INSTRUCTION BOOK

RESTRICTED CONFIDENTIAL

FOR

RADIO STATION

RS-6 and RS-6A

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CHAPTER 1

INTRODUCTION

SECTION I. GENERAL

All the following material covers both Radio Station RS-6 and Radio Station RS-6A unless specific notations are made referring to only one or the other. Basic nomenclature followed by (*) is used to indicate all models of the item of equipment included in this instruction book. Thus Radio Station RS-6(*) represents Radio Station RS-6 and RS-6A which are treated together in this instruction book.

Radio Station RS-6 is a compact four-unit set for transmitting CW and receiving CW or AM. It operates from AC, storage battery, or hand generator, and consists of a Transmitter RT-6, Receiver RR-6, Power Supply RP-6, and a Filter-Accessory Unit FA-6. See Figure 1.

Radio Station RS-6A is identical to Radio Station RS-6 except for frequency coverage and the component differences required for this modification. Photographs in this instruction book are of the RS-6. The general appearance, hook-up connections, location of alignment adjustments, and parts locations of the RS-6A are identical to those of the RS-6.

SECTION II. DESCRIPTION AND DATA

1. TRANSMITTER RT-6(*)

a. Type: 2-stage, crystal-controlled

b. Frequency range (two bands):

RT-6

(1) 3 to 7 mc

(2) 7 to 16.5 mc

RT-6A

(1) 4.5 to 10 mc

(2) 10 to 22 mc

c. Power Output:

RT-6 6-10 watts (depending upon frequency)

RT-6A 5-10 watts (depending upon frequency)

d. Power Input

(1) 400 v dc at 75 ma (transmitting)

400 v dc at 25 ma (idling during break-in)

(2) 6.3 v ac-dc at 1.2 amp

e. Weight: 2lbs 14 oz

f. Dimensions (inches): 6-3/4 x 5 x 2-3/32

2. RECEIVER RR-6(*)

a. Type: Superheterodyne, variable tuning or crystal-controlled

b. Frequency range (two bands):

RR-6

(1) 3 to 6.5 mc

(2) 6.5 to 15 mc

RR-6A

(1) 4.5 mc to 10 mc

(2) 10 to 22 mc

c. Power Input

(1) 90 v dc at 15 ma - regulated

(2) 90 v dc at 10 ma - regulated

(3) 6.3 v ac-dc at 1.2 amp

d. Weight: 3 lb 2 oz

e. Dimensions (inches): 6-3/4 x 5 x 2-1/4

3. POWER SUPPLY RP-6(*)

a. Power Source: a-c line or 6 volt storage battery

b. Power Input:

(1) a-c to 270 v, 40 to 400 cps, 80 watts nominal

(2) d-c 6.3 v at 12 amp

c. Power Output:

(1) 6.3 v ac-dc at 2.4 amps

(2) 400 v dc at 75 ma

(3) 90 v dc at 25 ma regulated

(4) 90 v dc at 25 ma regulated

d. Fuses:

(1) a-c - 1.5 amp

(2) d-c - 15 amp

e. Power Factor:

(1) 40 cps -

(2) 60 cps - 86.7

(3) 400 cps - 96.3

f. Weight: 5 lb 11 oz

g. Dimensions (inches): 8-1/16 x 4 x 2-3/16

4. FILTER-ACCESSORY UNIT RA-6(*)

a. Function:

(1) Filters B+

(2) Regulates receiver B+

(3) Switches B+ to transmitter and to receiver

(4) Provides storage space for accessories and power cables. See Figure 2.

b. Weight: 3 lb 11 oz

c. Dimensions (inches): 8-1/16 x 4 x 2

d. Accessories:

1 AC cable assembly

1 Battery cable assembly

1 Spare fuse - 1.5 amp

1 Spare fuse - 15 amp

1 Set Schematic Diagram & Parts List

5. ADDITIONAL ACCESSORIES

The following accessories are contained in a plastic pouch (see Figure 3):

1 Hank antenna (100 ft)

2 Antenna insulators

2 Battery clamps

1 12" hook-up wire to connect receiver antenna to transmitter

1 9" hook-up wire with clip to feed sidetone from transmitter to receiver earset

1 Earset and cord

CHAPTER 2

OPERATING INSTRUCTIONS

SECTION I. SETTING UP EQUIPMENT

1. AC OPERATION HOOK-UP

a. Turn input voltage selector switch on Power Supply RP-6(*) (Figure 4) to OFF.

b. Pull sending key out of recess on Transmitter RT-6(*).

c. Connect equipment as shown in Figure 5. (Receiver crystal shown is optional.)

(1) The Jones plug marked AC must be inserted in the OPERATE receptacle on Power Supply RP-6(*) before the power plug is connected to an A-C power source, otherwise "hot" terminals will be exposed and a power line fuse may be blown.

(2) Connect the two-prong plug of the A-C cable assembly to any A-C power source whose voltage is between 70 and 270 volts, and frequency between 40 and 400 cycles per second. The two prong A-C power plug can be adapted to various receptacles in the following ways:

(a) Vary the spacing between the prongs by compressing plug.

(b) Prongs can be unscrewed and reversed to provide any combination of small and large prongs as required to fit various power outlets.

d. Turn input voltage selector switch on Power Supply RP-6(*) clockwise to the first position at which the neon indicating light glows. The transmitter and receiver are now ready for operation.

e. Do not turn off the equipment by disconnecting Jones plug marked AC. This would expose "hot" terminals. Turn off equipment by pulling power plug from power source or by rotating the input voltage selector switch counter-clockwise to the OFF position.

f. Refer to Sections II and III of this chapter for detailed transmitter and receiver operation.

2. BATTERY OPERATION HOOK-UP

a. Turn input voltage selector switch on Power Supply RP-6(*) (Figure 4) to OFF.

b. Pull sending key out of recess on Transmitter RT-6(*).

c. Connect equipment as shown in Figure 6 (receiver crystal shown is optional).

(1) Use only a 6-volt storage battery source. If only an 8 or 12-volt storage battery is available, connect only across 6 volts (3 cells) of the battery. See Figure 6.

