TM 11-4006

WAR DEPARTMENT TECHNICAL MANUAL

RADIO RECEIVER AND TRANSMITTER BC-474-A,

REPAIR INSTRUCTIONS

RESTRICTED. DISSEMINATION OF RESTRICTED MATTER.
No person is entitled solely by virtue of his grade or position to knowledge or possession of classified matter. Such matter is entrusted only to those individuals whose official duties require such knowledge or possession. (See also paragraph 23b, AR 380–5, 15 March 1944.)

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United States Government Printing Office
Washington: 1945

WAR DEPARTMENT

Washington 25, D. C., 10 May 1945

TM 11–4006, Radio Receiver and Transmitter BC–474–A, Repair Instructions, is published for the information and guidance of all concerned.

[AG 300.7 (12 Apr 45)]

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Refer to FM 21–6 for explanation of distribution formula.

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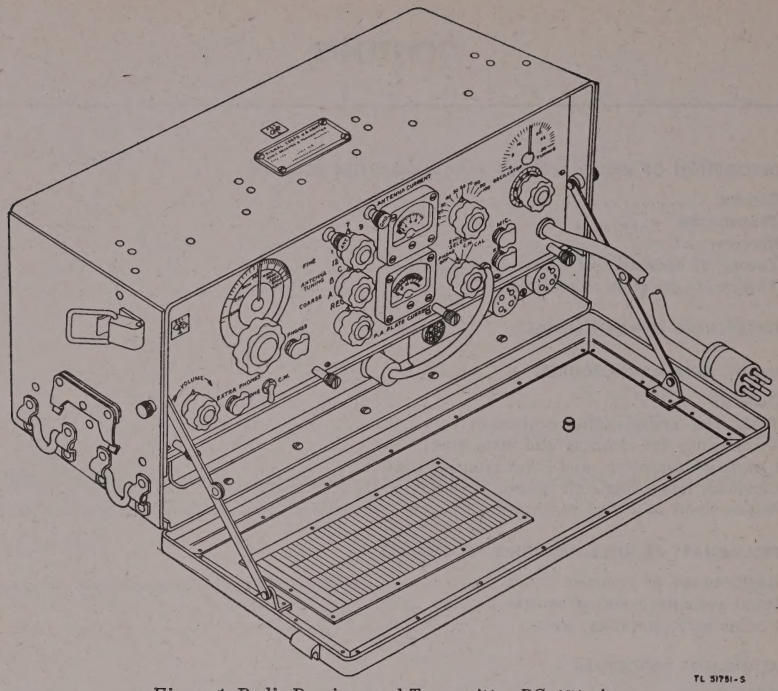


Figure 1. Radio Receiver and Transmitter BC–474–A.

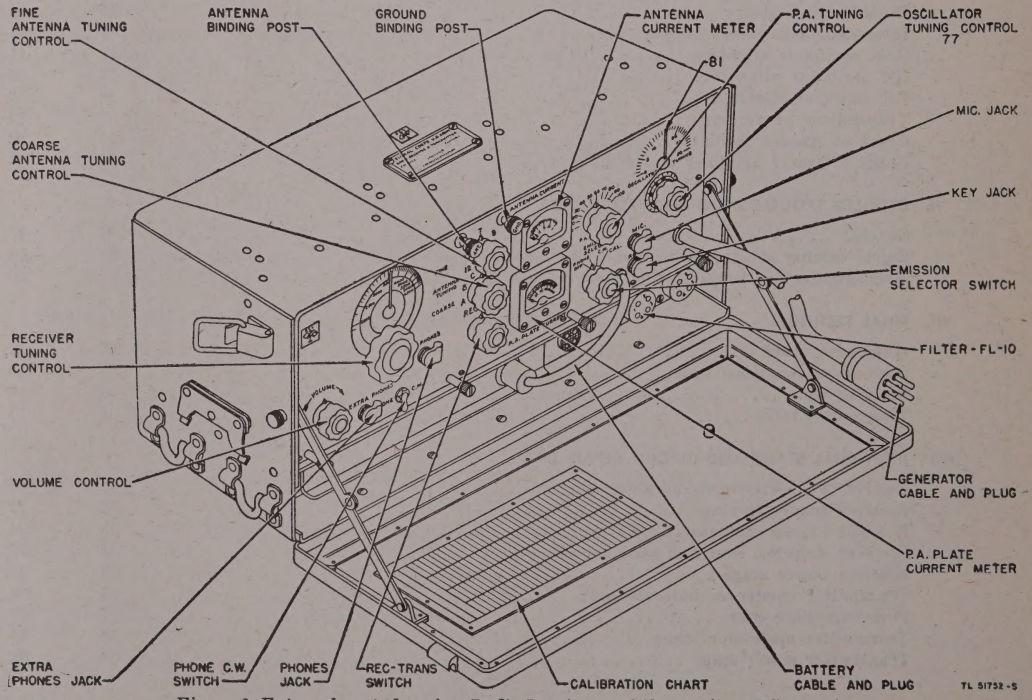


Figure 2. External parts location, Radio Receiver and Transmitter BC–474–A.

SECTION I

DESCRIPTION OF RADIO RECEIVER AND TRANSMITTER BC–474–A*

1. General

Radio Receiver and Transmitter BC–474–A (figs. 1 and 2), a component of Radio Set SCR–288, is a portable amplitude-modulated transmitter and receiver. It transmits and receives both voice-modulated (phone) and c-w (continuous-wave) signals.

2. Transmitter

a. USE. Radio Transmitter BC–474–A is used for ground operation.

b. FREQUENCY RANGE. The 3-tube transmitter is designed to operate within the frequency range of 3,500 to 6,300 kc (kilocycles).

c. OPERATING RANGE. The operating range is 15 miles for c-w operation and 8 miles for voice-modulated operation.

d. POWER INPUT. Power is furnished by hand-operated Generator GN–44–A which supplies 290 volts dc (direct current) to the plate circuits and 6.6 volts dc to the heater circuits.

e. POWER OUTPUT. The output of the transmitter is 4 watts for either phone or c-w operation. A 35-foot antenna and a 35-foot counterpoise are required for rated performance.

3. Receiver

a. USE. Radio Receiver BC–474–A is used for the reception of phone or c-w transmissions. Four tubes are employed in a superheterodyne circuit.

b. FREQUENCY RANGE. The frequency range of the receiver is from 2,300 to 6,500 kc.

c. POWER INPUT. Power is furnished by a dry cell power pack consisting of a 90-volt B battery and a 1.5-volt A battery, or by hand-operated Generator GN–44–A, Filter FL–10 and Cord CD–125.

d. POWER OUTPUT. Output circuits are provided for two sets of headphones. The receiver is capable of delivering 100 milliwatts into a 4,000-ohm load.

4. Theory of Operation of Transmitter

a. GENERAL. The block diagram of the transmitter (fig. 3) shows the path of the signal from the m-o (master-oscillator) stage to the antenna and counterpoise.

b. MASTER-OSCILLATOR STAGE. The m-o stage consists of a temperature-compensated electron-coupled oscillator which employs Tube JAN–6V6GT (VT–107–A). The frequency of oscillation is determined by a tuned circuit of the Hartley type. The ouput of the oscillator is developed across a resistor in the plate circuit.

c. POWER-AMPLIFIER STAGE. The output of the m-o stage is impressed on the grid of the p-a (power-amplifier) Tube JAN–6V6GT (VT–107–A) through a coupling capacitor. The amplified output appears across the plate resonant circuit. Signal energy is coupled to the antenna through an antenna-loading coil. For c-w operation, the cathode circuit of the power amplifier is keyed.

d. MODULATOR STAGE. The microphone is inductively coupled by the input transformer to the grid circuit of modulator Tube JAN–6V6GT (VT–107–A). The amplified audio-frequency output of the modulator tube is applied to the plate and screen grid of the p-a tube through a

*See TM 11–250 for installation, operation, and other maintenance data on this equipment.

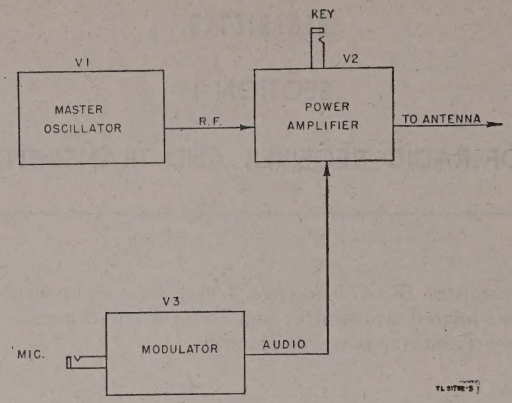


Figure 3. Transmitter block diagram, Radio Receiver and Transmitter BC–474–A.

modulation transformer. Another winding of the modulation transformer supplies sidetone to the receiver headphones. An EMISSION SELECTOR switch serves to select the type of emission desired. The first position (OFF) of this switch shuts the transmitter off. The second position (PHONE) enables the transmitter to be voice-modulated. The third position (C.W.) is for c-w operation and keying. The fourth position (CAL.) puts both the transmitter oscillator stage and the receiver on, enabling the operator to set the transmitter frequency to the frequency of a received signal.

5. Theory of Operation of Receiver

a. GENERAL. The receiver unit is a four-tube superheterodyne, capable of receiving phone or c-w signals, using either manual or automatic volume control. The signal path from the antenna input of the receiver to the output at the headphone jack, is shown in the block diagram for the receiver (fig. 4).

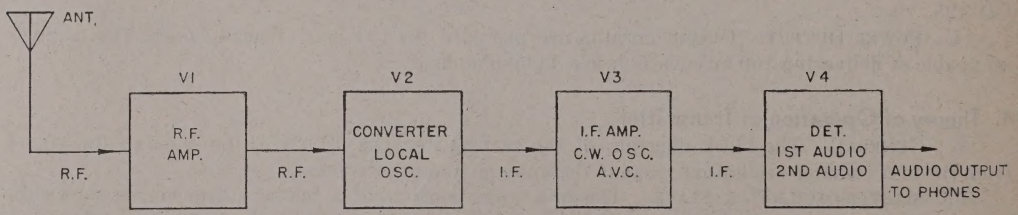


Figure 4. Receiver block diagram, Radio Receiver and Transmitter BC–474–A. TL 51763-S

b. RADIO-FREQUENCY AMPLIFIER STAGE. The input signal from the antenna is inductively coupled by a tuned r-f (radio-frequency) transformer to the grid of the r-f amplifier Tube JAN–1N5GT (VF–146), which amplifies the signal.

c. CONVERTER STAGE. The output signal of the r-f amplifier stage is inductively coupled by a tuned r-f transformer to the grid of the converter Tube, JAN–1A7GT (VT–147), which functions as an h-f (high-frequency) oscillator and mixer. In this tube, the incoming signal is mixed with the output of the high-frequency oscillator, producing an i-f (intermediate-frequency) of 455 kc.

d. INTERMEDIATE-FREQUENCY, C-W OSCILLATOR, AND A-V-C STAGE. The 455-kc output of the converter stage is inductively coupled by an i-f transformer to the grid of Tube JAN–3A8GT (VT–149). This tube consists of a pentode, triode, and diode. The pentode section acts as an i-f

amplifier. The amplified i-f signal appears in its plate circuit. The triode section is used as the c-w oscillator. The circuit is of the Hartley type and its output is capacitively coupled to the signal detector. A portion of the output of the i-f stage is capacitively coupled to the diode plates which develop a-v-c (automatic-volume-control) voltage for the grid circuits of the r-f and i-f amplifiers.

e. DETECTOR, FIRST AND SECOND AUDIO STAGES. The output of the pentode section of Tube JAN–3A8GT is inductively coupled by an i-f transformer to the diode plate of Tube JAN–1D8GT (VT–149). This tube consists of a diode, triode, and pentode. The diode detector rectifies the i-f signal and the audio component is capacitively coupled to the grid of the triode section which acts as the first audio amplifier. The amplified audio signal developed in its plate circuit is capacitively coupled to the grid of the pentode section, which is the second audio-amplifier output stage. The audio output of the pentode is coupled through the output transformer to the headphone jacks.

SECTION II

DIFFERENCES BETWEEN MODELS

(Not applicable)

SECTION III

INITIAL REPAIR PROCEDURES

6. General

Note. Before making any repairs or adjustments, all MWO's must be applied. See War Department Pamphlet 12–6 for listing of applicable MWO's.

Maintenance personnel should follow the procedure outlined in this manual when repairing and overhauling Radio Receiver and Transmitter BC–474–A. The repair information in this and the following sections is presented in the order in which the repairman should actually perform the various operations on the equipment in the repair shop. This procedure permits repair of the equipment in the shortest possible time, resulting in performance comparable to that of new equipment.

7. Tools, Test and Cleaning Equipment

The equipment listed in table I should be available for the proper repair of Radio Receiver and Transmitter BC–474–A.

Table I. Tools, test and cleaning equipment

Item	Description
Dental mirror	
Assorted hand tools	Soldering iron, pliers, screwdrivers with insulated handles, small socket wrenches, padded mallet, Allen wrenches RCA No. 14991 (fastened on inside rear of unit)
Neutralizing screwdriver	
Flashlight or probing light	
Assorted brushes	
Sandpaper	Fine grade
Crocus cloth	
Pipe cleaners	
Trimmer wrench	RCA–12,636 or equal
Grease, Lubricating, Special (GL)	
Oil, Lubricating	
Preservative, Special (PS)	
Solvent, Dry-cleaning (SD)	
Compressed air	Clean, dry, low-pressure
Battery pack	Burgess 6 TA60 or equal
Cord	CD–125
Generator	GN–44–A
Cranks (2)	For Generator GN–44–A
Legs (2)	For Generator GN–44–A
Seat and leg assembly (1)	For Generator GN–44–A
Filter	FL–10
Telegraph key with cord and plug	RCA type M1–8136–A
Microphone with cord and plug	RCA type M1–7929–2
Headset	RCA type M1–5803
Plug	PL–55
Plug	PL–68
Capacitor	Paper, 0.1 mf (microfarad), 600 volts, noninductive
Capacitor	Electrolytic, 8 mf
Capacitor	Mica, 100 mmf (micromicrofarad)
Capacitor	Mica, 150 mmf
Resistor	20-ohm, 10-watt, noninductive
Tube tester	Emission or mutual conductance type
Voltohmmeter	At least 1,000-ohm per volt sensitivity; a-c and d-c ranges to 500 volt and resistance from 1 ohm to 1 meg (megohm)
Vacuum-tube voltmeter (vtvm)	High input impedance; a-c and d-c ranges to 100 volt
Ammeter	Radio frequency; 0 to 1 amperes
Signal generator accurately calibrated such as I–72–( )	400 to 7,000 kc with 30 percent, 400-cycle modulation; attenuator calibrated in microvolts
Output meter such as in I–56–( )	4,000-ohm impedance; range 0 to 25 volts
Frequency meter such as SCR–211–( )	Range 400 to 7,000 kc
Audio oscillator	Range 0 to 3,000 cycles
Cathode-ray oscilloscope	Wide band vertical amplifier

8. Disassembly for Cleaning and Inspecting

a. REMOVAL OF CHASSIS. Loosen retainer trunk latches on sides of cabinet and lift up the lid. Unplug and remove the headphone, key, microphone, battery plugs and filter from the cabinet compartments. Withdraw battery cable from the battery socket. Detach stay-joints from the sides of the cabinet by loosening thumb knobs and fold stay-joints into the lid. Open lid fully to permit removal of chassis. Loosen the eight knurled-head panel screws holding the chassis to the cabinet, until the screws clear their threaded seats. Do not withdraw screws completely. Slide the panel forward and withdraw the chassis from the cabinet.

b. REMOVAL OF TUBES. Remove the grid clips from the four receiver tubes and lift the tubes out of their sockets with a slight rotary motion. Lift the three transmitter tubes out of their sockets.

