

FOR SURPLUS HOUNDS: THE BC-611, SCR-536 HANDY-TALKIE

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Special thanks to Henry Engstrom

The first of the hand held transceivers appeared in World War Two as the BC-611 Handy-Talkie. It looks like a squared off and all too large telephone handset, with a 39" antenna sticking out. It weighs in at just over 5 pounds. Nearby are several contemporary illustrations. A near-mint example came up at the AWA auction in Rochester (it sold for \$110), and photographs of it also appear. These and similar sets sometimes show up at swap meets for as little as \$10 in rough shape.

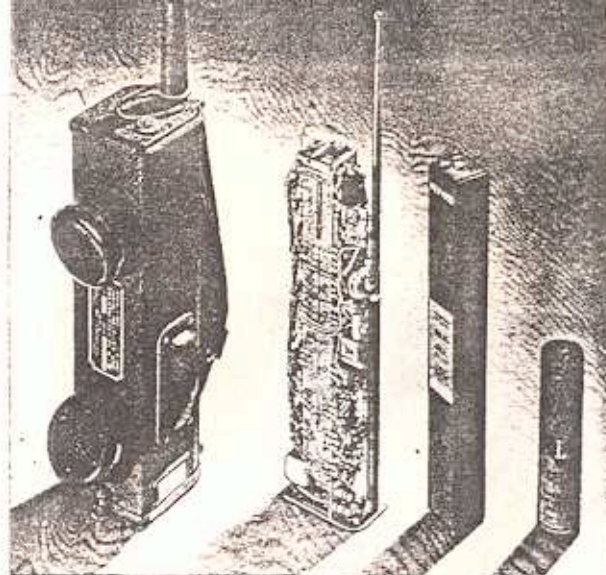
Motorola (then Galvin Mfg. Co.) designed and built the Handy-Talkie. They called it "the 'fightingest' radio set in the army!" because it was used primarily in the front lines. The set uses low filament voltage, miniature glass tubes of the sort developed for civilian portable radios just before the war, e.g., the 1R5 and the 1S5 and 1T4, announced in 1939, and the 3S4 of 1941. The circuit is a superheterodyne receiver, with the local oscillator and RF stage converted to a master oscillator-power amplifier for transmitting. It operated crystal controlled AM between 3.5 MHz and 6 MHz. The chassis is solidly constructed with spring clips for the tubes. Pulling the whip antenna out the top snaps an internal toggle switch to turn the set on. Range was of course limited to squad and platoon and maybe company uses, up to one mile. Nonetheless, it sure was an improvement over the BC-745 Horsey-Talkie on a stick (examined in this column last year), or a heavy back-pack radio.

The BC-611 implemented innovations beyond miniature tubes: "cups" of small parts placed together, powdered iron cores in the IF transformers, and miniaturized capacitors and resistors. The set is also watertight as well as rugged.



During the Second World War, CHRS member George Durfey had occasion to use this set on the front lines in Europe, when he wasn't firing his B.A.R. His comments to date on the set have been limited to: "It worked alright." Towards the end of the War, the Signal Corps developed a loop antenna accessory so that the set could be used as a direction finder. This would only have permitted American troops to locate an American beacon transmitter on the pre-set frequency, because the set did not tune. The last models of the Handy-Talkie, the BC-611F, had 50 available crystal channels, and a plug-in mike and headset. The Handy-Talkie was operational as early as 1942; by the end of the War, the Signal Corps had implemented its policy of FM line communications, with the so-called "Walkie-Talkie" manpack radios such as the SCR-195 (52 to 66 MHz, at 27 pounds). FM had about twice the useable range and improved clarity.

