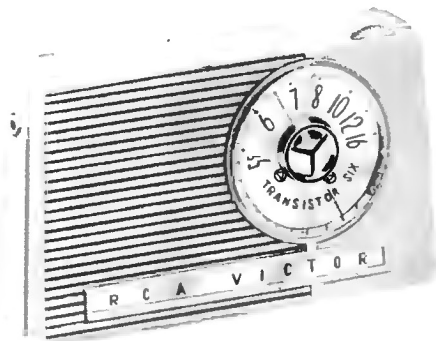




RCA VICTOR

Battery-Operated Pocket Radio

MODEL 9-BT-9 Series

Chassis No. RC-1164A, RC-1164B

Model 8BT9, RC-1164, is practically identical.

Model 9-BT-9 Series

The "Transistor Six"

Printed Circuit Board Wiring and Components
View from Wiring Side

Circuit Board No. 961919-1
Chassis No. RC-1164A

The assembly represented above is viewed from the wiring side of the board.

The printed wiring, on the near side of the board, is presented in "phantom" view superimposed on the component layout of the reverse side.

CRITICAL LEAD DRESS

Dress leads and components at gang so as not to interfere with rotor plates.

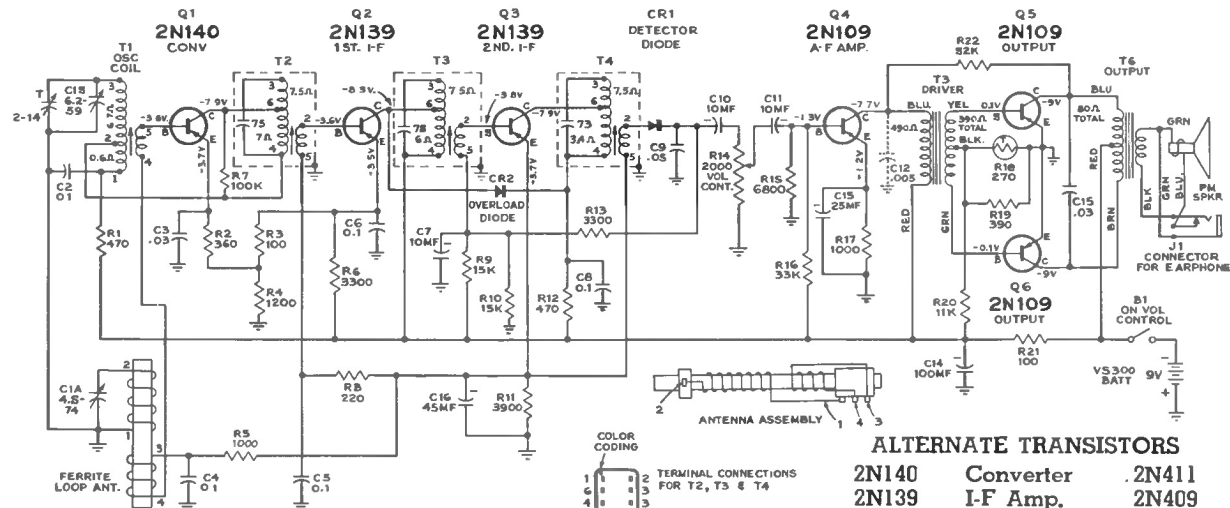
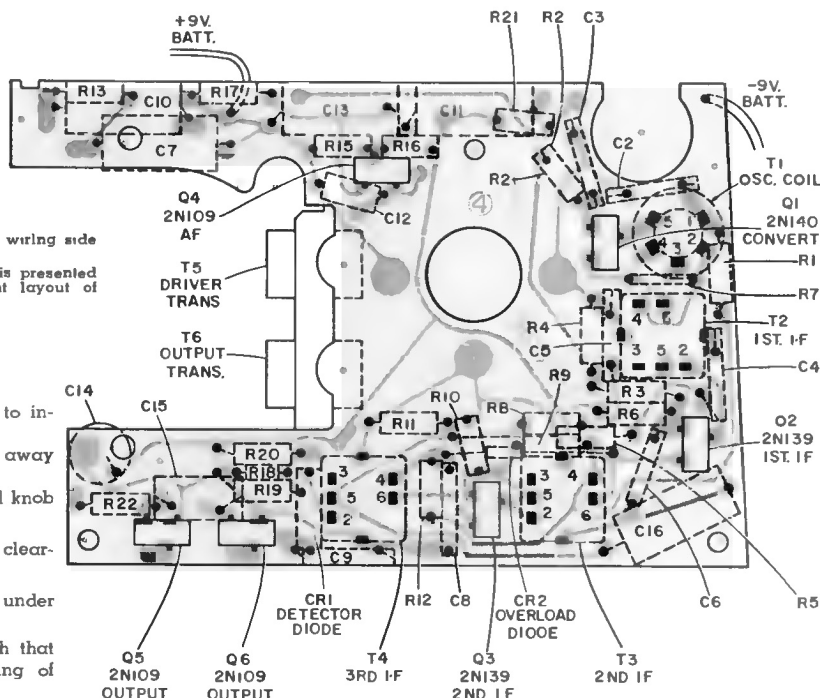
Dress lead from antenna to gang ant. terminal away from metal parts as far as practicable.