9. Cleaning, Inspecting, and Lubricating of Chassis

a. CLEANING. Thorough cleaning of the radio set is necessary to insure optimum performance and to prevent corrosion, rust, and dirt from damaging parts or causing arc-over or low-resistance leakage between high-voltage parts and ground. Use clean, dry, low-pressure compressed air to blow out all dust particles in the unit. Use a clean brush to remove dust from corners and other spots difficult to reach. Exercise care when cleaning terminal contact points and switches, jacks, binding posts, etc. Remove corrosion from terminals, pins and unpainted parts with a fine grade of sandpaper. *Do not use abrasives on switch contacts or nickel-plated surfaces.* Apply dry-cleaning solvent (SD) with a brush to switch contact points and other parts difficult to reach. Blow out loosened particles with compressed air. Clean gears with a pipe cleaner dipped in dry-cleaning solvent (SD).

b. INSPECTION. Inspect wires for broken connections, frayed ends, shorts or poor insulation. Check resistors, capacitors, chokes, and other elements for broken parts, charred spots and other signs of overload. Inspect terminals to see that they are secure and properly soldered. Check for chipped and broken parts in sockets, plugs, switches, jacks, binding posts and other parts. Check switches for loose or bent contacts and terminal boards for broken lugs or signs of burning. Tighten all screws and nuts. Straighten dial pointers, if bent, and test to see that they are secure. Inspect tuning knobs to see that they do not rub against the panel and are securely fastened on the shafts. Tighten the set screws. See that panel switches snap firmly into place at each contact position. Straighten all bent parts of chassis. Repaint all painted surfaces that are worn or chipped.

c. LUBRICATING. Use lubricants sparingly. After cleaning gears with compressed air and dry-cleaning solvent (SD) applied with a brush, lubricate with machine gear grease. Grease, Lubricating, Special (GL). *Do not use oil.* Lubricate switch contacts lightly with Oil, Lubricating, Preservative, Special (PS), applying oil with a clean brush.

10. Cleaning, Inspecting, and Testing of Tubes

Remove shield from Tube JAN–1D8GT (V–4). Note position of grounding clip and be sure to place it over the same pin when replacing shield. Clean pins of each tube with dry-cleaning solvent (SD) applied with a brush. For heavier corrosion, use crocus cloth applied with care on nickel-plated surfaces of pins. Inspect tubes for bent pins, and for internal and external breaks. Shake tube to detect loose pins and other loose elements. Check each tube on a tube tester, allowing sufficient time for tube to warm up. Tap each tube gently during the test for loose and defective elements.

11. Replacement of Defective Parts

a. Before replacing any part which, on inspection, indicates improper electrical operation, or signs of overload, such as charring and burning, make a thorough electrical check of the circuit to discover the cause of the improper operation. Check voltages and resistances, referring to the tube socket voltages and resistances (fig. 5), and correct trouble before replacing defective parts.

b. Replace all wires having charred or poor insulation. Resolder all poor or broken connections. Replace all defective tubes, resistors, capacitors, coils, transformers or other elements with new ones. Replace all missing or defective screws, washers, nuts, and other parts.

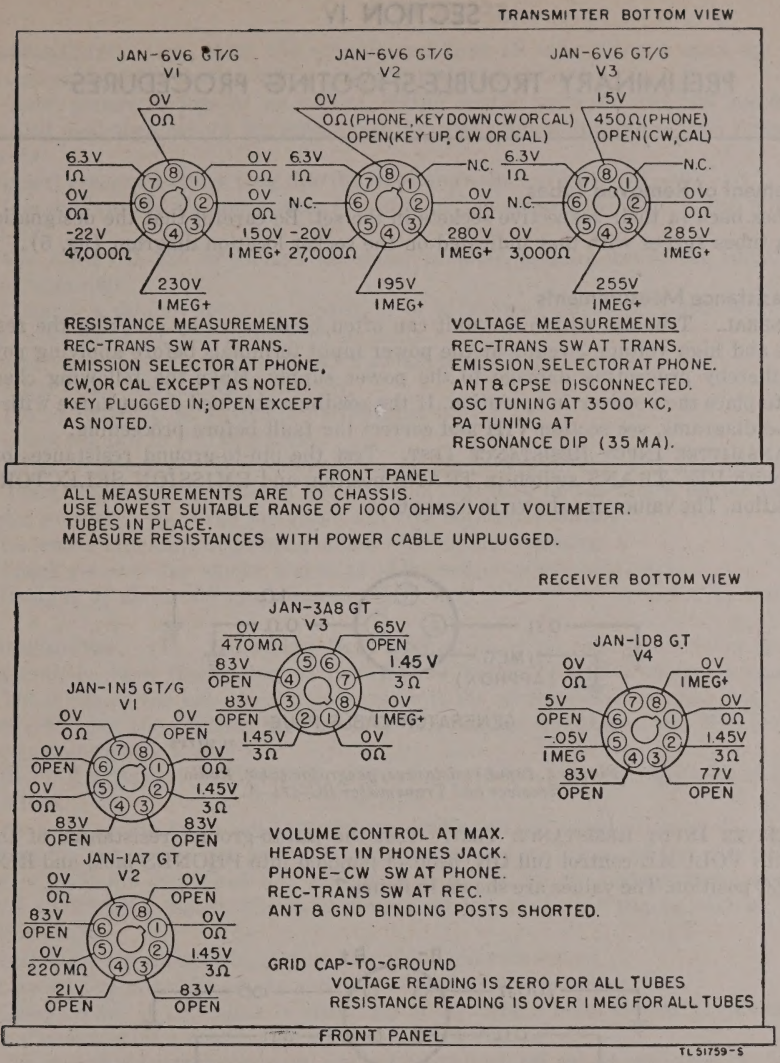


Figure 5. Tube socket voltages and resistances, Radio Receiver and Transmitter BC-474-A.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

12. Replacement of Removed Tubes

Place all tubes back in their respective sockets in the set. Be careful that the designation of each of the seven tubes agrees with that indicated on the socket location diagram (fig. 5).

13. Input Resistance Measurements

a. GENERAL. Troubles within the unit can often be detected by checking the resistance of the filament and high voltage circuits at the power input terminals before applying power to the equipment, thereby preventing damage to the power supply. Make the following checks before attempting to place the receiver in operation. If the readings obtained do not agree with the values shown on the diagrams, see section VIII and correct the fault before proceeding.

b. TRANSMITTER INPUT RESISTANCE TEST. Test the pin-to-ground resistances of the plug of cable 82 with REC-TRANS switch in TRANS position and EMISSION SELECTOR switch in PHONE position. The values are shown in figure 6.

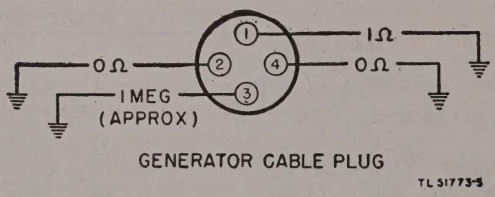


Figure 6. Input resistances, generator cable, Radio Receiver and Transmitter BC–474–A.

c. RECEIVER INPUT RESISTANCE TEST. Test the pin-to-ground resistances of the plug of cable 105 with VOLUME control full ON, headset plugged into PHONES jack, and REC-TRANS switch in REC position. The values are shown in figure 7.

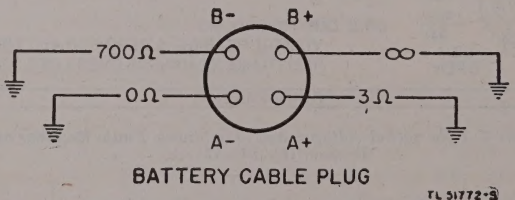


Figure 7. Input resistances, battery cable, Radio Receiver and Transmitter BC–474–A.

14. Preliminary Operating Tests

Safety Notice: The maximum voltage available in this equipment is less than 300 volts. Such voltages are not usually regarded as dangerous to human life, but may be the source of considerable discomfort or even injury to a person coming in contact with them. Care should be taken not to touch those components carrying transmitter plate potentials, especially the ungrounded side of the telegraph key, while the generator is being operated. It is to be noted that no interlocks are provided, as no high-potential parts are exposed or accessible during operation.

a. PREPARATION. (1) With the set removed from its case, place it upon the work bench so that the underside of the chassis will be visible during operation.

(2) Insert generator legs in leg sockets, taking care to place the seat and leg in the special socket provided, and then set up the seat, snapping seat support into its socket. Insert cranks in proper sockets.

(3) Insert receiver battery plug into the left-hand socket of Filter FL–10.

(4) Insert transmitter power plug into one of the sockets located on the filter unit and marked SO–22.

(5) Use Cord CD–125 to connect generator to filter, making use of the remaining socket SO–22 in the filter unit.

(6) Connect a dummy antenna consisting of a 20-ohm resistor in series with a 100-mmf capacitor between the ANT. and GND. binding posts.

b. RECEIVER. (1) Turn REC-TRANS switch to REC position.

(2) Turn VOLUME control switch ON.

(3) Turn PHONE-C.W. switch to PHONE position.

(4) Insert headset in PHONE jack.

(5) Have an assistant operate the cranks of the generator at a speed of approximately 50 to 70 rpm (revolutions per minute) in the direction indicated by the arrow on the gear housing. At the correct rotational speed the generator will turn noticeably easier.

(6) Listen for crackling or buzzing noises which indicate arcing.

(7) Check receiver for smoke and odor of burned or overheated parts.

(8) If signs of abnormal operation are indicated, *turn off set immediately* and see section VIII.

c. TRANSMITTER. (1) Determine from calibration chart, which is inside the lid of the receiver-transmitter case, the setting of the OSCILLATOR TUNING control corresponding to 5,000 kc. (The digits on the left of the hyphen refer to the setting of pointer 81; those on the right refer to the setting of the dial attached to knob 77.) Adjust OSCILLATOR TUNING control to required setting by turning knob 77.

(2) Place EMISSION SELECTOR switch to PHONE position, REC-TRANS switch to TRANS position.

(3) As soon as the tubes are warmed up (indicated by a deflection of the P.A. PLATE CURRENT meter), tune the p-a plate circuit to resonance by means of P.A. TUNING control. The correct adjustment will result in a minimum or dip in the p-a plate current as read on the P.A. PLATE CURRENT meter. The approximate setting of the p-a tuning control is shown on the calibration chart.

(4) Listen for crackling or buzzing noises which indicate arcing.

(5) Check transmitter for smoke and odor of burned or overheated parts.

(6) Check to see if generator is operating at too high a temperature. It should not be too hot to touch after it has been running for a long period of time.

(7) If signs of abnormal operation are indicated, *turn off set immediately.* See section VIII, and locate the source of trouble before proceeding.

(8) Halt the operation of the generator. Turn the VOLUME control switch and the EMISSION SELECTOR switch to OFF.

SECTION V

ALIGNMENT PROCEDURE

15. General

a. PRELIMINARY. Alignment should not be attempted until batteries and tubes have been tested and all necessary circuit checks have been completed. See section VI, for the procedure for localizing the trouble to a particular stage. After trouble has been localized to a particular stage, see the data given for that stage in section VIII.

b. PREPARATION. Place the set (which is removed from its case) on the work bench in a manner that makes the adjusting screws, which are located above and below the chassis, accessible. Connect the receiver battery cable (105) to the battery pack, and the generator cable (82) to the generator. Battery operation of the receiver during alignment is advisable because of the lowered noise and increased voltage stability obtained.

c. ALIGNMENT POINTS. The transformers and capacitors referred to in the alignment procedure are shown on the parts location drawings (figs. 8 and 9).

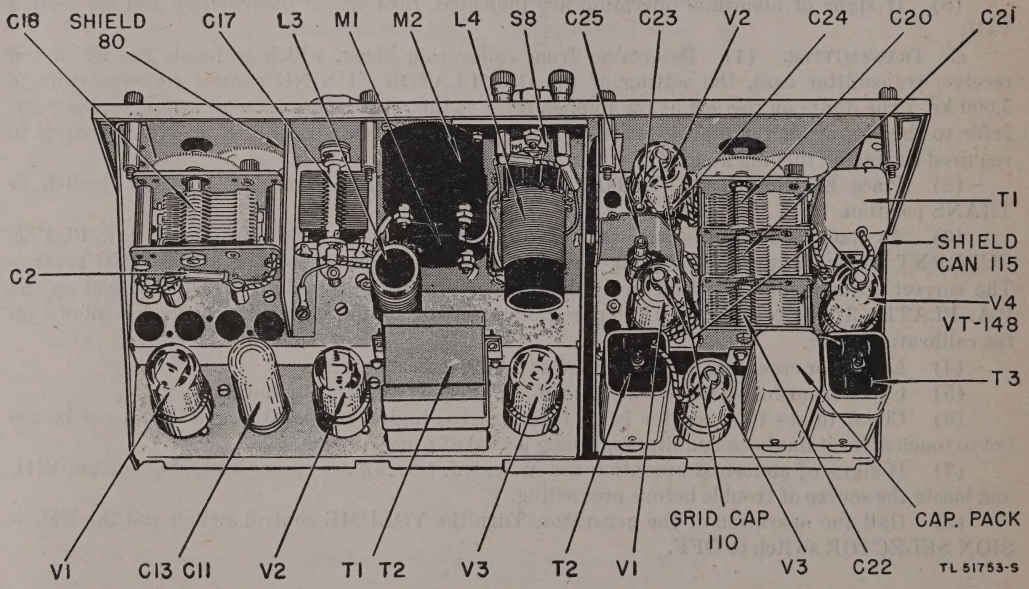


Figure 8. Top view of chassis, Radio Receiver and Transmitter BC–474–A.

16. Receiver Preliminary

Air trimmer capacitors C23, C24, and C25 are adjusted from under the chassis by loosening the friction sleeve with the neutralizing wrench. Loosen friction sleeve only enough to allow plunger to be moved in and out when rotating and pushing or pulling on the plunger with the air trimmer wrench. In order to do this, the hook of the air trimmer wrench must be inserted in the eye of the plunger. In making this adjustment, the plunger should be pulled out until it hits the stop and then, gradually pushed in until a maximum output is obtained. Tighten friction sleeve after adjustment has been completed. Care must be exercised to keep the wrench as far as possible from padding

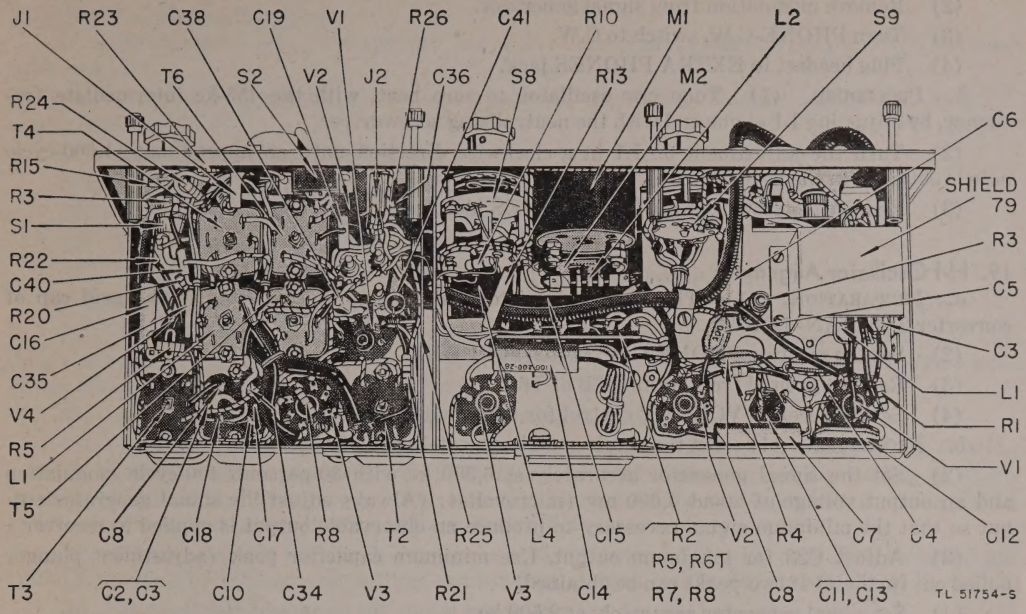


Figure 9. Bottom view of chassis, Radio Receiver and Transmitter BC–474–A.

capacitor C19. The i-f transformers T2 and T3 must be adjusted at both ends with the neutralizing screwdriver.

