TM 11-4041

WAR DEPARTMENT TECHNICAL MANUAL

RADIO RECEIVERS

BC-1147 and BC-1147-A

REPAIR INSTRUCTIONS

WAR DEPARTMENT • DECEMBER 1945

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TM 11–4041, Radio Receivers BC–1147 and BC–1147–A, Repair Instructions, is published for the information and guidance of all concerned.

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

CONTENTS

SAFETY NOTICE

There is no chance of shock on the outside of this equipment when it is in operation. However, voltages dangerous to life are present at various points within the equipment. Always observe all safety regulations. Do not change tubes or make adjustments inside the equipment with high voltage supply on. Do not depend upon door switches or interlocks for protection. Always shut down motor generators or other power equipment. Under certain conditions dangerous potentials may exist in circuits even with power controls off. This is due to charges retained by capacitors. To avoid casualties, always remove power, discharge, and ground circuits before touching them.

If you install, operate, and maintain this or similar equipment you must be prepared to give first aid. Your own life and the life of others may depend upon this.

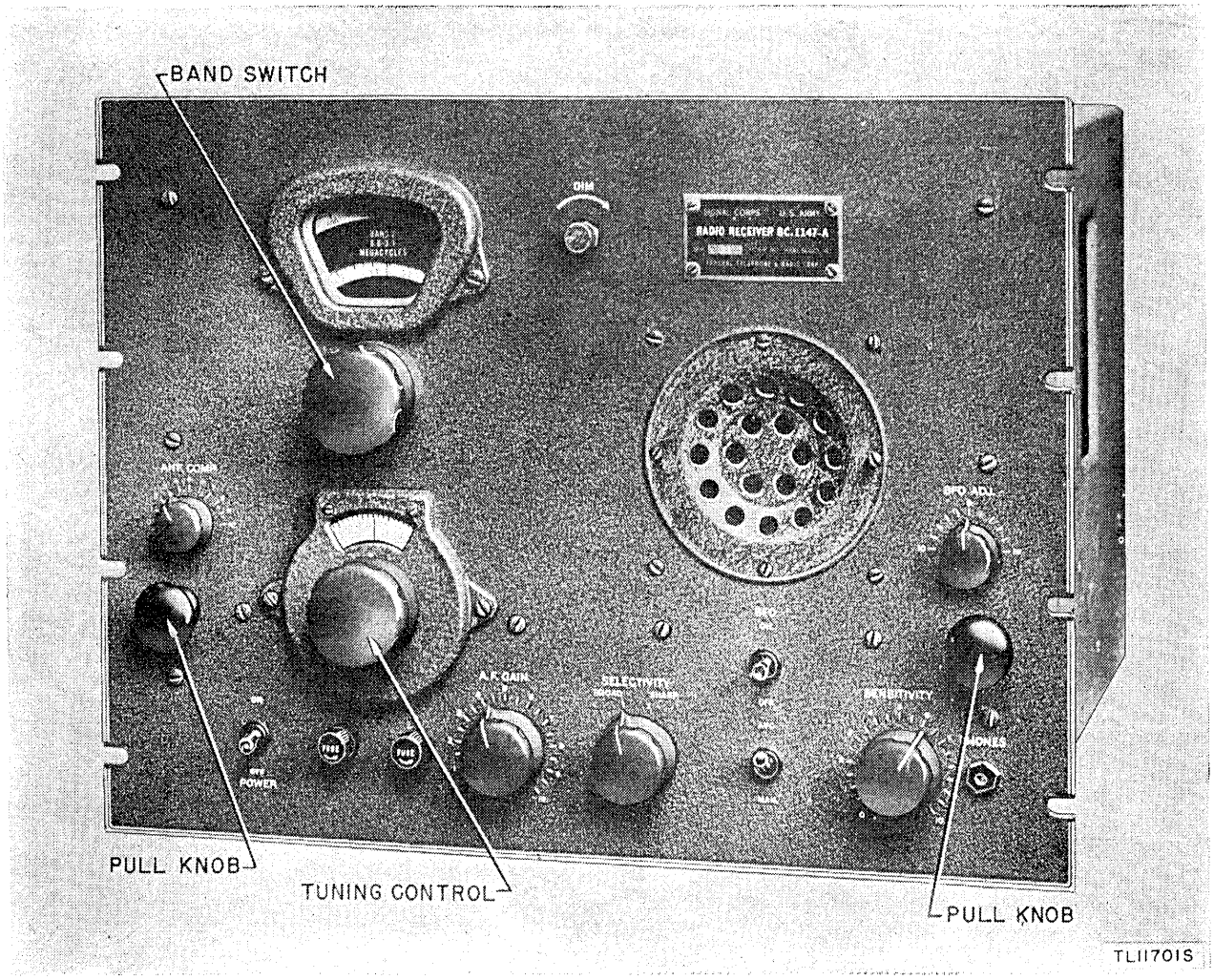


Figure 1. Radio Receiver BC–1147–(*), front view.

SECTION I

DESCRIPTION OF RADIO RECEIVERS BC–1147 AND BC–1147–A*

1. General

a. Radio Receiver BC–1147–(*) is a special purpose, four-band, thirteen-tube superheterodyne receiver designed for use in high-frequency (h-f) radio direction finding equipment, such as Radio Set SCR–291–A and Radio Set SCR–502. This receiver amplifies and rectifies the characteristic goniometer and antenna response for the indicator pattern control circuits associated with Bearing Indicator BC–1159. It also contains the conventional beat-frequency oscillator and audio circuits for reception of amplitude-modulated (a-m) signals. Loudspeaker and headphone outputs are used for stand-by service and simultaneous monitoring while taking bearings. The receiver is capable of receiving voice or continuous-wave (c-w) transmitted signals over the frequency range of 1.5 to 30 megacycles (mc). The frequency range is divided into four bands: 1.5 to 3.1 mc, 3.1 to 6.6 mc, 6.6. to 14.0 mc, and 14.0 to 30.0 mc. Figure 1 shows the front view of this receiver.

b. An automatic-volume-control (a-v-c) circuit is incorporated in the receiver. It may be included in or cut out of the circuit by turning the AVC-MAN. switch to either the AVC or MAN. position respectively.

c. A beat-frequency oscillator is incorporated in the receiver so that c-w signals may be received. A BFO ON-OFF switch is used to turn the beat-frequency oscillator on or off. The BFO ADJ control is used to change the pitch of c-w signals.

d. Official nomenclature followed by (*) is used to indicate all models of the item of equipment included in this Technical Manual. Thus Radio Receiver BC–1147–(*) represents Radio Receivers BC–1147 and BC–1147–A, which are treated together in this manual.

2. Over-all System Function

The circuit used in Radio Receiver BC–1147–(*) consists of two stages of tuned radio-frequency (r-f) amplification; a first detector and mixer stage; a heterodyne-frequency oscillator (hfo) stage; two stages of intermediate-frequency (i-f) amplification; a second detector and first audio-frequency (a-f) amplification stage; an audio-frequency output stage; a b-f-o oscillator stage (for c-w reception); an indicator detector and a-v-c stage; an indicator i-f amplification stage; a voltage-regulator stage; and a power-supply rectifier stage. The receiver sensitivity is manually controlled by means of the SENSITIVITY control. Figure 2 shows a simplified block diagram of the receiver.

* See TM 11–243, and TM 11–256, for installation, operation, and other reference data on this equipment.

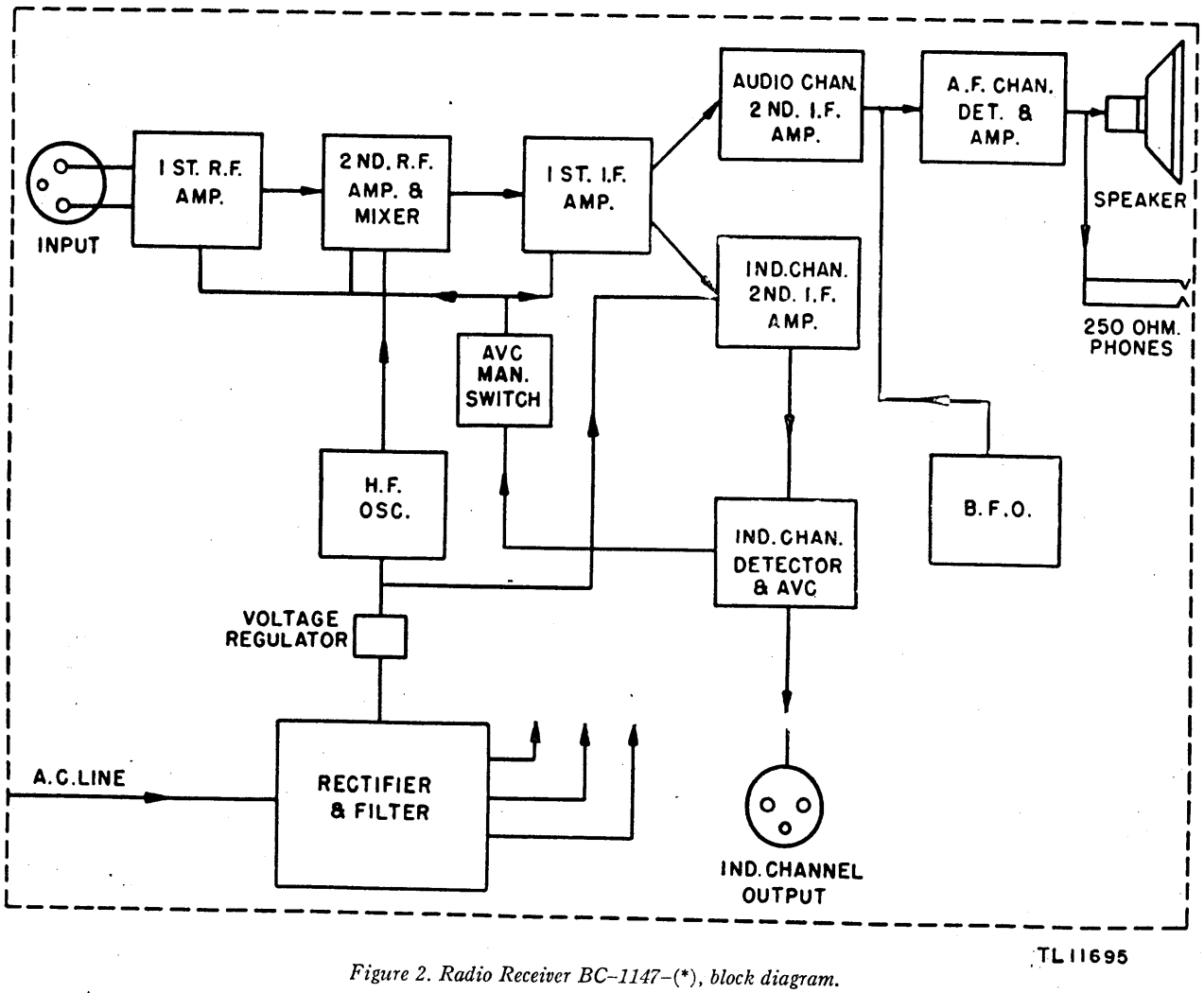


Figure 2. Radio Receiver BC–1147–(*), block diagram.

3. Simplified Circuit Analysis

The two stages of r-f amplification provide a high degree of selectivity and sensitivity while discriminating against interfering signals at intermediate or image frequencies. The beat-frequency oscillator provides a local oscillator signal which beats against the incoming signal in the first detector and mixer stage to produce an i-f signal. The i-f stages provide additional selectivity and amplification. The second detector stage (also first a-f amplifier) demodulates the signal and amplifies the audio component.

The gain of the second r-f amplifier, mixer, and first i-f amplifier stages is varied by varying the cathode bias of the associated tubes by means of the SENSITIVITY control. The gain of these stages is maintained essentially constant at any given SENSITIVITY control setting. This is accomplished by the a-v-c bias applied to the grids through the associated transformer secondaries when the AVC-MAN. switch is on AVC. When this switch is on MAN. the r-f, mixer, and first i-f transformer secondaries are grounded. Further amplification is supplied by the a-f output stage. The b-f-o stage produces an r-f signal which differs from the i-f signal by an audio frequency. The resultant beat note permits c-w reception. The first i-f stage provides one stage of i-f amplification for both the audio and indicator circuits. The second i-f stage has two tubes whose grids are connected in parallel. The output of one tube feeds the audio circuit, while the output of the other tube feeds the indicator circuit. The indicator second i-f stage feeds to the diode plates of the indicator-detector tube of the indicator-detector and a-v-c stage. Part of the rectified output is used for a-v-c bias and the rest is fed to the output socket for indicating. The power supply section

consists of a full-wave rectifying stage and a voltage-regulating stage which regulates the plate voltage to the h-f oscillator tube and maintains frequency stability even under conditions of large variations in the alternating-current (a-c) line voltage.

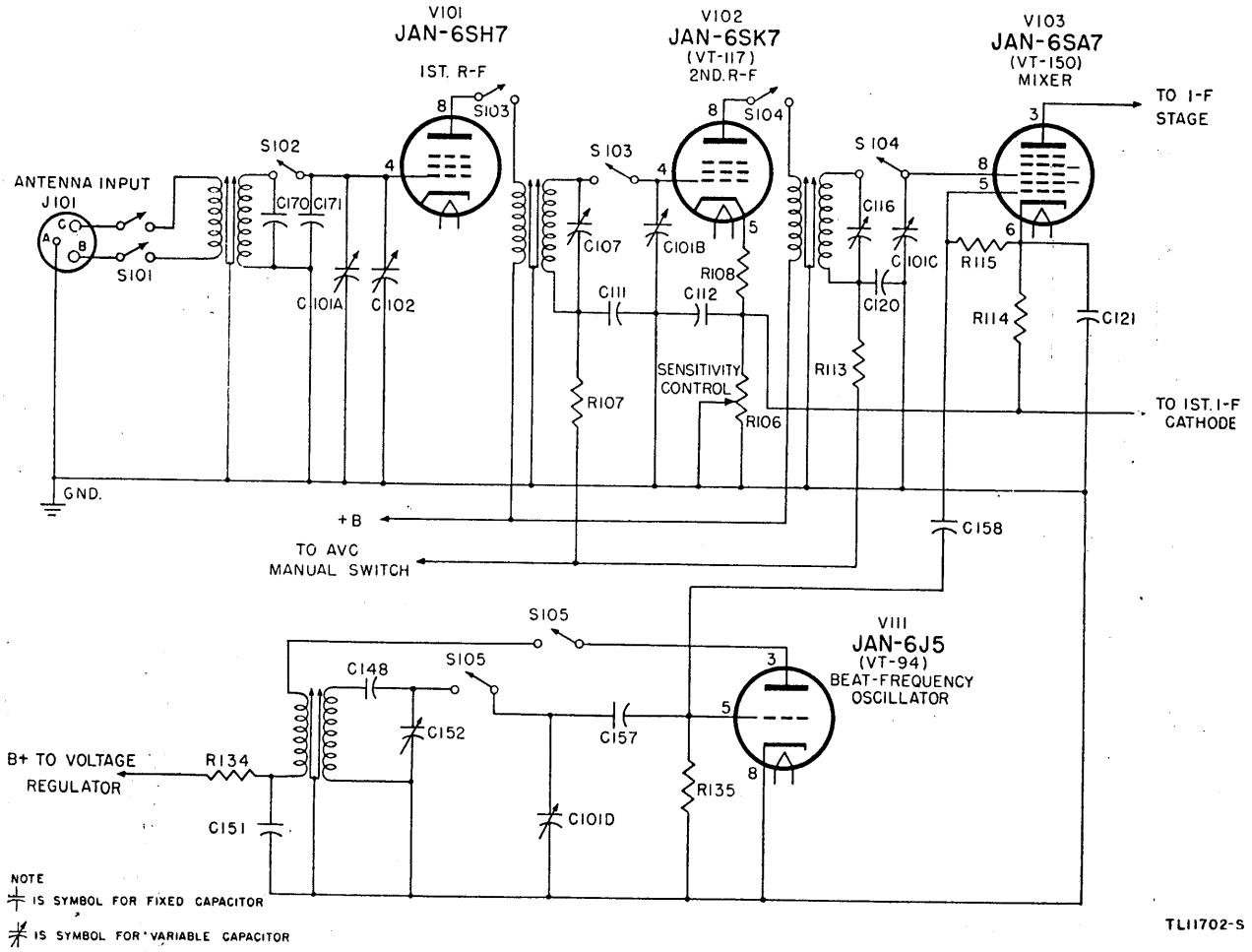


Figure 3. Radio Receiver BC–1147–(*), functional diagram of r-f section.

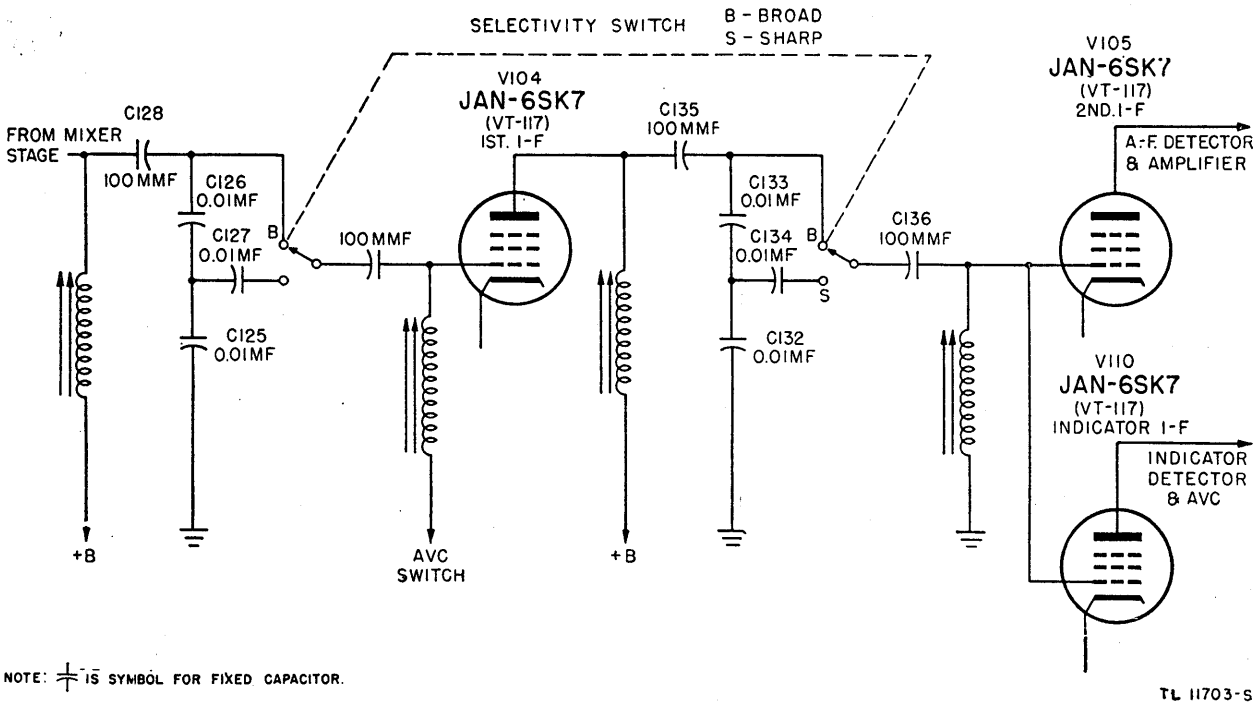


Figure 4. Radio Receiver BC–1147–(*), functional diagram of i-f section.

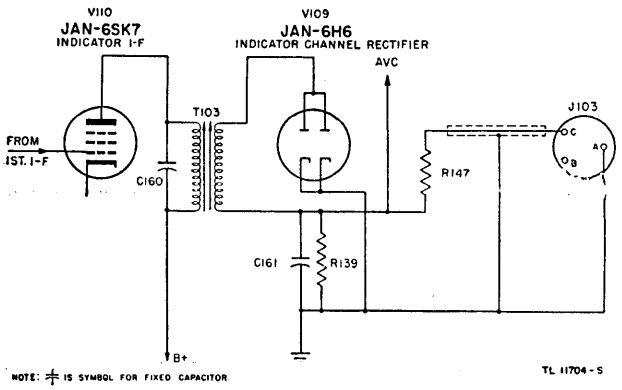


Figure 5. Radio Receiver BC–1147–(*), functional diagram of indicator section.

SECTION II

DIFFERENCES BETWEEN MODELS

4. Functional Differences

This manual covers two models of Radio Receiver BC–1147–( ), Radio Receiver BC–1147 and Radio Receiver BC–1147–A. Radio Receiver BC–1147 is used with Radio Set SCR–502 and Radio Receiver BC–1147–A is used with Radio Set SCR-291–A.

5. Electrical Differences

The only difference between the two models of the receiver is that the antenna compensator (C102) used in Radio Receiver BC–1147 has a maximum capacity of 40 micromicrofarads (mmf), while the antenna compensator used in Radio Receiver BC–1147–A has a maximum capacity of 17 mmf.

SECTION III

INITIAL REPAIR PROCEDURES

6. General

Note. Before any repairs or adjustments are made, all authorized modification work orders should be applied. (See FM 21–6, for list of applicable MWO's.)

Maintenance personnel should follow the procedure outlined in this manual when repairing and overhauling Radio Receiver BC–1147–(*). 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 time possible, resulting in sensitivity and selectivity comparable to that of new equipment.