Check for possible solder shorts to volume control knob from printed circuit wiring.

Antenna terminal of gang must be bent to insure clearance to output transformer.

Dress "B-" lead from ON-OFF switch to battery under positive (+) lead of C16.

Dress antenna rod to clear end of case and such that antenna terminal does not interfere with closing of case back.



ALTERNATE TRANSISTORS

2N140	Converter	2N411
2N139	I-F Amp.	2N409
2N109	Audio Amp.	2N407

BATTERY CURRENT

NO SIGNAL --- 8 MA
15 MW OUTPUT --- 13 MA

VOLTAGES MEASURED WITH "VOLTONMYST"
SHOULD HOLD WITHIN $\pm 20\%$ WITH NEW BATTERY
K=1000. ALL RESISTANCE VALUES IN OHMS.
ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF AND
1.0 & ABOVE IN MMF EXCEPT THOSE INDICATED



TRANSISTOR SOCKET CONNECTIONS

SERVICE PROBLEMS AND REMEDIES

Distorted Only On Weak Stations Or Only On Strong Stations

When distortion is present and varies with the strength of the station signals, it indicates an abnormal condition in the circuit of those transistors whose bias is AGC controlled.

Distortion only on weak stations is most often due to unsatisfactory operation of the detector. The diode should have a slight initial forward bias. Check for presence of this bias voltage, check to see that polarity does not reverse with signal and that AGC voltage with signal is of proper polarity (base to emitter voltage should decrease with increase of signal).

Distortion on strong stations indicates that the transistors are being driven to cutoff by a strong AGC voltage. An overload diode is used to reduce the gain of an IF circuit only on strong signals. Check terminal voltages and the overload diode. Transistor radios will not handle large variations of signal as well as vacuum tube radios, and it may be that on excessively strong signals the best solution is to turn the radio so that the antenna will pick up less signal.

Regeneration

An IF transistor having exceptionally high gain may cause regeneration on weak signals. A possible correction for this difficulty is to interchange the two IF transistors—realignment is advisable after any change of transistors in the IF circuit.

If a type 2N140 transistor is used in place of a type 2N139 transistor, regeneration may occur. Check for use of correct type of transistor.

Two specific types of regenerative squeal have been found in the Transistor Six. The first type in which the audible sound can be controlled by the volume control has had several causes which were as follows:

1. High internal battery resistance. A new battery corrects the trouble.
2. High resistance riveted connections at battery leads on printed board. This trouble can be overcome by soldering the rivets to the printed wiring.
3. High resistance connections at chassis mounting spacer. This condition is evidenced by a change in the frequency and intensity of the squeal when the tuning condenser mounting screws are first loosened and then tightened. The spacer and the mounting screws are in the tuning condenser "ground" circuit and electrolytic action between the copper wiring and the die-cast zinc spacer results in corrosion and high resistance joints. A 3-point wire jumper should be soldered between the three copper areas at the tuning condenser mounting screws. The spacers now being used are copper plated and can be soldered to the wiring.
4. Stripped tuning condenser mounting screw. The third tuning condenser mounting screw is also used as part of the tuning condenser "ground" circuit. The screw must be long enough to hold securely in the condenser and yet not long enough to touch the tuning condenser plates.
5. Rosin joint at tuning condenser mounting screw. The third tuning condenser mounting screw mentioned above is soldered to the printed wiring. Some cases of poor soldering have resulted in rosin joints.
6. The mounting lugs of IF transformers T3 and T4 are used for ground interconnections. Loose rivets can result in intermittent regeneration. Solder a jumper wire between the two mounting lugs of each can.

No Signal

In cases of "no signal," the first step is to check battery voltage with set turned on. New batteries are 9 volts, but transistor radios will operate on batteries as low as 6 volts. If the battery is O.K., check terminal voltages. There can be short-circuits in transistor radios just as in any other radio. One significant difference is that in a transistor radio, there is insufficient power to burn a resistor.

Transistors have no filaments to burn out, but lead wires can be broken. Battery leads and phone jack leads are the most likely source of such trouble. Transistors themselves should be the last items suspected.