17. Intermediate-frequency Stages

a. PREPARATION. (1) Turn on signal generator and permit it to reach its operating temperature.

(2) Plug output meter into PHONES jack.

(3) Set the REC-TRANS switch at REC.

(4) Set the PHONE-C.W. switch at PHONE.

(5) Set VOLUME control knob at its maximum clockwise position.

(6) Using a 3-inch length of wire with small battery clips on both ends, ground terminal B of coil assembly T6 (fig. 23).

(7) Connect the low side of the signal generator to GND. binding post, to chassis of the receiver, and to ground.

b. PROCEDURE. (1) Connect the high side of the signal generator through 0.1-mf capacitor to the grid cap of the i-f amplifier Tube JAN–3A8GT (VT–149).

(2) Set the tuning dial of the receiver at 2,500 kc.

(3) Accurately set the signal generator at 455 kc, modulated 30 percent at 400 cycles. Adjust signal generator output so that, at all times, the minimum signal necessary to produce an observable indication on the output meter is applied to the receiver.

(4) Adjust the 2d i-f transformer (T3) tuning plugs for maximum output on output meter.

(5) Connect the high side of the signal generator through a 0.1-mf capacitor to the grid cap of converter Tube JAN–1A7GT (VT–147).

(6) Adjust the 1st i-f transformer (T2), tuning slugs for maximum output on output meter. Reduce signal generator output as alignment proceeds.

18. C.W. Oscillator Alignment

a. PREPARATION. (1) Leave all connections and settings as in last step of i-f alignment.

(2) Remove modulation from signal generator.

(3) Turn PHONE-C.W. switch to C.W.

(4) Plug headset in EXTRA PHONES jack.

b. PROCEDURE. (1) Tune c-w oscillator to zero beat, with the 455-kc intermediate frequency, by adjusting L1 at one end with the neutralizing screwdriver.

(2) Turn the adjustment on L1 in a clockwise direction until an approximate 1,000-cycle note is obtained in the headset.

(3) Remove headset from EXTRA PHONES jack.

19. H-f Oscillator Alignment

a. PREPARATION. (1) The signal generator output lead is connected to the grid cap of converter Tube JAN–1A7GT.

(2) Set the receiver PHONE-C.W. switch at PHONE.

(3) Remove ground from terminal B of T6.

(4) Set the receiver VOLUME control for maximum output.

b. PROCEDURE. (1) Set the receiver dial accurately at 6,300 kc.

(2) Set the signal generator accurately at 6,300 kc with 30-percent, 400-cycle modulation and an output voltage of about 4,000 mv (microvolts). (Always adjust the signal generator output so that the minimum signal necessary to produce an observable output is applied to receiver.)

(3) Adjust C23 for maximum output. Use minimum capacitor peak (adjustment plunger pulled out furthest) if two peaks can be obtained.

(4) Set signal generator accurately at 2,500 kc.

(5) Set receiver dial carefully at 2,500 kc.

(6) Adjust T6 in oscillator circuit for maximum output.

(7) Reset the signal generator and the receiver tuning dial at 6,300 kc.

(8) Readjust C23 slightly for maximum output.

20. R-f Amplifier Alignment

a. PREPARATION. (1) Connect the high side of the signal generator to the antenna post of the receiver through a 150-mmf capacitor.

(2) Set the receiver PHONE-C.W. switch at PHONE.

b. PROCEDURE. (1) Set the receiver dial accurately at 6,300 kc.

(2) Set the signal generator accurately at 6,300 kc with 30-percent, 400-cycle modulation and an output voltage of about 30mv. (Always adjust the signal generator output so that the minimum signal necessary to produce an observable output is applied to the receiver.)

(3) Adjust C24 in converter grid circuit for maximum output.

(4) Adjust C25 in r-f amplifier grid circuit for maximum output.

(5) Set the signal generator and the receiver dial accurately at 2,500 kc.

(6) Adjust T4 in the converter grid circuit for maximum output.

(7) Adjust T5 in the r-f amplifier grid circuit for maximum output.

(8) Reset the signal generator and the receiver tuning dial at 6,300 kc.

(9) Slightly readjust C24 and C25 for maximum output.

(10) Turn off and disconnect the signal generator and the output meter.

21. Transmitter Preliminary

No alignment adjustments are provided on the transmitter, but the operation and dial calibration of the m-o-p-a stages should be checked before final and operational tests are attempted. The generator must be cranked by an assistant during these tests.

22. Check of Master Oscillator

a. PREPARATION. (1) Connect the low side of the signal generator to the GND. terminal of the set.

(2) Connect the high side of the signal generator through a 150-mmf capacitor to the ANT. terminal of the set.

(3) Plug headset into PHONES jack.

(4) Set the REC-TRANS switch at the REC position.

(5) Set the receiver PHONE-C.W. switch at the C.W. position.

(6) Set the EMISSION SELECTOR switch at OFF.

(7) Turn the VOLUME CONTROL to the full clockwise position.

b. PROCEDURE. (1) Accurately set the signal generator at 6,300 kc, unmodulated.

(2) Tune the receiver to zero beat with the 6,300-kc signal from the signal generator. Reduce volume to a comfortable level by adjusting the receiver VOLUME control or the signal generator attenuator. Turn off the signal generator.

(3) Set the EMISSION SELECTOR switch at the CAL. position.

(4) Tune the transmitter oscillator to zero beat with the receiver by means of the OSCILLATOR TUNING control. The OSCILLATOR TUNING control position and dial setting at which zero beat is obtained should agree closely with that marked on the calibration chart inside the lid of the set. If zero beat cannot be obtained, see section VIII.

(5) Repeat steps (1) through (4) above at 5,000 kc and 3,500 kc, each time checking the OSCILLATOR TUNING control setting against that marked on the calibration chart.

(6) Turn off and disconnect the signal generator.

23. Check of Power Amplifier and Modulator

a. PREPARATION. Connect a dummy antenna, consisting of a 20-ohm resistor in series with a 100-mmf capacitor, between the ANT. and GND. binding posts. Determine from the calibration chart, inside the lid of the case, the setting of the OSCILLATOR TUNING control for 5,000 kc. (The digits on the left of the hyphen refer to the setting of pointer 81; those on the right refer to the setting of the dial attached to knob 77.) Adjust OSCILLATOR TUNING control to required setting by turning knob 77.

b. PROCEDURE. (1) Set the EMISSION SELECTOR switch to PHONE and the REC-TRANS switch to TRANS. Have an assistant operate the generator.

(2) As soon as the tubes are warmed up (indicated by a deflection of the P.A. PLATE CURRENT meter), tune the p-a plate circuit to resonance by means of the P.A. TUNING control. The correct adjustment will result in a minimum or dip in the p-a plate current as read on the P.A. PLATE CURRENT meter. The approximate setting of the p-a tuning control should be as shown on the calibration chart. If the oscillator is tuned to the lower frequencies, it is possible to obtain two dips in the p-a plate current. The dip that indicates the correct setting of the p-a tuning control may be determined by a check against the calibration chart. If no sharp dip can be found, detune the antenna by changing setting of the COARSE antenna tuning control (A to G), or possibly the FINE antenna tuning control, and again adjust the P.A. TUNING control; repeat the process until a resonance dip is obtained. If improper operation is indicated, see section VIII.

(3) The antenna circuit should now be adjusted as follows: with FINE antenna control set at approximately position 5, tune COARSE antenna control until maximum antenna current is indicated on ANTENNA CURRENT meter. Now retune the P.A. TUNING control to resonance (minimum plate current) and adjust FINE antenna tuning control for maximum antenna current. At resonance, a plate current of approximately 35 ma (milliamperes) should be obtained. At this value, the power amplifier is correctly loaded for best modulation. The ANTENNA CURRENT meter will show a deflection of from 0.3 to 0.7 amperes.

(4) Plug the microphone plug into the MIC. jack of the transmitter and the headset into the PHONES jack.

(5) Speak into the microphone and check to see if the P.A. PLATE CURRENT and the ANTENNA CURRENT meter indications increase, and at the same time check for sidetone in the earphones.

(6) Plug key into KEY jack and set EMISSION SELECTOR switch to the C.W. position. *The key is not at ground potential. Observe high voltage precautions.* When the key is depressed, the ANTENNA CURRENT meter should indicate from 0.3 to 0.7 amperes.

(7) If improper operation is indicated in any of the above steps, see section VIII.

(8) Halt the operation of the generator and turn the EMISSION SELECTOR and the VOLUME control switches to OFF.

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

24. General

a. PURPOSE. The purpose of this section is to provide a systematic procedure for localizing trouble to a particular stage. When a faulty stage is found, see section VIII, for the repair procedure.

b. RECEIVER. The alignment procedure of section V automatically localizes trouble occurring in the stages preceding the i-f amplifier stage. Therefore, no additional trouble-shooting procedure for these stages is given.

c. TRANSMITTER. The tests in section V serve to localize trouble to a stage and therefore no additional trouble-shooting procedure is given for the transmitter stages.

25. Signal Tracing of I-f, Detector and Audio Stages

a. PREPARATION. (1) The receiver is operated from the battery pack during these tests.

(2) Turn on signal generator and permit it to reach its operating temperature.

(3) Plug output meter into PHONES jack.

(4) Set the REC-TRANS switch at REC.

(5) Set the PHONE-C.W. switch at PHONE.

(6) Set VOLUME control knob at its maximum clockwise position.

(7) Using a 3-inch length of wire with small battery clips on both ends, ground terminal B of coil assembly T6.

(8) Connect the low side of the signal generator to GND. binding post.

(9) Connect the r-f side of the signal generator through a 0.1-mf capacitor to the grid cap of the i-f amplifier Tube JAN–3A8GT (VT–149).

(10) Connect the low side of an a-c vacuum-tube voltmeter to the chassis ground, and the high side, in series with a 0.1-mf capacitor, to an insulated test prod.

b. TEST AND INDICATION. (1) Set the signal generator output to 455 kc with 30-percent, 400-cycle modulation and maximum output.

(2) Apply the probe of the a-c (alternating-current) vacuum-tube voltmeter to the test points listed in table II until the faulty circuit is located.

Table II. Signal tracing points

Apply a-c VTVM probe to—	*Faulty circuit if no indication on VTVM*
Terminal A, transformer T3	I-f amplifier stage
Pin No. 8, tube V4	Detector or T3
Grid cap, tube V4	Detector or 1st audio grid circuit
Pin No. 5, tube V4	1st audio
Pin No. 3, tube V4	2d audio
Tip EXTRA PHONES jack	T1

c. LOCALIZATION. If a circuit is defective, see information covering the stage under test in section VIII. Trace the trouble to the defective part or parts by resistance and voltage checks.

26. Moistureproofing, Fungiproofing, and Refinishing

After repairs have been completed on the set, check the date on which it was last moistureproofed and fungiproofed. If a new treatment is required refer to TB SIG 13 for method of application. If the case of the set has been scarred or chipped, remove any rough spots with fine sandpaper and apply paint to spots with a small brush. If the case is sufficiently scarred and scratched to warrant complete refinishing, remove the chassis from the case. Remove all dirt and rust with kerosene when necessary. Spray entire case with proper paint authorized by existing regulations.

SECTION VII

FINAL TESTING

27. Alignment Check

Although the unit was correctly aligned during the repair procedure, a recheck of alignment is necessary after moistureproofing and fungiproofing have been completed. Check alignment as given in section V.

28. Over-all Performance Tests

a. TESTS. After alignment has been checked, the following performance tests are to be made:

Note. Where these tests are not obtainable the equipment must be rechecked.

(1) *Receiver.*

Sensitivity and noise (phone).
Sensitivity and noise (c-w).
Over-all selectivity.
Image rejection ratio.
I-f rejection ratio.
Automatic volume control.
Receiver dial calibration test.
Receiver operational test.

(2) *Transmitter.*

Power output test.
Modulation capability.
Transmitter dial calibration test.
Transmitter operational test.

b. PREPARATION. (1) Check to see that all tubes are installed in their proper sockets, that all grid caps are in place, and that the tube shield is properly installed on Tube JAN–1D8GT (V–4).

(2) Replace the set in its case and tighten the eight knurled-head panel screws.

(3) Replace the case lid stay-joints.

(4) Supply power to the receiver by means of the battery pack and to the transmitter by means of Generator GN–44–A.

(5) Connect the r-f output of the signal generator, in series with a 150-mmf dummy antenna capacitor, to the ANT. binding post.

(6) Connect the ground of the signal generator to the GND. binding post.

(7) Insert the output meter phone plug in the PHONES jack.

(8) Set the receiver VOLUME control at its maximum clockwise position.

29. Receiver Tests

a. SENSITIVITY AND NOISE (PHONE). (1) Set the REC-TRANS switch to REC and the EMISSION SELECTOR switch at OFF. Set the receiver PHONE-C.W. switch to PHONE.

(2) Set the signal generator at 6,300 kc with 30-percent, 400-cycle modulation and an output voltage of 20 μv. Tune the receiver for maximum output.

(3) Adjust the setting of the VOLUME control to obtain an indication of 6.3 volts on the output meter. It is a requirement that this condition be obtainable.

(4) Turn off the modulation of the signal generator. The new indication on the output meter must not be more than 2.0 volts.

(5) Repeat steps (2) through (4) above at test-point frequencies of 4,500 kc and 2,500 kc.

b. SENSITIVITY AND NOISE (C-W). (1) Set the signal generator at 6,300 kc with 30-percent, 400-cycle modulation and an output voltage of 20 μv. With the receiver PHONE-C.W. switch set at PHONE, tune the receiver for maximum output.

(2) Set the receiver PHONE-C.W. switch at C.W., turn off the modulation of the signal generator, and slightly readjust the tuning of the receiver for maximum output.

(3) Adjust the setting of the VOLUME control to obtain an indication of 6.3 volts on the output meter. It is a requirement that this condition be obtainable.

(4) Increase the frequency setting of the signal generator by 10 kc (set the signal generator frequency at 6,310 kc). The new indication on the output meter must not be more than 2.0 volts.

(5) Repeat steps (1) through (4) above at test-point frequencies of 4,500 kc and 2,500 kc.

c. OVER-ALL SELECTIVITY. (1) Set the signal generator to 6,300 kc with 30-percent, 400-cycle modulation and an output voltage of 20 μv. With the receiver PHONE-C.W. switch set at PHONE tune the receiver for maximum output.

(2) Adjust the setting of the VOLUME control to obtain an indication of 6.3 volts.

(3) Increase the output of the signal generator to 2,000 μv. Vary the signal generator frequency to the points above and below the receiver resonance frequency at which the output meter indication returns to 6.3 volts. The difference between these two frequency settings must not be more than 27 kc.

(4) Increase the output of the signal generator to 20,000 μv. Vary the signal generator frequency to the points above and below the receiver resonance frequency at which the output meter indication returns to 6.3 volts. The difference between these two frequency settings must not be more than 45 kc.

(5) Repeat steps (1) through (4) above at test-point frequencies of 4,500 kc and 2,500 kc.

d. IMAGE REJECTION RATIO. (1) Set the signal generator to 6,300 kc with 30-percent, 400-cycle modulation and an output voltage of 20 μv. Tune the receiver for maximum output.

(2) Adjust the setting of the VOLUME control to obtain an indication of 6.3 volts.