(2) The Jones plug marked BAT must be inserted in the OPERATE receptacle on Power Supply RP-6(*) before the battery clamps are connected to the storage battery, otherwise "hot" terminals will be exposed and equipment may be damaged.

(3) Twist the red and black battery leads together along their entire length to reduce hash radiation.

(4) Connect red battery lead to the plus 6-volt side of the battery, and the black battery lead to the minus 6-volt side of the battery.

NOTE: The above method of connecting the RS-6(*) to a storage battery in a vehicle that has the positive terminal of the storage battery grounded to the body frame will cause the battery to rapidly discharge and the battery lead to overheat if electrical contact is made between the case of the RS-6(*) and the frame of the vehicle. To prevent such an occurence, the black battery lead should be connected to the battery terminal that connects to the vehicle body frame and the red battery lead should be connected to the "hot" terminal of the battery. That is, when the positive terminal of the battery is grounded, the black battery lead connects to the positive terminal and the red battery lead connects to the negative terminal. Use this alternate method only when the positive battery terminal is grounded. Do not attempt to charge the battery with the RS-6(*) when connected in this fashion as the fuse will burn out.

d. The transmitter and receiver are now ready for operation.

e. Do not turn equipment off by disconnecting Jones plug marked BAT. This would expose "hot" terminals. Turn off equipment by disconnecting clamp from either battery terminal.

f. Refer to Sections II and III of this chapter for detailed transmitter and receiver operation.

3. HAND GENERATOR OPERATION HOOK-UP

a. Pull sending key out of recess on Transmitter RT-6(*).

b. Connect equipment as shown in Figure 7. (Receiver crystal shown is optional.) Either Hand Generator GN-58 or SSP-11 may be used.

NOTE: Power Supply RP-6(*) is not used, in this method of operation. The transmitter and receiver are now ready for operation.

c. Refer to Sections II and III of this chapter for detailed transmitter and receiver operation.

4. BATTERY CHARGING HOOK-UP AND OPERATION

a. Only a 6-volt (3 cell) wet type storage battery can be charged.

(1) The charging rate is 3.5 amperes minimum when the electrolyte in a lead-acid storage battery has a specific gravity of 1.180. The charging current gradually reduces by 0.8 ampere as the specific gravity of the electrolyte increases to 1.280 when the battery charges.

(2) Battery should be charged only in a well ventilated room as dangerous gases are formed during the charging process.

b. It is desirable to keep the storage battery as fully charged as possible. The RP-6(*) when connected as a charger, should be used approximately 5 times as long as the period of time that the RS-6(*) was operating from the battery power source. A hydrometer is recommended to accurately determine the charge of the battery.

c. Connect equipment as follows: (See Figure 8).

(1) Turn the input voltage selector switch on Power Supply RP-6(*) to OFF. (Figure 4)

(2) Disconnect Power Supply RP-6(*) power plug from the Filter-Accessory Unit, RA-6(*), if it is not already disconnected. This connection must be severed to prevent fuse from being blown.

(3) Insert Jones plug marked BAT in receptacle marked BATT-CHARGE.

(4) Connect red battery lead to the plus 6-volt terminal of storage battery.

(5) Connect black battery lead to the minus 6-volt terminal of storage battery.

(6) Insert Jones plug marked AC in receptacle marked OPERATE.

(4) Connect the two-prong plug of the AC cable assembly to any a-c power source whose voltage is between 70 and 270 volts, and whose frequency is between 40 and 400 cps. The two-prong A-C power plug can be adapted to various receptacles in the following ways:

(a) Vary the spacing between the prongs by compressing plug.

(b) Prongs can be unscrewed and reversed to provide any combination of small and large prongs as required to fit various power outlets.

d. Turn input voltage selector switch of Power Supply RP-6(*) clockwise to the first position at which the neon indicating light glows. Battery is now being charged.

e. To stop charging process proceed as follows:

(1) Turn the input voltage selector switch on Power Supply RP-6(*) to OFF.

(2) Disconnect two-prong a-c plug from power source.

(3) Remove battery leads from battery.

SECTION II. TRANSMITTER RT-6(*)

1. CONTROLS AND FUNCTIONS (See Figure 9)

a. OSC BANDSWITCH - Selects desired band for oscillator.

RT-6

(1) Blue position - 3 to 7 mc

(2) Red position - 7 to 16.5 mc

RT-6A

(1) Blue position - 4.5 to 10 mc

(2) Red position - 10 to 22 mc

b. FINAL BANDSWITCH - Selects desired band for final amplifier.

RT-6

(1) Blue position - 3 to 7 mc

(2) Red position - 7 to 16.5 mc

RT-6A

(1) Blue position - 4.5 to 10 mc

(2) Red position - 10 to 22 mc

e. OSCILLATOR TUNING - Tunes oscillator tank to desired frequency.

RT-6

(1) Blue scale - 3 to 7 mc

(2) Red scale - 7 to 16.5 mc

RT-6A

(1) Blue scale - 4.5 to 10 mc

(2) Red scale - 10 to 22 mc

d. FINAL AMPLIFIER TUNING - Tunes final amplifier plate tank to desired frequency.

RT-6

(1) Blue scale - 3 to 7 mc

(2) Red scale - 7 to 16.5 mc

RT-6A

(1) Blue scale - 4.5 to 10 mc

(2) Red scale - 10 to 22 mc

e. ANTENNA IMPEDANCE MATCHING SWITCH - Matches the output impedance of the final amplifier to the antenna impedance.

f. SENDING KEY- Used for hand-keying transmitter and to control the operation of the transmitter with other methods of keying.

2. CRYSTAL SELECTION

a. By using the fundamental (the RESONANT FREQ OF THE QUARTZ PLATE frequency stamped on the crystal), AND USUALLY second harmonic (two times fundamental), or third harmonic (three times fundamental) of crystals of from 3 to 7 mc, the entire frequency range (3 to 16.5 mc) of the RT-6 can be covered. Likewise, the entire frequency range of the RT-6A (4.5 to 22 mc) can be covered with crystals from 4.5 to 7.5 mc.

b. DO NOT use overmode crystals, nor operate crystals on fourth or higher harmonics.