7. Tools, Test and Cleaning Equipment

The following equipment is needed for repairing, overhauling and testing the receiver.

a. TOOLS. The following tools are needed:

Item	Description
Screw drivers	$\frac{1}{8}$-inch and $\frac{1}{4}$-inch with insulated handle.
Pliers	Long-nose and cutting
Mallet	Padded
Pipe cleaners	Small-diameter, tobacco smoker's
Brush, fiber	$\frac{1}{2}$-inch
Iron, soldering	

b. MATERIALS. The following materials are needed:

Item	Description
Solvent, dry-cleaning	
Cloth	Lintfree
Sandpaper	#000 and #0000

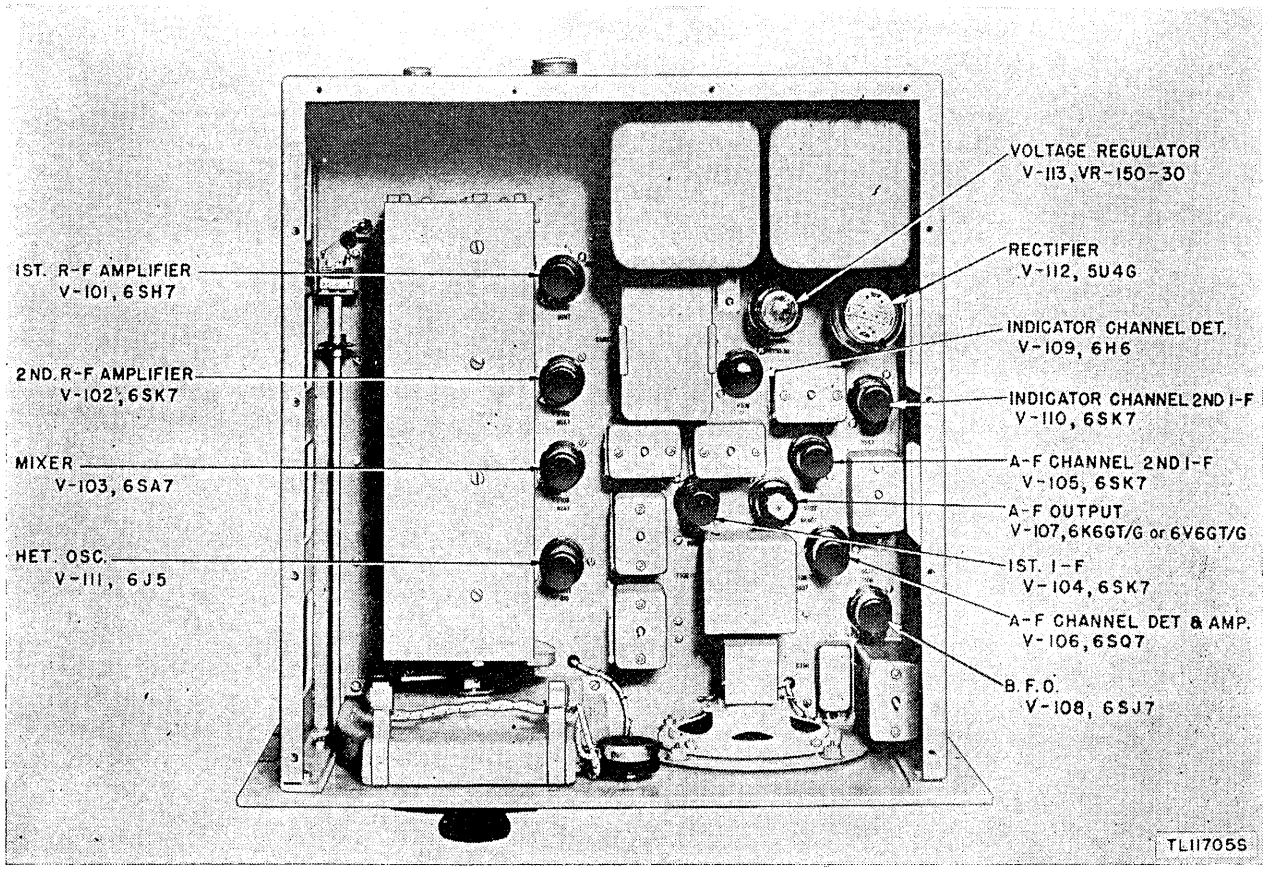


Figure 6. Radio Receiver BC–1147–(*), tube locations.

c. EQUIPMENT. The following equipment is needed:

Item	Description
Tube tester	Dynamic type
Ohmmeter	Weston test set No. 772 or equivalent
Voltmeter	Weston test set No. 772 or equivalent
Signal generator	Signal Generator I–72–( ) or equivalent
Frequency meter	Frequency Meter Set I–129–( ) or equivalent
Two voltmeters, vacuum-tube	A-c; d-c
Capacitance tester	
Capacitor	0.001 mf
Two resistors	68-ohm, noninductive
Output meter	4000-ohm impedance
Pad	Rubber or felt

8. Removal of Tubes

Remove the 12 screws holding the top cover plate to the upper section of the chassis. Remove the 17 screws holding the bottom cover plate to the bottom section of the chassis. With the exception of power-supply rectifier tube V112 and voltage-regulator tube V113, all tubes may be removed by pulling them out of their respective sockets. Before removing V112 and V113 it is necessary first to unfasten their clamps.

9. Chassis Cleaning, Inspecting, and Lubricating

a. CLEANING. In order to insure the best possible performance of the equipment and to prevent injury because of rust, dirt, or corrosion, the receiver should be thoroughly cleaned. Remove all loose dust and rust with an air line or brush. Remove all dirt and grease with a brush or cloth moistened with dry-cleaning solvent (SD). Clean the plates of the tuning capacitor C101 with an ordinary pipe cleaner dampened with dry-cleaning solvent (SD). Use lint-free cloth dampened with dry-cleaning solvent (SD) for cleaning band switch contacts. Remove excess dry-cleaning solvent (SD) and polish contacts with a clean dry cloth. Any corrosion remaining on the chassis after cleaning with dry-cleaning solvent (SD) should be remove by using ✻000 sandpaper; any remaining on contacts or other delicate parts should be removed by using ✻0000 sandpaper.

b. INSPECTING. After thoroughly cleaning the receiver, make a careful inspection of all parts for frayed or burned insulation, broken wires, loose screws or contacts, disconnections, charred transformers, and burned or charred resistors. Check all tube sockets for broken contacts and all switches and controls for loose or broken contacts, improper operation, or backlash. Inspect all terminal boards for broken lugs and signs of burning.

c. LUBRICATING. This receiver requires no lubrication.

10. Cleaning and Testing Tubes

Replace tubes which have badly corroded pins that do not yield to cleaning. Remove slight corrosion with ✻0000 sandpaper, and wipe clean with a cloth dampened with dry-cleaning solvent (SD). Insert tubes one at a time in the proper socket in a dynamic type tube tester. Set controls in accordance with the chart accompanying the tester. Test for short circuits, emission, transconductance, and power output. If the tube tester indicates that tubes are QUESTIONABLE, WEAK, or BAD, or if readings fluctuate when tube is tapped, replace tube. Since a tube may show no indication of malfunction in the tube tester and still not operate properly in the receiver, make substitutional test. To do this, substitute doubtful tubes for the corresponding tubes in a normally operating receiver. If the operation of the receiver is adversely affected, the tubes are defective.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

11. Power-Supply Measurements

a. INPUT RESISTANCE MEASUREMENT. Make sure all tubes and dial lamps have been removed and disconnect plug P101 from the a-c power supply. Set the POWER ON-OFF switch at ON.

(1) Measure the resistance between the two prongs of the a-c plug P101. The reading obtained should be 3.5 ohms. A zero reading indicates a short circuit. If no reading (infinite resistance) is obtained, check fuses F101 and F102 and the POWER ON-OFF switch. If the fuses and switch are in operating condition, measure the resistance of the primary winding of transformer T104 between the terminals marked 0 and 120. No reading indicates an open primary winding.

(2) Place one lead of the ohmmeter across both prongs of a-c plug P101; place the other lead on the chassis (ground). If the ohmmeter indicates any resistance value other than infinite, it means that the power-supply circuit is not properly insulated from ground. See paragraphs 46 and 47, and figures 25 and 26, for detailed information regarding the power-supply and voltage-regulator stages.

b. OUTPUT RESISTANCE MEASUREMENT. Check the resistance of the output side of the power circuit by measuring the resistance between terminal No. 8 of tube V112 and the chassis. The reading obtained should be 79,000 ohms. Investigate a deviation of more than 10 percent as it indicates trouble in either the B+ supply filter, the voltage-regulator circuit, or the h-f oscillator circuit. (See par. 45, 46, or 47, figs. 24, 25, and 26.)

c. FILAMENT RESISTANCE MEASUREMENT. Check the resistance of the filament winding by measuring the resistance between the two 6.3 terminals on transformer T104. This measurement should be approximately zero. A distinctly higher reading indicates a high resistance connection in the 6.3 volt circuit. No reading (infinite resistance) indicates an open filament winding in the secondary of transformer T104.

12. Operating Test

a. PREPARATION. Return all tubes to their proper sockets. Make certain that they are properly seated and that tube clamps are fastened. Put the dial lamps back in their sockets.

b. TESTING. (1) Turn the POWER switch to the ON position.

(2) Listen for any unusual noises that may be characteristic of defects in certain components.

(3) Watch for smoke, odor, or other indication of overheating which may be due to an overload of any of the unit parts.

(4) Connect the voltmeter between the chassis and each of the two terminals marked 6.3 on transformer T104. The voltage should be 6 to 7 volts alternating current in each case. If the voltmeter does not read 6 to 7 volts, check the filament wiring, the power supply, and the wiring leading to the dial lamps. (See par. 46, fig. 25.)

(5) Check the high-voltage winding of transformer T104 by connecting the voltmeter between pin No. 8 of tube V112 and the chassis. The voltage should be 310 volts direct current (dc) plus (+) or minus (−)10 percent. If there is any marked variation from this tolerance, check the equipment for shorted circuits or shorted or leaky capacitors.

(6) If the receiver is inoperative, see section VI, for detailed trouble shooting. If the receiver is operative, see section V, for alignment procedure.

SECTION V

ALIGNMENT PROCEDURE

13. Calibration

In order to insure accuracy of alignment, set the signal generator by checking it with the frequency meter as follows: place Signal Generator I–72–( ) near the Frequency Meter Set I–129–( ), turn them both on, and permit them to warm up for at least 15 minutes. Run a wire from the output of the signal generator to the antenna binding post of the frequency meter. Calibrate the frequency meter in accordance with the instructions furnished with it. Set the frequency meter to the frequency at which the signal generator is to be used and adjust the signal generator tuning control for zero beat in the headphones. Turn the frequency meter off and remove the wire attached to the output of the signal generator.

14. I-F Alignment

Align the i-f section of the receiver (figs. 7, 11, and 27) following the instructions below.

a. Place the receiver on its left side with the top and bottom plates off.

b. Connect the signal generator negative lead to chassis ground. Connect positive lead to the signal grid of tube V103 (pin No. 8).

c. Adjust the signal generator to a frequency of 455 kc and an output of 2,000 microvolts (mv) unmodulated.

d. Connect an a-c vacuum tube voltmeter (VTVM) across resistor R127 connecting from the high side of capacitor C142 to pin No. 3 of tube V106. (See fig. 27.) Set the VTVM on a 10-volt range.

e. Connect a d-c VTVM across pins B and C of socket J103. Set the VTVM on a 100-volt range.

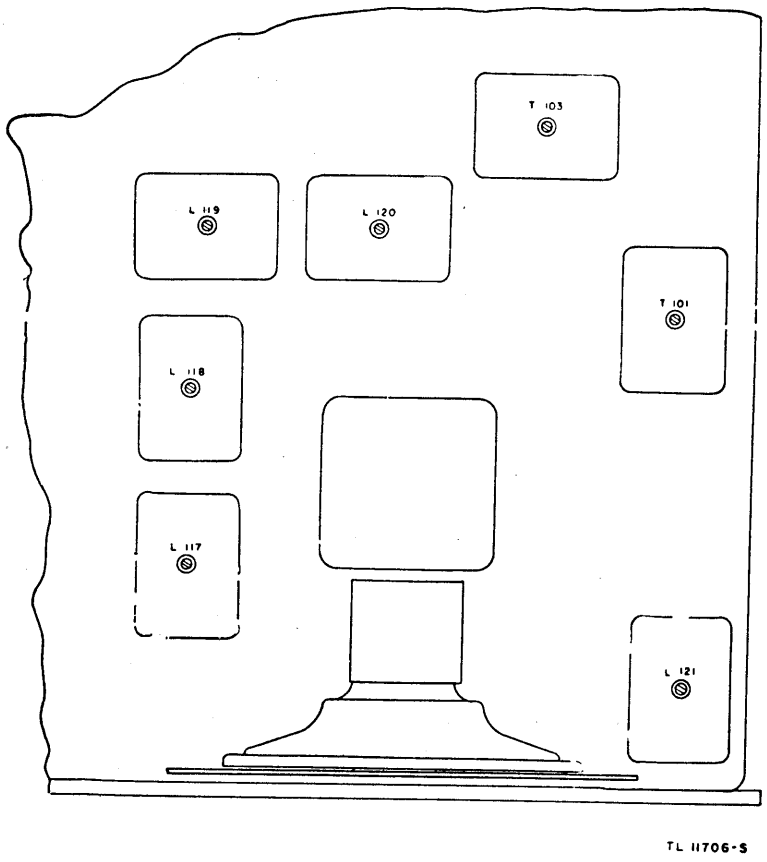


Figure 7. Radio Receiver BC–1147–(*), location of i-f trimmers.

f. Set the receiver controls in the positions specified below.

ANT. COMP.—3	AVC-MAN.—MAN.
A.F. GAIN—10	BFO ADJ.—0
SELECTIVITY—SHARP	SENSITIVITY—6* (approx)
BFO———OFF	Band Switch—BAND 1
	Tuning Control—2.5 mc

g. Allow receiver and test equipment to warm up for ½ hour before proceeding with alignment.

h. Use bakelite or high dielectric screw driver for trimming.

i. See figure 7, for trimmer locations.

j. Trim Transformer T101 for maximum VTVM reading.

k. Trim Transformer T103 for maximum VTVM reading.

l. Repeat adjustments listed in *j* and *k* above, until no further improvement is obtained.

m. Trim coils L120, L119, L118, and L117 in this sequence for maximum readings on a-c VTVM and d-c VTVM and repeat until no further improvement is obtained.

n. Turn BFO switch ON and trim coil L121 to zero beat audible in loudspeaker output.

o. Check BFO ADJ. control to determine that the pitch of the audible output may be varied as BFO ADJ. control is turned in either direction from 0.

15. R-F Alignment

Align the r-f section of the receiver (figs. 8, 11, and 27), following the instructions below.

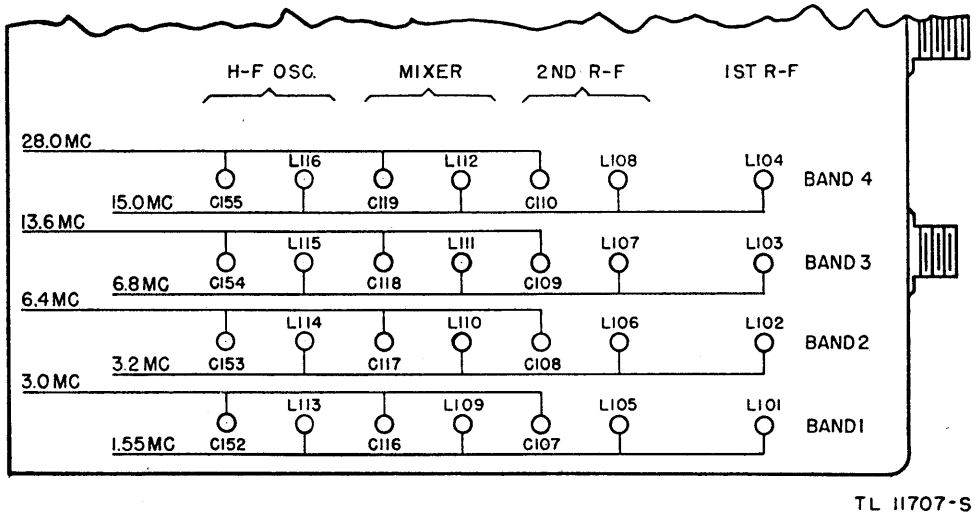


Figure 8. Radio Receiver BC–1147–(*), location of r-f trimmers.

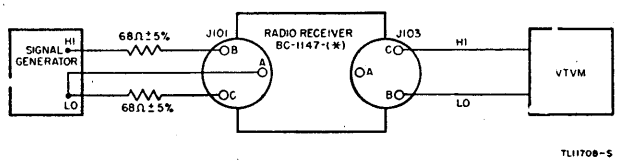


Figure 9. Radio Receiver BC–1147–(*), r-f alignment, test connections.

* During alignment, adjust SENSITIVITY control as required to maintain a constant output of approximately 15 volts to the VTVM connected to socket J103.

a. Place the receiver on its left side with the bottom plate on.

b. Connect the signal generator, receiver, and VTVM (100-volt range) as shown in figure 9.

c. Set the signal generator output to 5 and 10 μv unmodulated.

d. Set the receiver controls at the following positions: ANT. COMP. at 3; SELECTIVITY at SHARP; AVC-MAN. at MAN.; SENSITIVITY at 6. Adjust the SENSITIVITY control as required to keep the VTVM reading approximately 15 volts.

e. Allow the equipment to warm up ½ hour before alignment.

f. Use a bakelite or high dielectric screw driver for trimming.

g. See figure 8 for trimmer locations.

h. Check the receiver tuning accuracy by setting the signal generator at each of the following frequencies: BAND 1, 1.55 and 3.0 mc; BAND 2, 3.2 and 6.4 mc; BAND 3, 6.8 and 13.6 mc; BAND 4, 15.0 and 28.0 mc; and tuning the receiver for maximum VTVM deflection. The difference, if any, between the frequency of the signal generator and the receiver setting at which maximum deflection occurs is the tuning error. The signal generator frequency divided into the tuning error is the tuning error percentage.

i. If the tuning error is less than 0.6 percent for BANDS 1, 2, and 3, and less than 1 percent for BAND 4, proceed as follows:

(1) For BAND 1, adjust the signal generator and receiver to 1.55 mc and trim in sequence coils L109, L105, and L101 for maximum VTVM reading. Then adjust signal generator and receiver to 3.0 mc and trim capacitors C116, C107, and C102 (ANT. COMP.) for maximum VTVM reading. Repeat trimming operation several times at both 1.55 and 3.0 mc until no further improvement is possible. If final adjustment of ANT. COMP. control at the high end of the band is greater than 9.5 mc, see *k* below.

(2) For BAND 2, adjust the signal generator and the receiver to 3.2 mc and trim in sequence, coils L110, L106, and L102 for maximum VTVM reading. Set signal generator and receiver for 6.4 mc and trim in sequence capacitors C117, C108, and C102 (ANT. COMP.) for maximum VTVM reading. Repeat the trimming operations several times at 3.2 and 6.4 mc until no further improvement is possible. If final adjustment of ANT. COMP. control at the high end of the band is greater than 9.5 mc, see *k* below.

(3) For BAND 3, adjust the signal generator and the receiver to 6.8 mc and trim in sequence coils L111, L107, and L103 for maximum VTVM reading. Adjust the signal generator and the receiver to 13.6 mc and trim C118, C109, and C102 (ANT. COMP.) for maximum VTVM reading. Repeat the adjustment at 6.8 and 13.6 mc until no further improvement is possible. If final adjustment of ANT. COMP. control at the high end of the band is greater than 9.5, see *k* below.

(4) For BAND 4, adjust the signal generator and the receiver to 15.0 mc and trim coils L112, L108, and L104 for maximum VTVM reading. Then adjust the signal generator and the receiver to 28.0 mc and adjust capacitors C119, C110, and C102 (ANT. COMP.) for maximum VTVM reading. Repeat this procedure at 15.0 and 28.0 mc until no further improvement is possible. If final adjustment of ANT. COMP. control at the high end of the band is greater than 9.5 mc, see *k* below.

j. If the tuning error is greater than 0.6 percent for BANDS 1, 2, and 3 and 1 percent for BAND 4, proceed as follows:

(1) For BAND 1, adjust the signal generator and the receiver to 1.55 mc and trim coil L113 for maximum VTVM reading. Then adjust the signal generator and the receiver to 3.0 mc and trim capacitor C152 for maximum VTVM reading. Repeat this procedure at 1.55 and 3.0 mc until the dial error is less than 0.6 percent.

(2) For BAND 2, adjust the signal generator and the receiver to 3.2 mc and trim coil L114 for maximum VTVM reading. Then adjust the signal generator and the receiver to 6.4 mc and trim capacitor C153 for maximum VTVM reading. Repeat this procedure at 3.2 and 6.4 mc until the dial error is less than 0.6 percent.

(3) For BAND 3, adjust the signal generator and the receiver to 6.8 mc and trim L115 for maximum VTVM reading. Then adjust the signal generator and the receiver to 13.6 mc, and trim capacitor C154 for maximum VTVM reading. Repeat this procedure at both ends of the band until the dial error is less than 0.6 percent.

(4) For BAND 4, adjust the signal generator and the receiver to 15.0 mc and trim L116 for maximum VTVM reading. Then adjust the signal generator and the receiver to 28.0 mc and trim capacitor C155 for maximum VTVM reading. Repeat this procedure at 15.0 and 28.0 mc until

the dial error is less than 1 percent. Then trim r-f and mixer stages in accordance with *i* above.

k. If the final adjustment of the antenna compensator C102 (ANT. COMP.) at the high end of any band (that is 3.0 mc, 6.4 mc, 13.6 mc, 28.0 mc) is greater than 9.5 mc, realign the receiver in accordance with table I by setting the signal generator and receiver dial at the frequency specified in column 1, and proceeding to follow the table from left to right and from top to bottom.

