp, 14 V, 80 mA, Ducon RM6/14V/80 (for RF OUTPUT lamp)	
Microphone Assembly (complete)	4E63837
Microphone Clip (part of Microphone Assembly)	63837W6-2

Item	AWA Part or Code Number
Plug, 5-pin (mates with battery charger socket on portable carrying frame)	234071
Rubber foot, grey	345067

End of Part

NOTES

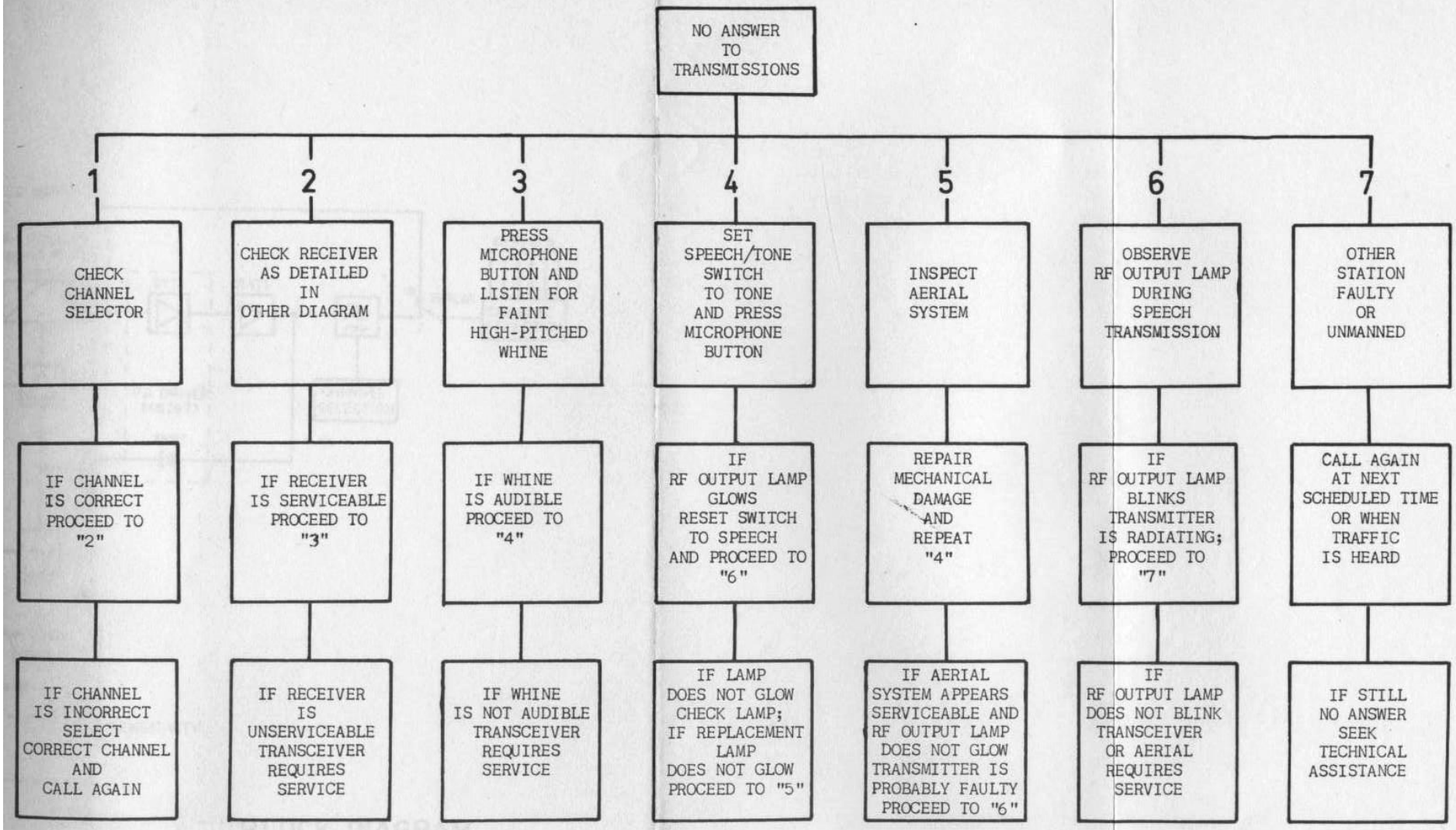


TROUBLE SHOOTING DIAGRAM