(3) Increase the signal generator frequency to approximately 7,210 kc and the signal generator output voltage to 4,000 μv. To obtain a maximum indication on the output meter, vary the signal generator frequency very slightly.

(4) The indication on the output meter must not be more than 6.3 volts.

e. INTERMEDIATE-FREQUENCY REJECTION RATIO. (1) Set the signal generator to 2,300 kc with 30-percent, 400-cycle modulation and an output voltage of 20 μv. Tune the receiver for maximum output.

(2) Adjust the setting of the VOLUME control to obtain an indication of 6.3 volts on the output meter.

(3) Reset the signal generator frequency to 455 kc and increase its output to 4,000 μv.

(4) The indication on the output meter must not be more than 6.3 volts.

f. AUTOMATIC-VOLUME-CONTROL TEST. (1) Set the signal generator to 6,300 kc with 30-percent, 400-cycle modulation and an output voltage of 20 μv. Tune the receiver for maximum output.

(2) Adjust the setting of the VOLUME control to obtain an indication of 6.3 volts.

(3) Increase the output voltage of the signal generator to 20,000 μv. The indication on the output meter must not rise above 20 volts.

g. RECEIVER DIAL CALIBRATION TEST. (1) Set the signal generator to 6,300 kc with 30-percent, 400-cycle modulation and an output voltage of 20 μv. Tune the receiver for maximum output. The receiver dial setting must be between 6,250 and 6,350 kc.

(2) Reset the signal generator frequency to 5,000 kc and tune the receiver to this frequency. The receiver dial setting must be between 4,950 and 5,050 kc.

(3) Reset the signal generator frequency to 3,000 kc and tune the receiver to this frequency. The receiver dial setting must be between 2,975 and 3,025 kc.

h. RECEIVER OPERATIONAL TEST. (1) Turn off and disconnect the signal generator. Connect a short antenna to the ANT. binding post and ground the GND. binding post.

(2) Disconnect the output meter and substitute a headset in the PHONES jack.

(3) Tune in a phone station and check to see that the receiver output is free from excessive noise and distortion. Check to see that no regenerative squeals or whistles are present. Check to see that the VOLUME control is free of excessive noise when it is rocked back and forth.

(4) Turn the PHONE-C.W. switch to C.W. and tune in a c-w station. Check for satisfactory operation.

(5) Turn the VOLUME control switch to OFF and disconnect the headset from the PHONES jack.

30. Transmitter Tests

a. POWER OUTPUT TEST. (1) Connect a dummy antenna, consisting of a 20-ohm, non-inductive resistor, in series with a 100-mmf capacitor and a 0.1-ampere r-f ammeter, between the ANT. and GND. binding posts.

(2) Insert the key plug in the KEY jack.

(3) Set the REC-TRANS switch to TRANS and the EMISSION SELECTOR switch to PHONE.

(4) Determine from the calibration chart, which is inside the lid of the receiver-transmitter case, the setting of the OSCILLATOR TUNING control corresponding to 6,300 kc. (The digits on the left of the hyphen, refer to the setting of pointer 81; those on the right, refer to the setting of the dial attached to knob 77.) Adjust OSCILLATOR TUNING control to required setting by turning knob 77.

(5) Have an assistant start cranking the generator. As soon as the tubes are warmed up (indicated by a deflection of the P.A. PLATE CURRENT meter), tune p-a plate circuit to resonance by means of the P.A. TUNING control. The correct adjustment will result in a minimum or dip in the p-a plate current as read on the P.A. PLATE CURRENT meter. The approximate setting of the p-a tuning control is shown on the calibration chart.

Note. If the oscillator is tuned to the lower frequencies, it is possible to obtain two dips in the p-a plate current. The dip that indicates the correct setting of the p-a tuning control may be determined by a check against the calibration chart. If no sharp dip can be found, detune the antenna by changing the setting of the COARSE antenna tuning control (A to G) or possibly the FINE antenna tuning control, and again adjust the P.A. TUNING control; repeat the process until a resonance dip is obtained.

(6) The antenna circuit should now be adjusted as follows: With FINE antenna control set at approximately position 5, tune COARSE antenna control until maximum antenna current is indicated on ANTENNA CURRENT meter. Now retune the P.A. TUNING control to resonance (minimum plate current) and adjust the FINE antenna tuning control for maximum antenna current. At resonance, a plate current of approximately 35 ma is obtained.

(7) The r-f ammeter in series with the dummy load circuit must not indicate less than 0.45 amperes (corresponding to 4 watts). The indication on the ANTENNA CURRENT meter should agree with that on the dummy load r-f ammeter.

(8) Repeat steps (4) through (7) above at frequencies of 5,000 kc and 3,500 kc.

(9) Turn EMISSION SELECTOR switch to C.W. and check to see that the dummy load current, with the key depressed, is the same as it was during phone operation.

b. MODULATION CAPABILITY. (1) Connect the high side of the audio oscillator to the negative side of an 8-mf electrolytic capacitor.

(2) Connect the positive side of the capacitor to the ring of Plug PL–68.

(3) Connect the ground terminal of the audio oscillator to the sleeve of the plug.

(4) Insert the plug into the MIC. jack.

(5) Also connect the high side of the audio oscillator to the SYNC. binding post of the cathode-ray oscilloscope, and the ground of the audio oscillator to the ground post of the oscilloscope.

(6) Loosely couple the vertical amplifier binding post of the oscilloscope to the output of the transmitter. (If necessary readjust the settings of the ANTENNA TUNING controls for resonance.)

(7) Adjust the EMISSION SELECTOR switch to the PHONE position and set the audio oscillator frequency to 1,000 cycles.

(8) Set the oscilloscope controls so as to obtain a modulation envelope pattern.

(9) Increase the output of the audio oscillator until the modulation pattern begins to indicate distortion. This must not occur until greater than 75-percent modulation has been obtained. See figure 10 for some examples of modulation patterns.

(10) Remove Plug PL–68 from the MIC. jack and insert the plug of the microphone cable in its place. Synchronize the sweep of the oscilloscope to the line-frequency and set the sweep-frequency to about 1,000 cycles.

(11) Whistle into the microphone with approximately normal speech intensity and check to see that the pattern obtained indicates about 75 percent modulation.

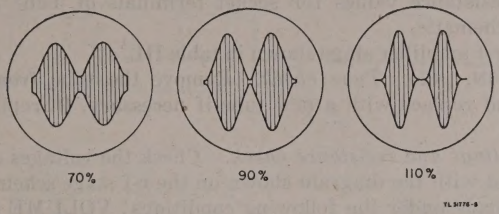


Figure 10. Modulation patterns, Radio Receiver and Transmitter BC–474–A.

c. TRANSMITTER DIAL CALIBRATION TEST. (1) Set the EMISSION SELECTOR switch to the CAL. position.

(2) Couple the input of the frequency meter to the transmitter output.

(3) Check the OSCILLATOR TUNING control settings at every 100-kc point from 3,500 to 6,300 kc.

(4) At no point should the setting of the dial attached to the OSCILLATOR TUNING knob (77) be more than ±20 (two divisions) off from the value indicated on the calibration chart mounted on the case lid.

d. TRANSMITTER OPERATIONAL TEST. (1) Plug a headset into the receiver EXTRA PHONES jack.

(2) The microphone and the key are inserted in their respective jacks in the transmitter.

(3) Set the REC-TRANS switch at REC. Remove the dummy antenna from the ANT. and GND. posts and replace with a small loop of wire.

(4) Set up an auxiliary receiver in the vicinity of the transmitter.

(5) Set the REC-TRANS switch at TRANS and the EMISSION SELECTOR switch at PHONE.

(6) Adjust the transmitter P.A. TUNING and ANTENNA TUNING controls for the resonance dip in the p-a plate current.

(7) Tune in the transmitter carrier on the auxiliary receiver, employing its beat-frequency oscillator, and then turn off the beat-frequency oscillator. Speak into the microphone and check for sidetone in the headset connected to the PHONES jack of Radio Receiver BC–474–A and for clear output from the auxiliary receiver.

(8) Turn the EMISSION SELECTOR switch to C.W. Turn on the beat-frequency oscillator of the auxiliary receiver.

(9) Key the transmitter and check for satisfactory reception.

(10) Turn the EMISSION SELECTOR switch to OFF. Disconnect the battery and generator cables. Turn off the auxiliary receiver.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

31. Receiver Radio-frequency Amplifier Stage

a. STAGE DATA. (1) R-f stage schematic shown in figure 11.

(2) Voltage and resistance values for socket terminals of Tube JAN–1N5GT (V–1), to ground, shown on stage schematic.

(3) Parts data for r-f amplifier stage shown in table III.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from the socket. Test tube with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the r-f stage schematic. Voltage and resistance measurements are made under the following conditions: VOLUME control full ON; headset plugged in PHONES jack; tubes in place; PHONE-C.W. switch at PHONE position; and REC-TRANS switch at REC position. Resistance measurements are made under the same conditions as above, except that the battery plug is removed from battery pack or filter. The voltage from grid cap to ground may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter. Check the resistance from grid cap to ground, rotating the ganged tuning capacitor, thus checking for shorts between rotor and stator plates.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the practical wiring diagram (fig. 23). Check for broken leads, faulty soldered joints and shorts. Check capacitors for leakage.

(4) *Additional checks.* (*a*) Connect the output of the signal generator (maximum output with 30-percent 400-cycle modulation) to the ANT. and GND. posts through a 150-mmf capacitor. Set the signal generator to any frequency selected on the tuning dial of the receiver. Connect a test prod in series with a 0.01-mf capacitor to the r-f terminal of an a-c vacuum-tube voltmeter. Apply prod to the following test points: grid cap of tube V–1; terminal No. 3 of tube V–1; and grid cap of tube V–2. If there is no indication at any one of the test points listed, that portion of the r-f stage is defective.

(*b*) Check fixed capacitors for open circuits by paralleling each with a good capacitor of equivalent value.

(*c*) Check continuity of primary and secondary windings of r-f transformers T4 and T5.

Table III. Parts data, r-f amplifier stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C22	3D9013V	CAPACITOR, variable: min C less than 13.0 mmf, effective max C 441.7 mmf; (ant. variable tuning).
C25	2C5344–474A/C10	CAPACITOR: air trimmer; 1 to 12 mmf; (ant. adjustable trimming).
C26	3D9008A2	CAPACITOR: molded type; 8.2 mmf ±10%; 400 vdcw; 500 v peak; (part of T5; ant. fixed).
C32	3DA12–1	CAPACITOR: 12 mmf ±10%; (part of T4; det coil cplg).
C38	3D281	CAPACITOR: molded type; 0.01 mf ±10%; 400 vdcw; (a-v-c filter).
R13	3Z6756	RESISTOR: 560,000 ohm ±10%; ½ w; insulated; (part of T5; a-v-c filter).
R17	3Z6756	RESISTOR: same as R13; (a-v-c filter).
T4	2C5344–474A/C5	COIL ASSEM: includes C32; term. board; assembled in part No. 115; (det cplg).
T5	2C5344–474A/C6	COIL ASSEM: includes C26, R13, R17, term. board; assembled in part No. 115; (ant. cplg).
V1		TUBE: JAN–1N5GT/G (VT–146; r-f amplr).
	2Z8795.1	SOCKET: molded-in-plate; octal; (tube socket).

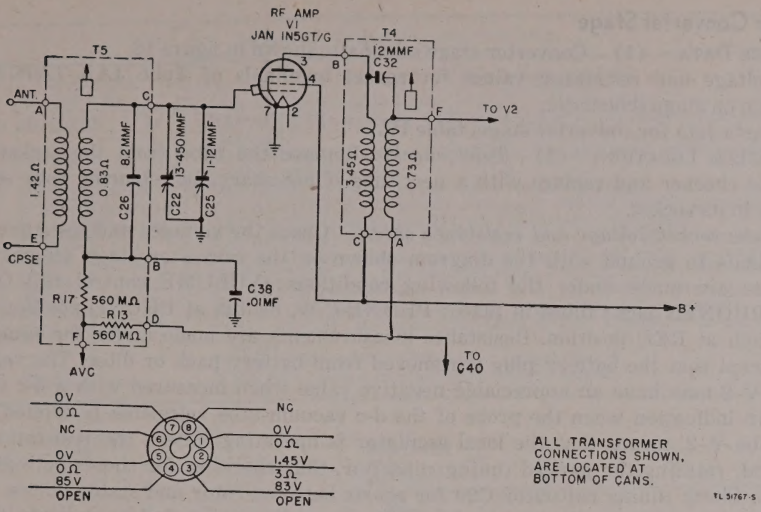


Figure 11. Receiver radio-frequency amplifier stage, Radio Receiver and Transmitter BC–474–A.

32. Receiver Converter Stage

a. STAGE DATA. (1) Converter stage schematic shown in figure 12.

(2) Voltage and resistance values for socket terminals of Tube JAN–1A7GT (V–2) to ground, shown on stage schematic.

(3) Parts data for converter stage, table IV.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from the socket. Test tube with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the converter stage schematic. Voltage measurements are made under the following conditions: VOLUME control full ON; headset plugged in PHONES jack; tubes in place; PHONE-C.W. switch at PHONE position; and REC-TRANS switch at REC position. Resistance measurements are made under the same conditions as above, except that the battery plug is removed from battery pack or filter. The voltage on the grid cap of V–2 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter. An indication when the probe of the d-c vacuum-tube voltmeter is applied to terminal No. 5 of Tube V–2, means that the local oscillator is operating. Check the resistance from grid cap to ground, rotating the ganged tuning capacitor, thus checking for shorts between rotor and stator plates. Check tuning capacitor C20 for shorts between rotor and stator plates.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the practical wiring diagram (fig. 23). Check for broken leads, faulty soldered joints and shorts. Check capacitors for leakage.

(4) *Additional checks.* If the converter stage is inoperative, make the following checks:

(*a*) Connect the output of the signal generator (with 30-percent, 400-cycle modulation) through a 150-mmf capacitor to terminal No. 3 of tube V–1. Set the signal generator to any frequency selected on the tuning dial of the receiver.

(*b*) Connect a test prod in series with a 0.01-mf capacitor to the r-f terminal of an a-c vacuum-tube voltmeter. Apply the prod to the following test points and check for indication.

1. Grid cap of tube V–2: this checks r-f tuned grid circuit of converter tube.
2. Terminal No. 6 of tube V–2: this checks operation of the local oscillator section of converter stage.
3. Terminal No. 3 of tube V–2: this checks mixer action of the converter stage tube V–2 and the i-f transformer in the plate circuit.

(*c*) If there is no indication at any one of the test points listed, that particular portion of the converter stage is defective.

(*d*) Check fixed capacitors for open circuits by paralleling with a good capacitor of equivalent value.

(*e*) Check continuity of primary and secondary windings of i-f transformer T2 and oscillator transformer T6.

Table IV. Parts data, converter stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C19	3DA1.100	CAPACITOR: molded; 1,100 mmf ±2½%; 500 vdcw; (osc series tuning (padding)).
C20	3D9013V	CAPACITOR, variable; min C less than 13.0 mmf, effective max C 441.7 mmf; (osc variable tuning).
C21	3D9013V	CAPACITOR: same as C20; (det variable tuning).
C23	2C5344–474A/C10	CAPACITOR: air trimmer; 1-12 mmf; (osc adjustable trimming).
C24	2C5344–474A/C10	CAPACITOR: same as C23; (det adjustable trimming).
C33	3D9070–2	CAPACITOR: 70 mmf ±10%; 500 vdcw; (part of T6; osc grid cplg).
C36	3D281	CAPACITOR: molded type; 0.01 mf ±10%; 400 vdcw; (converter screen filter).
C40	3D284	CAPACITOR, CA–284: molded type; 0.05 mf ±10%; 400 vdcw; (a-v-c filter).
R21	3Z6668	RESISTOR: 68,000 ohm ±10%; ½ w; insulated; (converter screen dropping).
R26	3Z6722–1	RESISTOR: 220,000 ohm ±10%; ½ w; insulated; (osc grid).
T6	2C5344–474A/C7	COIL ASSEM: includes C33; term. board; assembled in part No. 115; (oscillator).
V2		TUBE: JAN–1A7GT(VT–147); (converter).
	2Z8795.1	SOCKET: molded-in-plate octal; (tube socket).