Table I. R-F adjustment for antenna compensator correction

Set signal generator and receiver dial (mc)	Set ANT. COMP. (mc)	Trim for maximum VTVM reading	Trim in sequence for maximum VTVM reading
3.0	9.5	L101	.....
1.55	3.0	.....	L109, L105, L101
3.0	3.0	.....	C116, C107, and ANT. COMP.
6.4	9.5	L102	.....
3.2	3.0	.....	L110, L106, L102
6.4	3.0	.....	C117, C108, and ANT. COMP.
13.6	9.5	L103	.....
6.8	3.0	.....	L111, L107, L103
13.6	3.0	.....	C118, C109, and ANT. COMP.
28.0	9.5	L104	.....
15.0	3.0	.....	L112, L108, L104
28.0	3.0	.....	C119, C110, and ANT. COMP.

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

16. General

If the receiver was aligned properly in accordance with the procedure outlined in section V, and appears to be in good working order, this section may be omitted and the equipment submitted to final testing as outlined in section VII. The procedure detailed in this section is to be utilized in isolating any defect in the equipment to a definite stage. As an aid to isolating the defective stage and the defective part within the stage, this section includes information on the following: tube testing, power-supply testing, method of locating a defective stage through signal substitution, voltage and resistance analysis, and method of location of defective part or parts within a stage. This section also includes instructions on refinishing, moisture-proofing, and fungiproofing.

17. Tube-Testing and Power-Supply Testing

Although the tubes have been tested previously, they should now be tested again as described in paragraph 10. Since the tubes may have become defective during operation, any defective tube should be replaced. Check the input and output of the power-supply section as outlined in paragraph 11. The purpose of making this test at the present time is to make certain that the correct power supply is present for the signal substitution procedure that is used for isolating a defective stage.

18. Signal Substitution

Localize the trouble to a specific stage by means of signal substitution. Sometimes signal substitution may be eliminated by the following short cut: Turn the set on, and after the tubes have warmed up, touch each control grid in the voice section with an insulated screw driver. Be careful to touch only the control grid. Begin with output tube V107 and work back to input tube V101. If a clicking or humming noise is heard in the speaker, the stage is usually in operating condition. When no sound is produced, the trouble generally lies between the last tube which produced a sound and the first one that did not. If the above procedure fails to isolate the defective stage, follow the procedure below for signal substitution.

a. Set the control switches on the equipment as follows: the POWER switch at ON; the BFO switch at OFF; the AVC-MAN. switch at MAN.; the SELECTIVITY switch at BROAD; the A. F. GAIN control for maximum gain; the band switch at BAND 1, and the tuning control for 1.55 mc.

b. Connect either an a-c VTVM or an output meter with an input impedance of 4,000 ohms to socket J103. All measurements are taken in the indicator circuit because the equipment is primarily designed for indication.

c. Connect the signal generator to terminals B and C of the ANTENNA INPUT socket J101. (See fig. 27.) Insert a 0.01-microfarad (mf) capacitor between the positive lead of the signal generator and the terminal.

d. Adjust the signal generator to a frequency of 1.55 mc and an input of 2.0 microvolts 30 percent modulated with 400 cycles per second.

e. Adjust the SENSITIVITY so as to obtain an output of 15 volts on the VTVM or output meter connected to socket J103. If it is impossible to secure an output of 15 volts it is permissible to increase the input to 2.5 μv. A properly aligned receiver should not require any greater input.

f. If the correct reading is obtained with the correct input, it is not necessary to check any further, as this is a clear indication that the equipment is in good working order. If it is impossible to obtain the correct reading with the correct input, then proceed to substitute the signal in the successive stages as outlined below. The stage immediately preceding the first stage from which the proper response is obtained (indicated by specified change in output voltage) is the stage in which the trouble occurs. The defect should be further localized by checking the individual resistors, capacitors, and tube socket values as shown in section VIII, and figures 10 and 26.

g. Connect the signal generator ground lead to the chassis of the equipment and the positive lead to pin No. 4 (the grid) of tube V101. Because of the transformer effect of coil L101, the output reading should decrease, making it necessary to in-

crease the input voltage from the signal generator in order to register a 15-volt output on the VTVM. If the output remains the same for the same input, the trouble lies in coil L101 and it should be checked for a short between primary and secondary windings.

h. Connect the positive lead of the signal generator to pin No. 4 (the grid) of tube V102. The output voltage should decrease. In order to register 15 volts on the VTVM, a much higher input voltage should now be necessary.

i. Connect the positive lead of the signal generator to pin No. 8 (the grid) of tube V103. The output voltage should decrease. In order to register the same output as in the previous stages a much higher input voltage should now be required.

j. Adjust the signal generator to a frequency of 455 kilocycles (kc), the intermediate frequency of the equipment. Connect the positive lead of the signal generator to pin No. 5 of tube V103. The input voltage required to produce the output of 15 volts on the VTVM should be approximately the same as that required at pin No. 8 of the same tube. Before connecting the signal generator to pin No. 5, remove the heterodyne-frequency oscillator (h-f-o) tube VIII. The heterodyne-frequency oscillator must remain out for all succeeding steps and the frequency of the signal generator must be kept at 455 kc.

k. Connect the positive lead of the signal generator to pin No. 4 (the grid) of tube V104. At this point it may be possible to obtain the 15-volt reading on the VTVM with a decreased voltage input from the signal generator.

l. Connect the positive lead from the signal generator to pin No. 4 (the grid) of tube V105. It should now be necessary to use a very much increased output from the signal generator to secure the necessary 15-volt output at the VTVM.

m. Repeat all the steps outlined in (*a*) through (*m*) above, for each of the other three bands. The frequency fed to the grids of tubes V101, V102, V103, and to the ANTENNA INPUT must be: 3.2 kc for BAND 2; 6.8 kc for BAND 3; and 15 kc for BAND 4.

19. Voltage Analysis

Figure 10 shows the voltage readings from socket pins to chassis (except where otherwise indicated) as measured by a VTVM. Variations of more than 10 percent generally indicate either a defective circuit or tube. Measurement of the socket voltages is a convenient method of checking the operation of the equipment. When the voltage reading deviates from the value given in figure 10 by more than the permissible variation, proceed with a resistance check of the socket. (See par. 20.) If the resistance deviates by more than the permissible variation, check the individual resistors and capacitors by referring to the appropriate stage diagram. (See sec. VIII.)

a. Receiver connected to an input of 117 volts, 60 cycles alternating current.

b. All tubes in their sockets.

c. The A. F. GAIN control set at 10.

d. The SENSITIVITY control set at 8.

e. The DIM control turned clockwise as far as it will go.

f. The ANT. COMP. control set at 10.

g. The BFO switch set at OFF (except when taking readings at the socket of tube V108).

h. The AVC-MAN. switch set on MAN.

i. The band switch turned to BAND 2.

j. The tuning dial set at 4.5 mc.

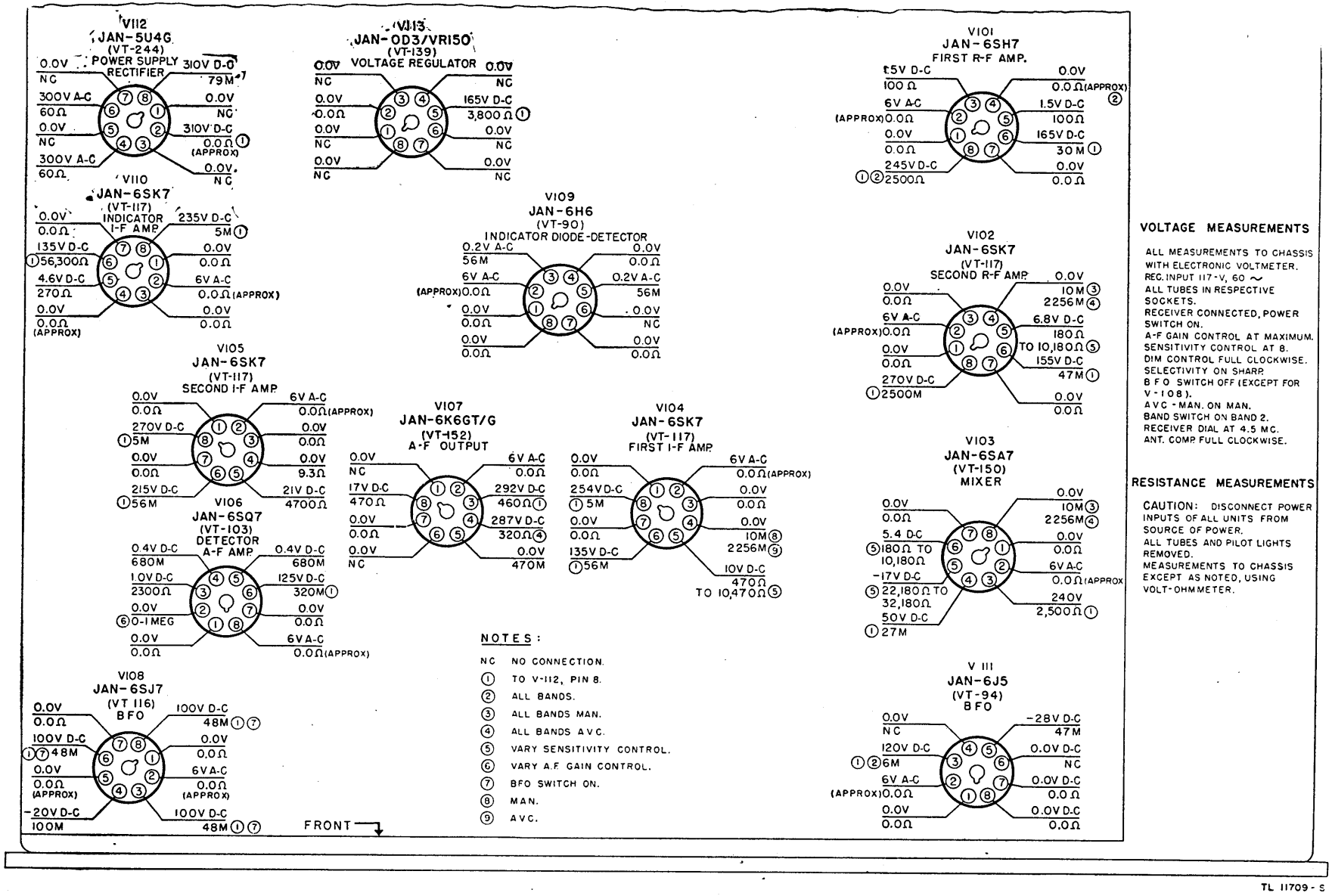


Figure 10. Radio Receiver BC–1147–(*), chassis lay-out diagram showing socket voltage and resistance values.

20. Resistance Analysis

Figure 10 shows the resistance readings taken at the tube socket pins. Variations of more than 10 percent call for a complete point-to-point circuit check of the associated stage in accordance with the applicable stage diagram in section VIII. Disconnect the receiver from the power source and remove all tubes and pilot lights before making these measurements.

21. Locating Defective Part

If any of the preceding tests in this section points to a defective stage or section in the receiver, it will be necessary to locate the defective part by testing each capacitor and resistor in the stage to determine if it is shorted or open. Use a capacitance tester and ohmmeter for these tests. A circuit diagram of each stage showing the rated values of each part appears in section VIII. Figures 11 and

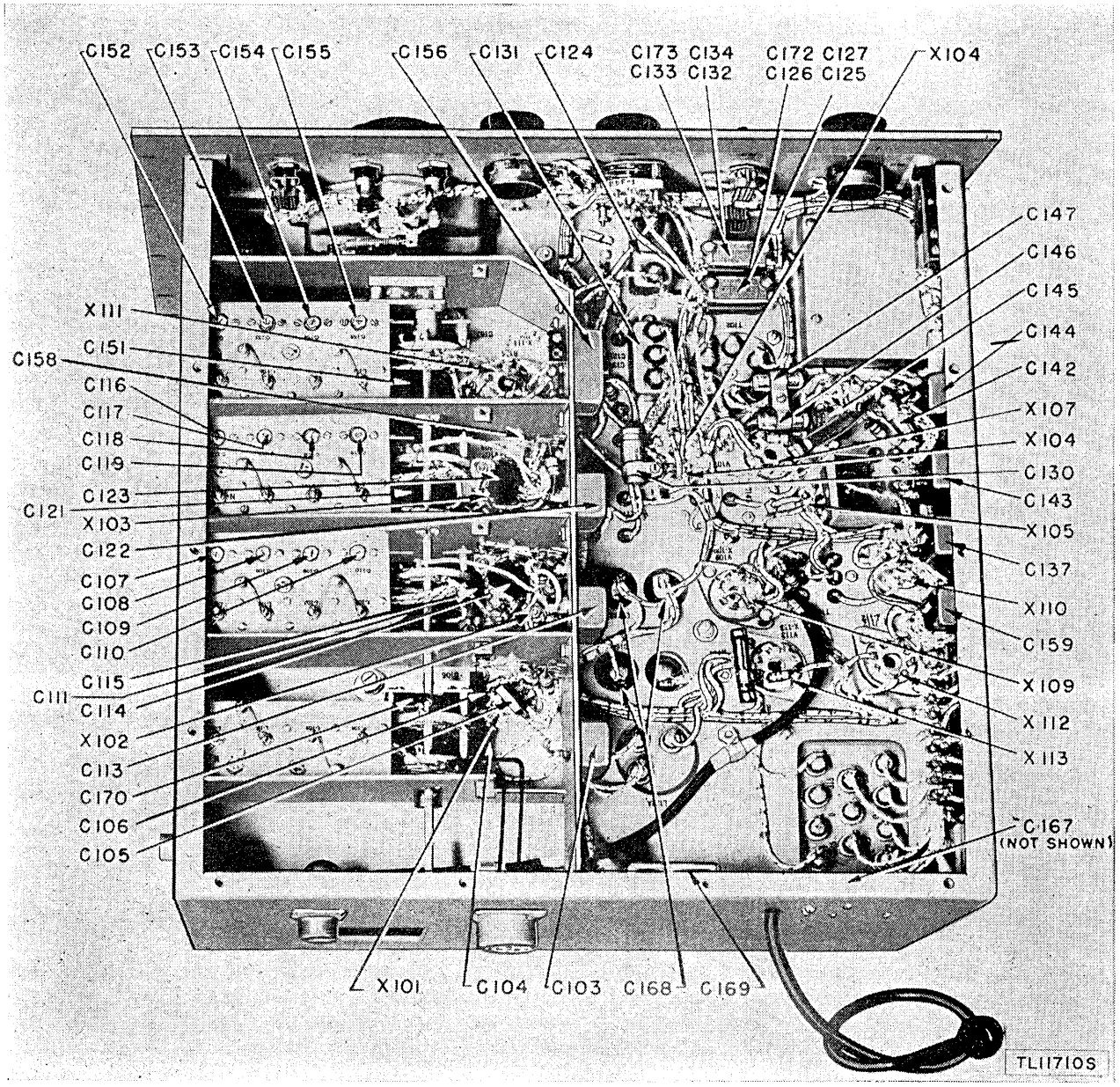


Figure 11. Radio Receiver BC–1147–(*), bottom view showing location of capacitors.

12, which show the location of the resistors and capacitors in the receiver, may be used to help locate the parts in the defective stage. Remove and replace any parts which are found to be defective and continue testing other parts in the circuit. Often more than one part in a stage becomes defective, and much time will be saved if all are checked before submitting the equipment to final testing.

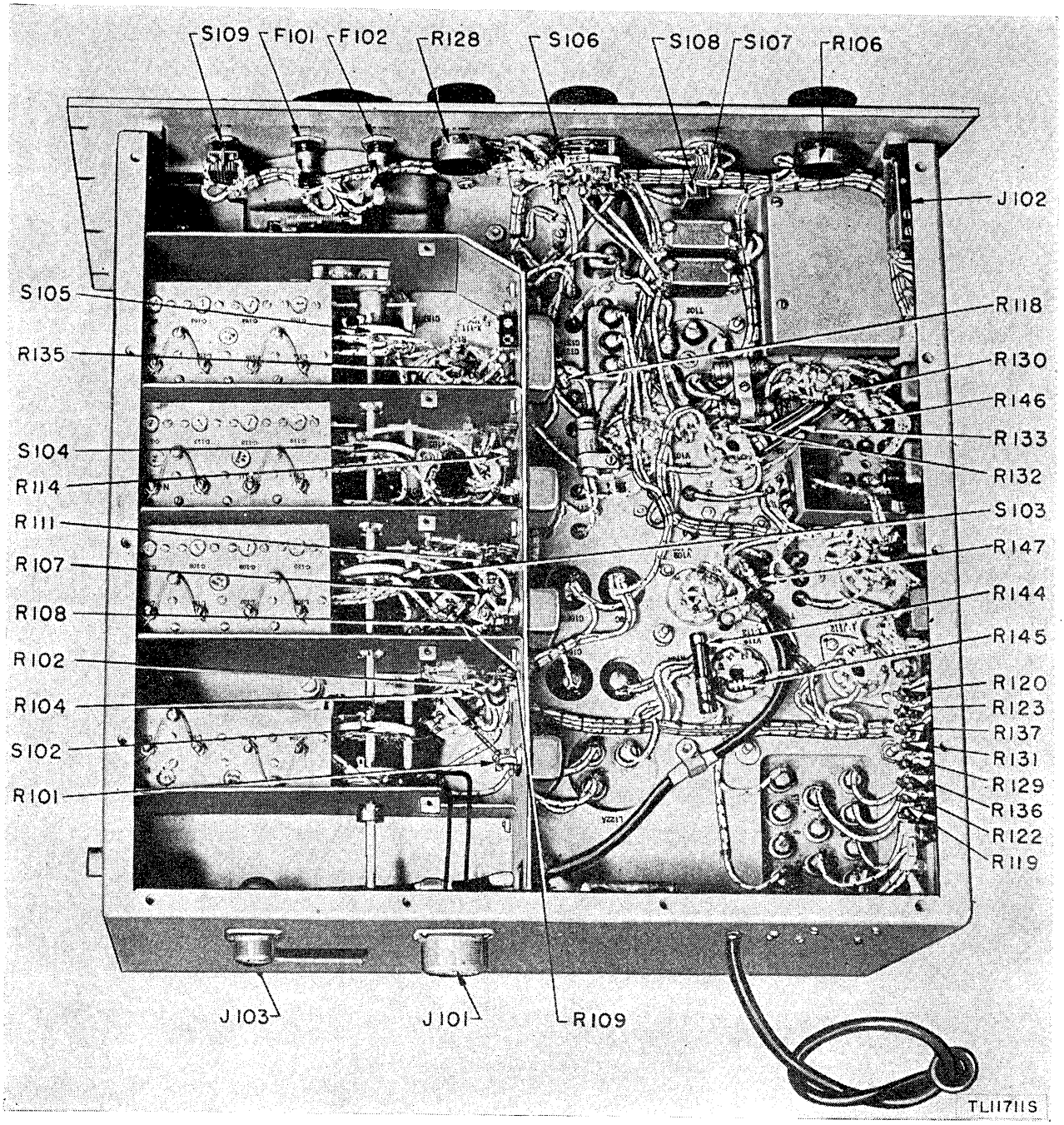


Figure 12. Radio Receiver BC-1147-(*), bottom view showing location of resistors.

22. Refinishing, Moistureproofing, and Fungiproofing

a. PAINTING AND REFINISHING. Where the finish on the case has been badly scarred or damaged, the repairmen may easily touch up the bared surface of the case by the following simple method to prevent rust and corrosion.

(1) Remove all rough spots using ⁄0000 sandpaper, and clean the surface down to metal, obtaining a bright smooth finish.

Caution: The use of steel wool, while it does permit quick removal of the rust, is not recommended. The use of steel wool allows small particles of the metal to enter the case and damage the equipment by causing internal electrical shorting or grounding of circuits.

(2) Rust must be removed from the case by first cleaning the corroded metal with dry-cleaning solvent (SD). In severe cases, it may be necessary to use dry-cleaning solvent (SD) to soften up the rust and then follow by using sandpaper until all the rust is removed.

(3) Touch up small parts by applying paint with a small brush. Where the case has so many scars and scratches as to warrant repainting, remove the chassis from the case and spray-paint the entire case. The paint applied shall be of the quality authorized by existing regulations.

(4) Accomplish the above procedures in accordance with accepted shop practices.

b. MOISTUREPROOFING AND FUNGIPROOFING. Apply moistureproofing and fungiproofing varnish to repaired connections and all parts from which the coating was removed. If more than 6 months have elapsed since moistureproofing and fungiproofing varnish was last applied, repeat the entire process in accordance with TB Sig 13, Moistureproofing and Fungiproofing Signal Corps Equipment. Moistureproofing and fungiproofing treatment must be repeated after each alignment of the receiver or after any soldering operation.

SECTION VII

FINAL TESTING

23. General

After repairs have been completed on the equipment and it has been moistureproofed and fungiproofed, final tests must be made to ascertain that the equipment is in proper condition for tactical use. The purpose of this section is to provide the procedure for making these final tests. Paragraphs 24 to 34, describe the test procedure in detail.

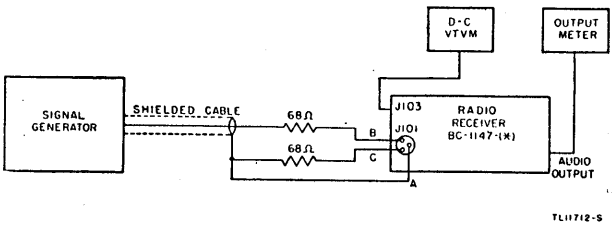


Figure 13. Radio Receiver BC–1147–(*), test set-up.