3. ANTENNA LENGTH AND HEIGHT

a. The length of the quarter wave "L" antenna for a given frequency can be calculated from the following formulas:

$$L \text{ (feet)} = \frac{234}{\text{freq (megacycles)}}$$

L (meters) = 0.238 x wavelength

b. The antenna should be as high as possible.

c. Connect the color coded lead of the short twisted cord to the REC ANT post on the transmitter and to the ANT TERM on the receiver.

4. GROUND CONNECTION

Connect the terminal marked GND to a metal member buried in moist earth (water pipe, gas pipe, or ground stake). A GOOD GROUND IS DESIRABLE

5. TUNING (Refer to Figure 9)

a. Plug a crystal into the socket marked CRYSTAL. Its fundamental operating frequency must be either:

(1) The same as the desired broadcast frequency (fundamental operation),

(2) One-half the desired broadcast frequency (2nd harmonic operation), or

(3) One-third the desired broadcast frequency (3rd harmonic operation).

b. Set the oscillator and final bandswitches to the desired broadcast band. Both switches must be set to the same color.

In the RT-6:

Blue position covers frequencies from 3 to 7 mc.

Red position covers frequencies from 7 to 16.5 mc.

In the RT-6A:

Blue position covers frequencies from 4.5 to 10 mc.

Red position covers frequencies from 10 to 22 mc.

c. Set oscillator and final amp tuning dials as closely as possible to the desired broadcast frequency. Both dials must be set to the same color scale.

(1) The dials are calibrated in megacycles.

(2) The blue scale covers the same frequencies as covered by the blue position of the bandswitch.

(3) The red scale covers the same frequencies as covered by the red position of the bandswitch.

d. Set RECVR-TRANS switch on the Filter-Accessory Unit RA-6(*) to TRANS. (See Figure 10).

e. Turn antenna impedance matching switch to TUNE (zero). This disconnects the antenna and reduces radiation to a minimum while tuning up transmitter.

f. Press sending key and retune final amp tuning dial slightly to obtain distinct increase in brilliance of FINAL TUNE FOR MAX indicator. Release key.

g. Press sending key and retune osc tuning dial slightly to obtain distinct increase in billiance of OSC TUNE FOR MAX indicator. If pronounced brilliance peak is not noted on indicator (as may be the case

when using third harmonic of crystal) repeak oscillator tuning dial for peak brilliance of FINAL TUNE FOR MAX indicator. Release key.

h. Press sending key down and turn antenna impedance matching switch to position where ANT ADJ MAX indicator glows brightest. Release key.

i. Press sending key down and retune final amp tuning dial slightly for peak brilliance of ANT ADJ MAX indicator. Release key.

6. KEYING

a. The transmitter is keyed:

(1) by the attached sending key (Figure 9) at up to 40 wpm.

(2) by half-way inserting a bug key into the KEY JACK (Figure 9) and leaving the sending key out. Up to 40 wpm are realisable.

(3) by completely inserting an automatic tape keyer into the KEY JACK (Figure 9) and leaving the sending key out. Up to 60 wpm are realizable.

b. Break-in operation is provided on the TRANS position of the RECVR-TRANS switch. When the attached sending key or the bug key is released, the receiver will operate. Automatic switching of the antenna from the transmitter to the receiver is accomplished by the keying relay. The antenna signal is fed to the receiver through the color coded lead in the twisted cord connected between the ANT TERM on the receiver and to the REC ANT post on the transmitter. When the RECVR-TRANS switch is in the RECVR position, it is necessary to connect the antenna directly to

ANT TERM on the receiver.

c. Sidetone for monitoring the transmitted signal is fed to the earset by the twisted cord lead inserted in the MONITOR post on the transmitter and clipped to the upper phones connector pin.

d. The transmitter is ON when the sending key is folded into the recess on the front panel. The attached sending key, therefore must be left out when using external keying.

e. Coding of the transmitted signal is possible by inserting a frequency shift unit into the crystal socket.

SECTION III. RECEIVER RR-6(*)

1. CONTROLS & FUNCTIONS (See Figure 11)

a. VOLUME - Controls volume of received signals.

b. RANGE - Selects proper frequency band.

RR-6

Blue position 3 to 6.5 mc

Red position 6.5 to 15 mc

RR-6A

Blue position 4.5 to 10 mc

Red position 10 to 22 mc

c. TUNING - Rapidly adjusts oscillator and r-f tuned circuits to any point within receiver frequency range.

d. VERNIER TUNING - A finer control of the large TUNING dial.

e. PRESS TO CALIBRATE - Provides crystal-controlled frequency for dial calibration every 0.5 megacycle (500 Kc).

f. ADJUST CALIBRATION - Corrects error in dial calibration by moving indicator hairline with respect to the dial scale.

g. BFO - Turns 455 Kc oscillator on and off and varies pitch of audio signal produced.

2. CALIBRATING THE TUNING DIAL

a. A signal generated by a crystal-controlled oscillator in the receiver offers a means of checking the accuracy of the frequency read on the dial. By means of harmonics, the 500 Kc crystal provided signals in 500 Kc steps throughout the dial. Thus, each megacycle mark and each half-megacycle mark become a calibration point. To calibrate dial, proceed as follows:

(1) Set RECVR-TRANS switch (Figure 10) on Filter-Accessory Unit RA-6(*) to RECVR. Although calibration can be accomplished with the RECVR-TRANS switch in the TRANS position, power consumption will be less with this switch in the RECVR position.

(2) Turn the BFO dial until zero is aligned with the white mark on the housing.

(3) Hold down button marked PRESS TO CALIBRATE.

(4) Turn VERNIER TUNING until zero beat is heard. NOTE: Zero

beat is the no sound point between the two sound peaks. The VOLUME control should be set at the lowest gain setting sufficient to hear the zero beat. Higher settings may make it possible to hear erroneous spurious responses that will result in an inaccurate calibration. A beat note that sounds discordant may be an undesired spurious response. Generally, a low gain setting of the VOLUME control is sufficient at the lower frequency settings of the dial. High frequency settings of the dial usually require higher gain settings of the VOLUME control to compensate for the weaker harmonics of the 500 Kc calibration crystal at those frequencies.