The BC-611 was followed, during the Korean conflict in 1952, by the banana-shaped AN/PRC-6 Handy-Talkie, an FM set operating on 47 to 55 MHz. This was, if anything, more awkward to use and heavier. It did have as an accessory a lightweight plug in handset. By Nam-time, the hand-held AN/PRC-68, the size of a pack of Camel-wides, and with a microphone and speaker, provided line-unit communications, along with later developed helmet radios. The BC-611 was the first of these workhorse radios, and a modern expert calls it "...one of the outstanding designs of all time." (Walt Hutchens, "The BC-611 Handy Talkie," *Electric Radio in Uniform*, *Electric Radio* (No. 24, April, 1991 at p. 4); see also Robert F. Scott, "Inside the Handy-Talkie," in *Radio Craft* (July, 1946 at p. 684)). ##



Inside and outside views of Motorola Handie-Talkie and batteries.



EXTENDING
BOTTOM ANTENNA
SECTION TURNS
LEFT ON
Antenna switch detail.

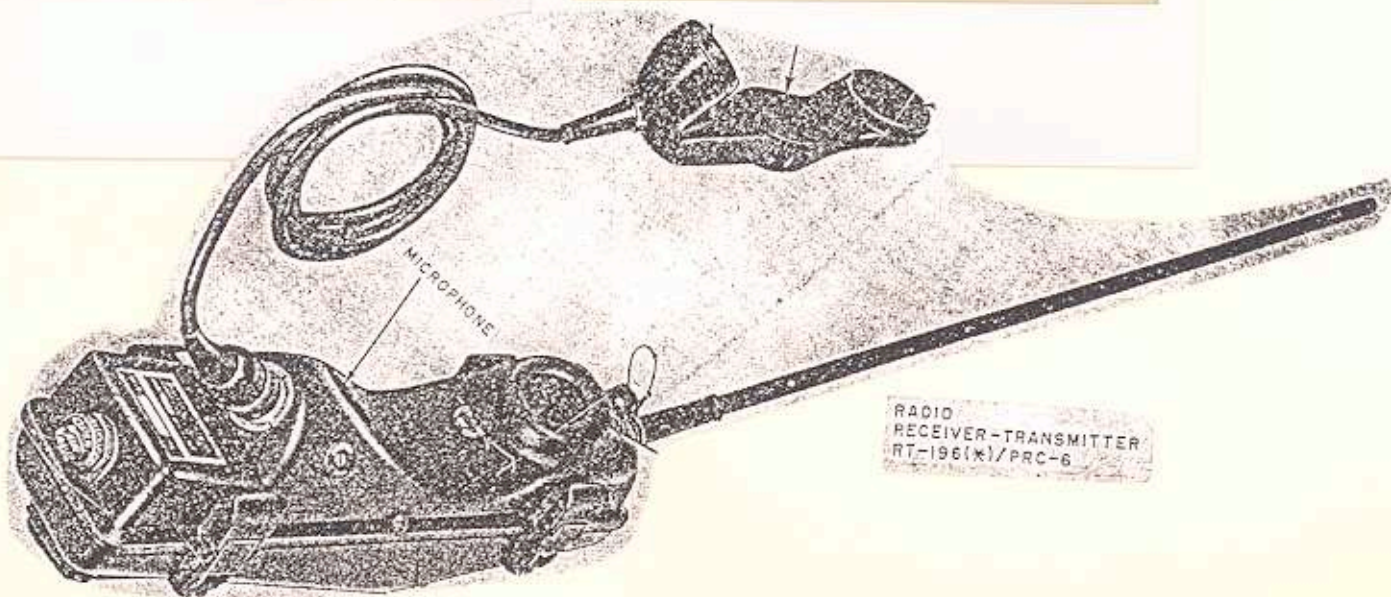
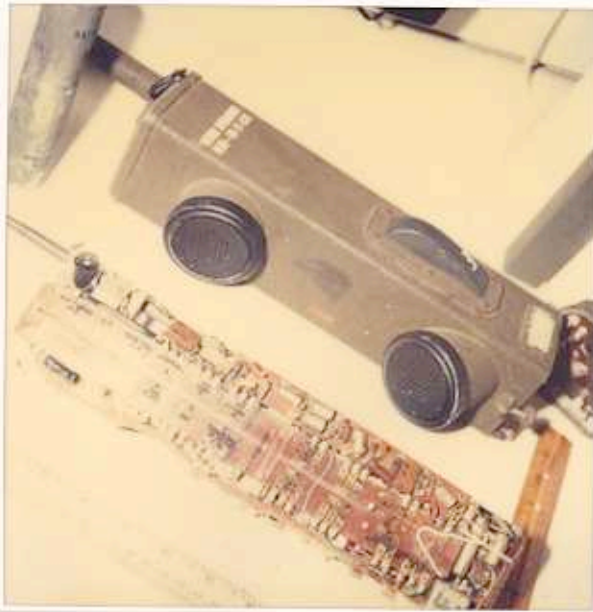
Handie-Talkie signals
the **attack!**