Weak RF/IF Signal

Transistor life in normal service has no known limit; service deterioration is so negligible as to be dismissed without further thought.

In all cases of RF/IF low sensitivity, first check terminal voltages. Although voltages may vary widely without greatly affecting stage gain, the voltages should all have the same proportion of variation. The bias voltages are the most difficult to measure but must not be neglected. A transistor having a normal "forward" bias of 0.15 volt will have a slight decrease in gain when operating with a bias of 0.12 volt but may have a great decrease in gain when operated with a bias of 0.10 volt. If a large voltage discrepancy is found it will be necessary to remove transistors before making resistance measurements in localizing the trouble.

Where a transistor stage shows low gain, shunt each bypass capacitor in that stage with another capacitor to detect open capacitors.

Alignment should be checked in all cases of low RF/IF sensitivity. There is only one core to each IF transformer but in some cases two peaks may be reached, one peak being higher than the other. If a transformer can not be peaked, it may have to be replaced—first check transformer terminal connections. The following are alignment suggestions:

1. IF transformer will not peak at 455KC—may be either defect in transformer or defective transistor (IF or converter)—try replacing transistor before changing transformer. An open bypass capacitor in the circuit of that transformer could give an unsatisfactory peaking condition.
2. IF transformers may be peaked incorrectly—maximum gain is obtained when cores are peaked at the "farthest in" peak.

Other possibilities of low RF/IF sensitivity are as follows:

1. Incorrect transistor—if type 2N139 is used in place of specified type 2N140, conversion gain will be down and oscillator section may fail to operate when battery voltage is down slightly.
2. Resistor value change in oscillator or converter stage—measure oscillator a.c. voltage at Q1 base (should be 0.20 to 0.70 volts p-p)—measure d.c. voltages—remove transistors and check resistors in converter circuit; if transistors are soldered in, unsolder one end of suspected resistor and measure without removing transistors.
3. Detector diode reversed—output is down slightly. Check by noting polarity of AGC voltage at the diode source. AGC line voltage at the diode will become more positive (or less negative) in respect to circuit ground with signal increase.

Audio Distortion

One type of audio distortion is regeneration due to low capacity filters and/or high resistance joints.

Because the output transistors are in a "Class B," circuit, even a small change in bias may result in distortion. The no-signal emitter or collector current of each of the output transistors should be 1.5 to 2 ma with a new battery. A bias voltage of -0.1 v. is required at that current drain.

Negative feedback is used to reduce distortion, the feedback resistor R22 is 82K. If the resistor is connected to the wrong output collector, the distortion would be increased instead of decreased. This tells us that the YEL. and GRN. leads of the driver transformer must not be interchanged and neither should the BLUE and RED leads be reversed. Some transformers had incorrect color coding.

A simple case of low output and distortion has resulted from one pin of one output transistor being bent at right angles and not in its socket; the other two pins held the transistor in place.

In factory production, selected pairs of transistors are used for Class "B" output. Mismatched transistors will result in some distortion, this may or may not be noticeable during listening. Transistors may be matched by injecting an audio signal at the volume control and measuring the audio signal from each output collector to "ground." Matched transistors will give matched output signal.

RCA Victor Model 9-BT-9 Series, Chassis RC-1164A, -B

SERVICE HINTS

Recommended Test Procedure

Use signal tracing or signal injection as basic test procedure in conjunction with voltage measurements.

Make stage-by-stage check by injecting signal from signal generator and checking with a high-gain oscilloscope (at least .03 volts/inch). Oscillator action must be stopped in order to measure RF signal at converter base since oscillator signal also appears at this point. Oscillator action can be stopped by touching a finger to oscillator section of the tuning condenser.

NOTE. All transformers are step-down type and will show voltage loss from primary to secondary.

Extreme care should be used to avoid accidental shorting of transistor elements to circuit ground. This is especially true of the output transistors; if the junction of R18-R19-R20 should be accidentally grounded for a few seconds, the output transistors would be permanently damaged.

It is possible to damage a transistor when testing circuit continuity. Since a transistor needs only low voltage applied to its terminals for conduction, testing continuity of a circuit which includes a transistor can result in misleading continuity indications. To avoid transistor damage and misleading continuity indications, remove the transistor from the chassis before making continuity tests of its circuit.