(5) Turn ADJUST CALIBRATION (Figure 11) until the hairline coincides with the calibration point on the dial scale.

b. When setting the receiver to a desired frequency, first calibrate the tuning dial at the closest calibration point.

3. TUNING (Variable)

a. The receiver will operate with the RECVR-TRANS switch in the TRANS position when the transmitter is not keyed. Automatic switching of the antenna from the transmitter to the receiver is accomplished by the keying relay when the ANT TERM on the receiver is connected to the REC ANT post on the transmitter. When the RECVR-TRANS switch is in the RECVR position, it is necessary to connect the antenna directly to ANT TERM on the receiver.

NOTE: Momentarily press the sending key down after switching the RECVR-TRANS switch to the RECVR position. This must be done in order to release

the keying relay and remove B power from the transmitter. The transmitter will idle until the sending key circuit is closed when the RECVR-TRANS switch is thrown to RECVR because the short time interval between the break and make of the switch is not sufficient to open the B supply link between the receiver and transmitter through the keying relay. If this precaution is not taken, the additional current drain will unnecessarily reduce battery life.

b. Set RANGE switch (Figure 11) for proper frequency band:

RR-6

blue - low band: 3 - 6.5 mc

red - high band: 6.5 - 15 mc

RR-6A

blue - low band: 4.5 - 10 mc

red - high band: 10 - 22 mc

c. The dial scale is calibrated directly in megacycles. Use the blue scale for the low band and the red scale for the high band.

d. First tune for stations with the TUNING (coarse) control. For more precise adjustment use VERNIER TUNING, always tuning in from the low frequency direction to eliminate any error from slack in the tuning system.

e. Calibrate dial on the nearest megacycle or half-megacycle calibration point as directed in the previous paragraph. Turn BFO dial until zero is aligned with the white mark on the housing before calibrating dial.

NOTE: For a-m (voice) reception, turn BFO clockwise to OFF.

f. Set dial to desired frequency and then retune slightly, if necessary, for best reception.

4. TUNING (Crystal)

a. Plug specified crystal in CRYSTAL CONTROL socket (Figure 11).

NOTE: Oscillator frequency is 455 Kc higher than the received frequency. The fundamental, the second harmonic, or the third harmonic of a crystal may be used.

b. Tune receiver to working frequency and proceed as above.

5. LOG SCALE

a. Signals may be accurately logged to three figures through the use of the LOG SCALE.

(1) After station is accurately tuned in, note the position of the white horizontal line with respect to the numerals 0, 1, or 2 located to the left of the dial scale window. These numerals represent the first digit of the log scale.

(2) Read and record the numeral located immediately above the white horizontal line on the window for the first digit. Read and record the other two digits on LOG SCALE.

(3) Once a station is logged in, the tuning dial may be re-set by these numbers for future location of the station.

CHAPTER 3

MAINTENANCE

SECTION I. RECEIVER RR-6(*)

1. CIRCUIT DESCRIPTION (See schematic, Figures 12 & 13)

Receiver RR-6(*) is an eight-tube superheterodyne, two-band receiver. The incoming signal is amplified by a 5899 tuned r-f stage (V1) and is transformer coupled to the mixer grid. The transformer has both mutual and capacity coupling. In addition to selecting the desired coils, the bandswitch prevents resonant suck-outs from occurring by shorting the low band coils when not in use. The 5899 local oscillator (V2) is a tuned plate type when used as a variable oscillator and is a Pierce electron coupled type when crystal controlled. When used with crystal control, the plate tank tunes to the desired harmonic of the crystal. Normally the circuit is that of a variable oscillator. It is converted to crystal control by inserting the crystal into the socket (X1). A switch in the socket automatically makes the necessary circuit changes.

Oscillator injection is accomplished inductively by small coupling loops on the oscillator and r-f transformer coil forms. Very loosely coupled double-tuned i-f transformers (T7, T8, and T9) operating at 455 Kc are used; the primaries of T8 and T9 are center-tapped to reduce plate loading. This design results in a very narrow band receiver. The mixer i-f transformer (T7) primary tap is not used because of the need for effective bypassing of the high frequency components in the mixer plate

circuit. Two i-f stages (V4 and V5) are used, not so much to achieve gain, but to obtain selectivity. Large unbypassed cathode resistors (R13 and R18) are used in the i-f stages in order to reduce the gain to a usable value.

Plate detection is used in the 2nd detector (V6) in order to reduce loading of the 3rd i-f transformer (T9) and thereby maintain utmost selectivity. An i-f filter consisting of R23 (56K), C39 (.001), and C40 (56mmf), is in the plate of the 2nd detector to prevent i-f energy from getting into the audio amplifier. Capacitor C40, in conjunction with C51, also controls the feedback for the 500 Kc crystal calibrator.

By means of a capacity probe, the signal from the Hartley BFO stage (V8, 5718) is injected into the detector grid. This signal mixes with the 455 Kc i-f frequency and produces an audio beat in the output of the second detector. The audio beat is applied to the audio amplifier (V7, 5718) and reaches the headphone. When the BFO is turned off, C49 is shorted out and the frequency of the tank is lowered to approximately 400 Kc, which is far enough away in frequency to be rejected by the i-f amplifier. Any signal which does get to the detector produces a beat outside the audio range. With the BFO "off" the receiver can operate on a-m signals. The frequency of the BFO is changed rather than turning it off in order to provide the negative d-c voltage required by the volume control. A germanium crystal detector (CR1) in the BFO stage rectifies part of the oscillator tank voltage. This rectified voltage is applied as fixed bias to the detector, V6, and is also applied to the VOLUME control, R28, to control the bias of the r-f and i-f stages.

The audio output stage, V7, is also used as a 500 Kc, crystal-controlled oscillator to provide an accurate signal for checking the calibration of the dial. Sufficient harmonics are generated to provide 500 Kc check points throughout the two bands. The stage is converted to a Pierce-type oscillator by the PRESS TO CALIBRATE button, which connects the crystal (Y2) between the grid and plate. The signal is fed back to the r-f end of the RR-6 by a capacity probe and to the r-f end of the RR-6A by C (2.2 mmf).