24. Test Conditions

a. ALIGNMENT CHECK. Although the equipment was aligned during the repair procedure, recheck the alignment in accordance with paragraphs 13, 14, and 15.

b. TEST SET-UP. For all tests in this section make connections in the following manner:

(1) Connect the positive lead from the signal generator to terminal B of socket J101 through a 68-ohm noninductive resistor. Connect the shield of the signal generator positive lead to terminal A of socket J101 (ground). If the signal generator has a negative lead, connect it through a 68-ohm noninductive resistor to terminal C of socket J101. If the signal generator does not have a negative lead, connect a 68-ohm noninductive resistor between the shield and terminal C of socket J101.

(2) Connect the positive lead of a d-c VTVM to terminal C of socket J103, and connect the negative lead to terminal A of socket J103. Maximum deflection on this VTVM indicates resonance.

(3) Connect an output meter with 4000-ohm impedance or an a-c VTVM to jack J102 (PHONES) with phones connected.

c. SIGNAL-TO-NOISE RATIO. To obtain a signal-to-noise voltage ratio of 10 to 1 adjust the receiver as follows:

(1) Tune signal generator and receiver to the same frequency. Adjust the ANT. COMP. control for maximum output.

Note. It is necessary to adjust the ANT. COMP. control for maximum output at each new frequency setting.

Adjust the signal generator output to approximately 5 μv with the signal 30 percent modulated at 400 cycles.

(2) Turn the signal generator off and adjust the SENSITIVITY control on the receiver to obtain 0.38 volts output on the a-c VTVM. This is the standard noise level of the receiver.

(3) Turn on the signal generator and adjust the signal generator output control until a reading of 3.8 volts is obtained on the VTVM connected to the receiver output. This is considered standard output.

(4) Always set for standard noise with the SENSITIVITY control and for standard output with the signal generator output control.

(5) If it is not possible to obtain this 10 to 1 ratio, there is too much noise in the receiver. Check the line filter capacitors, and capacitors C169, C103, C170, and C171. Inspect switch contacts, tube pins, and socket contacts for poor connections. Replace tubes one at a time. Microphonic or gaseous tubes may cause excess noise.

25. M-C-W Sensitivity Test (Broad)

a. CONTROL SETTINGS. (1) Set the ANT. COMP. control for maximum output.

(2) Set the BFO switch on OFF.

(3) Set the A.F. GAIN control for maximum gain.

4. Set the SELECTIVITY switch on BROAD.

b. PROCEDURE. Tune receiver to resonance and adjust receiver for signal-to-noise ratio of 10 to 1 (par. 24*c*) at each of the following frequencies:

(1) BAND 1—1.55 and 3.0 mc.
(2) BAND 2—3.2 and 6.4 mc.
(3) BAND 3—6.8 and 13.6 mc.
(4) BAND 4—15.0 and 28.0 mc.

c. TEST LIMITS. The maximum signal generator inputs required to give 3.8 volts output from the receiver should be no more than the following:

(1) 2.5 μv for BANDS 1 and 2.
(2) 2.0 μv for BAND 3.
(3) 4.0 μv for BAND 4.

26. M-C-W Sensitivity Test (Sharp)

a. CONTROL SETTINGS. Same as paragraph 25*a* except set SELECTIVITY switch at SHARP.

b. PROCEDURE. Tune receiver to resonance and adjust receiver for signal-to-noise ratio of 10 to 1 (par. 24*c*) at each of the following frequencies.

(1) BAND 1—2.2 mc.
(2) BAND 2—4.5 mc.
(3) BAND 3—9.8 mc.
(4) BAND 4—22.0 mc.

c. TEST LIMITS. The maximum signal generator inputs required to give a 3.8-volt output from the receiver should not exceed the following:

(1) 2.5 μv for BANDS 1, 2, and 3.
(2) 6.0 μv for BAND 4.

27. C-W Sensitivity Test

a. CONTROL SETTINGS. (1) Set the BFO at ON.
(2) Set the A. F. GAIN control at maximum.
(3) Set the ANT. COMP. control at maximum output.
(4) Set the SELECTIVITY switch on SHARP.

b. AUDIO SENSITIVITY. (1) *Procedure.* Tune receiver to resonance, and adjust BFO trimmer to give 400 cycles audio output. Adjust receiver for signal-to-noise ratio of 10 to 1 (par. 24*c*) at each of the following frequencies.

(*a*) BAND 1—2.2 mc.
(*b*) BAND 2—4.5 mc.
(*c*) BAND 3—9.8 mc.
(*d*) BAND 4—22.0 mc.

(2) *Test limits.* The maximum signal generator inputs required to give 3.8 volts output from the receiver should not exceed the following:

(*a*) 1.5 μv for BANDS 1, 2, and 3.
(*b*) 3.6 μv for BAND 4.

c. INDICATOR SENSITIVITY (1) *Procedure.* Tune the receiver to resonance at each of the frequencies specified in *b*(1) above. Turn off the signal generator and adjust the SENSITIVITY control to give 1.5 volts output on the VTVM connected to socket J103. Turn on the signal generator and adjust the signal generator output to give 10.5 volts on the VTVM.

(2) *Test limits.* The maximum signal generator inputs required to obtain 10.5 volts output on the VTVM should not exceed the following:

(*a*) 2 μv for BANDS 1, 2, and 3.
(*b*) 2.5 μv for BAND 4.

28. Image Ratio Test

a. CONTROL SETTINGS. (1) Set the ANT. COMP. control for maximum output.
(2) Set the BFO in OFF position.
(3) Set the A. F. GAIN control for maximum gain.
(4) Set the SELECTIVITY switch at BROAD.

b. PROCEDURE. Set the signal generator at each of the frequencies specified in *c* below, and adjust the output to feed into the receiver 5 μv for BANDS 1, 2, and 3 and 10 μv for BAND 4. Modulate the carrier 30 percent with 400 cycles at the test frequency. Tune the receiver to resonance. Set the SENSITIVITY control to give 10 volts output on the VTVM connected to socket J103. Adjust the A. F. GAIN control to give 1.2 volts output on the meter connected to the PHONES jack. Without changing the receiver control settings, tune the signal generator to image frequency and increase the signal generator output to give 1.2 volts output on the meter connected to the PHONES jack. The ratio of the input voltage required at the image frequency to produce a receiver output of 1.2 volts to that required to produce the same output at the specified frequency should be greater than the limits specified in *c* below.

c. TEST FREQUENCIES AND TEST LIMITS.

BAND	Signal frequency (mc)	Image frequency (mc)	Image ratio
1	3.0	3.91	30,000/1
2	6.4	7.31	280/1
3	13.6	14.51	400/1
4	22.0	22.91	100/1
4	28.0	28.91	100/1

29. I-F Rejection Ratio Test

a. CONTROL SETTINGS. (1) Set the ANT. COMP. control for maximum output.
(2) Set the BFO switch on OFF.
(3) Set the A. F. GAIN control for maximum gain.
(4) Set the SELECTIVITY switch on BROAD.

b. PROCEDURE. Set the signal generator at 1.55 mc. Adjust signal generator output to feed into the receiver 5 μv for BANDS 1, 2, and 3 and 10 μv for BAND 4. Modulate carrier 30 percent with 400 cycles. Set SENSITIVITY control to give 10 volts as measured on the VTVM in socket

J103 and adjust the A. F. GAIN control to give 1.2 volts output on the meter connected to the PHONES jack. Without changing the receiver control settings, tune the signal generator to i-f frequency, and increase the signal generator output to give 1.2 volts receiver output on the meter connected to the PHONES jack.

c. TEST LIMITS. The ratio of the voltage input required at the i-f frequency to produce a receiver output of 1.2 volts to that required to produce the same output at 1.55 mc should be greater than 100,000 to 1. Repeat this test at 3.3 mc, 6.8 mc, and 15 mc.

30. I-F Selectivity Test

a. CONTROL SETTINGS. (1) Set band switch on BAND 1.

(2) Set tuning dial at 2.5 mc.

(3) Set ANT. COMP. control at 5.

(4) Set BFO switch on OFF.

b. PROCEDURE. (1) *Sharp selectivity.* With the SELECTIVITY switch in the SHARP position, adjust the signal generator output to 2.0 millivolts. Modulate carrier 30 percent with 400 cycles at i-f frequency, 455 ± 1 kc. Set SENSITIVITY control to give an indicator reference level of 15 volts measured on the VTVM connected to socket J103. Adjust A. F. GAIN control to give an a-f reference level of 1.2 volts on the meter connected to the PHONES jack. Without changing the receiver control settings, increase the signal generator output to 2 times, 10 times, 100 times, and 1,000 times the original input. At each different input, vary the signal generator frequency above and below the resonance frequency and find the two frequencies where the receiver output on the VTVM connected to socket J103 is again 15 volts. The difference between these two frequencies is the bandwidth. Find, also, the two frequencies at which the output on the meter connected to the PHONES jack is again 1.2 volts. The bandwidths should be within the limits specified in *c* below.

(2) *Broad selectivity.* Repeat the test in *b*(1) above, with the SELECTIVITY switch in the BROAD position but without changing the setting of the SENSITIVITY control.

c. TEST LIMITS. The bandwidths should be within the limits specified below.

Input μv	Bandwidth, sharp		Bandwidth, broad	
	min (kc)	max (kc)	min (kc)	max (kc)
4	1.5	3.0	5.0	7.5
20	4.0	6.5	9.0	13.0
200	9.5	14.0	17.5	24.0
2,000	17.0	27.0	28.0	38.0

31. Audio Fidelity Test

a. PROCEDURE. Set the signal generator at 2.5 mc and adjust the signal generator output control to feed a 5 μv signal from the signal generator into the receiver. Modulate this signal 30 percent with 400 cycles. Set the receiver SELECTIVITY switch in the BROAD position and tune the receiver to resonance at 2.5 mc. Adjust the SENSITIVITY control for an indicator output voltage of 15 volts on the VTVM connected to socket J103, and the A. F. GAIN control for an a-f output of 1.2 volts on the meter connected to the PHONES jack. Vary the audio frequency of the signal generator modulation and note the output voltage on the meter connected to the PHONES jack when the modulation is 150, 400, 800, 1,000, and 1,500 cycles per second.

b. TEST LIMITS. The output voltage should not exceed 3.548 at any frequency between 150 and 2,500 cycles.

32. Tuning Dial Calibration Test

a. PROCEDURE. Set the SELECTIVITY switch in the SHARP position. Set the signal generator at the frequencies specified in *b* below, and verify the accuracy of the frequency calibration of the signal generator with Frequency Meter Set I-129-(*). Check the accuracy of the tuning dial calibration at the specified frequencies by tuning the receiver for maximum deflection on the VTVM connected to socket J103. The difference between the frequency of the signal generator and the receiver setting at which maximum deflection occurs is the dial calibration error. The dial calibration error divided by the signal generator frequency is the dial calibration error percentage.

b. TEST FREQUENCIES.

BAND 1 (mc)	BAND 2 (mc)	BAND 3 (mc)	BAND 4 (mc)
1.5	3.1	6.6	14.0
1.9	4.0	8.0	18.0
2.3	5.0	10.0	22.0
2.7	6.0	12.0	26.0
3.1	6.6	14.0	30.0

c. TEST LIMITS. The dial calibration must be accurate within 0.6 percent at all points on the dial scale for BANDS 1, 2, and 3 and within 1 percent at all points for BAND 4.

33. A-V-C Characteristics Test

a. CONTROL SETTINGS. (1) Set BFO switch at OFF.

(2) Set A. F. GAIN control for maximum gain.

(3) Set ANT. COMP. control for maximum output.

(4) Set SELECTIVITY switch on SHARP.

(5) Set band switch on BAND 2.

(6) Set tuning dial at 5 mc.

(7) Set AVC-MAN. switch on MAN.

b. PROCEDURE. Tune receiver to resonance using VTVM connected to socket J103 as resonance indicator. Turn off the signal generator and adjust the SENSITIVITY control to give 1-volt noise output on the VTVM connected to the PHONES jack. Turn on the signal generator and vary the input signal strength. Record the output voltage on the VTVM connected to socket J103 at signal inputs of 1,000 and 500,000 μv.

c. TEST LIMITS. The voltage output on the VTVM connected to socket J103 at 500,000 μv input should be 42 $\pm$ 8 volts, and the ratio between the voltage output at 500,000 μv and that at 1,000 μv should be no greater than 3.162.

34. Operational Test

Put the cover plate on the receiver and fasten the screws. Connect a suitable antenna to the receiver. Place the receiver on a felt or rubber pad. Connect receiver to an a-c power source and turn POWER switch ON.

a. Tune the receiver to a voice-modulated transmitted signal in the BAND 1 frequency range. Listen to the output from the loudspeaker. The receiver signal should be clear and understandable under all conditions. Tap the receiver lightly with a padded mallet and listen for cutting off of signal or noise that might be due to loose contacts or microphonic conditions.

Caution: Do not strike the receiver forcibly. Tapping is sufficient. Plug headset in the PHONES jack and listen to signal.

b. Repeat procedure as given in *a* above, on each band.

c. Rotate the ANT. COMP., SENSITIVITY, and A. F. GAIN controls as far as they will go in each direction. Controls should turn easily and smoothly and cause a regular variation in receiver output. Listen to the received signal with the SELECTIVITY switch on both BROAD and SHARP and the AVC-MAN. switch on both AVC and MAN. Rotate DIM control. The tuning dial light should dim gradually.

d. Turn BFO switch ON. Listen to a c-w signal. Turn BFO ADJ. and the frequency of the beat note should vary gradually.

e. Check operation of the indicator circuit by presence of a voltage reading on the VTVM connected to socket J103.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

35. First R-F Amplifier Stage (fig. 14)

a. SPECIAL CIRCUIT FEATURES. The r-f voltages enter the receiver at antenna input socket J101 and are fed to the first tuned r-f transformer coil which is L101 for BAND 1, L102 for BAND 2, L103 for BAND 3, or L104 for BAND 4. It is the purpose of the band switch S101 to determine into which of the transformer coils the r-f voltages will be fed. From the first tuned r-f transformer the voltages are then impressed on the control grid (pin No. 4) of V101, the first r-f amplifier tube. Grid bias for tube V101 is supplied by the voltage drop across cathode resistor R101. The output voltage of the tube appears across the primary of the second r-f transformer.

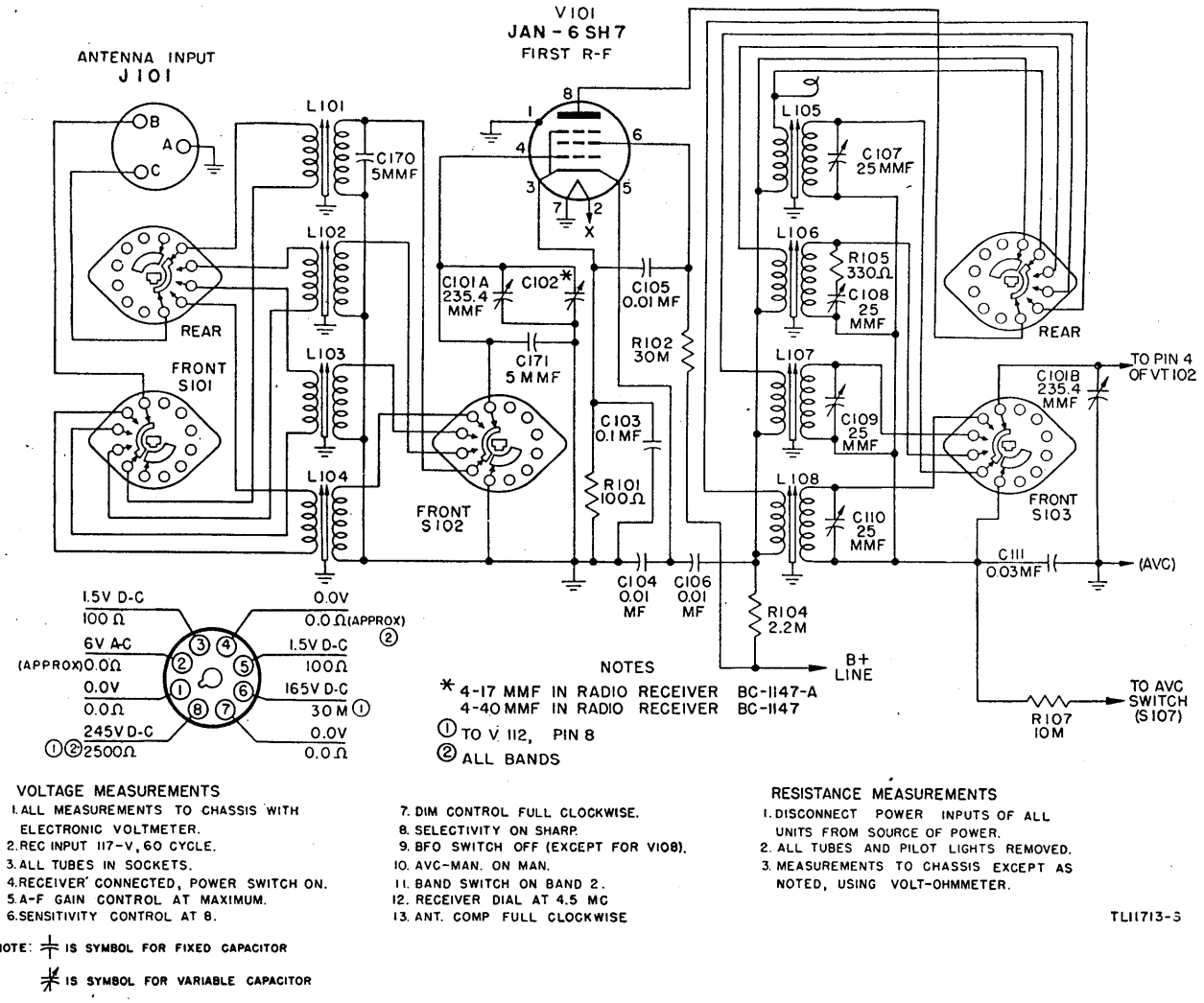


Figure 14. Radio Receiver BC-1147-(*), first r-f amplifier stage.

b. PARTS DATA FOR FIRST R-F STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C101A	3DE2335VA4	CAPACITOR, variable: 4 gang; 235.4 mmf per section; section A	First r-f tuning.
C101B	3DE2335VA4	CAPACITOR, variable: 4 gang; 235.4 mmf per section; section B	Second r-f tuning.
C102 (BC-1147)*	3D9040V-11	CAPACITOR, variable: 4 to 40 mmf; air	Antenna compensator.
C102 (BC-1147-A)*	3D9017VE8	CAPACITOR, variable: 17 mmf; miniature (same as C163)	Antenna compensator.
C103	3DA100-108.2	CAPACITOR: 0.1 mf ±10%; 600 v dc; paper; oil impregnated; type XDRBMW6, or equal (same as C113, C122)	First r-f cathode bypass.
C104	3DA10-170.1	CAPACITOR: 0.01 mf; −20% +60%; 400 v dc; paper; moulded bakelite; type IDM, or equal (same as C105, C106, C112, C114, C115, C121, C123, C151, C165, C601, C602)	Cathode bypass.
C105	3DA10-170.1	CAPACITOR: same as C104	First r-f screen bypass.
C106	3DA10-170.1	CAPACITOR: same as C104	First r-f plate bypass.
C107	3D9025V-25.2	CAPACITOR, variable: 4 to 25 mmf; air-trimmer (same as C109, C116, C118, C152, C154)	Second r-f band 1 trimmer.
C108	3D9025V-25.1	CAPACITOR, variable: 4 to 25 mmf; air-trimmer (same as C110, C117, C119, C153, C155)	Second r-f band 2 trimmer.
C109	3D9025V-25.1	CAPACITOR: same as C107	Second r-f band 3 trimmer.
C110	3D9025V-25.1	CAPACITOR: same as C108	Second r-f band 4 trimmer.
C111	3DA30-15	CAPACITOR: 0.03 mf + 30% −10%; 100 v dc; tubular; paper type S-7-11 (same as C120, C130)	Second r-f a-v-c bypass.
C170	3K2005024	CAPACITOR: 5 mmf ± 20%; 500 v dc; mica; type 5WLS, or equal (same as C171)	R-f tracking.
C171	3K2005024	CAPACITOR: same as C170	R-f tracking.
J101	2Z8673.1	RECEPTACLE: AN-3102-22-2S; 3 contact	Antenna input connector.
L101	3C301-4	COIL, r-f	Band 1, first r-f.
L102	3C301-3	COIL, r-f	Band 2, first r-f.
L103	3C301-5	COIL r-f	Band 3, first r-f.
L104	3C301-6	COIL, r-f	Band 4, first r-f.
L105	3C1084K	COIL, r-f amp	Band 1, second r-f.
L106	3C1084K-1	COIL, r-f amp	Band 2, second r-f.
L107	3C1084K-2	COIL, r-f amp	Band 3, second r-f.
L108	3C1084K-3	COIL, r-f amp	Band 4, second r-f.
R101	3Z6010-39	RESISTOR: 100 ohms; ± 5%; ½ watt; insulated type 504, or equal	First r-f amplifier cathode.
R102	3Z6630-49	RESISTOR: 30,000 ohms; ± 5%; 1 watt; insulated; type 518, or equal	First r-f amplifier screen.
R104	3Z6220-3	RESISTOR: 2200 ohms; ± 10%; ½ watt; insulated; type 504, or equal (same as R111, R117, R129, R134)	First r-f amplifier plate.
R105	3Z6033-13	RESISTOR: 330 ohms; ± 10%; ½ watt; insulated; type 504, or equal (same as R112)	Gain equalizer.
R107	3Z6610-57	RESISTOR: 10,000 ohms; ± 10%; ½ watt; insulated; type 504, or equal (same as R113, R118)	A-v-c filter.
S101	3Z9550.6	SWITCH: ceramic wafer; type H (per FTR spec. F-36334-1) (same as S102, S103, S104, S105)	Band change, first r-f amplifier primary.
S102	3Z9550.6	SWITCH: same as S101	Band change, first r-f amplifier secondary.
S103	3Z9550.6	SWITCH: same as S101	Band change, second r-f amplifier primary and secondary.
V101	2J6SH7	TUBE: JAN-6SH7; pentode	First r-f amplifier.