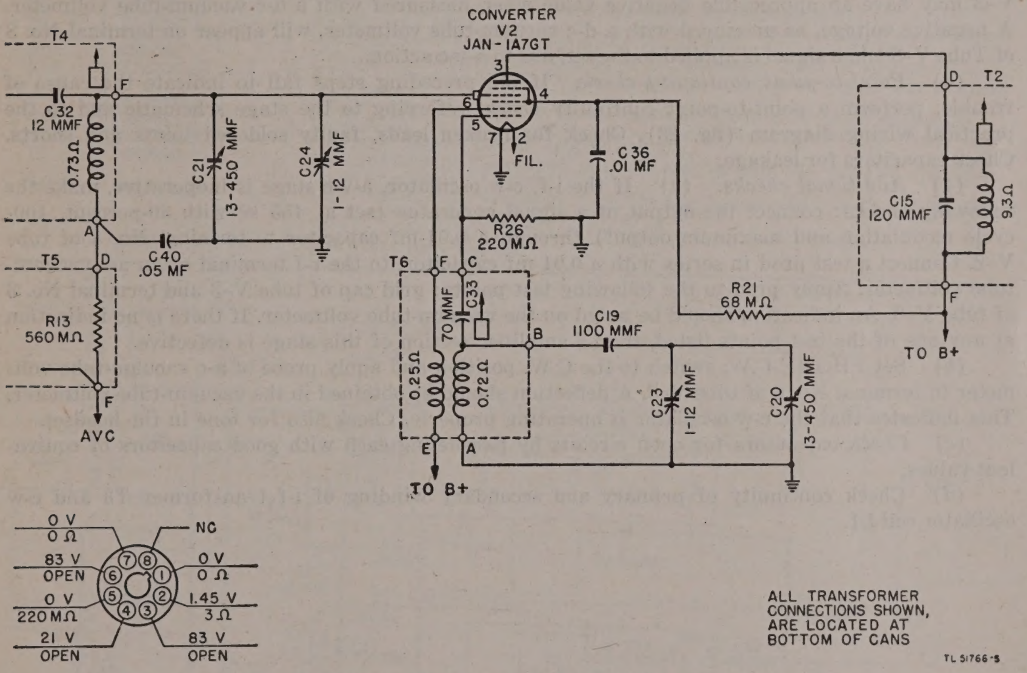


Figure 12. Receiver converter stage, Radio Receiver and Transmitter BC–474–A.

33. Receiver I-f, C-w Oscillator, A-v-c Stage

a. STAGE DATA. (1) I-f, c-w oscillator, a-v-c stage schematic shown in figure 13.

(2) Voltage and resistance values for socket terminals of Tube JAN–3A8GT (V–3) to ground, shown on stage schematic.

(3) Parts data for i-f, c-w oscillator, a-v-c stage, shown in table V.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test tube with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the i-f, c-w oscillator, a-v-c stage schematic. Voltage and resistance measurements are made under the following conditions: VOLUME control full ON; headset plugged in PHONES jack; tubes in place; PHONE-C.W. switch at PHONE position; and REC-TRANS switch at REC position. Resistance measurements are made under the same conditions as above, except that the battery plug is removed from battery pack or filter. After the trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage. The voltage on the grid cap of tube V–3 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter. A negative voltage, as measured with a d-c vacuum-tube voltmeter, will appear on terminal No. 8 of Tube V–3 when signal is applied to the set, due to a-v-c action.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the practical wiring diagram (fig. 23). Check for broken leads, faulty soldered joints and shorts. Check capacitors for leakage.

(4) *Additional checks.* (*a*) If the i-f, c-w oscillator, a-v-c stage is inoperative, make the following checks: connect the output of a signal generator (set at 455 kc with 30-percent, 400-cycle modulation and maximum output) through a 0.01-mf capacitor to terminal No. 3 of tube V–2. Connect a test prod in series with a 0.01-mf capacitor, to the r-f terminal of an a-c vacuum-tube voltmeter. Apply prod to the following test points: grid cap of tube V–3 and terminal No. 3 of tube V–3. An indication should be noted on the vacuum-tube voltmeter. If there is no indication at any one of the test points listed, the i-f amplifier section of this stage is defective.

(*b*) Set PHONE-C.W. switch to the C.W. position and apply probe of a-c vacuum-tube voltmeter to terminal No. 6 of tube V–3. A deflection should be obtained in the vacuum-tube voltmeter. This indicates that the c-w oscillator is operating properly. Check also for tone in the headset.

(*c*) Check capacitors for open circuits by paralleling each with good capacitors of equivalent values.

(*d*) Check continuity of primary and secondary winding of i-f transformer T3 and c-w oscillator coil L1.

Table V. Parts data, i-f, c.-w. oscillator, a-v-c stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C4	3D9220	CAPACITOR: 220 mmf ±10%; 500 vdcw; (part of T3; audio diode r-f filter).
C5	3D9070–2	CAPACITOR: 70 mmf ±10%; 500 vdcw; (part of T3; a-v-c diode cplg).
C6	3D9120–1	CAPACITOR: 120 mmf ±5%; 500 vdcw; (part of T3; 2d i-f sec tuning).
C7	3D9120–1	CAPACITOR: same as C6; (2d i-f pri tuning).
C8	3DE100	CAPACITOR PACK: 0.1 mf ±10%; 300 vdcw; (a-v-c filter).
C9	2C5344–474A/C8	CAPACITOR: 5 mmf ±10%; (part of L1; c-w osc to diode cplg).
C11	2C5344–474A/C9	CAPACITOR: 400 mmf ±5%; (part of L1; c-w osc (shunt feed) plate cplg).
C12	3D9330–1	CAPACITOR: 330 mmf ±5%; 400 v d-c, peak a-c 500 v; (part of L1; c-w osc tuning).
C13	3D9070–2	CAPACITOR: 70 mmf ±10%; 500 vdcw; (part of L1; c-w osc grid cplg).
C14	3D9120–1	CAPACITOR: 120 mmf ±5%; 500 vdcw; (part of T2; 1st i-f sec tuning).
C15	3D9120–1	CAPACITOR: same as C14; 1st i-f pri tuning).
C34	3DE100	CAPACITOR PACK: 0.1 mf ±10%; 300 vdcw; (a-v-c filter).
C37	3D266	CAPACITOR, CA–266: molded type; 100 mmf ±14%, —6%; 250 vdcw; (audio diode r-f filter).
L1	2C5344–474/C1	COIL ASSEM: includes C9, C11, C12, C13, R7; term. board assem; assembled in part No. 115; (c-w osc coil).
R3	3Z6801–17	RESISTOR: variable; 1 meg ±20%; (audio volume control potentiometer).
R4	3Z6656–3	RESISTOR: 56,000 ohm ±10%; ½ w; insulated; (part of T3; audio diode, r-f filter).
R5	3Z6801–1	RESISTOR: 1 meg ±10%; ½ w; insulated; (a-v-c diode load).
R7	3Z6656–1	RESISTOR: 56,000 ohm ±10%; ½ w; insulated; (part of L1; c-w osc plate).
R8	3Z6747	RESISTOR: 470,000 ohm ±10%; ½ w; insulated; (c-w osc grid).
R9	3Z6756	RESISTOR: 560,000 ohm ±10%; ½ w; insulated; (part of T2; a-v-c filter).
R15	3Z6620–33	RESISTOR: variable; 20,000 ohm ±15%; (r-f sensitivity (bias) control potentiometer).
R19	3Z6801–2	RESISTOR: 1 meg ±10%; ½ w; insulated; (part of T3; a-v-c diode load).
R23	3Z6647–1	RESISTOR: 47,000 ohm ±10%; ½ w; insulated; (r-f sensitivity filter).
S2	3Z9846–2	SWITCH: toggle; DPDT; (PHONE–C.W.).
T2	3Z9999–1	TRANSFORMER: assembled in shield can; includes C14, C15, R9, coil assem, and term. board; (1st i-f).
T3	3Z9999–2	TRANSFORMER: assembled in shield can; includes C4, C5, C6, C7, R4, R19, coil assem, and term. board; (2d i-f).
V3		TUBE: JAN–3A8GT (VT–149; i-f amplr, c-w osc, a-v-c diode).
	2Z8659–6	SOCKET: (tube socket).

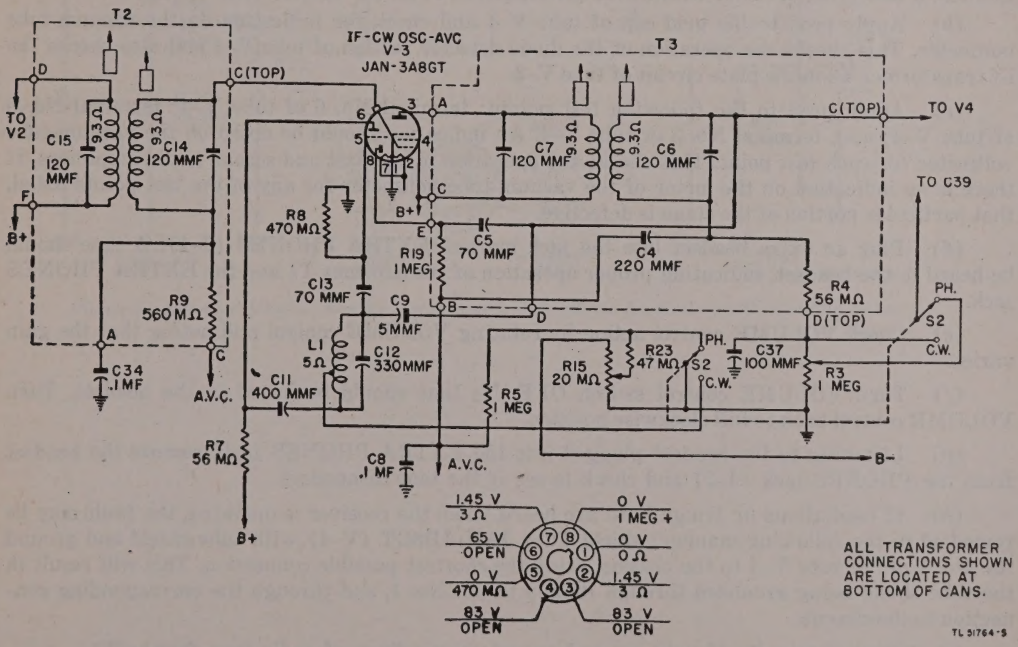


Figure 13. Receiver i-f, c-w osc, avc stage, Radio Receiver and Transmitter BC–474–A.

34. Receiver Detector, First and Second Audio Stage

a. STAGE DATA. (1) Detector, first and second audio stage schematic shown in figure 14.

(2) Voltage and resistance values for socket terminals of Tube JAN–1D8GT (V–4) to ground, shown on stage schematic.

(3) Parts data for detector, first and second audio stages, shown in table VI.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test tube with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the detector, first and second audio stage schematic. Voltage measurements are made under the following conditions: VOLUME control full ON; headset plugged in PHONES jack; tubes in place; PHONE-C.W. switch at PHONE position; and REC-TRANS switch at REC position. Resistance measurements are made under the same conditions as above, except that the battery plug is removed from battery pack or filter. After the trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the practical wiring diagram (fig. 23). Check for broken leads, faulty soldered joints and shorts. Check all capacitors for leakage. Check capacitors for open circuit by paralleling each with a good capacitor of equivalent value.

(4) *Additional checks.* If the detector, first and second audio stages are inoperative, make the following checks:

(*a*) Connect the output of a signal generator (set at 455 kc with 30-percent, 400-cycle modulation and maximum output) through a 0.01-mf capacitor to terminal No. 3 of tube V–3. Connect a test prod, in series with a 0.01-mf capacitor, to an a-c vacuum-tube voltmeter.

(*b*) Apply prod to the grid cap of tube V–4 and check for indication on the vacuum-tube voltmeter. This checks the operation of the diode detector section of tube V–4 and also checks the i-f transformer T3 in the plate circuit of tube V–3.

(*c*) Apply prod to the following test points: terminal No. 6 of tube V–4; terminal No. 5 of tube V–4; and, terminal No. 3 of tube V–4. An indication should be noted on the vacuum-tube voltmeter for each test point. This checks the operation of the first and second audio amplifiers. If there is no indication on the meter of the vacuum-tube voltmeter for any of the test points listed, that particular portion of the stage is defective.

(*d*) Plug an extra headset into the jack marked EXTRA PHONES (J–1). A tone should be heard in the headset, indicating proper operation of transformer T1 and the EXTRA PHONES jack.

(*e*) Check VOLUME control action by rotating VOLUME control and noting that the gain varies.

(*f*) Turn VOLUME control switch OFF. No tone should be heard in the headset. Turn VOLUME control back to full clockwise position.

(*g*) Listening to the headset plugged into the EXTRA PHONES jack, remove the headset from the PHONES jack (J–2) and check to see if the tone disappears.

(*h*) If oscillations or fringe howl are heard when the receiver is operated, the fault may be remedied in the following manner: shield Tube JAN–1D8GT (V–4) with tube shield and ground the No. 1 pin of tube V–4 to the chassis, using the shortest possible connection. This will result in the tube shield being grounded through its clip to pin No. 1, and through the corresponding connection to the chassis.

(*i*) Check continuity of primary and secondary windings of audio transformer T1.

Table VI. Parts data, detector, first and second audio stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C16	3DA3–21	CAPACITOR: shell type; 0.003 mf ±20%; 700 vdcw; (output pentode (impedance limiting)).
C35	3D281	CAPACITOR, CA–281: molded type; 0.01 mf ±10%; 400 vdcw; (1st audio cplg).
C39	3D281	CAPACITOR: same as C35; (audio input cplg).
J1	2Z5595	JACK: (EXTRA PHONES).
J2	2Z5580	JACK: (PHONES).
R20	3Z6747	RESISTOR: 470,000 ohm ±10%; ½ w; insulated; (1st audio plate load).
R22	3Z6801–1	RESISTOR: 1 meg ±10%; ½ w; insulated; (2d audio grid).
R24	3Z6802A2	RESISTOR: 2.2 meg ±10%; ½ w; insulated; (1st audio grid).
R27	3Z6610–7	RESISTOR: 10,000 ohm ±10%; ½ w; insulated; (output load).
T1	2Z9999	TRANSFORMER: ratio, pri to sec 1.9 to 1 ± 3%; (output (audio)).
V4		TUBE: JAN–1D8GT (VT–148); (detector 1st and 2d audio).
	2Z8795.1	SOCKET: molded-in-plate octal; (tube socket).