2. CORRECTIVE MAINTENANCE OF RECEIVER

Because of the compactness of the RR-6(*) receiver, the difficulty of repairing various sections of the unit, and the ease with which new troubles can be created in the unit in the process of changing parts, it is very important that a careful analysis of the exact location of the fault be made before any substitution of parts is attempted.

The nature of the specific trouble will determine the steps to be taken in the analysis process. The general method of attack is to first determine the faulty section and then locate the defective component. A trouble-shooting chart is supplied as an aid in locating trouble. This chart lists the symptoms which the serviceman may observe while making a few tests. The particular stage or circuit that may be defective is indicated in the second column. Voltage and resistance measurements of the defective circuit should ordinarily be sufficient to isolate defective components not specifically mentioned.

RECEIVER RR-6(*) TROUBLE-SHOOTING CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
Too much variation in gain across band.	Mistracking.	Realign.
	Mistracking due to bent plates in antenna or r-f sections of variable capacitor.	Replace variable capacitor and realign.
	Insufficient oscillator injection in mixer at low end of band.	Replace oscillator tube.
	Insufficient injection due to open link circuit.	Replace or repair oscillator coil or mixer coil.
500 Kc crystal calibrator inoperative.	Defective crystal.	Replace.
	Defective switch.	Replace.
No calibration beats at upper end of high band.	Weak crystal.	Replace.
	Open feedback capacitor C40 or C27.	Replace.
Spurious beats 45 Kc above or below correct beat when using crystal calibrator.	Open capacitor C39.	Replace.
	Volume control set for too much receiver gain.	Reduce volume control setting.
Beat note produced on calibration check sounds broken up and does not change pitch with tuning of variable capacitor.	Volume control set for too much receiver gain.	Reduce volume control setting.
Low sensitivity.	Low i-f gain.	Realign i-f transformers.
	Low r-f gain.	Realign antenna and r-f coils.

RECEIVER RR-6(*) TROUBLE-SHOOTING CHART (CONT.)

SYMPTOM	PROBABLE CAUSE	REMEDY
Low sensitivity (cont.)	Insufficient oscillator injection in mixer.	Replace oscillator tube.
	Open oscillator injection link (usually broken at coil terminal).	Repair or replace coil.
	Low detector gain.	Change tube.
	Too high fixed bias on detector.	Repair bfo.
	Open r-f or i-f bypass: C32 or C12.	Replace.
	Open antenna coil.	Replace or repair.
Audio output low.	Bias on detector less than 3.0 volts.	Repair bfo.
High noise output.	I-f amplifier cathode resistor shorted to ground.	Remove short.
Gain control not effective on strong signals.	Short to ground at i-f transformer grid return lug.	Remove short.
	Shorted bypass capacitor C32, C35, or C12.	Replace.
	Bfo not operating or operating weakly.	Repair bfo.
	Bfo signal not rectified.	Replace 1N34 crystal.
Dial calibration off.	Improper oscillator alignment.	Realign receiver.
	Bent oscillator plates in variable capacitor.	Replace gang.

RECEIVER RR-6(*) TROUBLE-SHOOTING CHART (CONT.)

SYMPTOM	PROBABLE CAUSE	REMEDY
No beat heard on cw signal.	Bfo coil improperly aligned.	Align bfo coil.
	Bfo trimmer shorted.	Remove short.
Squeal heard on a-m signal reception.	Bfo trimmer shorting stop bent or broken.	Replace bfo trimmer.
Fine tuning mechanism binds when rotating large dial by hand.	Rubber idler shaft in fine tuning mechanism improperly aligned.	Remove assembly and adjust.
	Screw holding fine tuning bracket and earphone jack to post loose.	Tighten screw.
	Pivot bolt on fine tuning assembly too loose.	Take out looseness by tightening nut.
No B+	Broken wire in plug.	Repair.
No filament voltage.	Broken wire in plug.	Repair.
B+ much higher than 105 volts.	Defective voltage regulator tube in filter unit.	Replace.

Use of the Signal Input Chart will make it possible to locate the defective section to correct a set having low overall gain.

Low overall gain could be the result of trouble in any of the following sections: the audio amplifier, the detector, the i-f amplifiers or the antenna coil. The first step would be to measure the sensitivity of the

receiver at the various stages starting with the antenna input and proceeding toward the audio output stage. By consulting the Signal Input Chart, the nominal input at each grid is known for 5 mw of audio output. A .01 mf capacitor should be connected in series with the hot lead of the signal generator so as not to upset the bias at the test signal input points. The gain of the audio stage can be measured best with an audio oscillator such as a Hewlitt Packard model 200C.

The conversion gain of the mixer stage may be low due to insufficient oscillator injection voltage. With the oscillator grid, pin 1 of V2, shorted to ground, measure the contact potential at the grid, pin 1, of the mixer tube, V3, using the d-c probe of a vacuum tube voltmeter. The residual contact potential usually measures from .5 to .8 volts. Remove the short from the oscillator and observe the rise of potential on the mixer grid. The oscillator injection voltage should result in a rise of .5 volt or more above the residual contact potential. Any value less than this value would indicate insufficient injection of the oscillator signal.

SIGNAL INPUT CHART

Signal generator output connection.	Frequency (mc) 400 cps 30% modulation.		Signal generator output (mv).	
	RS-6	RS-6A	RS-6	RS-6A
Antenna terminal through a ___ ohm resistor.	4.1 9.0	7.0 16.0		
RF grid, pin 1, V1.	4.1 9.0	7.0 16.0		
Mixer grid, pin 1, V3.	4.1 9.0	7.0 16.0		

SIGNAL INPUT CHART (CONT.)