*Applies only to model indicated.

36. Second R-F Amplifier Stage (fig. 15)

a. SPECIAL CIRCUIT FEATURES. The r-f voltage from the secondary of the second r-f transformer is impressed on the control grid (pin No. 4) of tube V102, the second r-f amplifier tube. Grid bias for the tube is supplied by the voltage drop across cathode resistor R108 and variable resistor R106 which is the SENSITIVITY control. In addition to varying the gain at the second r-f amplifier, the SENSITIVITY control also varies the gain of the mixer and first i-f amplifier stages by varying the cathode bias of the associated tubes. The gain of these stages is maintained essentially constant, at any given SENSITIVITY control setting, by the a-v-c bias applied to the grids through the associated transformer secondaries when the AVC-MAN. switch is on AVC. When this switch is on MAN. the i-f, mixer, and first i-f transformer secondaries are grounded. The output voltage of the tube appears across the primary of the mixer r-f transformer.

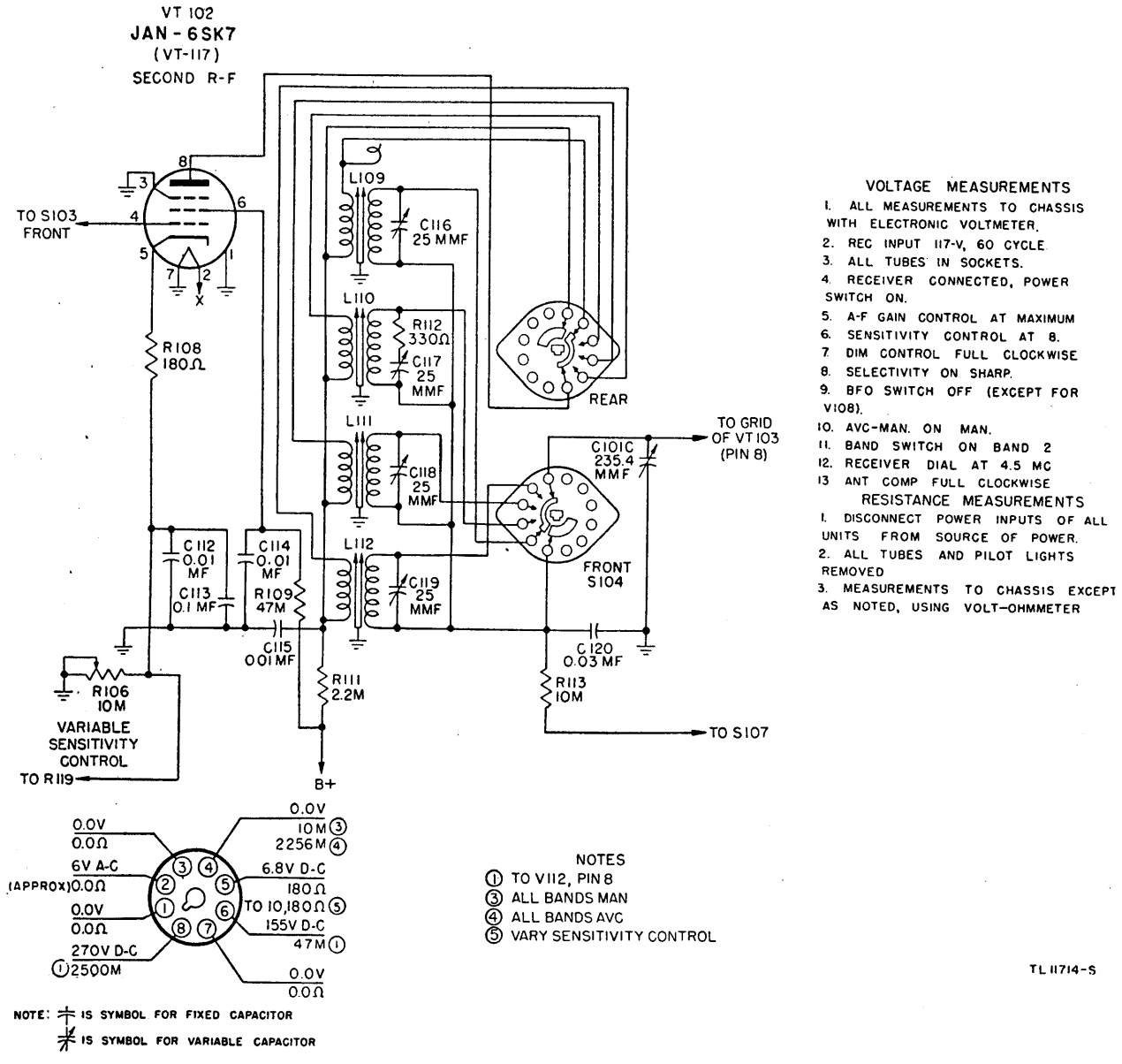


Figure 15. Radio Receiver BC-1147-(*), second r-f amplifier stage.

b. PARTS DATA FOR SECOND R-F AMPLIFIER STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C101C	3DE235VA4	CAPACITOR, variable: 4 gang; 235.4 mmf per section; section C	Mixer tuning.
C101D	3DE235VA4	CAPACITOR, variable: 4 gang; 235.4 mmf per section; section D	Oscillator tuning.
C112	3DA10–170.1	CAPACITOR: 0.01 mf; −20% +60%; 400 v dc; paper; moulded bakelite; type IDM, or equal	Second r-f cathode bypass.
C113	3DA100–108.2	CAPACITOR: 0.1 mf; ±10%; 60 v dc; paper; oil impregnated; type XDRBMW6, or equal	Second r-f cathode bypass.
C114	3DA10–170.1	CAPACITOR: same as C112	Second r-f screen bypass.
C115	3DA10–170.1	CAPACITOR: same as C112	Second r-f plate bypass.
C116	3D9025V–25.2	CAPACITOR, variable: 4 to 25 mm ; air-trimmer	Mixer, band 1 trimmer.
C117	3D9025V–25.1	CAPACITOR, variable: 4 to 25 mmf; air-trimmer	Mixer, band 2 trimmer.
C118	3D9025V–25.2	CAPACITOR: same as C116	Mixer, band 3 trimmer.
C119	3D9025V–25.1	CAPACITOR: same as C117	Mixer, band 4 trimmer.
C120	3DA30–15	CAPACITOR: 0.03 mf; +30% −10%; 100 v dc, tubular; paper; type S–7–11	Mixer, a-v-c bypass.
L109	3C1084K	COIL, r-f	Band 1, mixer.
L110	3C1084K–1	COIL, r-f	Band 2, mixer.
L111	3C1084K–2	COIL, r-f	Band 3, mixer.
L112	3C1084K–3	COIL, r-f	Band 4, mixer.
R106	2Z7269.23	POTENTIOMETER: 10,000 ohms, ±10%; 2 watts; type CP; taper E; FTR spec. F–40745–1	R-f sensitivity.
R108	3Z6018–11	RESISTOR: 180 ohms, ±5%; ½ watt; insulated; type 504, or equal (same as R114)	Second r-f amplifier cathode.
R109	3Z6647–1	RESISTOR: 47,000 ohms, ±10%; ½ watt; insulated; type 504, or equal (same as R135)	Second r-f amplifier screen.
R111	3Z6220–3	RESISTOR: 2,200 ohms, ±10%; ½ watt; insulated type 504, or equal	Second r-f amplifier plate.
R112	3Z6033–13	RESISTOR: 330 ohms, ±10%; ½ watt; insulated; type 504, or equal	Gain equalizer.
R113	3Z6610–57	RESISTOR: 10,000 ohms, ±10%; ½ watt; insulated; type 504, or equal	A-v-c filter.
S104	3Z9550.6	SWITCH, ceramic wafer: type H	Band change, mixer r-f primary and secondary.
V102	2J6SK7	TUBE: JAN–6SK7 (VT–117); pentode; 71–1099 (same as V104, V105, V110)	Mixer.

37. MIXER STAGE (fig. 16)

a. SPECIAL CIRCUIT FEATURES. R-f voltages from the secondary of the mixer transformer are impressed on the control grid (pin No. 8) of tube V103, the mixer. Heterodyne-frequency oscillations are impressed on another grid (pin No. 5). Grid bias for the tube is supplied by the voltage drop across cathode resistor R114 and the SENSITIVITY control R106. (See fig. 15.) The output voltage of the tube appears across the primary of the first i-f transformer. The function of the SELECTIVITY switch S106 is explained in paragraph 38 and figure 17.

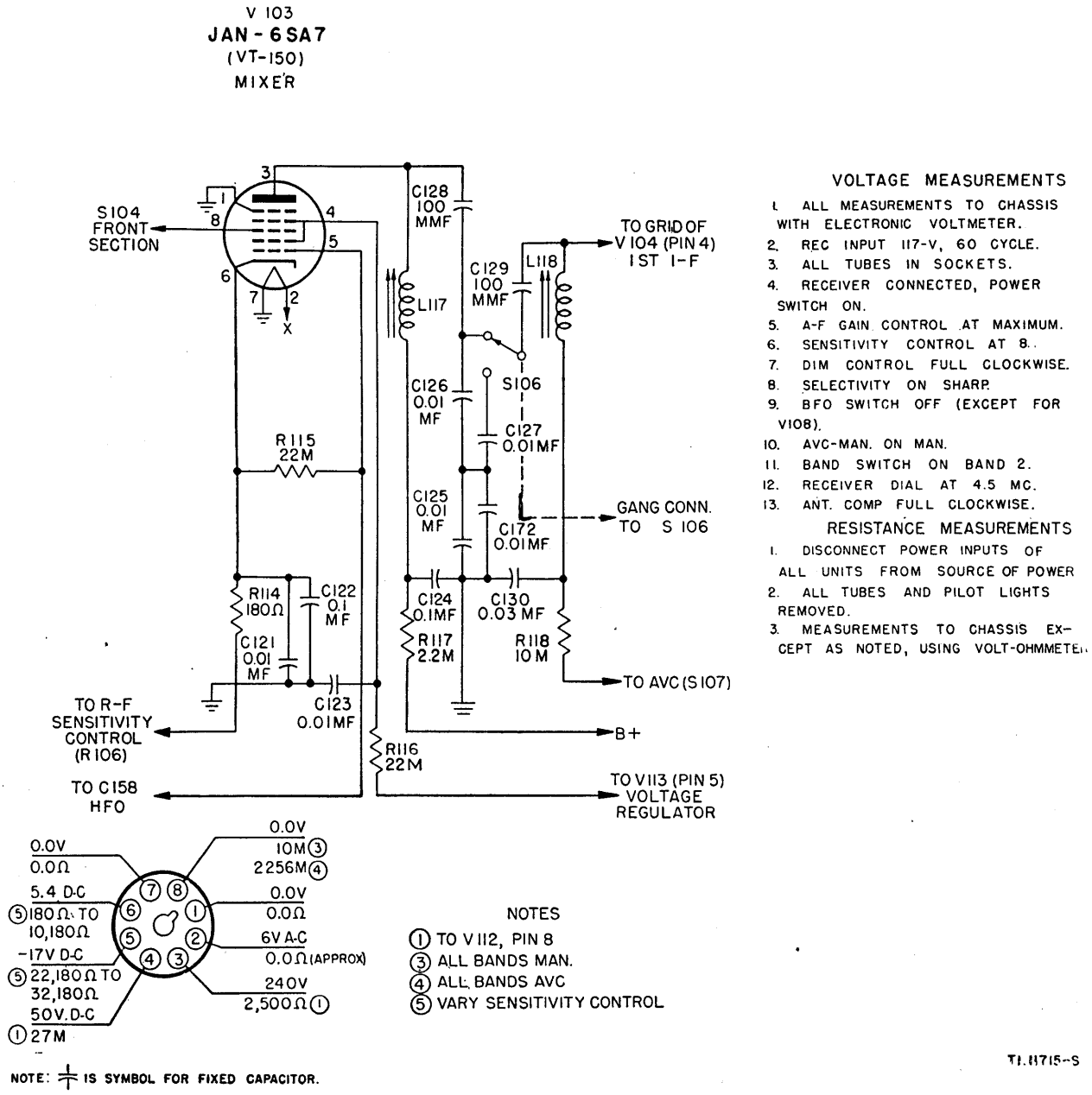


Figure 16. Radio Receiver BC-1147-(*), mixer stage.

b. PARTS DATA FOR MIXER STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C121	3DA10–170.1	CAPACITOR: 0.01 mf, –20% +60%; 400 v dc; paper; molded bakelite; type 1DM, or equal	Mixer cathode bypass.
C122	3DA100–108.2	CAPACITOR: 0.1 mf, ±10%; 600 v dc; paper; oil impregnated; type XDRBMW6 or equal	Mixer cathode bypass.
C123	3DA10–170.1	CAPACITOR: same as C121	Mixer screen bypass.
C124	3DA100–127.1	CAPACITOR: 0.1 mf, ±10%; 600 v dc; single section; paper, oil impregnated; Sprague type	Mixer plate bypass.
C125	3K7010322	CAPACITOR: 0.01 mf, ±5%; 300 v dc; mica; low loss; bakelite body; type 8LS–381; (same as C126, C127, C132, C133, C134)	First i-f coupling.
C126	3K7010322	CAPACITOR: same as C125	First i-f coupling.
C127	3K7010322	CAPACITOR: same as C125	First i-f coupling.
C128	3K2010133	CAPACITOR: 100 mf, ± 2%; 500 v dc; silver mica; type 5R, or equal (same as C129, C135, C136, C138, C160)	First i-f primary.
C129	3K2010133	CAPACITOR: same as C128	First i-f secondary.
C130	3DA30–15	CAPACITOR: 0.03 mf, + 30% –10%, 100 v dc; tubular; paper; type S–7–11. (same as C111, C120)	First i-f a-v-c bypass.
C172	3K7010322	CAPACITOR: 0.01 mf, ± 5% 300 v dc; mica; (same as C173)	First i-f coupling.
L117	2Z9641.30	COIL: primary of first i-f transformer system	I-f amp.
L118	2Z9641.28	COIL: secondary of first i-f transformer system	I-f amp.
R114	3Z6018–11	RESISTOR: 180 ohms; ± 5%; ½ watt; insulated; type 504 or equal	Mixer cathode.
R115	3Z6622–2	RESISTOR: 22,000 ohms, ± 10%; ½ watt; insulated; type 504, or equal (same as R146)	Mixer injection grid.
R116	3Z6622–28	RESISTOR: 22,000 ohms, ±10%; 1 watt; insulated type 518, or equal	Mixer screen.
R117	3Z6220–3	RESISTOR: 22,000 ohms, ±10%; ½ watt; insulated type 504, or equal (same as R104)	Mixer plate.
R118	3Z6610–57	RESISTOR: 10,000 ohms, ±10%; ½ watt; insulated; type 504, or equal (same as R107)	A-v-c filter.
V103	2J6SA7	TUBE: JAN–6SA7 (VT–150); converter	Mixer.

38. First I-F Amplifier Stage (fig. 17)

a. SPECIAL CIRCUIT FEATURES. Voltages from the secondary of the first i-f transformer are impressed on the control grid (pin No. 4) of tube V104, the first i-f amplifier tube. Grid bias for the tube is supplied by the voltage drop across cathode resistor R119 and the SENSITIVITY control R106. (See fig. 15.) The output voltage of the tube appears across the primary of the second i-f transformer system. The bandwidth or selectivity of the receiver is varied by changing the coupling capacitance of the interstage i-f tuned circuits. (See fig. 4.) The magnitude of the coupling capacitance determines the tightness of coupling and hence the bandwidth or selectivity of the stage. When the SELECTIVITY switch S106 is on BROAD the effective coupling capacitance is greater than when the switch is on SHARP. When the SELECTIVITY switch is on SHARP, the effective coupling capacitance is reduced by inserting capacitors C126 and C127 and C133 and C134 in series in the first and second i-f circuits respectively. Changing the selectivity does not affect the i-f tuning since the total tuning capacitance is the same for both settings of the SELECTIVITY switch.

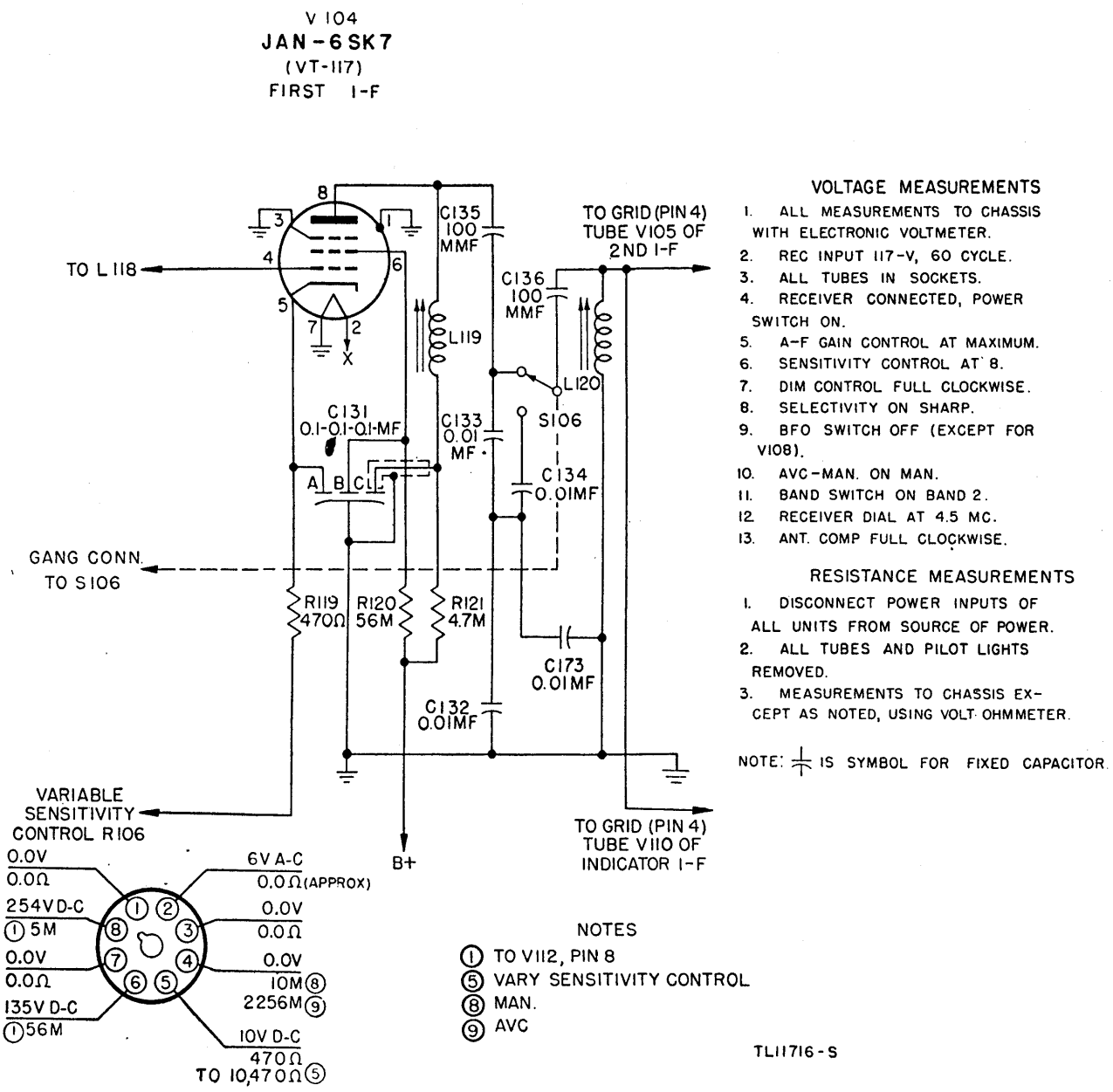


Figure 17. Radio Receiver BC–1147–(*), first i-f amplifier stage.

b. PARTS DATA FOR FIRST I-F STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C131	3DKA100-92.1	CAPACITOR: 0.1-0.1-0.1 mf; ±20%, 600 v dc; paper; oil impregnated; consisting of sections, A, B, & C (same as C-137, C-159)	First i-f bypass; section A, cathode; section B, screen; section C, plate.
C132	3K7010322	CAPACITOR: 0.01 mf, ±5%; 300 v dc; mica; lowless; bakelite body; type 8LS-3S1	Second i-f coupling,
C133	3K7010322	CAPACITOR: same as C132	Second i-f coupling.
C134	3K7010322	CAPACITOR: same as C132	Second i-f coupling.
C135	3K2010133	CAPACITOR: 100 mmf, ±2%; 500 v dc; silver mica; type 5R, or equal	Second i-f primary.
C136	3K2010133	CAPACITOR: same as C135	Second i-f secondary.
C173	3K7010322	CAPACITOR: 0.01 mf ±5%; 300 v dc; mica	Second i-f coupling.
L119	2Z9641.29	COIL: primary of second i-f transformer system	I-f amp.
L120	2Z9641.31	COIL: secondary of second i-f transformer system	I-f amp.
R119	3Z6047-5	RESISTOR: 470 ohms, ±10%; ½ watt; insulated; type 504, or equal	First i-f amplifier cathode.
R120	3Z6656-3	RESISTOR: 56,000 ohms, ±10%; ½ watt; insulated; type 504 or equal (same as R123, R126, R137 R139)	First i-f amplifier screen.
R121	3Z6470-2	RESISTOR: 4,700 ohms, ±10%; ½ watt; insulated; type 504, or equal (same as R124, R138, R122)	First i-f amplifier plate.
S106	3Z9550.7	SWITCH: 4 circuit; 2 position; 1 wafer; type H	SELECTIVITY, BROAD-SHARP.
V104	2J6SK7	TUBE: JAN-6SK7 (VT-117); (same as V102, V105, V110)	First i-f amplifier.