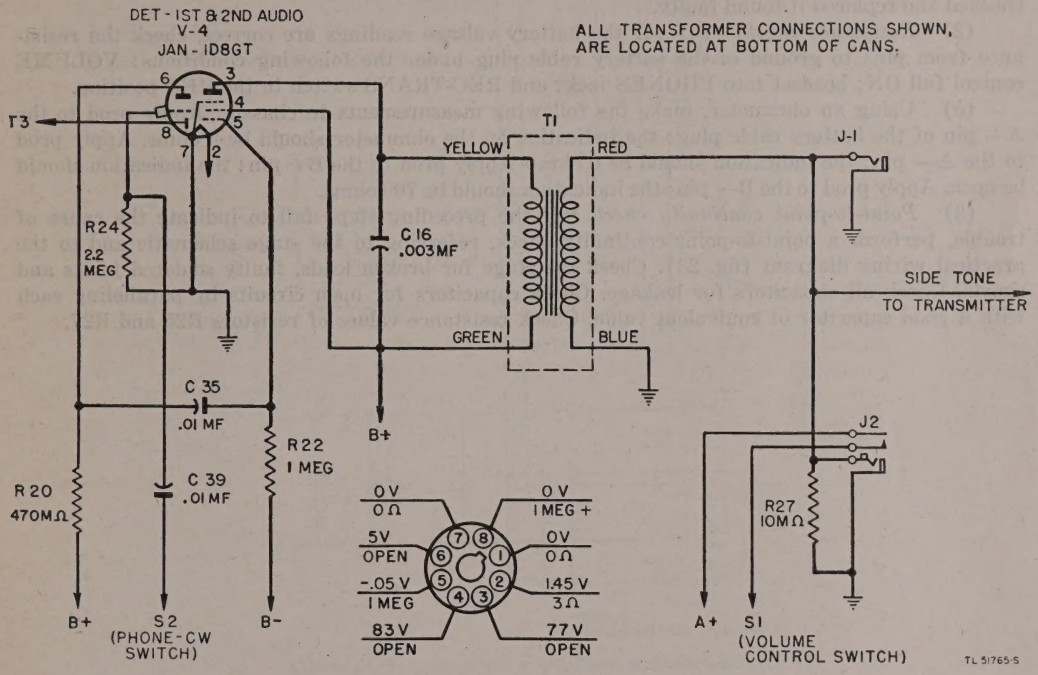


Figure 14. Receiver detector, first and second audio stage, Radio Receiver and Transmitter BC–474–A.

35. Receiver Power Stage

a. STAGE DATA. (1) Receiver power stage schematic shown in figure 15.

(2) Parts data for receiver power stage schematic shown in table VII.

b. TROUBLE LOCATION. (1) *Voltage check.* (*a*) The following voltage check is to be made with receiver input voltage supplied by the battery pack through cable plug.

(*b*) Set the REC-TRANS switch to the REC position and turn the VOLUME control switch ON.

(*c*) Apply the prod of a d-c voltmeter to terminal No. 3 of Tube JAN–1N5GT (V–1) of the receiver. The voltage reading should not be less than 66 volts (B+ voltage at pin of battery cable plug to chassis).

(*d*) Apply the prod of the voltmeter to terminal No. 2 of tube V–1, the voltage reading should not be less than 1.1 volt (A+ voltage at pin of battery cable plug to chassis).

(*e*) If the voltage readings are below the required limits, the battery pack should be checked and replaced if found faulty.

(2) *Resistance check.* (*a*) If the battery voltage readings are correct, check the resistance from pins to ground of the battery cable plug under the following conditions: VOLUME control full ON; headset into PHONES jack; and REC-TRANS switch in the REC position.

(*b*) Using an ohmmeter, make the following measurements to chassis: Apply prod to the A+ pin of the battery cable plug; the indication on the ohmmeter should be 3 ohms. Apply prod to the A— pin; the indication should be 0 ohms. Apply prod to the B+ pin; the indication should be open. Apply prod to the B— pin; the indication should be 700 ohms.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the practical wiring diagram (fig. 23). Check the stage for broken leads, faulty soldered joints and shorts. Check all capacitors for leakage. Check capacitors for open circuits by paralleling each with a good capacitor of equivalent value. Check resistance values of resistors R25 and R27.

Table VII. Parts data, receiver power stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C10	3DE100	CAPACITOR PACK: 0.25 mf ±10%; 200 vdcw; (B+ bypass).
C17	3DE100	CAPACITOR PACK: 0.25 mf ±10%; 300 vdcw; (B+ bypass).
C18	3DE100	CAPACITOR PACK: 0.01 mf ±10%; 1,000 v d-c; (B+ bypass).
C41	3D310	CAPACITOR: electrolytic; 25 mf —25 vdcw; (fixed bias bypass).
J6	2Z7227–12	PLUG: (part of No. 41; battery cable plug).
R25	3Z6802	RESISTOR: 820 ohm ±10%; ½ w; insulated; (fixed bias dropping).
S1	3Z9848	SWITCH: SPST; 3 amp, 125 v; 1 amp, 250 v; (part of volume control R3 and R15; OFF-ON).

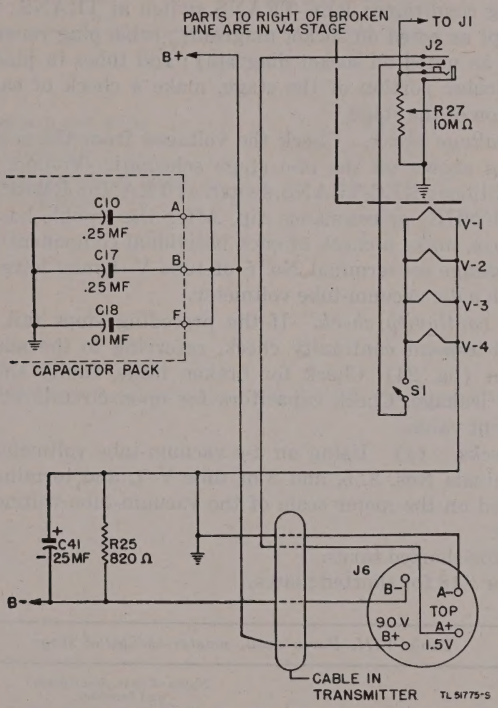


Figure 15. Receiver power stage, Radio Receiver and Transmitter BC–474–A.

36. Transmitter Master-oscillator Stage

a. STAGE DATA. (1) M-o stage schematic, shown in figure 16.

(2) Voltage and resistance values for socket terminals of Tube JAN–6V6GT (V–1) to ground, shown on stage schematic.

(3) Parts data for m-o stage, shown in table VIII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket resistance check.* Check the resistances from the socket terminals to ground, referring to the diagram shown on the m-o stage schematic. Resistance measurements are made under the following conditions: REC-TRANS switch at TRANS; EMISSION SELECTOR switch at PHONE (except as noted on socket diagram); cable plug removed from generator; key plugged in (open except as noted on socket diagram); and tubes in place. After the trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

(3) *Tube socket voltage check.* Check the voltages from the socket terminals to ground, referring to the diagram shown on the m-o stage schematic. Voltage measurements are made under the following conditions: REC-TRANS switch at TRANS; EMISSION SELECTOR switch at PHONE; and P.A. TUNING at resonance dip. After the trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage. The voltage on terminal No. 5 of tube V–1 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.

(4) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the practical wiring diagram (fig. 24). Check for broken leads, faulty soldered joints and shorts. Check all capacitors for leakage. Check capacitors for open circuits by paralleling each with a good capacitor of equivalent value.

(5) *Additional checks.* (*a*) Using an a-c vacuum-tube voltmeter, apply probe to the following test points: terminals Nos. 3, 5, and 8 of tube V–1, and terminal No. 5 of tube V–2. An indication should be noted on the meter scale of the vacuum-tube voltmeter after it has been adjusted to a suitable range.

(*b*) Check coil L1 for shorted turns.

(*c*) Check capacitor C18 for shorted plates.

Table VIII. Parts data, master-oscillator stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C2	3D9100–53	CAPACITOR, fixed: ceramic; 100 mmf ±5%; 500 v d-c; (temp cmpsng).
C3	3D9100–52	CAPACITOR: molded type; 100 mmf ±10%; operating E 400 v d-c; 500 v peak; (osc grid cplg).
C4	3DA3.900	CAPACITOR: molded type; 3,900 mmf ±20%; max E 400 v d-c; 500 v peak; (osc screen bypass).
C5	3D9100–52	CAPACITOR: same as C3; (power amplr grid cplg).
C6	3DA50–27	CAPACITOR, fixed: paper; 0.05 mf ±20%; 400 vdcw; (osc plate supply filter).
C18	3D343A	CAPACITOR, variable: max effective capacity 343.7 mmf ±1%; min capacity 10.2 mmf ±1%; (osc tuning).
L1	3C1998	COIL: single layer; close wound; (osc tank, L).
R1	3Z6647–1	RESISTOR: carbon; 47,000 ohm ±10%; ½ w; insulated; (osc grid R).
R2	3Z6615–14	RESISTOR: carbon; 15,000 ohm ±10%; 1 w; insulated; (osc screen R).
R3	3Z6500–59	RESISTOR: 5,000 ohms; 4 w; (osc plate R).
S9	3Z8312–9	SWITCH: 4 position; 1 sec; ceramic; (emission selector).
V1		TUBE: JAN–6V6GT/G (VT–107A); (osc).
	2Z8795.1	SOCKET: molded-in-plate; octal; (tube socket).

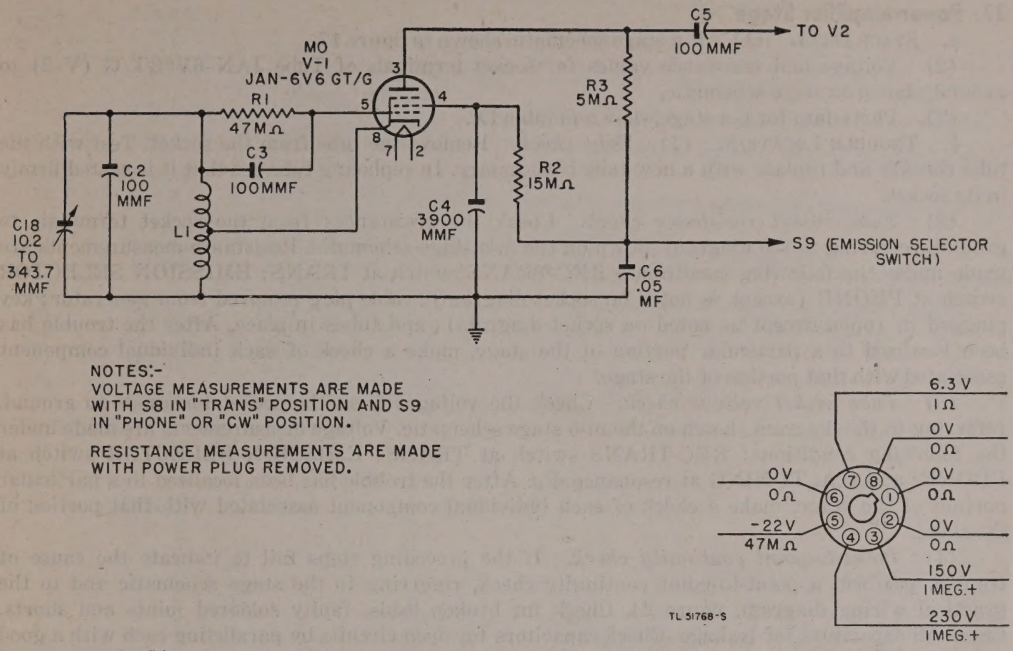


Figure 16. Transmitter oscillator stage, Radio Receiver and Transmitter BC–474–A.

37. Power-amplifier Stage

a. STAGE DATA. (1) P-a stage schematic shown in figure 17.

(2) Voltage and resistance values for socket terminals of Tube JAN–6V6GT/G (V–2) to ground, shown on stage schematic.

(3) Parts data for p-a stage, shown in table IX.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from the socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket resistance check.* Check the resistances from the socket terminals to ground, referring to the diagram shown on the m-o stage schematic. Resistance measurements are made under the following conditions: REC-TRANS switch at TRANS; EMISSION SELECTOR switch at PHONE (except as noted on socket diagram) ; cable plug removed from generator; key plugged in (open except as noted on socket diagram) ; and tubes in place. After the trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

(3) *Tube socket voltage check.* Check the voltages from the socket terminals to ground, referring to the diagram shown on the m-o stage schematic. Voltage measurements are made under the following conditions: REC-TRANS switch at TRANS; EMISSION SELECTOR switch at PHONE; and P.A. TUNING at resonance dip. After the trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

(4) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the practical wiring diagram, figure 24. Check for broken leads, faulty soldered joints and shorts. Check all capacitors for leakage. Check capacitors for open circuits by paralleling each with a good capacitor of equivalent value.

(5) *Additional checks.* (*a*) Using an a-c vacuum-tube voltmeter, apply probe to the following test points: to terminals No. 3 and 5 of tube V–2; to both terminals of ANTENNA CURRENT meter; and to the ANT. binding post. At each point, there should be indication on the vacuum-tube voltmeter after it has been adjusted to a suitable range.

(*b*) Check coils L2, L3, and L4 for continuity and for shorted turns.

(*c*) Check capacitor C17 for shorted plates.

(*d*) If meters do not show a deflection, check them with an ohmmeter for continuity and replace if found defective.

(*e*) Check contacts on coil L4 by testing continuity from sliding contact arms of both COARSE and FINE antenna controls, to the fixed contacts, for all contact positions.

(*f*) Turn the EMISSION SELECTOR switch to the C.W. position. There should be no indication on the P.A. PLATE CURRENT meter with the key opened. If there is an indication, then the KEY jack is shorted internally or the cathode terminal No. 8 of tube V–2 is grounded. Turn the EMISSION SELECTOR switch back to PHONE.

Table IX. Parts data, power-amplifier stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C7	3DA50–27	CAPACITOR, fixed: paper; 0.05 mf ±20%; 400 vdcw; (cathode bypass).
C8	3D9470	CAPACITOR: molded type; 470 mmf ±20%; max operating E 400 v d-c; 500 v peak; (screen bypass).
C9	3DA1–57	CAPACITOR: molded type; 1,000 mmf ±20%; max operating E 400 v d-c; 500 v peak; (plate cplg).
C17	3D9200V	CAPACITOR, variable; 200 mmf MC–200S; midget; max C counterclockwise; (tuning).
J2	2Z5534	JACK: JK–34; single ckt; (key jack).
L2	3C364	CHOKE COIL: distributed capacity 1 mmf; d-c resistance 50 ohms; current 125 ma; (plate choke).
L3	3C1998–1	COIL: single layer; close wound; (tank coil).
L4	3C1998–2	COIL: single layer; close wound; includes S6; (ant. loading coil).
M1	3F3329	METER: scale 0 to 100 ma d-c; 2 inch rectangular bakelite case; (plate current meter).
M2	3F3329–1	METER: 0 to 1 amp r-f; 2 inch rectangular bakelite case; (ant current meter).
R4	3Z6627	RESISTOR: carbon; 27,000 ohm ±10%; ½ w; insulated; (grid R).
R6	3Z6618–2	RESISTOR: carbon; 18,000 ohm ±10%; 1 w; insulated; (screen R).
S6	3Z8312–6	SWITCH: 12 position; (ant tuning (fine)).
S7	3Z8312–7	SWITCH: 7 position; 1 sec; ceramic; (ant tuning (coarse)).
V2		TUBE: JAN–6V6GT/G (VT–107A); (power amplr).
	2Z8795.1	SOCKET: molded-in-plate; octal; (tube socket).

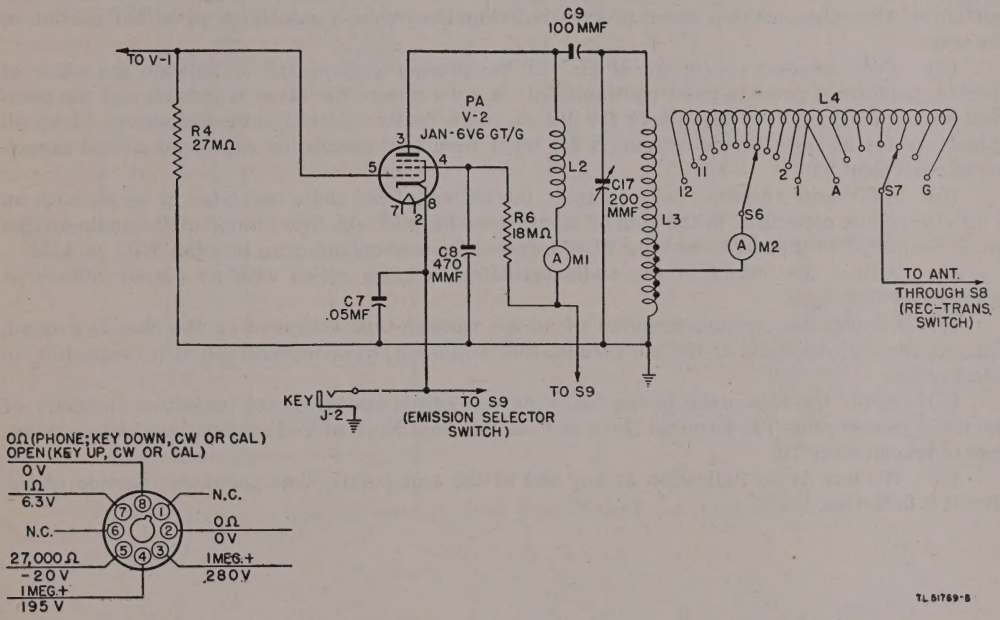


Figure 17. Transmitter power amplifier stage, Radio Receiver and Transmitter BC–474–A.