Signal generator output connection.	Frequency (mc) 400 cps 30% modulation. RS-6(*)	Signal generator output (mv). RS-6(*)
Mixer grid, pin 1, V3.	.455	
1st i-f grid, pin 1, V4.	.455	
2nd i-f grid, pin 1, V5.	.455	
Det grid, pin 1, V6.	.455	
Audio grid, pin 1, V7.	1000 cycles	

A diagram of point to point resistance measurements on the r-f band-switch is provided to locate defective coils with the least difficulty. See figure 00. It is advisable to obtain an ohmmeter capable of accurate readings down to .01 ohms such as the _____. If such a meter is not obtainable, a makeshift low range ohmmeter can be constructed and calibrated as shown in figure 00.

Idea ok
insert

3. ALIGNMENT

a. Equipment Required

(1) AM signal generator having:

(a) accurately calibrated, adjustable output.

(b) 400 cycle, 30% modulation.

(2) Output power meter, GR type 583-A or equivalent.

(3) Non-metallic screwdriver with 1/8" blade (for i-f transformers).

(4) Small size screwdriver to fit antenna, r-f, and oscillator transformers.

(5) Medium size screwdriver with blade ground to fit trimmer slots without play. Blade should not ride in bottom of slot.

b. Procedure

(1) Connect the equipment, as directed in Chapter 2, Section I (do not connect phone when the output meter is used, as the output impedance will be reduced by one-half).

(2) Set RECVR-TRANS switch on Filter-Accessory Unit RA-6(*) to RECVR.

(3) Expose bottom alignment adjustments as follows (see Figure 14):

(a) i-f - slide cover plate to right.

(b) bfo - turn cover plate counterclockwise.

(c) r-f - remove two screws and cover plate.

(4) Connect the output meter across the phones terminals J2. Set the "ohms" knob to 40 and the impedance multiplier to 100. Set the meter multiplier to 1.

NOTE: Throughout the alignment procedure, reduce the generator output to a level which produces about 5 mw output indication on the output meter to avoid overloading the receiver.

(5) Remove the top cover and turn VOLUME control to maximum volume.

(6) Refer to Figure 14 for adjustment locations.

(7) Remove glyptal from the cores and trimmers in the r-f section with thinner. If thinner doesn't loosen the core sufficiently, apply the heat from a soldering iron.

c. IF Alignment

(1) Connect the AM generator to the grid of the mixer (pin 1, V3 - See Figure 15 - RF panel front view) and set it to 455 Kc with 400 cycle, 30% modulation.

(2) Set generator output high enough to give about 5 mw output on the meter.

(3) Tune the primaries and secondaries of T9, T8, and T7 for maximum output on meter. (See Figure 14).

(4) The i-f sensitivity is normal if a generator output of 100 microvolts or less produces 5 mw output.

d. BFO Alignment

(1) With equipment connected as above, turn off generator modulation, and set BFO dial to zero. (The zero on the dial should be at three o'clock when viewed as in Figure 14.)

(2) Adjust bfo coil (L2) for zero beat.

(3) After alignment of bfo, apply glyptal to the slug.

e. RF Alignment

(1) Replace top cover which was removed during i-f alignment, and place receiver on side.

(2) Connect generator to the ANT-GND terminals (J1). Use a 270 ohm carbon resistor (dummy antenna) in series with the antenna terminal.

NOTE: This value is for a 30-ohm generator. If generator output impedance is other than 30 ohms, subtract the generator impedance from 300 ohms for the correct value of dummy antenna.

(3) Turn BFO dial to OFF.

(4) Set low-band trimmers C10, C16, and C26 so that screwdriver slots are parallel to the long edge of the compartment. This represents the mid-capacity positions.

(5) Turn the TUNING dial clockwise until it reaches the end stop (low frequency end). Then turn the VERNIER counterclockwise slightly to take up any motion in the drive.

(6) Turn ADJUST CALIBRATION knob until hairline passes through

the approximate center of the circle at the bottom of the dial window.

(7) Set the generator frequency for alignment of the RS-6 to 3.5 mc (RS-6A to 5.0 mc) and the generator output at 100 microvolts, with 400 cycle, 30% modulation.

(8) Set RANGE switch to "blue" position (3 to 6.5 mc for the RS-6) (4.5 to 10 mc for the RS-6A).

(9) Set the receiver tuning dial of the RS-6 at 3.5 mc (RS-6A at 5.0 mc).

(10) Tune the oscillator slug in T 5 for maximum output on the meter.

CAUTION: Do not turn slug too far into the coil; when turning becomes difficult do not force, as damage to terminal assembly may result.

NOTE: For final adjustment of slug, reduce the generator output until a receiver output of 5 mw is obtained.

(11) Tune the slugs in T1 (antenna), T3 (r-f) and T5 (oscillator) for maximum output.

(12) Set receiver and generator dials for alignment of the RS-6 at 6.0 mc (RS-6A at 9.5 mc).

CAUTION: There will be two generator frequencies which will produce an output indication. One will be near the frequency setting of the receiver and the other, the image frequency, will be 0.91 mc higher. The lower one is the correct alignment frequency.

(13) Adjust oscillator trimmer (C16) and antenna trimmer (C10) for maximum output.

(14) Since the r-f trimmer (C26) has some pulling effect on the oscillator, it will be necessary to find the true resonant frequency of the r-f tank by a "rocking" procedure as follows:

(a) Note output reading on meter.

(b) Turn r-f trimmer (C26) slightly counterclockwise until the output drops approximately one-third to one-half.

(c) Readjust oscillator trimmer (C16) for maximum output.

(d) If maximum reading is higher than that in step (a), repeat steps (a), (b), and (c), until the highest output is obtained. Lower the generator output as required to keep the output around 5 mw.

(e) If in step (d) the maximum reading is lower than that in step (a), it indicates that the r-f resonance has been passed. In this case, repeat steps (a), (b), (c), and (d), turning r-f trimmer (C26) clockwise instead of counterclockwise.

(15) After the true r-f resonance has been found, recheck the alignment of T1, T3, and T5 at 3.5 mc for the RS-6 (5.0 mc for the RS-6A).

(16) If, while rechecking the alignment at the low alignment point on the dial (3.5 mc for the RS-6) (5.0 mc for the RS-6A), it was necessary to move any of the slugs (T1, T3, or T5), recheck the alignment at the high alignment point on the dial (6.0 mc for the RS-6) (9.5 mc for the RS-6A).