39. Second I-F Amplifier Stage (fig. 18)

a. SPECIAL CIRCUIT FEATURES. Voltages from coil L120, the secondary of the second i-f transformer system, are impressed on the control grid (pin No. 4) of tube V105, the second i-f amplifier tube. The control grid of tube V105 is connected in parallel with the control grid of indicator i-f amplifier tube V110. (See fig. 22.) Grid bias for the tube is supplied by the voltage drop across cathode resistor R122. The output voltage of the tube appears across the primary of i-f transformer T101.

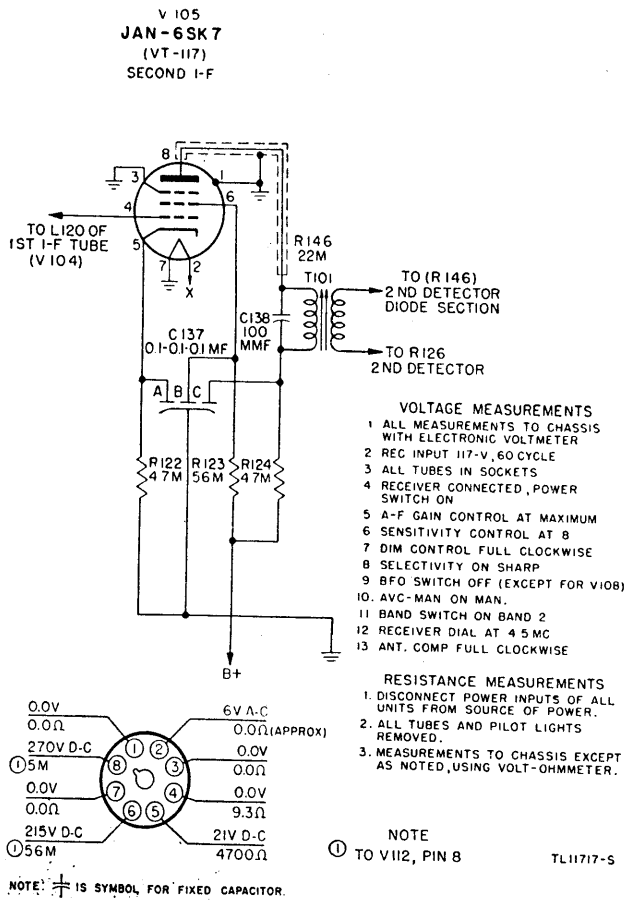


Figure 18. Radio Receiver BC–1147–(*), second i-f amplifier stage.

b. PARTS DATA FOR SECOND I-F STAGE.

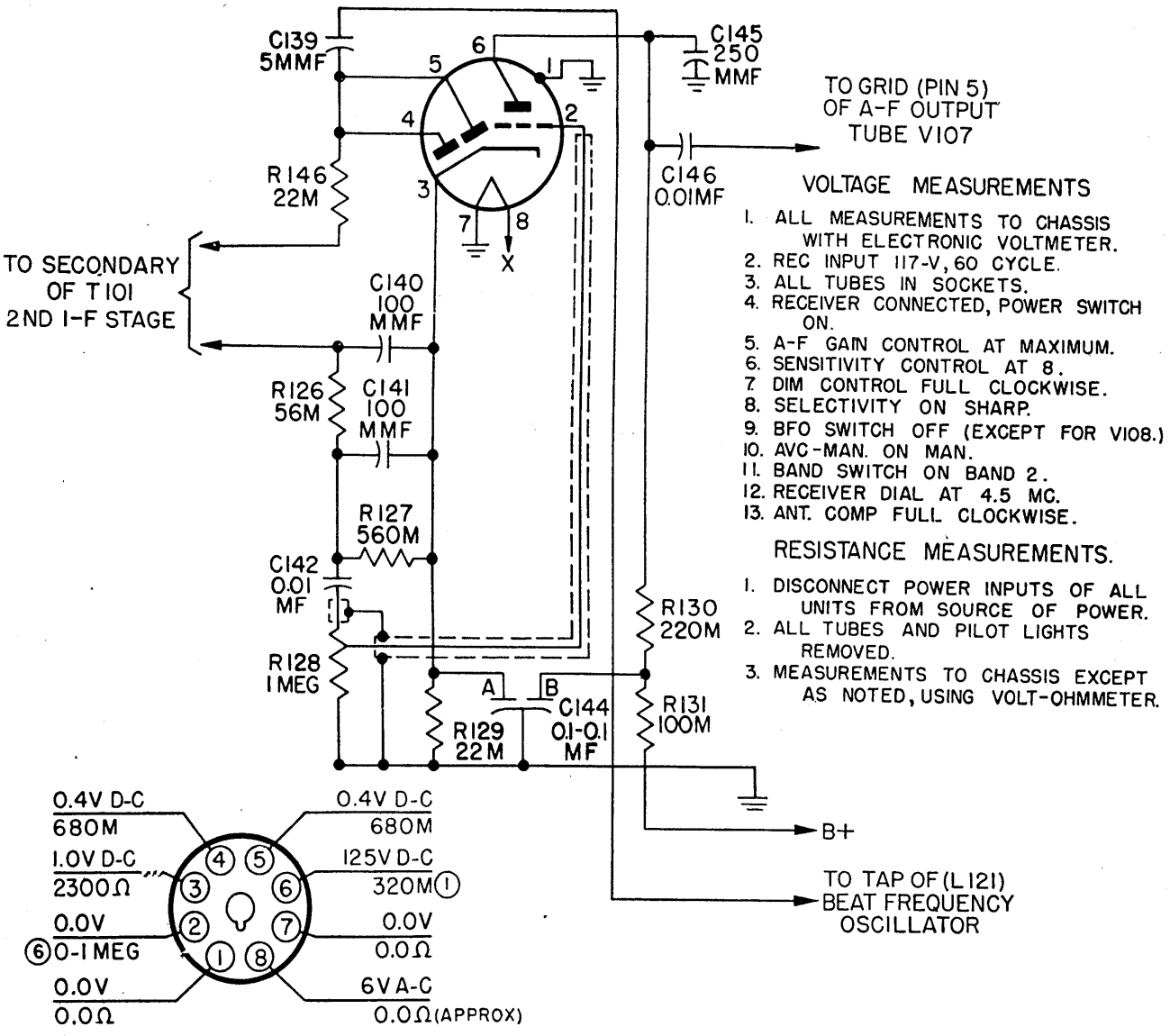
Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C137	3DKA100-92.1	CAPACITOR: 0.1-0.1-0.1 mf; ±20%; 600 v dc; paper; oil impregnated; consisting of sections, A, B, & C (same as C131, C159)	Second i-f bypass; section A, cathode; section B, screen; section C, plate.
C138	3K2010133	CAPACITOR: 100 mmf; ±2%; 500 v dc; silver mica; type 5R or equal (same as C128, C129, C135, C136, C160)	Diode transformer primary.
T101	2Z9641.32	TRANSFORMER: i-f	Diode transformer a-f channel.
V105	2J6SK7	TUBE: JAN-6SK7 (VT-117); pentode (same as V102, V104, V110)	Second i-f amplifier.

40. Detector and A-F Amplifier Stage

(fig. 19)

a. SPECIAL CIRCUIT FEATURES. Voltages from the secondary of i-f transformer T101 are impressed on the diode plates (pins No. 4 and 5) of the detector section of tube V106, the detector and a-f amplifier tube, where the signal is demodulated. When the BFO switch, S108 is in the ON position, the output of the b-f-o circuit is also fed to pins Nos. 4 and 5 where the two signals heterodyne to produce an audible beatnote for use in c-w reception. The a-f energy from the detector output is applied to the grid (pin No. 2) of the a-f amplifier section of tube V106 through the manually operated A. F. GAIN control R128.

V-106
JAN-6SQ7
VT-103
A-F DETECTOR



VOLTAGE MEASUREMENTS

1. ALL MEASUREMENTS TO CHASSIS WITH ELECTRONIC VOLTMETER.
2. REC INPUT 117-V, 60 CYCLE.
3. ALL TUBES IN SOCKETS.
4. RECEIVER CONNECTED, POWER SWITCH ON.
5. A-F GAIN CONTROL AT MAXIMUM.
6. SENSITIVITY CONTROL AT 8.
7. DIM CONTROL FULL CLOCKWISE.
8. SELECTIVITY ON SHARP.
9. BFO SWITCH OFF (EXCEPT FOR V108.)
10. AVC-MAN. ON MAN.
11. BAND SWITCH ON BAND 2.
12. RECEIVER DIAL AT 4.5 MC.
13. ANT. COMP FULL CLOCKWISE.

RESISTANCE MEASUREMENTS.

1. DISCONNECT POWER INPUTS OF ALL UNITS FROM SOURCE OF POWER.
2. ALL TUBES AND PILOT LIGHTS REMOVED.
3. MEASUREMENTS TO CHASSIS EXCEPT AS NOTED, USING VOLT-OHMMETER.

NOTE: ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

NOTES

① TO V112, PIN 8
⑥ VARY A-F GAIN CONTROL

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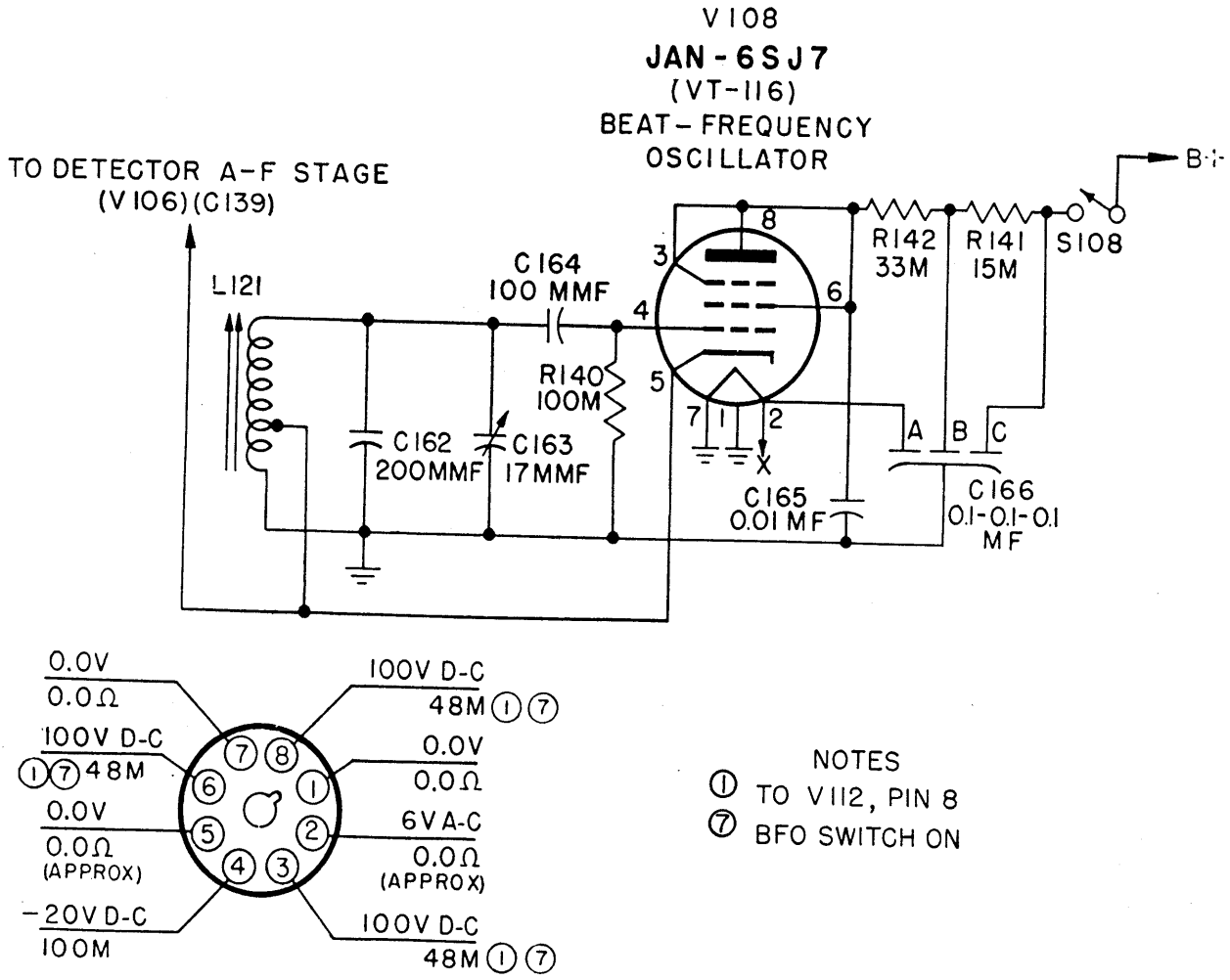
Figure 19. Radio Receiver BC-1147-(*), detector and a-f amplifier stage.

b. PARTS DATA FOR DETECTOR AND A-F.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C139	3K2005024	CAPACITOR: 5 mmf, ±20%; 500 v dc; mica; type 5WLS or equal (same as C170, C171)	B-F-O coupling.
C140	3K2010124	CAPACITOR: 100 mmf, ±20%; 500 v dc; mica; type 5WLS or equal (same as C141, C161, C164)	Diode bypass.
C141	3K2010124	CAPACITOR: same as C140	Diode filter.
C142	3DA10-170.1	CAPACITOR: 0.01 mf, +50% -25%; 500 v dc; tubular; paper; hermetically sealed; oil filled; type 538 (same as 146)	Diode filter first a-f coupling.
C144	3DA100-28	CAPACITOR: 0.1 mf, ±15%; 600 v dc; two sections A & B; paper; oil impregnated; DYRT-6011 or equal	First a-f bypass; section A, cathode; section B, plate.
C145	3K2024122	CAPACITOR: 250 mmf, ±20%; 500 v dc; mica; type 5WLS or equal	First a-f plate filter.
C146	3DA10-170.1	CAPACITOR: same as C142	Second a-f coupling.
R126	3Z6656-3	RESISTOR: 56,000 ohms, ±10%; ½ watt; insulated; type 504 or equal (same as R120, R123, R137, R139)	Diode load.

41. Beat-Frequency Oscillator Stage (fig. 20)

a. SPECIAL CIRCUIT FEATURES. The tube V108 and associated circuit is used in the reception of c-w signals. The b-f-o output is coupled through capacitor C139 to the audio circuit diode detector plates (pins No. 4 and 5 of tube V106) where it beats with the i-f signal and produces an audible beatnote in the a-f output system. (See fig. 19.) The BFO is turned ON or OFF at the front panel by a toggle switch S108. The pitch of the beatnote is controlled by trimmer capacitor C163 in the b-f-o tuning circuit. The trimmer is operated by the BFO ADJ. control on the panel.



NOTES

① TO V112, PIN 8

⑦ BFO SWITCH ON

VOLTAGE MEASUREMENTS

1. ALL MEASUREMENTS TO CHASSIS WITH ELECTRONIC VOLTMETER.
2. REC INPUT 117-V, 60 CYCLE.
3. ALL TUBES IN SOCKETS.
4. RECEIVER CONNECTED, POWER SWITCH ON.
5. A-F GAIN CONTROL AT MAXIMUM.
6. SENSITIVITY CONTROL AT 8.
7. DIM CONTROL FULL CLOCKWISE.
8. SELECTIVITY ON SHARP.
9. BFO SWITCH OFF (EXCEPT FOR V108).
10. AVC-MAN. ON MAN.
11. BAND SWITCH ON BAND 2.
12. RECEIVER DIAL AT 4.5 MC.
13. ANT. COMP FULL CLOCKWISE.

NOTE: ⏤ IS SYMBOL FOR FIXED CAPACITOR.

IS SYMBOL FOR VARIABLE CAPACITOR.

RESISTANCE MEASUREMENTS

1. DISCONNECT POWER INPUTS OF ALL UNITS FROM SOURCE OF POWER.
2. ALL TUBES AND PILOT LIGHTS REMOVED
3. MEASUREMENTS TO CHASSIS EXCEPT AS NOTED, USING VOLT-OHMMETER.

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Figure 20. Radio Receiver BC-1147-(*), beat-frequency oscillator stage.

b. PARTS DATA FOR BFO STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C162	3K2020133	CAPACITOR: 200 mmf, ±2%; 500 v dc; silvered mica; type 5R	Indicator diode bypass b-f-o tank.
C163	3D9017VE8	CAPACITOR: 17 mmf; miniature; variable; (same as C102)	B-f-o pitch adjustment.
C164	3K2010124	CAPACITOR: 100 mmf ±20%; 500 v dc; mica; type 5WLS or equal; (same as C141, C161)	B-f-o grid.
C165	3DA10-170.1	CAPACITOR: 0.01 mf, −20% +60%; 400 v dc; paper; moulded bakelite; type 1 DM or equal; (same as C105, C106, C112, C114, C115, C121, C123, C151, C601, C602)	B-f-o plate bypass.
C166	3DA100-126.1	CAPACITOR: 0.1 mf, ±20%; 600 v dc each section; 3 sections A, B, and C; paper; oil impregnated; type 3XDRB-MW6.1-20 or equal	B-f-o bypass; section A, heater; section B, plate filter; section C, plate filter.
L121	2Z9644.3	COIL, b-f-o tank	B-f oscillator tank.
R140	3Z4550	RESISTOR: 100,000 ohms, ±10%; ½ watt; insulated; type 504 or equal	B-f-o grid.
R141	3Z6615-26	RESISTOR: 15,000 ohms ±10%; ½ watt; insulated; type 504 or equal	B-f-o plate filter.
R142	3Z6615-26	RESISTOR: 33,000 ohms ±10%; ½ watt; insulated; type 504 or equal	B-f-o plate filter.
S108	3Z9857.25	SWITCH: SPST; 3a; 250 v; toggle	BFO ON-OFF.
V108	2J6SJ7	TUBE: JAN-6SJ7 (VT-116); pentode	B-f oscillator.

42. A-F Output Stage (fig. 21)

a. SPECIAL CIRCUIT FEATURES. The output of the a-f amplifier section of tube V106 is resistance coupled to the grid (pin No. 5) of the a-f power output tube V107 which operates with cathode degeneration to insure low distortion. The a-f power output is applied to the audio-output load through the output transformer T102, whose secondary is tapped for the proper impedance match to either the normal 4-ohm loudspeaker or the 250-ohm phones.

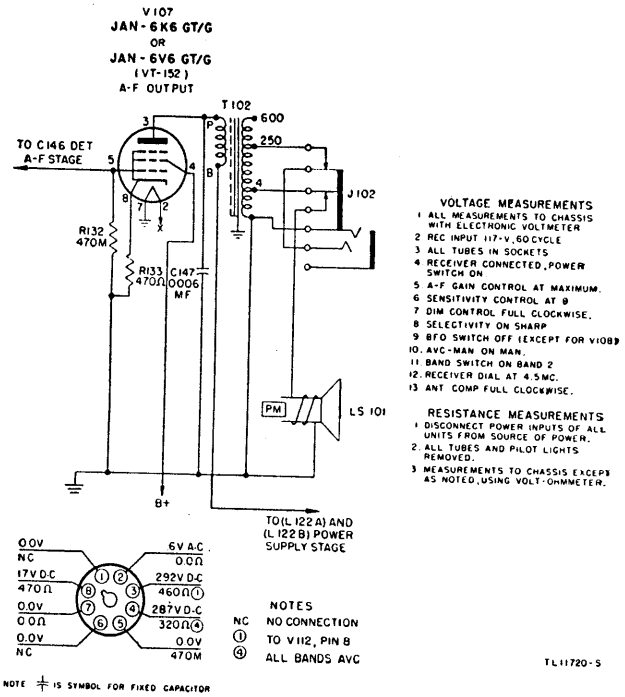


Figure 21. Radio Receiver BC–1147–(*), a-f output stage.

b. PARTS DATA FOR A-F OUTPUT STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C147	3DA6–52	CAPACITOR: 0.006 mf, ±50% –25%; 500 v dc; paper: tubular; hermetically sealed; oil filled; type 538	Second a-f plate bypass.
J102	4C4312–2	RECEPTACLE: jack, multicircuit	Headphone connector.
LS101	6C35–6	SPEAKER: 5" permanent magnet dynamic	Audio output.
R132	3Z6747–10	RESISTOR: 470,000 ohms, ±10%; ½ watt; insulated; type 504 or equal	Second a-f amplifier grid.
R133	3RC41BE471K	RESISTOR: 470 ohms, ±10%; 2 watt; insulated; type BT2 or equal	Second a-f amplifier cathode.
T102	2Z9632.60	TRANSFORMER: audio output	A-f output.
V107	2J6K6GT/G	TUBE: JAN–6K6GT/G (VT–152); pentode	A-f output.