38. Transmitter Modulator Stage

a. STAGE DATA. (1) Modulator stage schematic shown in figure 18.

(2) Voltage and resistance values for socket terminals of Tube JAN–6V6GT (V–3) to ground, shown on stage schematic.

(3) Parts data for modulator stage shown in table X.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test tube with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket resistance check.* Check the resistances from the socket terminals to ground, referring to the diagram shown on the m-o stage schematic. Resistance measurements are made under the following conditions: REC-TRANS switch at TRANS; EMISSION SELECTOR switch at PHONE (except as noted on socket diagram); cable plug removed from generator; key plugged in (open except as noted on socket diagram); and tubes in place. After the trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

(3) *Tube socket voltage check.* Check the voltages from the socket terminals to ground, referring to the diagram shown on the m-o stage schematic. Voltage measurements are made under the following conditions: REC-TRANS switch at TRANS; EMISSION SELECTOR switch at PHONE; and P.A. TUNING at resonance dip. After the trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

(4) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check referring to the stage schematic and the practical wiring diagram (fig. 24). Check for broken leads, faulty soldered joints and shorts. Check all capacitors for leakage. Check capacitors for open circuit by paralleling each with a good capacitor of equivalent value.

(5) *Additional checks.* (*a*) Connect the output of an audio oscillator in series with an 8 mf electrolytic capacitor, to the ring of microphone Plug PL–68. The ground of the audio oscillator is connected to the sleeve of Plug PL–68. Insert the microphone plug into the MIC. jack.

(*b*) Adjust the output of the audio oscillator to 1,000 cycles with an output voltage of approximately 2 volts.

(*c*) Connect the ground terminal of an a-c vacuum-tube voltmeter to the chassis ground. Connect the high terminal of the a-c vacuum-tube voltmeter, in series with a 0.01-mf capacitor, to a test probe.

(*d*) Apply the test probe to the following test points and check for indication; primary of the input transformer T1; terminal No. 5 of V–3; terminal No. 3 of V–3; and both secondary windings of transformer T2.

(*e*) If there is no indication at any one of the test points, that particular portion of the circuit is defective.

Table X. Parts data, modulator stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C11	3DEB20	CAPACITOR: dry electrolytic; 20 mf +40%, —10%; 25 v operating; (cathode bypass).
C12	3DA3.900	CAPACITOR: molded type; 3,900 mmf ±20%; max operating E 400 vdcw; 500 v peak; (heater bypass).
C15	3DA100–75	CAPACITOR, fixed: paper; 0.100 mf ±20%; 400 vdcw; (screen bypass).
J4	2Z5533	JACK: JK–33; 2 ckt; (mic jack).
R5	3Z6612–3	RESISTOR: carbon; 12,000 ohm ±10%; 1 w; insulated; (screen R).
R7	3Z6033–4	RESISTOR: carbon; 330 ohm ±10%; 1 w; insulated; (cathode R).
R8	3Z6012–1	RESISTOR: carbon; 120 ohm ±10%; ½ w; insulated; (cathode R).
T1	2Z9971	TRANSFORMER PACK: mic transf; (T1 and T2 form 1 unit; mic to mod grid cplg transf).
T2	2Z9971	TRANSFORMER PACK: mod transf; (mod to power amplr cplg transf).
V3	2Z8795.1	TUBE: JAN–6V6GT/G (VT–107A); (mod).
		SOCKET: molded-in-plate; octal; (tube socket).

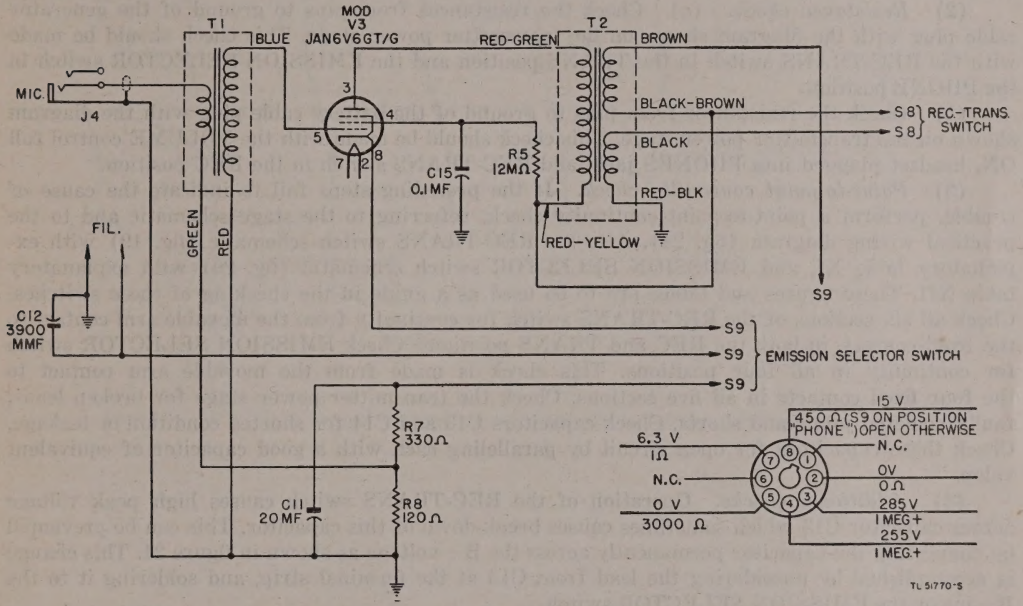


Figure 18. Transmitter modulator stage, Radio Receiver and Transmitter BC–474–A.

39. Transmitter Power Stage

a. STAGE DATA. (1) Transmitter power stage schematic shown in figure 22.

(2) Resistance values for generator cable plug J6 shown on the stage schematic.

(3) REC-TRANS switch schematic, shown in figure 19 with explanatory table XI.

(4) EMISSION SELECTOR switch schematic, shown in figure 20, with explanatory table XII.

(5) Parts data for transmitter power stage schematic, table XIII.

b. TROUBLE LOCATION. (1) *Voltage check.* (*a*) Set the EMISSION SELECTOR switch in the PHONE position and the REC-TRANS switch in the TRANS position.

(*b*) Apply the prod of a d-c voltmeter to terminal No. 3 of JAN–6V6GT/G (V–2) of the transmitter, referring to the practical wiring diagram (fig. 24). The voltage reading should not be less than 275 volts (B+ voltage to chassis at pin of generator cable plug).

(*c*) Apply the prod of the voltmeter to terminal No. 7 of tube V–2, the voltage reading should not be less than 6 volts (A+ voltage to chassis at pin of generator cable plug).

(2) *Resistance check.* (*a*) Check the resistances from pins to ground of the generator cable plug with the diagram shown on the transmitter power stage. This check should be made with the REC-TRANS switch in the TRANS position and the EMISSION SELECTOR switch in the PHONE position.

(*b*) Check the resistances from pins to ground of the battery cable plug with the diagram shown on the transmitter power stage. This check should be made with the VOLUME control full ON, headset plugged into PHONES jack, and REC-TRANS switch in the REC position.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the practical wiring diagram (fig. 24). Also see REC-TRANS switch schematic (fig. 19) with explanatory table XI, and EMISSION SELECTOR switch schematic (fig. 20) with explanatory table XII. These figures and tables are to be used as a guide in the checking of these switches. Check all six sections of the REC-TRANS switch for continuity from the movable arm contact to the fixed contact, in both the REC and TRANS positions. Check EMISSION SELECTOR switch for continuity in all four positions. This check is made from the movable arm contact to the four fixed contacts in all five sections. Check the transmitter power stage for broken leads, faulty soldered joints and shorts. Check capacitors C13 and C14 for shorted condition or leakage. Check these capacitors for open circuit by paralleling each with a good capacitor of equivalent value.

(4) *Additional checks.* Operation of the REC-TRANS switch causes high peak voltage across capacitor C13 which sometimes causes break-down of this capacitor. This can be prevented by connecting the capacitor permanently across the B+ voltage as shown in figure 21. This change is accomplished by unsoldering the lead from C13 at the terminal strip, and soldering it to the B+ lug on the EMISSION SELECTOR switch.

Table XI. REC-TRANS switch operation

Section	REC position connections	TRANS position connections
1	Connects antenna to the receiver	Connects the antenna to the COARSE adjustment, S7
2	Open	Connects the counterpoise to ground
3	Open	Connects B— to ground
4	Open	Connects B+ to transmitter plates
5	Open	Connects sidetone winding of the modulation transformer T2 to receiver output
6	Connects B+ to receiver plates	Open

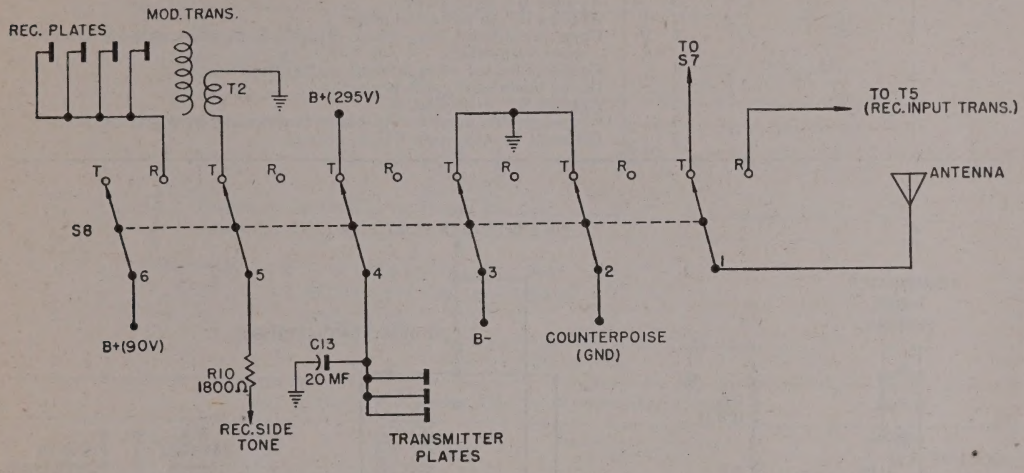


Figure 19. REC-TRANS switch schematic, Radio Receiver and Transmitter BC–474–A.

TABLE XII. Emission selector switch operation

Position	Operating condition	Section	Connections
1	OFF	1 to 5	All circuits open
2	PHONE	1	Connects heater voltage to all transmitter tubes
		2	Allows modulator to function by connecting cathode to the ground through R7 and R8
		3	Applies B+ to oscillator
		4	Applies B+ to power amplifier through modulator transformer
		5	Allows power amplifier to function by grounding cathode
3	C.W.	1	Connects heater voltage to all transmitter tubes
		2	Opens modulator cathode circuit
		3	Applies B+ to oscillator
		4	Applies B+ to power amplifier
		5	Open permitting key, when depressed, to close cathode circuit of power amplifier
4	CAL	1	Connects heater voltage to all transmitter tubes
		2	Opens modulator cathode circuit
		3	Applies B+ to oscillator
		4	Causes power amplifier to cease functioning by removing B+
		5	Connects B— through R13 to ground

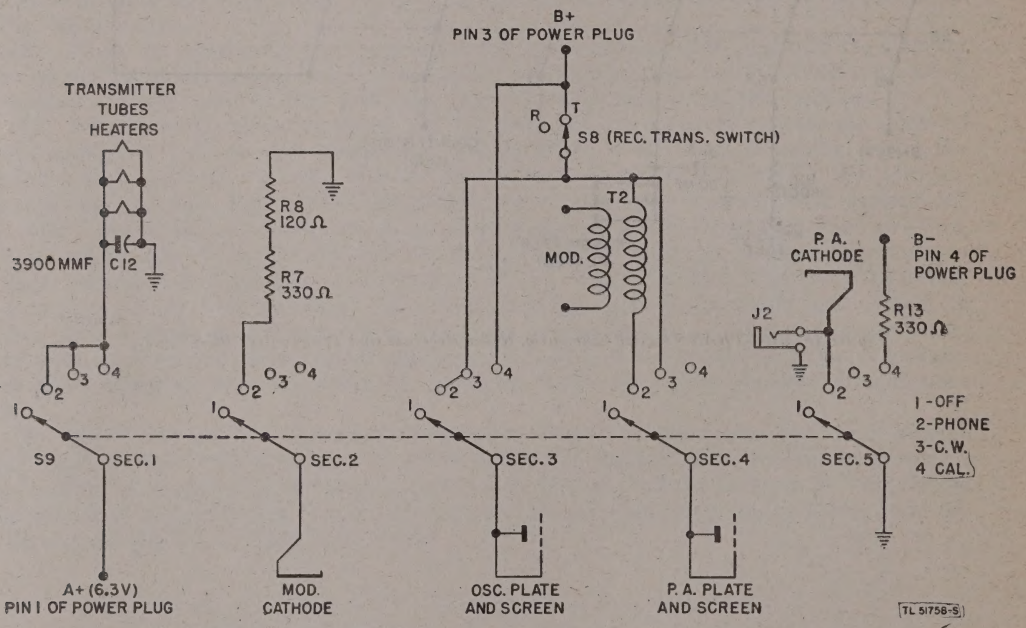


Figure 20. EMISSION SELECTOR switch schematic, Radio Receiver and Transmitter BC–474–A.

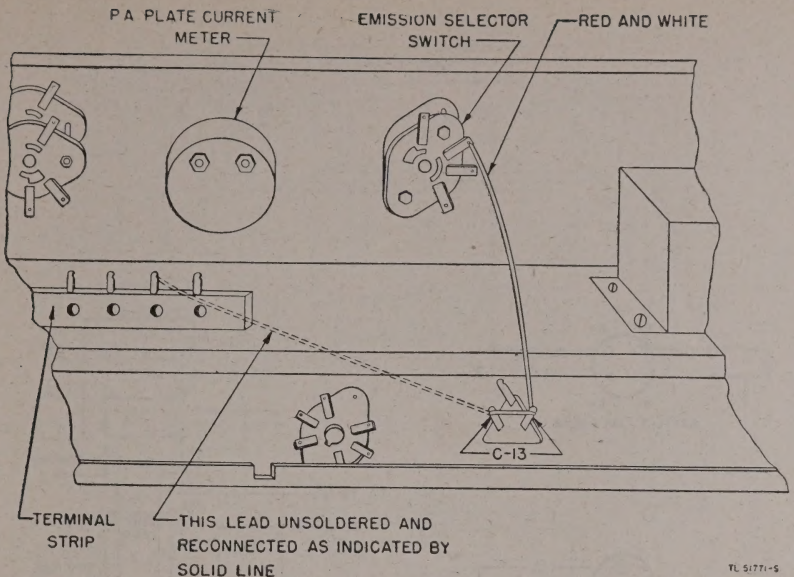


Figure 21. Modification of wiring of capacitor C–13, Radio Receiver and Transmitter BC–474–A.