NOTE: Due to the extreme accuracy desired in this receiver, it is well to recheck the alignment at both the low and high alignment points on the dial three times. After the first alignment the r-f resonance should be close enough to the true resonance so that only the oscillator trimmer and slug need be re-adjusted.

(17) After the low band has been accurately aligned, apply glyptal to the low-band trimmers and slugs.

(18) Set RANGE switch to "red" position (6.5 - 15 mc for the RS-6) (10 - 22 mc for the RS-6A).

(19) Set receiver and generator dials at 7.0 mc for the RS-6 (10.5 mc for the RS-6A).

CAUTION: Check for image frequency as in step 12.

(20) Turn trimmers C11, C17, and C29 so that slots are parallel to long edge of compartment.

(21) Tune oscillator slug in T6 for maximum output.

CAUTION: Do not force slug into the coil.

(22) Tune T2, T4, and T6 slugs for maximum output.

(23) Set the generator and receiver dials at 14.5 mc for the RS-6 (21 mc for the RS-6A).

(24) Adjust oscillator trimmer (C17) and antenna trimmer (C11) for maximum output.

(25) Repeat "rocking" procedure as in step 14 to find the true resonant frequency of the r-f tank. In this case, however, adjust r-f trimmer C29, and oscillator trimmer C17.

(26) Repeat the alignment at both the low and high alignment points on the dial three times.

(27) Replace glyptal on trimmers and slugs.

(28) The set when properly aligned will have a sensitivity on both bands of less than 20 microvolts for 5 milliwatts output.

f. Alignment by Crystal

The receiver may be aligned in the field by replacing the a-m signal generator with the radiated signal from the calibrating crystal and by using the phone as an output indicator. The alignment procedure is the same as with the generator except that the bfo is turned on. The gain of the receiver must be reduced sufficiently after the beat is located to permit hearing a change of volume when the adjustments are made.

If aligned on the image, the dial calibration will be off, and large sensitivity variations will be noticed over the band. Aligning on an image or wrong harmonic of the crystal will result in an abnormal position of the coil slugs and trimmers. The slugs normally extend 1/16" to 3/16" beyond the end of the coil base. The slots in the trimmers are normally less than perpendicular to the long edge of the compartment. A slot perpendicular to the long edge would very likely indicate that the set is misaligned.

4. DIAL SCALE MECHANISM - DISASSEMBLY AND REASSEMBLY (REFER TO FIGURE 17)

a. DISASSEMBLY

(1) Lift frequency channel indicator (B) up at large end, and slide out of spring clamp (D).

(2) Remove screws (J) and remove assembly consisting of (A), (C), (D), AND (L).

(3) Remove three screws (K).

(4) Push vernier (E) in direction indicated until it clears dial. Hold it in position until dial scale has been removed.

(5) Remove dial by lifting straight up as it fits snugly on hub.

b. REASSEMBLY

(1) Replace dial, placing pin in hole (F).

(2) Replace screws (K).

(3) Replace assembly consisting of (A), (C), (D), and (L) and screws (J).

(4) Turn dial until tuning capacitor is fully meshed.

(5) Hold spring (A) back and insert end of frequency channel indicator (B) into spring clamp (D) until the white line (G) falls over the line between the top two scales on dial.

(6) Engage pinion gear (H) with rack gear teeth on rear of

frequency channel indicator (B).

(7) Make sure end loop on spring (A) rests on top of frequency channel indicator (B).

SECTION II. TRANSMITTER RT-6(*)

1. CIRCUIT DESCRIPTION (See Schematic, Figure 18)

Transmitter RT-6(*) is a two-stage, crystal-controlled, CW transmitter. It has two bands with variable capacitors that provide oscillator and final tuning.

A keying relay is employed in the RT-6(*) to switch the necessary circuits for break-in operation. Closing the key removes the blocking bias from the cathode of V101 (6AG5) causing oscillations to develop in the modified Pierce electron-coupled oscillator stage. A keying filter consisting of C101 (1 mf), R102 (68K), and LR101 (80 uh, 68Ω) in the oscillator circuit and C116 (5 mf), and the cathode circuit resistance in the RF power amplifier stage properly shapes the keyed character to eliminate "clicks". Cathode current from the r-f power amplifier V102 (2E26) flow through the relay coil. The relay armature is held when the transmitter is not keyed. Closing the key shorts the relay coil, bypassing the 2E26 cathode current to ground, and releases the relay armature. This switches B power from the receiver and applies the B power to the 6AG5 oscillator and to the neon bulb relaxation oscillator (E104) which develops the sidetone for monitoring the transmitter. Releasing the relay armature also switches the antenna from the receiver to the transmitter. When the key is closed, the terminal labeled REC ANT is grounded through C114 (.01 mf) to prevent stray coupling of the transmitted signal from paralyzing the receiver. The added resistance of the relay coil is sufficient to increase the cathode bias of the 2E26 to prevent excessive power from being dissipated in the r-f power amplifier when no grid drive is applied.

A bug key when inserted halfway into the KEY JACK will operate the relay the same as the attached sending key. The automatic tape keyer when inserted all the way into the KEY JACK shorts out the relay and adds into the 2E26 cathode circuit a 1200 ohm resistor which holds the plate current to a safe value in the key up position. In the key down position, this resistor is shorted out.

L102, in the plate of the power amplifier is a parasitic suppressor.

A five-position rotary switch provide a range of output impedances for maximum antenna output. Each position doubles the impedance of the previous position from 75 ohms on position 1 to 1200 ohms on position 5. An incandescent bulb, E103, serves as an output power indicator.

The resonant frequency of the oscillator and final amplifier plate tanks is indicated by the maximum glow of two neon bulbs, E101 and E102, respectively.

2. CORRECTIVE MAINTENANCE OF TRANSMITTER

A trouble-shooting chart for the transmitter is supplied as an aid in locating trouble. Voltage and resistance measurements of the defective circuit should ordinarily be sufficient to isolate defective components not specifically mentioned.