HANDIE-TALKIE IS
ANOTHER MOTOROLA RADIO FIRST!



The "FIGHTINGEST" Radio in the Armed Service.

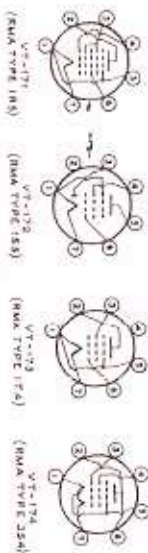
BC-611, EXTERIOR VIEWS AND DETAIL OF ANTENNA SWITCH. The lower graphic is the BC-611's successor, the AN/PRC-6 (1952).



Daddy fought in the war.

The Motorola MicroTAC Ultra Lite™ comes from a long line of heroes. Like the original SCR 536 hand-held wireless radio, which cut our boys loose from the wires of war. Lives depended on us then. Busy lives depend on us now. Motorola. The best-selling, most-preferred cellular phones in the world.





Low

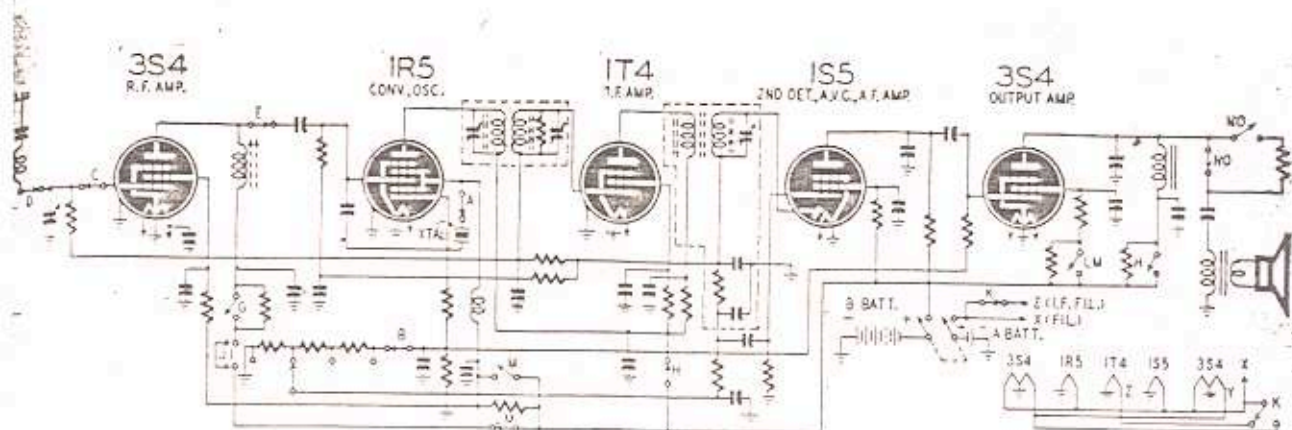


Fig. 1—Handie-Talkie switched to the "receive" position. Letters refer to switches shown in schematic form in the drawing below. Note that only one side of the two 3S4 filaments are heated when the set is used as a receiver. Tuning is controlled by the oscillator crystal.