43. Indicator I-F Amplifier Stage

(fig. 22)

a. SPECIAL CIRCUIT FEATURES. Voltages from the secondary of the second i-f transformer system are impressed on the control grid (pin No. 4) of the indicator i-f amplifier tube V110. Grid bias for the tube is supplied by the voltage drop across cathode resistor R136. The output voltage of the tube appears across the primary of a single-tuned, inductively coupled i-f transformer T103.

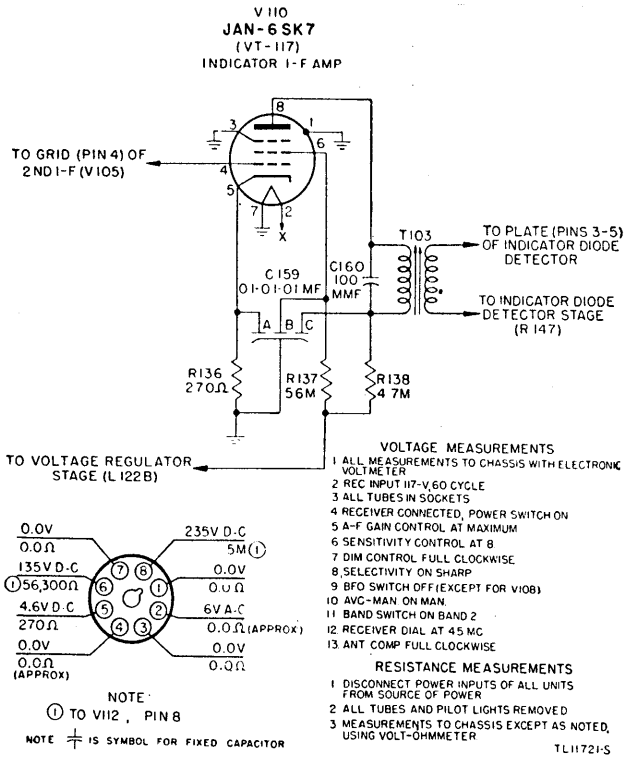


Figure 22. Radio Receiver BC–1147–(*), indicator i-f amplifier stage.

b. PARTS DATA FOR INDICATOR I-F STAGE.

Ref Symbol	Signal Corps stock No.	Name of part and description	Function
C159	3DKA100-92.1	CAPACITOR: 0.1-0.1-0.1 mf ±20%; 600 v dc; paper; oil impregnated; consisting of sections, A, B, & C (same as C137)	Indicator i-f bypass; section A, cathode; section B, screen; section C, plate filter.
C160	3K2010133	CAPACITOR: 100 mmf ±2%; 500 v dc; silver mica; type 5R or equal (same as C129, C135, C136, C138)	Tuning of indicator diode transformer.
R136	3Z6027-13	RESISTOR: 270 ohms, ±5%; ½ watt; insulated; type 504 or equal	Indicator i-f cathode.
R137	3Z6656-3	RESISTOR: 56,000 ohms, ±10%; ½ watt; insulated; type 504 or equal (same as R123, R126, R139)	Indicator i-f screen.
R138	3Z6470-2	RESISTOR: 4,700 ohms, ±10%; ½ watt; insulated; type 504 or equal (same as R124, R122)	Indicator i-f plate.
V110	2J6SK7	TUBE: JAN-6SK7 (VT-117); pentode; (same as V104, V105)	Indicator i-f amplifier.

44. Indicator Diode Detector Stage

(fig. 23)

a. SPECIAL CIRCUIT FEATURES. Voltages from the secondary of the indicator i-f transformer T103 are impressed on the plates (pins No. 3 and 5) of the indicator diode detector tube V109. Part of the rectified output is used for a-v-c bias, which is applied to the grids of the second r-f amplifier, mixer, and first i-f amplifier stages through their associated transformer secondaries when the AVC-MAN. switch S107 is on AVC. When this switch is on MAN., the r-f mixer, and first i-f transformer secondaries are grounded. The rest of the rectified output of tube V109 is fed to output socket J103.

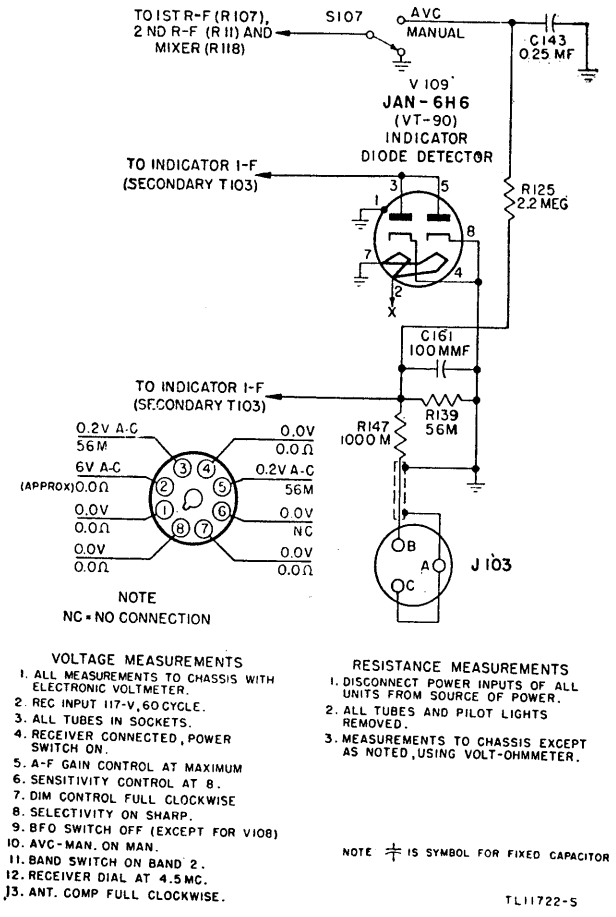


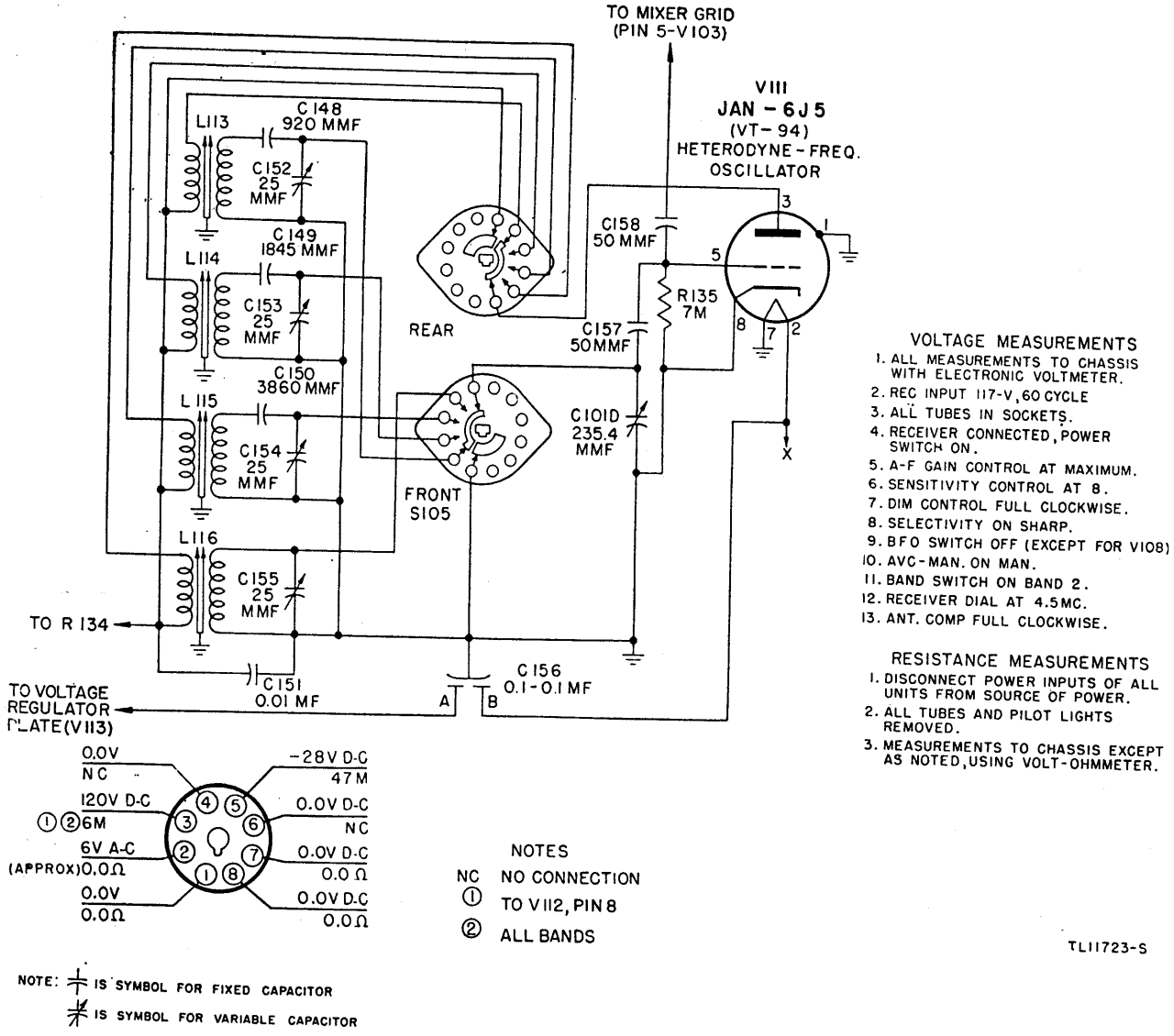
Figure 23. Radio Receiver BC-1147-(*), indicator diode detector stage.

b. PARTS DATA FOR INDICATOR DIODE DETECTOR STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C143	3DA250–49.1	CAPACITOR: single section; 0.25 mf, ±10%; 600 v dc; oil impregnated; paper	A-v-c timing.
C161	3K2010124	CAPACITOR: 100 mf, ±20%; 500 v dc; mica; type 5WLS or equal (same as C141, C164)	Tuning.
J103	2Z8673.20	RECEPTACLE: AN–3102–14S–1S; 3 contact	Indicator channel output.
R125	3Z6802A2-6	RESISTOR: 2.2 meg, ±10%; ½ watt; insulated; type 504 or equal	A-v-c timing.
R139	3Z6656-3	RESISTOR: 56,000 ohms, ±10%; ½ watt; insulated; type 504 or equal (same as R123, R126, R137)	Indicator diode load.
R147	3Z6801–36	RESISTOR: 1 meg, ±10%; ½ watt; insulated; type 504 or equal	Indicator diode filter.
S107	3Z9550.4	SWITCH: SPDT; 3a; 125 v; toggle	AVC-MAN.
V109	2J6H6	TUBE: JAN–6H6 (VT–90); diode	Indicator diode detector and avc.

45. Heterodyne - Frequency Oscillator Stage (fig. 24)

a. SPECIAL CIRCUIT FEATURES. The heterodyne-frequency oscillator circuit tracks at 455 kc above the r-f amplifier and mixer circuits to produce the 455-kc i-f output from the mixer stage. The output from the h-f-o tube V111 is impressed on the grid of the mixer tube V103 (pin No. 5).



VOLTAGE MEASUREMENTS

1. ALL MEASUREMENTS TO CHASSIS WITH ELECTRONIC VOLTMETER.
2. REC INPUT 117-V, 60 CYCLE
3. ALL TUBES IN SOCKETS.
4. RECEIVER CONNECTED, POWER SWITCH ON.
5. A-F GAIN CONTROL AT MAXIMUM.
6. SENSITIVITY CONTROL AT 8.
7. DIM CONTROL FULL CLOCKWISE.
8. SELECTIVITY ON SHARP.
9. BFO SWITCH OFF (EXCEPT FOR V108)
10. AVC-MAN. ON MAN.
11. BAND SWITCH ON BAND 2.
12. RECEIVER DIAL AT 4.5MC.
13. ANT. COMP FULL CLOCKWISE.

RESISTANCE MEASUREMENTS

1. DISCONNECT POWER INPUTS OF ALL UNITS FROM SOURCE OF POWER.
2. ALL TUBES AND PILOT LIGHTS REMOVED.
3. MEASUREMENTS TO CHASSIS EXCEPT AS NOTED, USING VOLT-OHMMETER.

NOTES

NC NO CONNECTION
① TO V112, PIN 8
② ALL BANDS

TL11723-S

NOTE: ⫩ IS SYMBOL FOR FIXED CAPACITOR
⫩ IS SYMBOL FOR VARIABLE CAPACITOR

Figure 24. Radio Receiver BC-1147-(*), h-f oscillator stage.

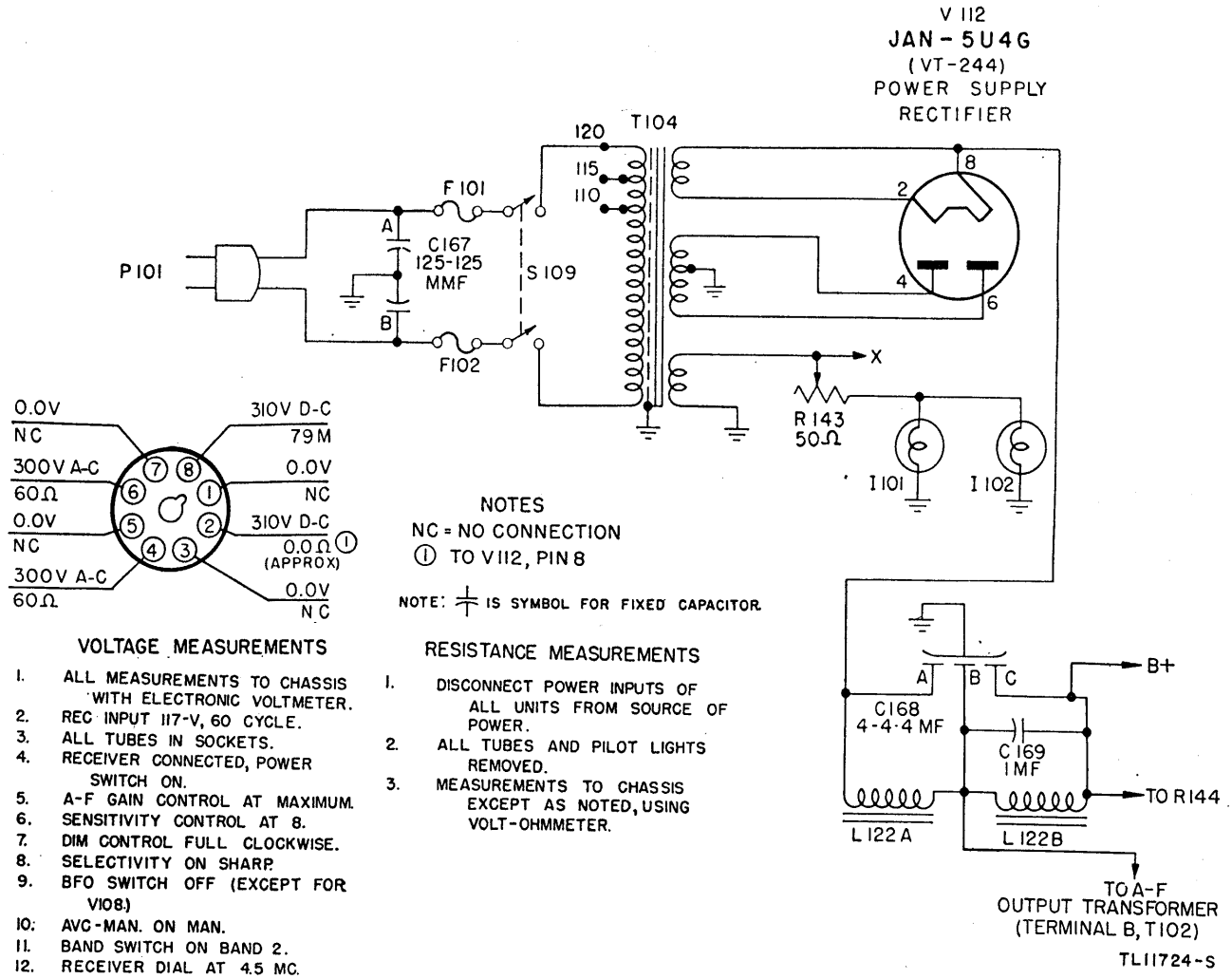
b. PARTS DATA FOR F-H-O- STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C148	3D9920	CAPACITOR: 920 mmf, ±1%; 500 v dc; silvered mica; type 1R	Oscillator padder.
C149	3K3018233	CAPACITOR: 1845 mmf, ±2%; 500 v dc; silvered mica; type 1R	Oscillator padder.
C150	3K3539233	CAPACITOR: 3860 mmf, ±3%; 300 v dc; silvered mica; type 1R	Oscillator padder.
C151	3DA10-170.1	CAPACITOR: 0.01 mf, −20% +60%; 400 v dc: paper; moulded bakelite; type 1 DM or equal (same as C105, C106, C112, C114, C115, C121, C123, C165, C601, C602)	Oscillator plate.
C152	3D9025V-25.2	CAPACITOR: 4-25 mmf; air trimmer (same as C109, C116, C118, C154)	Oscillator band 1 trimmer.
C153	3D9025V-25.1	CAPACITOR: 4-25 mmf; air trimmer (same as C110, C117, C119, C155)	Oscillator band 2 trimmer.
C154	3D9025V-25.2	CAPACITOR: 4-25 mmf; air trimmer (same as C109, C116, C118, C152)	Oscillator band 3 trimmer.
C155	3D9025V-25.1	CAPACITOR: same as C153	Oscillator band 4 trimmer.
C156	3DKA100-171	CAPACITOR: 0.1 mf, ±10%; 600 v dc; section A & B; paper; oil impregnated; type 2XDRBMW6.1-10 or equal	Oscillator bypass; section A, plate filter; section B, heater bypass.
C157	3DK9050-49.1	CAPACITOR: 50 mmf, ±5%; 500 v dc; ceramic; type N750K (same as C158)	Oscillator grid.
C158	3DK9050-49.1	CAPACITOR: same as C157	Oscillator coupling.
L113	3C1081-11E	COIL, oscillator	Band 1.
L114	3C1081-11C	COIL, oscillator	Band 2.
L115	3C1081-11B	COIL, oscillator	Band 3.
L116	3C1081-11A	COIL, oscillator	Band 4.
R135	3Z6647-1	RESISTOR: 47,000 ohms, ±10%; ½ watt; insulated; type 504 or equal (same as R109)	H-f oscillator plate.
S105	3Z9550.6	SWITCH: ceramic wafer; type H (same as S102, S103, S104)	Band change oscillator primary and secondary.
V111	2J6J5	TUBE: JAN-6J5 (VT-94); triode	H-f oscillator.

46. Power Supply Rectifier Stage

(fig. 25)

a. SPECIAL CIRCUIT FEATURES. The power supply consists of a multiwinding power transformer T104, a full-wave rectifier tube V112, and a substantial smoothing filter. Filament voltage for all tubes except tube V112 is obtained from the 6.3-volt winding. The 6.3 volt winding also supplies the dial lamps. The voltage for the dial lamps first passes through an adjustable series resistor R143 which controls the brightness of the lamps. This resistor is varied by the DIM control on the panel. The filament voltage for tube V112 is obtained from the 5.0-volt winding of the power transformer. Plate voltage to all tubes except tube V111 is obtained from pin No. 8 of tube V112 and is filtered through a filter network consisting of coils L122A, L122B, and capacitors C168 and C169.



VOLTAGE MEASUREMENTS

1. ALL MEASUREMENTS TO CHASSIS WITH ELECTRONIC VOLTMETER.
2. REC INPUT 117-V, 60 CYCLE.
3. ALL TUBES IN SOCKETS.
4. RECEIVER CONNECTED, POWER SWITCH ON.
5. A-F GAIN CONTROL AT MAXIMUM.
6. SENSITIVITY CONTROL AT 8.
7. DIM CONTROL FULL CLOCKWISE.
8. SELECTIVITY ON SHARP.
9. BFO SWITCH OFF (EXCEPT FOR V108.)
10. AVC-MAN. ON MAN.
11. BAND SWITCH ON BAND 2.
12. RECEIVER DIAL AT 4.5 MC.
13. ANT. COMP FULL CLOCKWISE.

RESISTANCE MEASUREMENTS

1. DISCONNECT POWER INPUTS OF ALL UNITS FROM SOURCE OF POWER.
2. ALL TUBES AND PILOT LIGHTS REMOVED.
3. MEASUREMENTS TO CHASSIS EXCEPT AS NOTED, USING VOLT-OHMMETER.

Figure 25. Radio Receiver BC-1147-(*), power supply rectifier stage.

b. PARTS DATA FOR POWER-SUPPLY STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
C167	3D9125-1	CAPACITOR: 125 mmf; 2 sections A & B; mica; low reactance	A-c line filter.
C168	3DB4-69	CAPACITOR: 4 mf, ±20%; 600 v dc each section, 3 sections A, B, and C; paper; oil impregnated; Dykanol Type PC 2 125	Section A, B, & C B-supply filter.
C169	3DB1.6100B	CAPACITOR: 1.0 mf, +50% −0%; 600 v dc; paper; oil impregnated; type DYR-6100	B filter tuning.
F101	3Z2605.2	FUSE: 5 amp; 250 v; type 3 AG or equal (same as F102)	A-c line fuse.
F102	3Z2605.2	FUSE: same as F101	A-c line fuse.
I101	2Z5952	LAMP: 6-8 v; bayonet base; Mazda #47 or equal (same as I102)	Dial light.
I102	2Z5952	LAMP: same as I101	Dial light.
L122	3C315-11	CHOKE: power supply; reactor 2 section A & B; 10 henries at 120 cps with 0.150 amps; d-c peak voltage to ground 350 volts; 150 w; ±10% d-c resistance per section	Filter B supply choke.
P101	6Z3151/1	PLUG, male twist lock, with cord grip #7465; 2 wire midget; 10 amp, 250 v; 15 amp, 115 v	A-c line.
R143	2Z7277.9	RHEOSTAT: 50 ohms, ±10%; 2 watts type W-1-50	Dial lamp dimmer.
S109	3Z9857.24	SWITCH: DPST; 3 amp; 125 v; toggle	POWER ON-OFF.
T104	2Z9613.55	TRANSFORMER: primary; 0-110; 120 v 1 amp at 60 cycles; secondary 315-0-315 v 0.15 a; 0-5 v 3.0 a; 0-6.3 v 5.0 a	Power supply.
V112	2J5U4G	TUBE: JAN-5U4G (VT-244); rectifier	Power-supply rectifier.