1. The first thing to check when the receiver is inoperative, is the battery. With the receiver turned on, a new battery should show 9 volts although the receiver can be expected to operate on any battery which checks between 6 volts and 9 volts.
2. To check for a circuit defect which would cause excessive battery drain, an overall current measurement and supplementary voltage measurements should be made. For reasons explained above, continuity measurements can be misleading.
3. Signal tracing by injection of a signal from a signal generator is done on transistor radios in exactly the same manner as with conventional vacuum tube radios. The signal generator should be connected (as in past practice) in series with a capacitor to avoid shorting out bias voltages. With the transistors used in this receiver, the BASE is the signal input terminal (corresponding to signal grid of tubes), the COLLECTOR is the signal output terminal (corresponding to plate of tubes), and the EMITTER is the common terminal (corresponding to cathode of tubes).
4. The output of this receiver is of the "Class B" type. It should be noted that in "Class B" output the battery

current increases noticeably with increased signal input. Refer to the schematic diagram for current specifications.

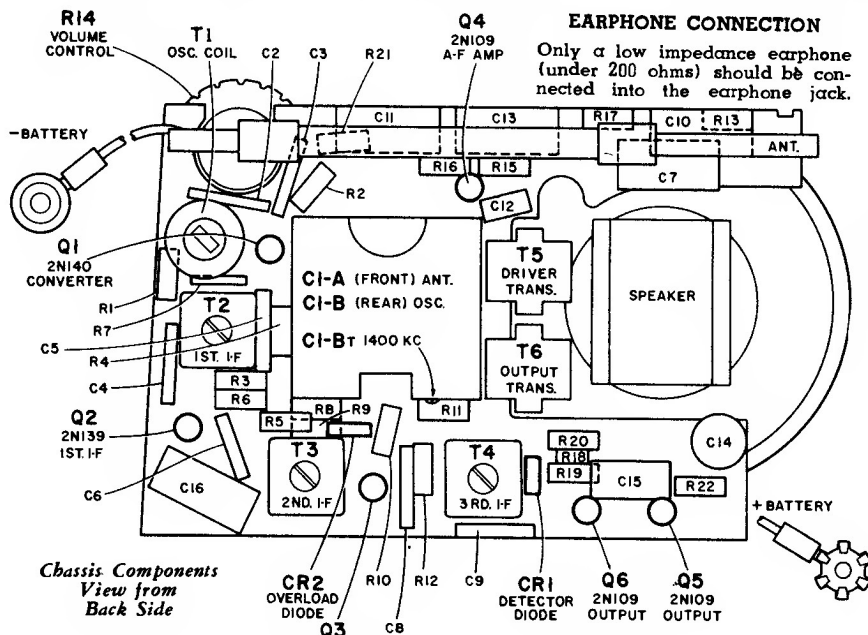
5. Application of a signal from a signal generator to the input (B) of Q1 will stop oscillator action (R-F signal can not be injected at this point although 455 kc I-F signal can be injected).
6. Measurement of oscillator signal strength with an oscilloscope at the input of Q1 (base contact) will give an indication of oscillator performance. Voltage should be 0.20 to 0.70 volts peak-to-peak.
7. D-C measurements should be made only with a sensitive voltmeter, such as an RCA VoltOhmst®.
8. Interchanging transistors in the I-F stages may necessitate realignment.
9. The transistors and the printed wiring board can be readily damaged by excessive heat. When soldering on the printed wiring board, use a soldering iron which is both HOT and CLEAN. The soldering operation can then be completed quickly with a minimum of heat radiation to components.

ALIGNMENT PROCEDURE

Test Oscillator—For all alignment operations, connect the low side of the test oscillator to the "common positive" wiring and keep the oscillator output as low as possible to avoid AVC action.

Step	Connect High Side of Sig. Gen. to —	Sig. Gen. Output	Dial Pointer Setting	Adjust for Max. Output
1	#2 terminal of ant. assembly L1	455 kc	Quiet point near 1600 kc	T4 3rd I-F T3 2nd I-F T2 1st I-F
2		Repeat Step 1		
3	Short wire placed near antenna for radiated signal	1400 kc	1400 kc rock gang	trimmer* C1-B (osc.)
4		600 kc	600 kc rock gang	T1 osc. coil
5		Repeat Steps 3 and 4		

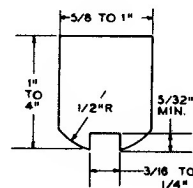
* Oscillator trimmer is located on bottom of gang.



Chassis Components
View from
Back Side

Production Changes

1. R4 was 1000 ohms.
R5 was 220 ohms.
2. C9 was .03 mf.
C12 (.005 mf.) removed—it was connected from collector of Q4 to gnd.
C16 (45 mf.) was a wire-in type of capacitor in early production. It may be either a wire-in type or upright type in late production.



MATERIAL—STEEL OR BRASS
THICKNESS OF .256 COIN.

Tool Required for Removal of
Chassis Mounting Nut