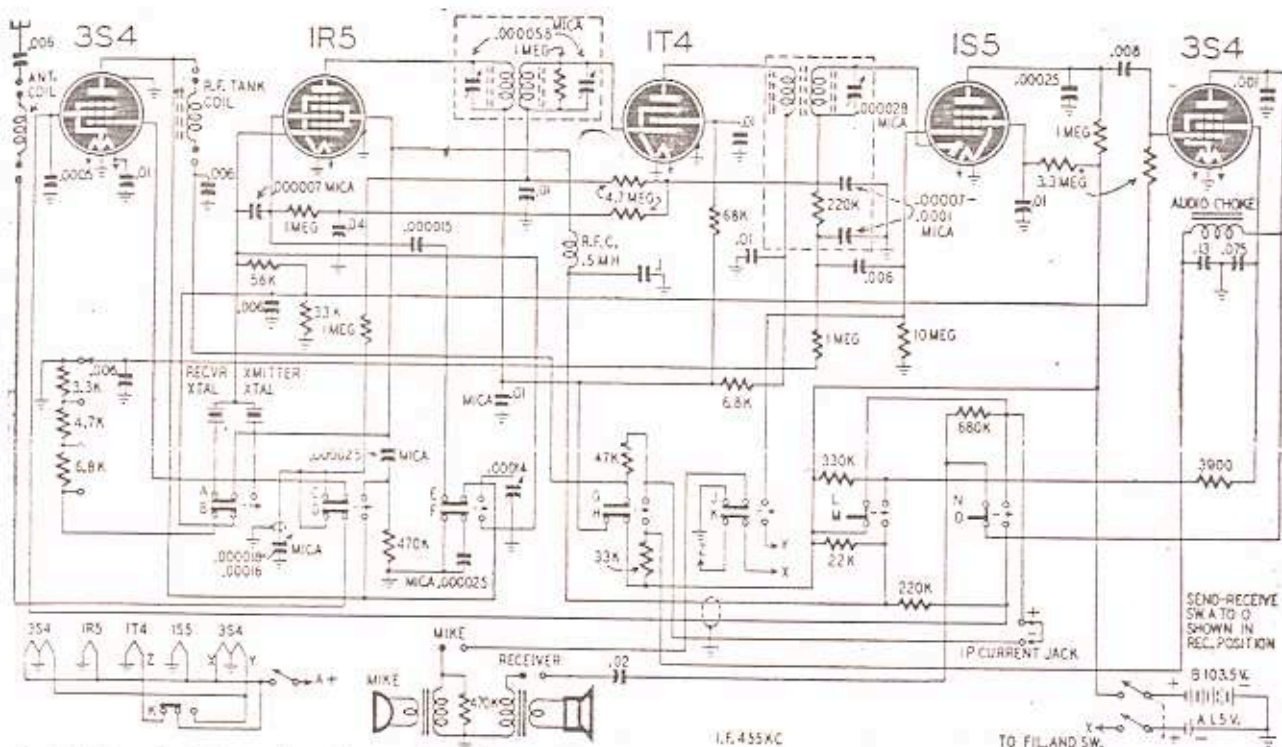


Fig. 2—Schematic of the war's most famous piece of communications equipment. Made by Galvin Motorola for the Signal Corps, it was used "in the air, on land and on the sea." Each set employs two crystals ground to frequencies 455 kc apart. The 1R5 acts as a Pierce oscillator in both transmitting and receiving circuits. The 1T4-section changeover switch is lettered to agree with the other two figures. Early Handie-Talkies had crystal earphones, but later ones used the inductor type illustrated in these diagrams.