TRANSMITTER RT-6(*) TROUBLE-SHOOTING CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
Low power output.	Low oscillator output.	Replace 6AG5.
		Replace C106.
	Defective crystal.	Replace crystal.
	Weak 2E26.	Replace.
	Open output indicator.	Replace.
	Shorted coil turn (check coil at taps).	Remove short.
Limited tuning range.	Shorted coil turn.	Remove short.
Low harmonic output.	Defective crystal.	Replace.
Poor keying waveform.	Open C101 or C112.	Replace.
	Defective crystal.	Replace.
No sidetone.	Defective neon bulb.	Replace.
No break-in operation.	Receiver B- relay contact not making contact.	Readjust contact or replace relay.
No B+	Jumper open between pins 2 and 6 on transmitter cable plug.	Repair.

The power output of the transmitter is dependent upon the frequency of the signal transmitted. The following table lists the nominal output at various frequencies.

RT-6

Band	Frequency (mc)	Output (watts)
Low	3.0 4.0 5.0 6.5	
High	7.0 8.0 10.0 12.0 15.0	

RT-6A

Band	Frequency (mc)	Output (watts)
Low	4.5 6.0 8.0 10.0	
High	10.0 14.0 18.0 22.0	

3. SENDING KEY ADJUSTMENT

The sending key spring tension adjustment is the screw below the chassis nearest the knob of the sending key shown in Figure 19. The degree of spring tension preferred by different operators varies. The spring tension should be sufficient to cause the key to open immediately when the pressure is released and yet not so great as to require the expenditure of unnecessary energy.

The sending key gap adjustment is the screw on the chassis to the rear of the spring tension adjustment screw. See Figure 19. The gap between the contacts if too narrow, will result in a jittery style of sending or, on the other hand, if too wide, will result in a sluggish sending style.

Excessive play at the hinge provided for folding the key into the case can be taken up by tightening the screw and lock-nut at the pivot point.

SECTION III. POWER SUPPLY RP-6(*)

1. CIRCUIT DESCRIPTION (See Schematic Diagram, Figure 20)

a. AC - An eight-tap primary on the transformer provides for a wide range of input voltages at frequencies from 40 to 400 cps. The secondary voltage is rectified by a full-wave rectifier tube (6X4) and passed on to the Filter-Accessory Unit RA-6(*).

b. Battery - The 6-volt dc is converted to ac and stepped up by the vibrator and transformer. It is rectified by a type 6X4 rectifier tube

and passed on to the Filter-Accessory Unit RA-6(*). L201, L202, C203, C204, C205, and the ground strap serve as hash suppressors.

c. Battery Charging - A tap on the low voltage winding of the transformer provides a suitable voltage for charging a battery by means of a full-wave selenium rectifier (CR201), which is contained in the unit. The charging rate depends upon the charge in the battery being a minimum of 3.5 amperes when the electrolyte has a specific gravity of 1.180 and gradually dropping by 0.8 ampere as the specific gravity increases to 1.280.

2. HOW TO REPLACE VIBRATOR

a. Loosen nut shown in Figure 21.

b. Tilt chassis up as shown and take off the clamp holding the vibrator in the socket by removing the two screws at the ends of the clamp.

c. Remove the vibrator.

3. HOW TO REPLACE POWER TRANSFORMER (SEE FIGURE 22)

a. Disconnect all leads from transformer terminal strips.

b. Remove hex spacer nuts (A, Figure 22).

c. Lift out transformer.

SECTION IV. FILTER-ACCESSORY UNIT RA-6(*)

1. CIRCUIT DESCRIPTION (See Schematic Diagram, Figure 23)

a. AC Operation - The Filter-Accessory Unit RA-6(*) filters the dc from the power supply and delivers it to the transmitter and receiver. Two 5644 (or 5787) voltage regulator tubes provide regulation for the receiver supply. The filter unit provides four output voltages.

(1) 6.3 v ac at 2.4 amperes for filaments

(2) 400 v dc at 75 ma (unregulated) for the transmitter

(3) two 90 v dc at 25 ma (regulated) taps for the receiver.

The B supply for the transmitter or the receiver is chosen by a DPDT switch marked RECVR-TRANS. When in the RECVR position, power is applied only to the RECVR. When in the TRANS position, power is applied to the transmitter and also to the receiver through the break-in relay when not transmitting.

b. Battery Operation - Filter-Accessory Unit RA-6(*) performs the same under battery operation as under ac. The output voltages are also the same except that the filament voltage is dc instead of ac and is furnished by the battery.

c. Interlock - An interlock is provided by the plug connections to avoid damage to the rectifier or input filter capacitor should the input power be applied when no load is connected to the power supply output.

If the power is applied to Power Supply RP-6(*) alone, both the filaments and cathode of the rectifier are open due to S03 being disconnected.

If only Filter-Accessory Unit RA-6(*) is connected to the power supply, there are two conditions possible:

(1) With the toggle switch set at TRANS, the rectifier filaments are connected but the cathode is open due to S05 being disconnected.

(2) With the toggle switch set at RECVR, the rectifier cathode is connected to the input filter capacitor; however, the filter output is connected to the voltage regulator stages, and the load is sufficient to keep the voltage across the input capacitor at a safe value.

2. HOW TO DISASSEMBLE

a. Remove two flat head screws from bottom of housing.

b. Remove three screws on cover (A, Figure 10).

c. The chassis can then be lifted from the housing and serviced without disconnecting the choke leads.

d. To remove choke, remove two binderhead screws on bottom of housing, and lift out.

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SECTION V. PACKAGING

1. HOW TO REPLACE UNITS IN PLASTIC POUCH

a. When not in use, or when transporting, the units should be kept in the plastic pouches provided, as shown in Figure 25. The pouches ~~are waterproof if folded in the prescribed manner~~. WILL RESIST THE ENTRANCE OF WATER IF THEY ARE FOLDED IN THE PRESCRIBED MANNOR.

b. There are two sizes of pouches - two large ones for Transmitter RT-6(*) and Receiver RR-6(*) and two small ones for the Power Supply RP-6(*) and Filter-Accessory Unit RA-6(*). All are used as shown in Figure 25.

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