TELERADIO SS70

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED SYDNEY

DRG62570C1

0 ISSUE



TROUBLE SHOOTING DIAGRAM
TELERADIO SS70

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED SYDNEY

DRG 62570C2

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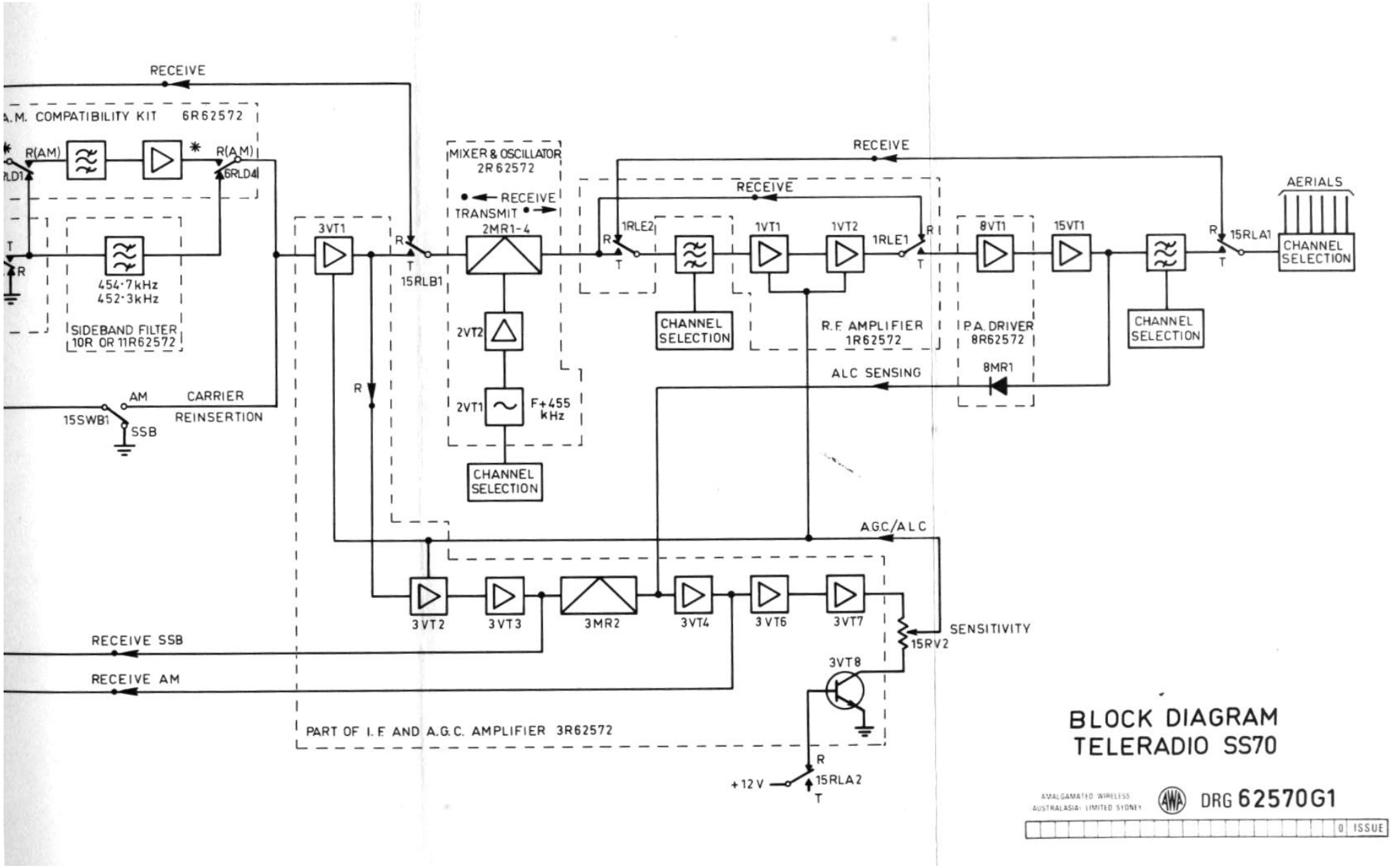
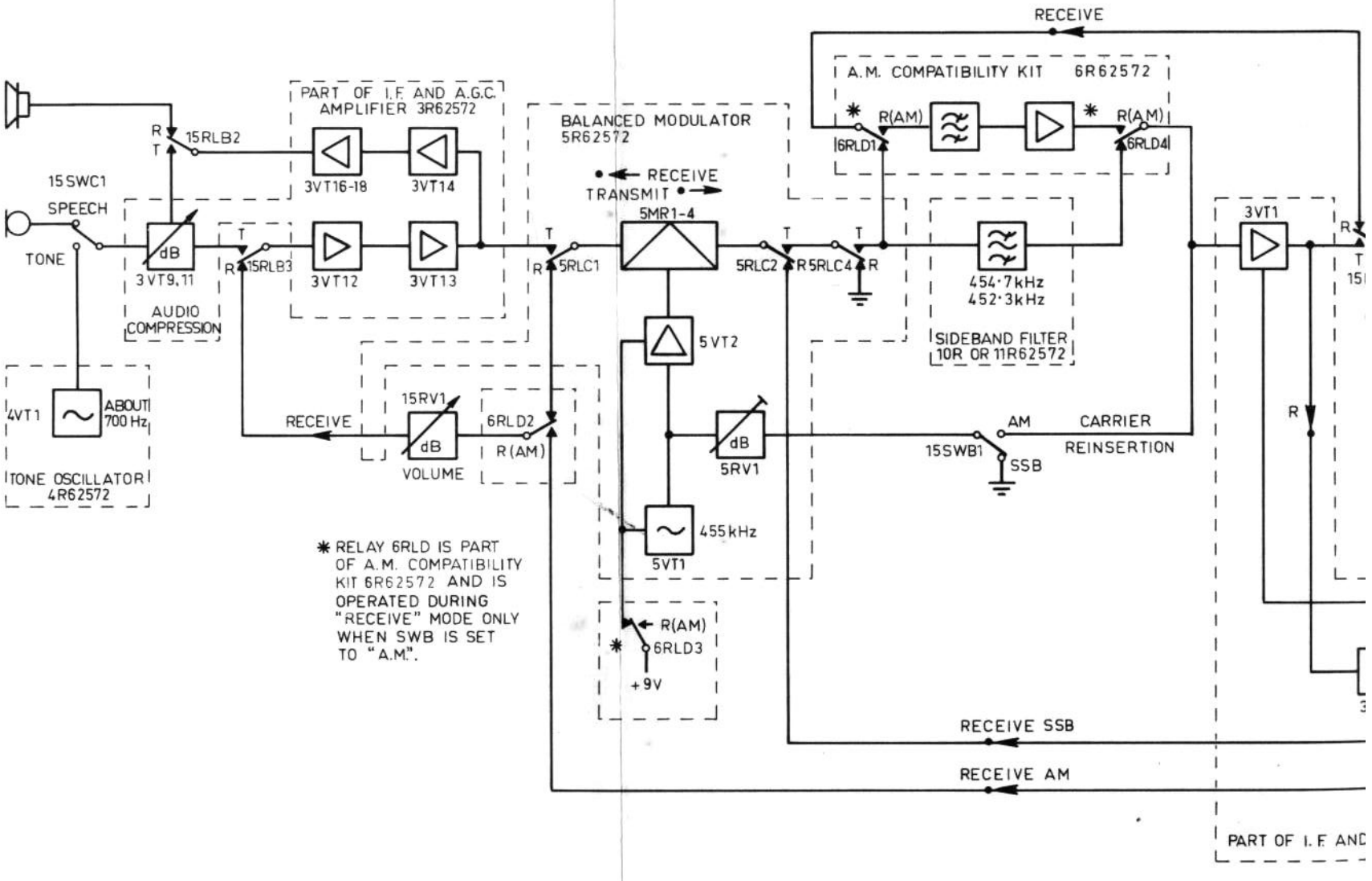