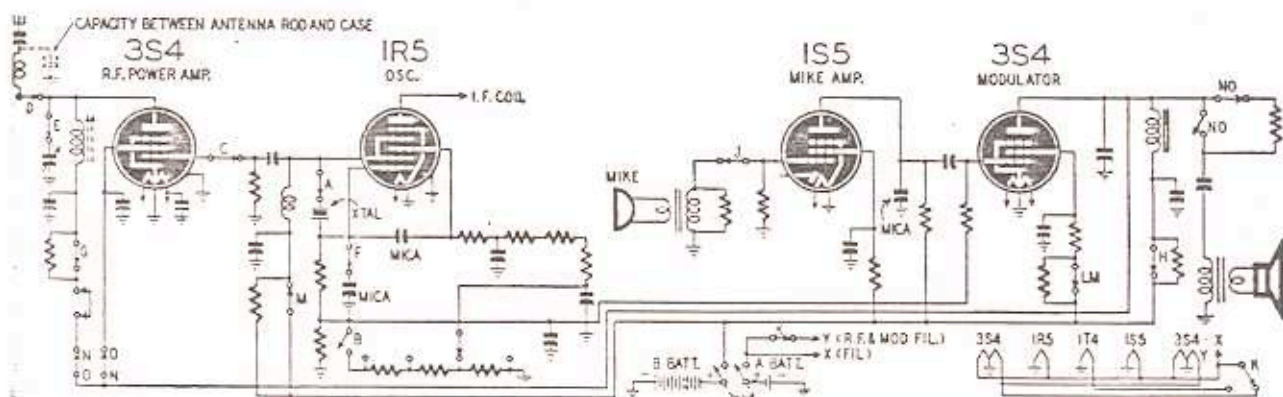


Fig. 3—As a transmitter, the Handie-Talkie is a four-tube set. The 1R5 functions as master oscillator in a Pierce circuit, driving one of the 3S4's as r.f. power output tube. The 1S5 and the other 3S4 are speech amplifier and modulator, Heising system being used.

SCHEMATIC DIAGRAMS FOR
MAINTENANCE OF GROUND RADIO
COMMUNICATION SET
RADIO RECEIVER & TRANSMITTER BC-611



RESTRICTED

DISSEMINATION OF RESTRICTED MATTER. The information contained in restricted documents and the essential characteristics of restricted material may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized Military public relations agencies. (See also par. 186, AR 380-5, 28 Sep 1942.)

RADIO RECEIVER & TRANSMITTER BC-611-(*)

BC-611-(*) = BC-611-A, BC-611-B, BC-611-C

Part of: SCR-536-(*)

Reference:
TM 11-235

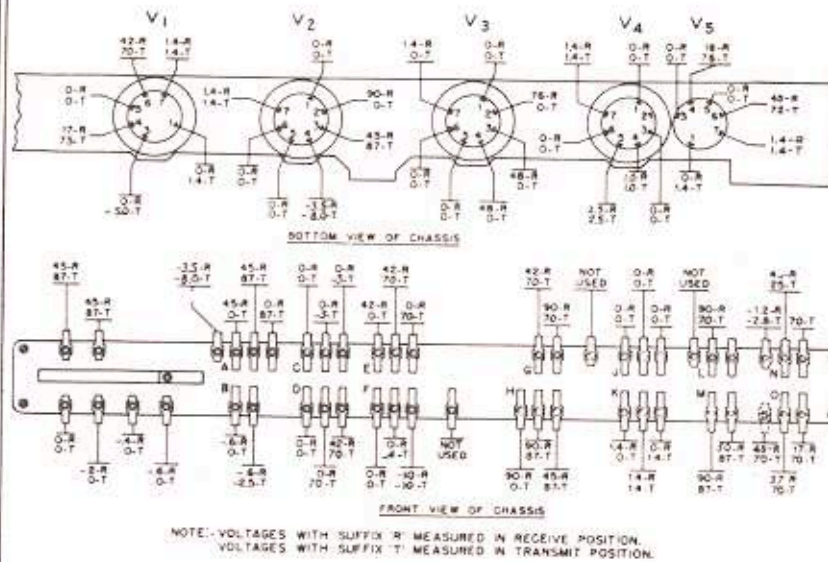


Fig. 1.—Voltage readings.