47. Voltage Regulator Stage (fig. 26)

a. SPECIAL CIRCUIT FEATURES. The voltage-regulator tube V113 regulates the plate voltage to the h-f oscillator tube obtaining frequency stability even under conditions of large variations in the a-c line voltage.

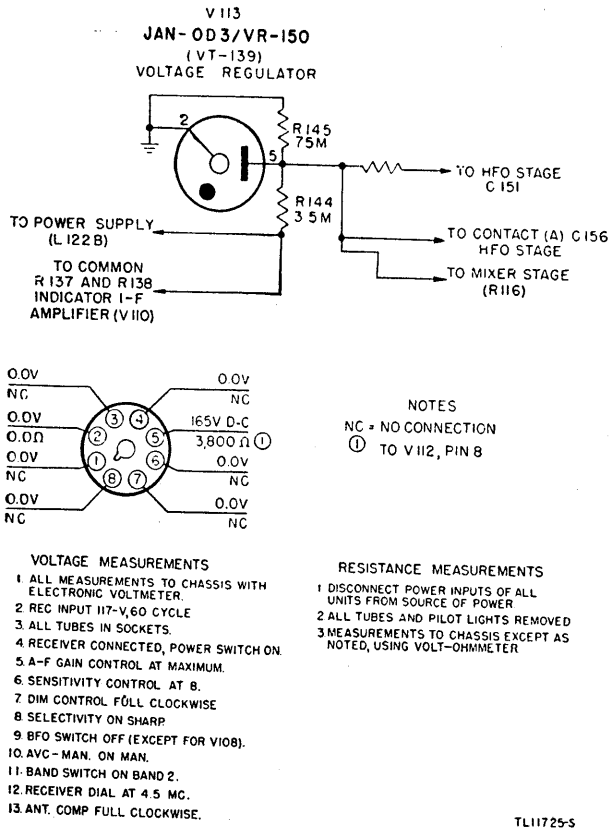


Figure 26. Radio Receiver BC-1147-(*), voltage regulator stage.

b. PARTS DATA FOR VOLTAGE REGULATOR STAGE.

Ref. Symbol	Signal Corps stock No.	Name of part and description	Function
R134	3Z6220–3	RESISTOR: 2200 ohms, ±10%; ½ watt; insulated; type 504 or equal (same as R111, R117, R129)	H-f oscillator plate.
R144	3Z6350–15	RESISTOR: 3500 ohms, ±10%; 10 watt; type "Brown Devil" or equal	Voltage regulator dropping.
R145	3Z6675–20	RESISTOR: 75,000 ohms, ±10%; ½ watt; insulated; type 504 or equal	Voltage regulator bleeder.
V113	2JOD3/VR150	TUBE: JAN–OD3/VR–150 (VT–139)	Voltage regulator.

SECTION IX

SUPPLEMENTARY DATA

48. Replacement of Potentiometer Controls and Switches

a. Remove bottom cover plate.

b. Remove knobs after loosening set screws with Allen hex wrench.

c. Unsolder all connections one at a time and tag them to insure that each will be reconnected properly to the replacement unit.

d. Remove the hex nuts and washers from all shaft bushings, mount the replacement unit, and resolder all connections.

49. Replacement of I-F Transformer Components

a. Remove top and bottom cover plates.

b. Remove two tap screws and lift the shield from the required transformer assembly. (See fig. 7 for location.)

c. Remove nearby tubes.

d. Unsolder the connections one at a time and tag them to insure that they will be reconnected properly to the replacement part. Place the receiver on its left side while soldering and unsoldering.

e. If it is necessary to remove the entire assembly in order to effect the repair, disconnect the under-chassis connections for the assembly in question, being careful to tag all terminals and leads for reconnection, then remove the frame mounting screws.

f. With the exception of coil L121 for the beat-frequency oscillator, all assemblies may be removed directly.

g. To replace the L121 coil assembly, remove the under-chassis shield; unsolder the necessary connections; remove the coil assembly mounting screws; remove the knobs from the BFO ADJ. control, the ANT. COMP. control, the tuning control, and the bandswitch; remove the front panel mounting screws; pull the panel away from the chassis until it clears the BFO ADJ. control shaft; and remove the L121 coil assembly.

50. Removal of R-F, Mixer or H-F Oscillator Coil Assemblies

a. Remove bottom cover plate.

b. Loosen the setscrews on the band switch shaft, and withdraw it from the rear of the chassis.

c. Remove all screws from the cross partitions between r-f coil assemblies and move back the long common partition.

d. Lift out the rear cross partition adjacent to the r-f assembly which is to be removed.

e. Remove the screws holding the associated switch wafer bracket to the chassis.

f. Unsolder all the connections from the switch wafer and the coil assembly to parts mounted on the chassis. Identify all connections for reassembly.

g. Remove the two mounting screws from the coil and the capacitor trimmer board and lift out the assembly.

h. Replace or repair defective parts or connections. Maintain the same lead lengths and lead locations as in the original assembly.

Caution: Do not change the core or the trimmer capacitor adjustments.

i. In reassembling the unit set all the switch wafer keys in BAND 1 position. With the BAND SWITCH on BAND 1, tighten the setscrew on the band switch shaft. Then turn to BAND 4 position and tighten the remaining setscrew on the band switch shaft.

51. Servicing Main Tuning Capacitor

a. To gain access to the interior of the capacitor without removing it from the chassis, remove the capacitor shield.

b. If the main tuning capacitor must be removed from the chassis, first remove the top and bottom cover plates.

c. Loosen the two Allen head setscrews securing the counterweighted coupling to the capacitor shaft and drive out the taper pin. Strike the small end of the taper pin. If it is in doubt as to which end is the smaller, test each end by a few light hammer blows.

d. Disconnect all wiring to the five stator terminals, and unsolder the five rotor-grounding braided leads from the chassis ground terminals.

e. The capacitor is secured to the chassis by three fillister-head machine screws, one at the rear and two at the front. The screws can be reached from the bottom side of the chassis. Each mount-

ing screw passes through an adjustable mounting device, which permits precise control of elevation and alignment of the tuning capacitor shaft with the drive shaft. The adjustment of these mountings has been carefully made at the factory for the particular capacitor in the receiver; the adjustment is locked by the large hexagon nut. To remove the capacitor, remove the fillister-head machine screws. Do not loosen the mounting locknut.

f. Turn the chassis on its right hand side (as seen facing the front panel). Place the left hand under the rear of the main tuning capacitor and remove the rear mounting screws.

g. Hold the rear of the capacitor to avoid strain on the shafts, turn the chassis on its base to the normal operating position. Permit the front edge of the chassis to hang over the edge of the workbench by a few inches. Remove the two front capacitor-mounting machine screws with the chassis in this position, in order to avoid strains on the capacitor and the drive shafts.

h. Slide the capacitor to the rear and lift it up and out.

i. If a new capacitor is to be installed, it may be necessary to readjust the height of the three mounting assemblies. To do this, loosen the locknuts and elevate or lower the threaded spacers as much as required to align the capacitor shaft with the coupling. This adjustment should be made with the mounting screws in place, but not tightened. For this operation the chassis must be resting on its base.

j. When rewiring the capacitor, take care not to drop solder into the plates through the terminal clearance holes. It is advisable to lay the chassis on its left side when soldering.

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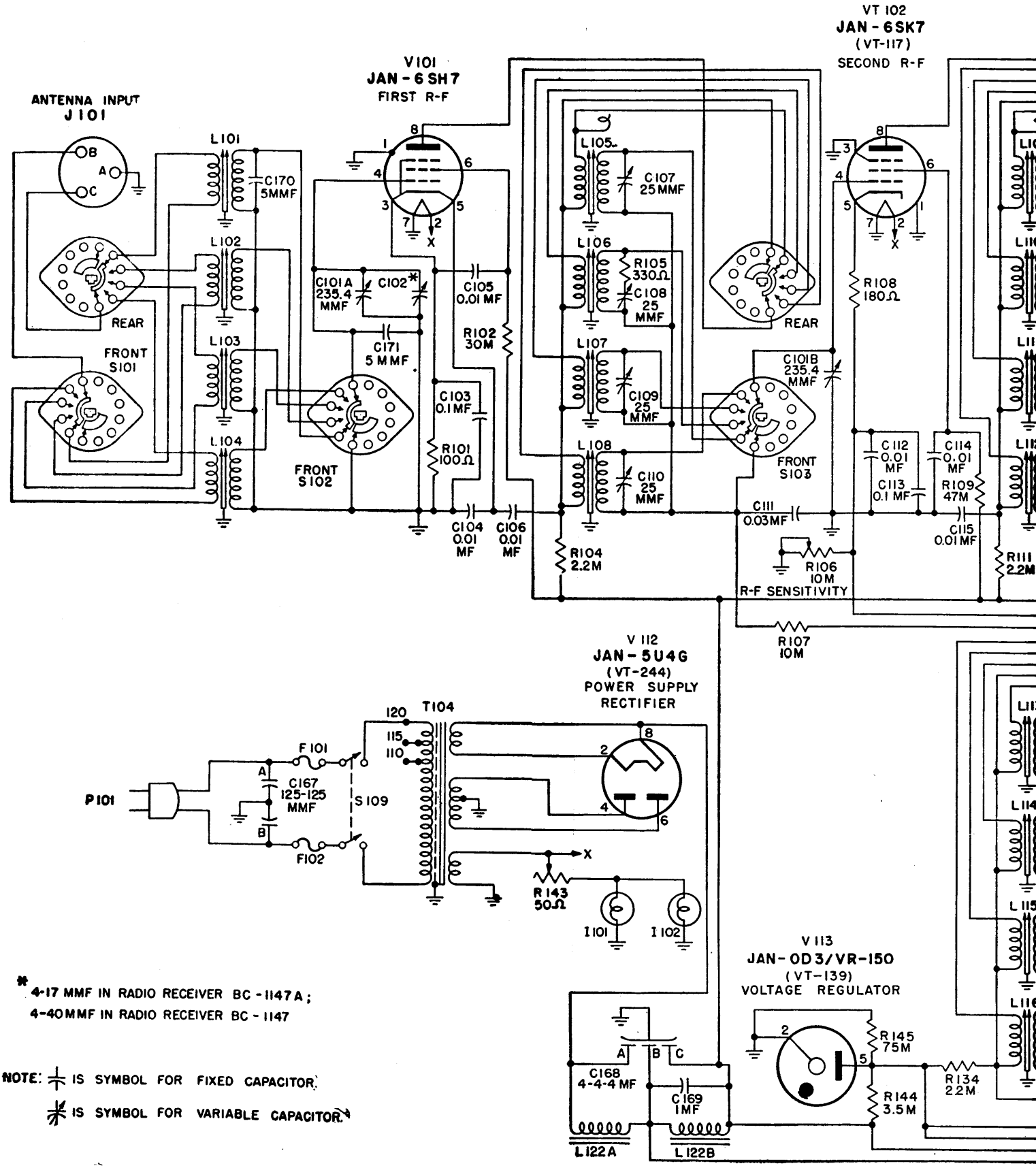


* 4-17 MMF IN RADIO RECEIVER BC - 1147A ;
4-40 MMF IN RADIO RECEIVER BC - 1147

NOTE: ⏤ IS SYMBOL FOR FIXED CAPACITOR.
✳ IS SYMBOL FOR VARIABLE CAPACITOR.

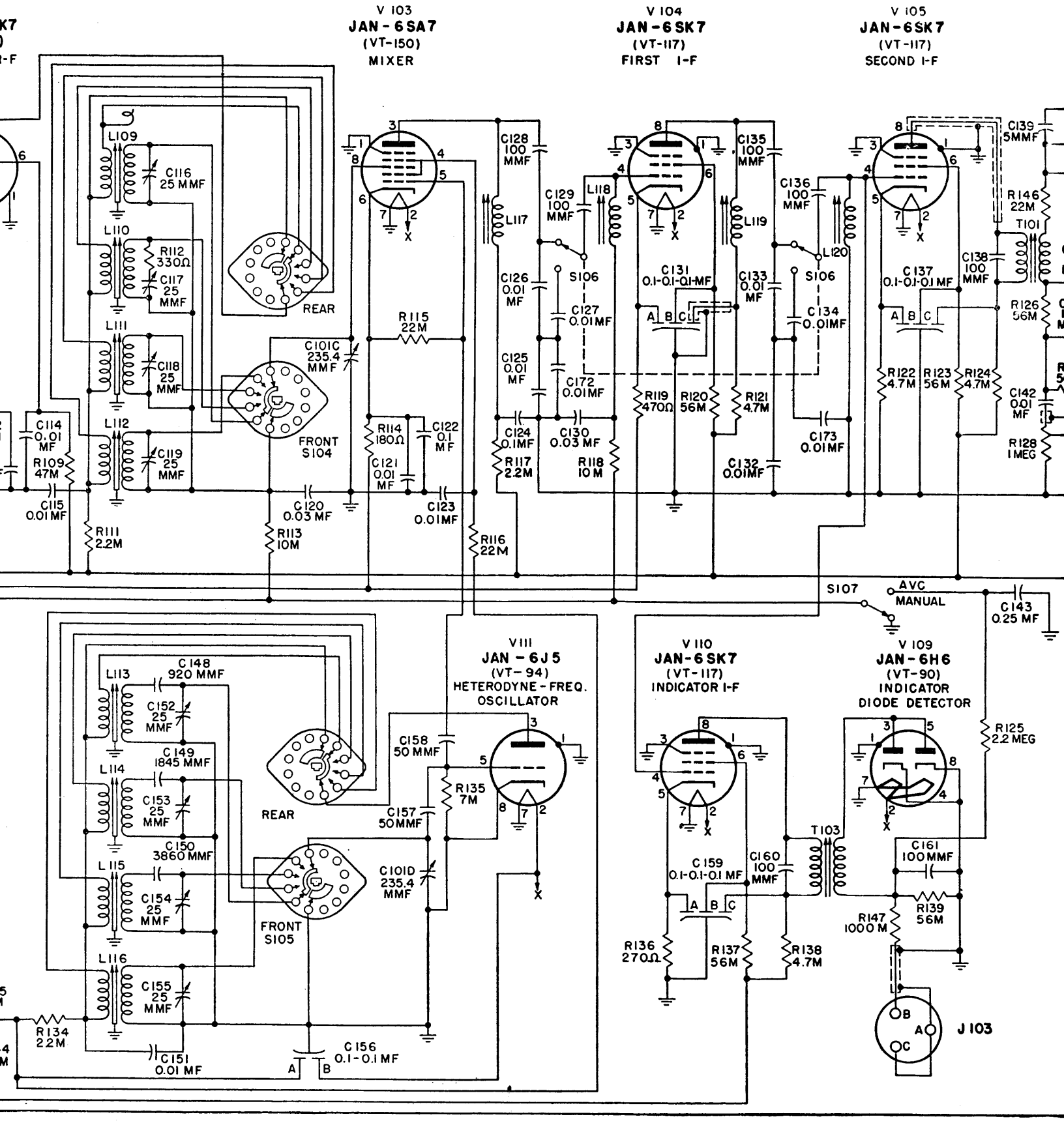
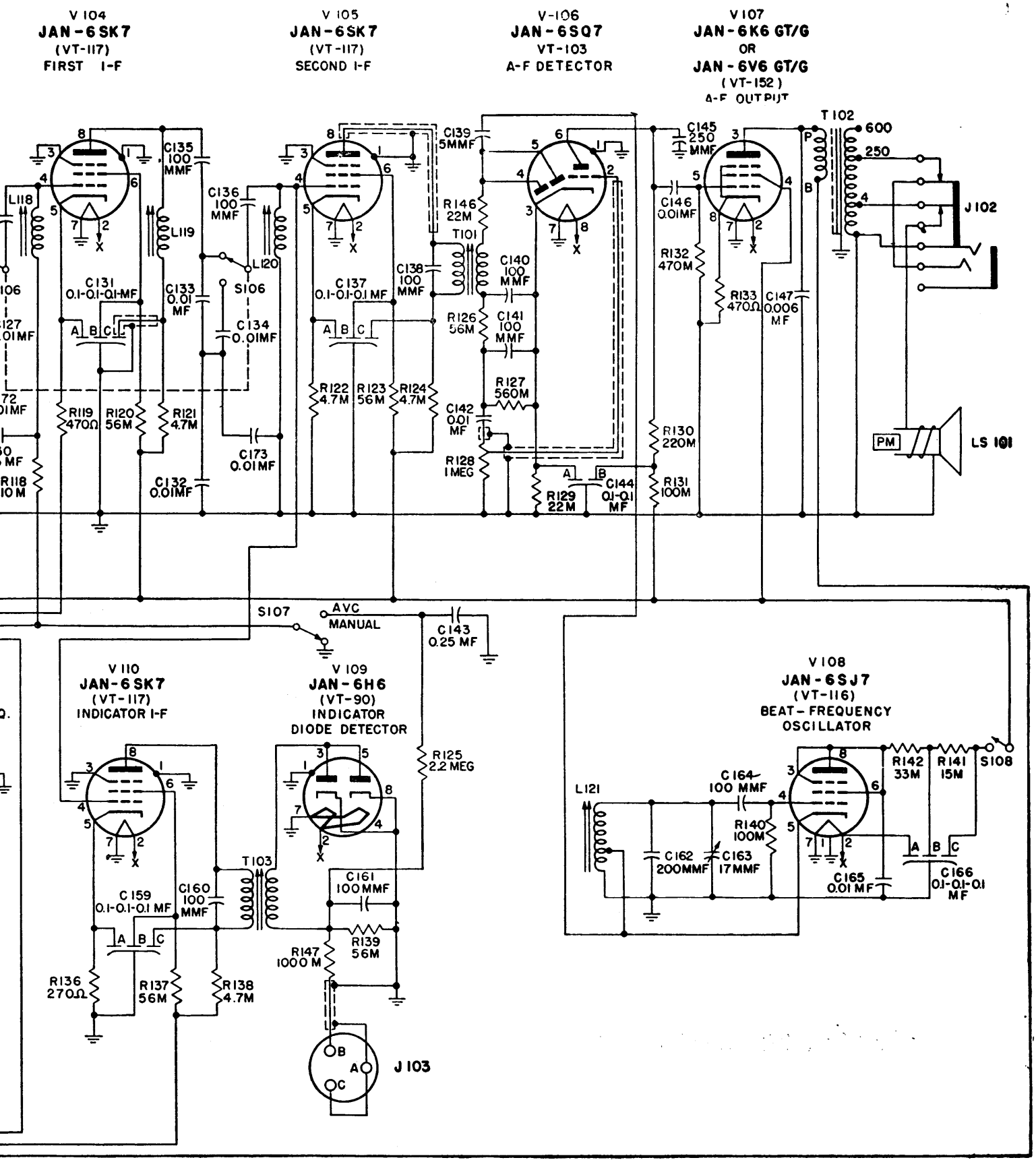


Figure 27. Radio Receiver BC-1147-(*), circuit diagram.


V 104
JAN-6SK7
(VT-117)
FIRST I-F
V 105
JAN-6SK7
(VT-117)
SECOND I-F
V-106
JAN-6SQ7
VT-103
A-F DETECTOR
V 107
JAN-6K6 GT/G
OR
JAN-6V6 GT/G
(VT-152)
A-F OUTPUT
T102
600
250
J102
PM
LS 101
C135 100 MMF
L118
L119
C131 0.1-0.1-0.1-MF
C133 0.01 MF
C134 0.01MF
C136 100 MMF
L120
S106
C173 0.01MF
C132 0.01MF
R119 470Ω
R120 56M
R121 4.7M
R118 10M
C137 0.1-0.1-0.1 MF
R122 4.7M
R123 56M
R124 4.7M
C138 100 MMF
C139 5MMF
R146 22M
T101
C140 100 MMF
R126 56M
C141 100 MMF
R127 560M
C142 0.01 MF
R128 1MEG
R129 22M
C144 0.1-0.1 MF
C145 250 MMF
C146 0.01MF
R132 470M
R133 470Ω
C147 0.006 MF
R130 220M
R131 100M
S107
AVC
MANUAL
C143 0.25 MF
V 110
JAN-6SK7
(VT-117)
INDICATOR I-F
V 109
JAN-6H6
(VT-90)
INDICATOR
DIODE DETECTOR
R125 2.2 MEG
T103
C159 0.1-0.1-0.1 MF
C160 100 MMF
C161 100MMF
R139 56M
R147 1000 M
R136 270Ω
R137 56M
R138 4.7M
J 103
V 108
JAN-6SJ7
(VT-116)
BEAT-FREQUENCY
OSCILLATOR
L121
C164 100 MMF
R140 100M
C162 200MMF
C163 17MMF
R142 33M
R141 15M
S108
C165 0.01 MF
C166 0.1-0.1-0.1 MF

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