BLOCK DIAGRAM
TELERADIO SS70

AMALGAMATED WIRELESS AUSTRALASIA LIMITED SYDNEY

DRG 62570G1

0 ISSUE


RECEIVE
A.M. COMPATIBILITY KIT 6R62572
R(AM)
6RLD1
6RLD4
PART OF I.F. AND A.G.C. AMPLIFIER 3R62572
BALANCED MODULATOR 5R62572
15RLB2
3VT16-18
3VT14
15SWC1
SPEECH
TONE
dB
3VT9,11
AUDIO COMPRESSION
15RLB3
3VT12
3VT13
RECEIVE
TRANSMIT
5MR1-4
5RLC1
5RLC2
5RLC4
454·7kHz
452·3kHz
SIDEBAND FILTER 10R OR 11R62572
5VT2
4VT1
ABOUT 700 Hz
TONE OSCILLATOR 4R62572
15RV1
6RLD2
R(AM)
VOLUME
5RV1
AM
CARRIER
REINSERTION
15SWB1
SSB
455kHz
5VT1
6RLD3
+9V
3VT1
RECEIVE SSB
RECEIVE AM
PART OF I.F. AND
* RELAY 6RLD IS PART OF A.M. COMPATIBILITY KIT 6R62572 AND IS OPERATED DURING "RECEIVE" MODE ONLY WHEN SWB IS SET TO "A.M.".