Readings with "A" batt voltage 1.4v, "B" batt voltage 90v under load.

Measurements above taken between point indicated and chassis, using 1000 ohms/volt meter. Filament and bias voltage read on 30v range, all others on 300v range.

Measurements in point-to-point chart at right taken across the part, using meter range indicated.

NOTE: Do not attempt to take measurements across parts not listed because of likely damage to circuit or tubes.

VOLTAGES - POINT TO POINT

PART	REC.	TRANS.	V.M. RANGE
R ₁ , R ₂	0	0	3
R ₃	0.2	0.5	3
R ₄	0.2	0.7	3
R ₅	0.1	0	3
R ₆	15	90	300
R ₇	0.2	0	3
R ₈ , R ₉	0	0	3
R ₁₀ , R ₁₁	18	0	30
R ₁₂	28	0	30
R ₁₃ , R ₁₄	0	0	3
P ₁₅	10	0	30
R ₁₆	65	0	300
R ₁₇	45	0 (5) ¹	300
R ₁₈	15	15	30
R ₁₉	18	0	30
R ₂₀	0	0	3
R ₂₁	65	60	300
R ₂₂	5	5	30
R ₂₃	0	0	3
R ₂₄	0	1	3
R ₂₅	0.1	0	3
R ₂₆ , R ₂₇	0	0	3
C ₁	0	0	3
C ₂	5	80	300
C ₃	24	80	300
C ₄	0.2	2	3
C ₅	0	2	3
C ₆	0	0	3
C ₇	0	0	3
C ₈	0	1.3	3
C ₁₁	50	90	300
C ₁₂	0	75	300
C ₁₃ -C ₁₆	0	0	3
C ₁₇	27	0	30
C ₁₈	80	0	300
C ₁₉ -C ₂₁	0	0	3
C ₂₃	*0.2	0	3
C ₂₅	0.2	0.2	3
C ₂₆	0.1	0.1	3
C ₂₈	.85	80	300
C ₂₉	40	85	300
C ₃₀	80	90	300
C ₃₁	95	0	300
L ₆	0	.10	30

* Depends on bias connection.

¹ -Late BC-611-C.