Table XIII. Parts data, transmitter power stage

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C13	3DEB20	CAPACITOR: dry electrolytic; 20 mf +40%, —10%; operating E450 v; (part of C11; h-v filter).
C14	3DA100–77	CAPACITOR, fixed: paper; 0.100 mf ±20%; 200 vdcw; (heater bypass).
J3	2Z7150A	PLUG: PL–50A; (power cable plug).
J6	2Z7227–12	PLUG: (battery cable plug).
R10	3Z6180–1	RESISTOR: carbon; 1,800 ohm ±10%; ½ w; insulated; (sidetone R).
R13	3Z6033–3	RESISTOR: carbon; 330 ohm ±10%; 1 w; insulated; (bias equalizing R).
S8	3Z8312–8	SWITCH: 2 position; 2 sec; ceramic; (antenna and power transfer switch).
S9	3Z8312–9	SWITCH: 4 position; 1 sec; ceramic; (emission selector).

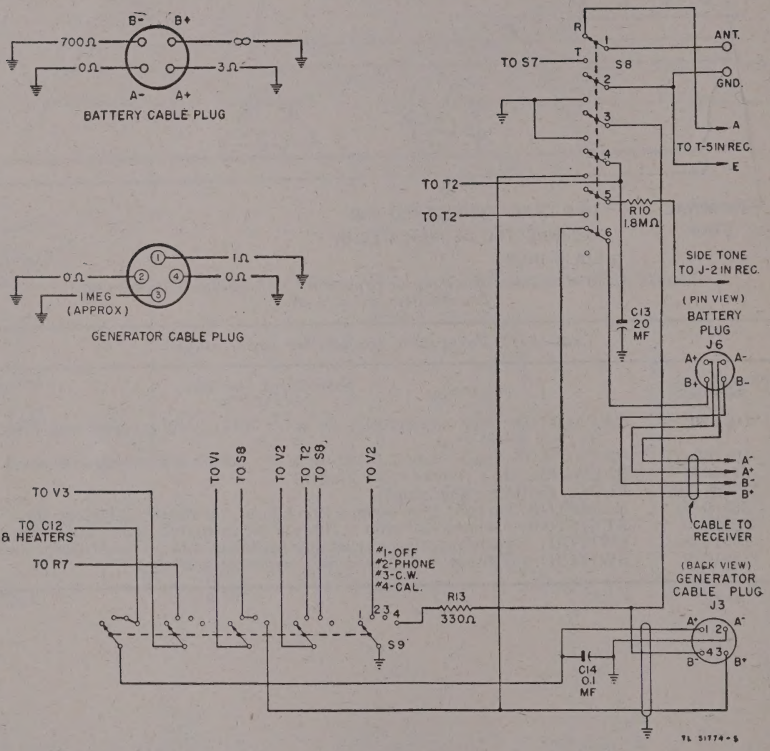


Figure 22. Transmitter power stage, Receiver and Transmitter BC–474–A.

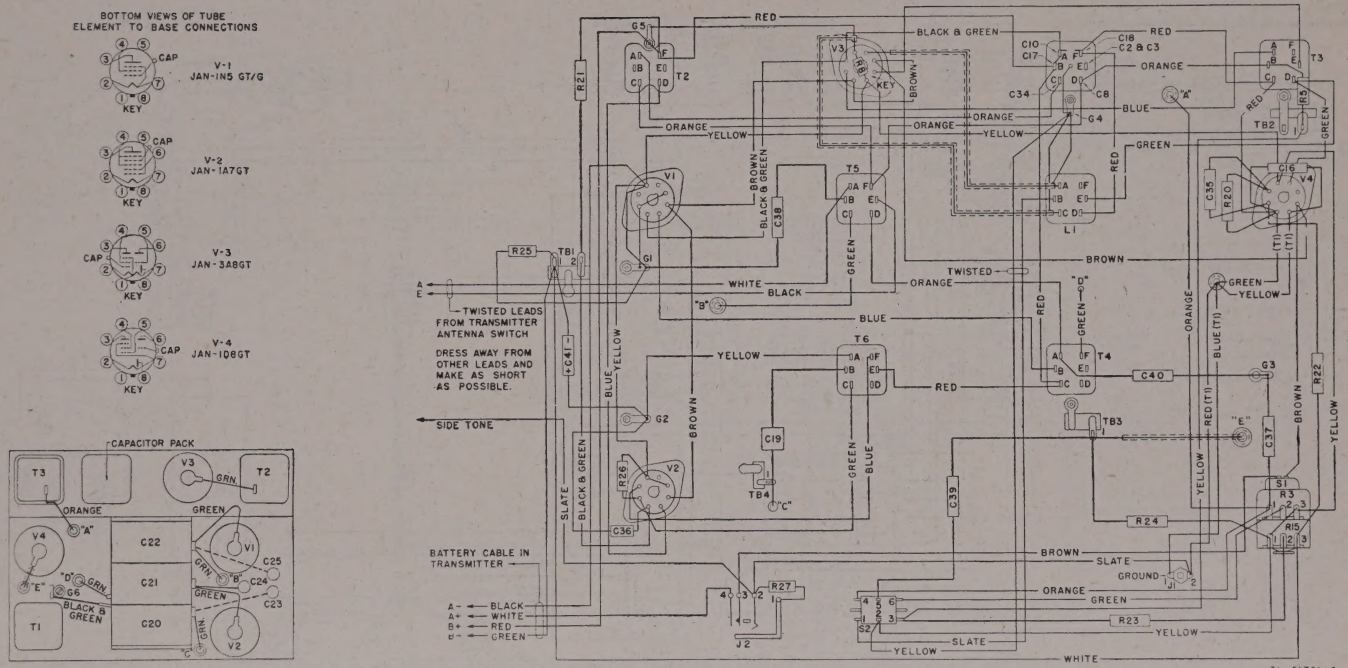


Figure 23. Receiver practical wiring diagram, Receiver and Transmitter BC–474–A.

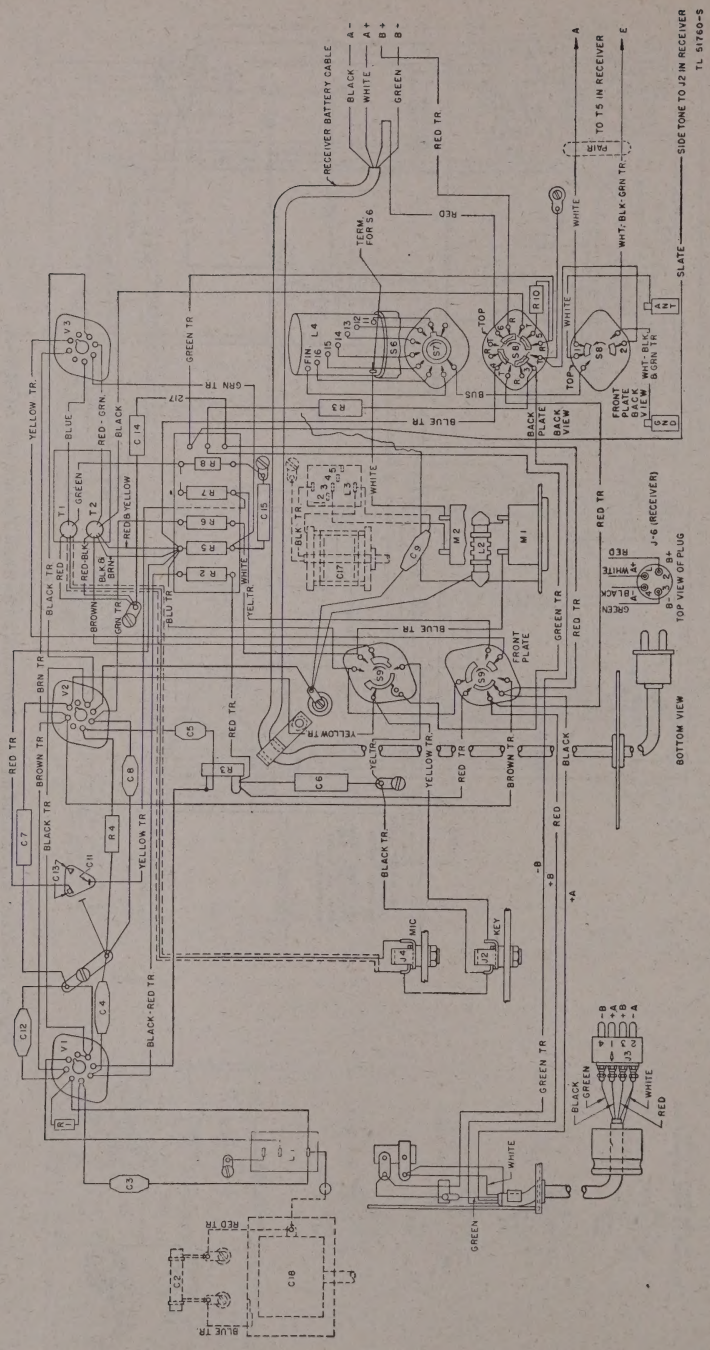


Figure 24. Transmitter practical wiring diagram, Receiver and Transmitter BC-474-A.

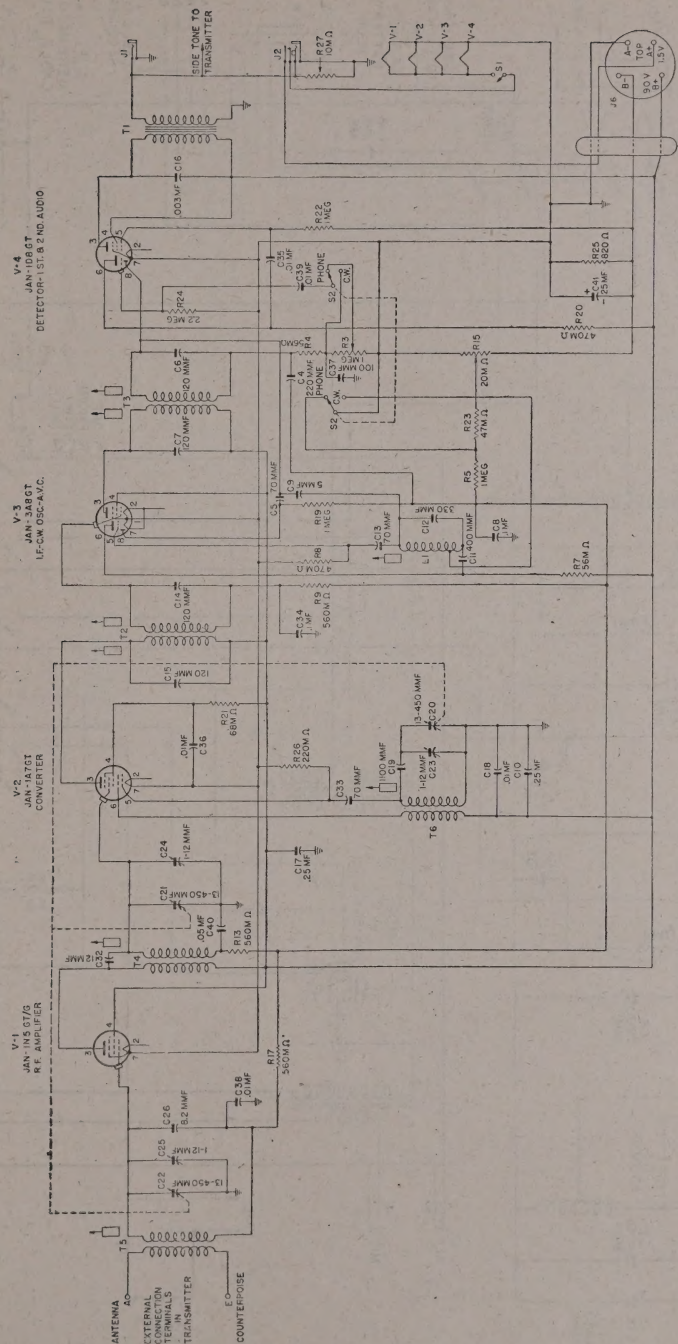


Figure 25. Receiver schematic, Receiver and Transmitter BC–474–A.

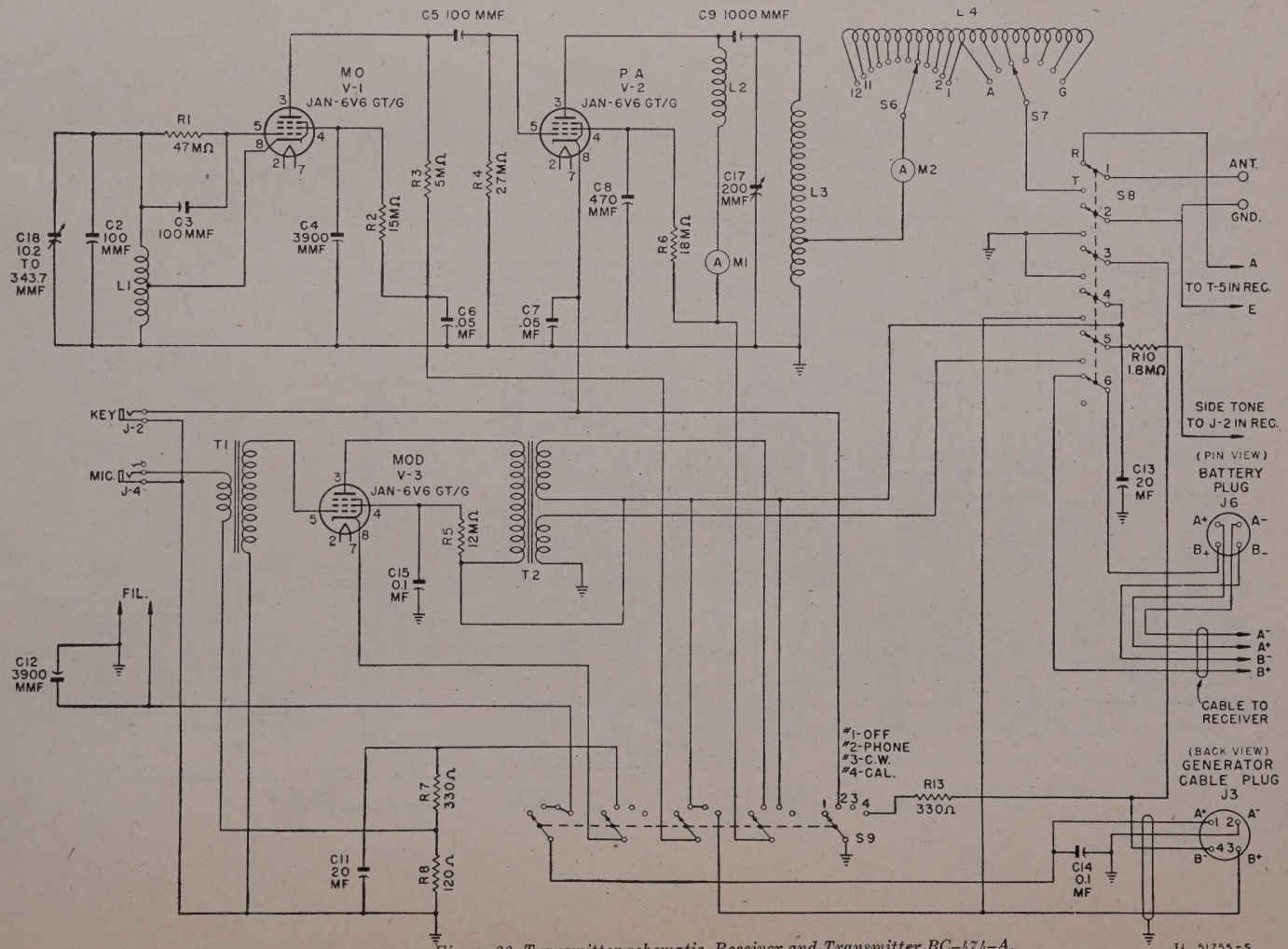


Figure 26. Transmitter schematic, Receiver and Transmitter BC–474–A.