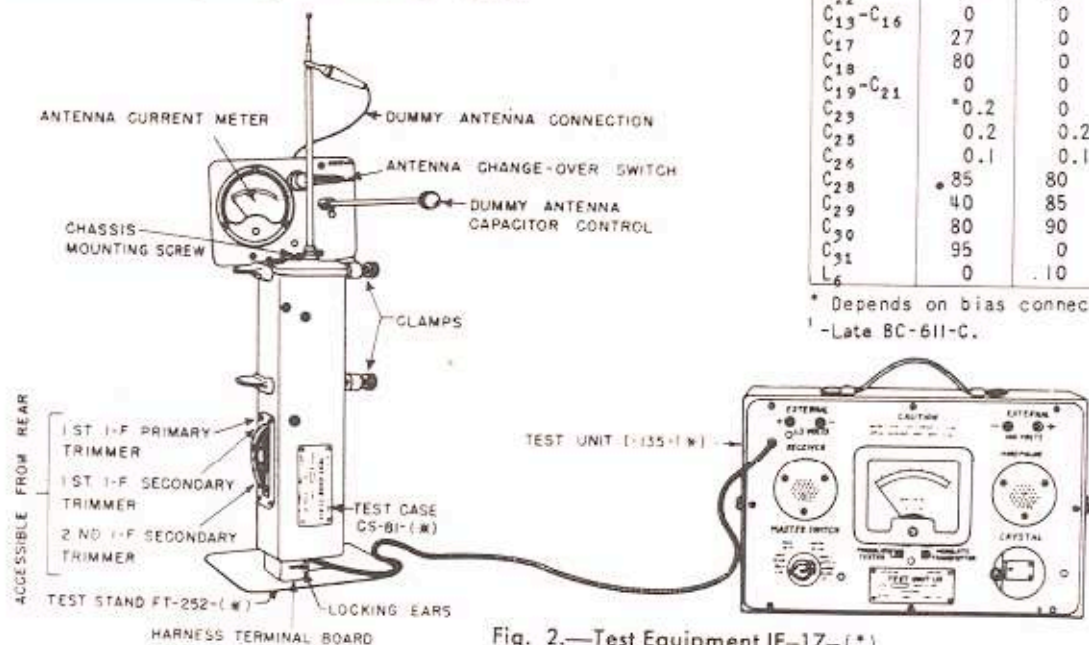


Fig. 2.—Test Equipment IE-17-(*)

RADIO RECEIVER & TRANSMITTER BC-611-(*)

PRESETTING AND ALIGNMENT

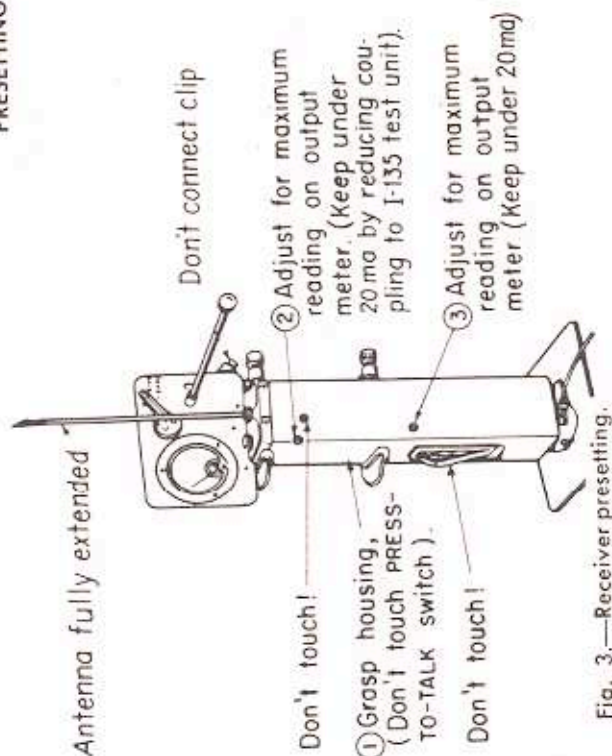


Fig. 3.—Receiver presetting.

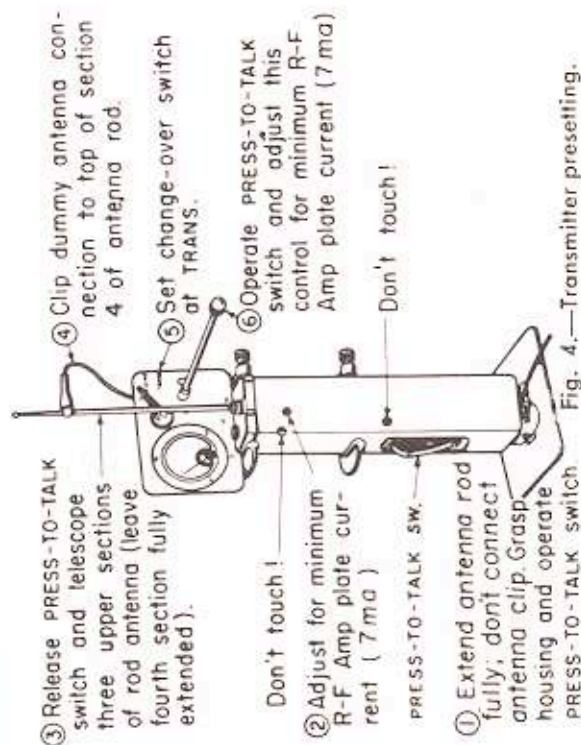


Fig. 4.—Transmitter presetting.

Using I-135-(*) test unit as shown in Fig. 2 (with external heavy duty batteries, if available). Remove BC-611 plate current jumper before attaching harness, and REPLACE after tests.

TEST OR ADJUSTMENT	Trans Crystal in	Rec Crystal in	I-135 SWITCH POSITIONS Master Switch Crystal Activity	Mod Tester	Trans Mod	PRESS TO TALK SWITCH	I-135 METER READING	REMARKS
Crystal Activity Check	Tester	Tester	BA-37 0-3v BA-38 0-600ma BA-38 0-150v BA-38 0-60ma	OFF	OFF		0.3 (min)	Test one at a time. Check that rec crystal is 455 kc higher than trans crystal.
Receiver Operation Check	Tester	Set	OUTPUT	OFF	OFF		1.35 (min) 250 85 (min) 3-11	
2 Receiver Presetting	Tester	Set	OUTPUT	ON	ON		Keep under 20	See Fig. 3 above for steps.
2 I-F Alignment (if needed)	Tester	Set	OUTPUT	ON	ON		1.35 (min) 275-300 75 (min) 26-30	See Fig. 2. Adjust in order for max. Repeat. Antenna fully extended. Test clip off.
Transmitter Operation Check	Set	Tester	BA-37 0-3v BA-38 0-600ma BA-38 0-150v BA-38 0-60 ma	OFF	OFF	Press	7	See Fig. 4 for steps. Ant current 15ma or more. Ant current should increase at least 6 percent.
Transmitter Presetting	Set	Tester	PWR AMP	ON	ON	Press	31.35-1.5	Disconnect internal batteries, install BA-37 and BA-38 in I-135. Ant fully extended. Test clip off.
Modulation Check	Set	Tester	PWR AMP	ON	ON	Press	37.5-103.5	
BA-37, BA-38 Battery Test	Set	Set	BA-37 0-3v BA-38 0-150v	OFF	OFF			

IMPORTANT

1 Always turn to OFF when changing crystals, batteries, or connections, and when not in use.
 2 Crystal slide cover of I-135 open. Attach short wire for additional radiation if needed. Lower limits - 1.25v and 70v.
 3 Both batteries should be replaced if either is low.

DON'T FORGET TO REPLACE PLATE CURRENT JUMPER!

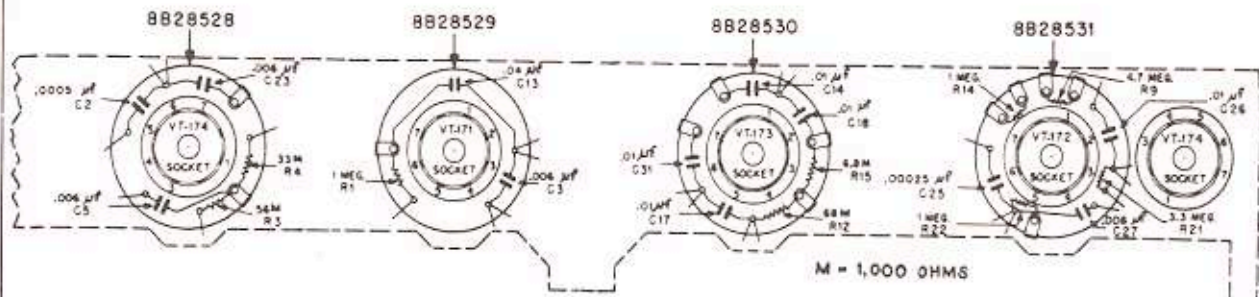


Fig. 5.—Resistor-capacitor cup schematic.

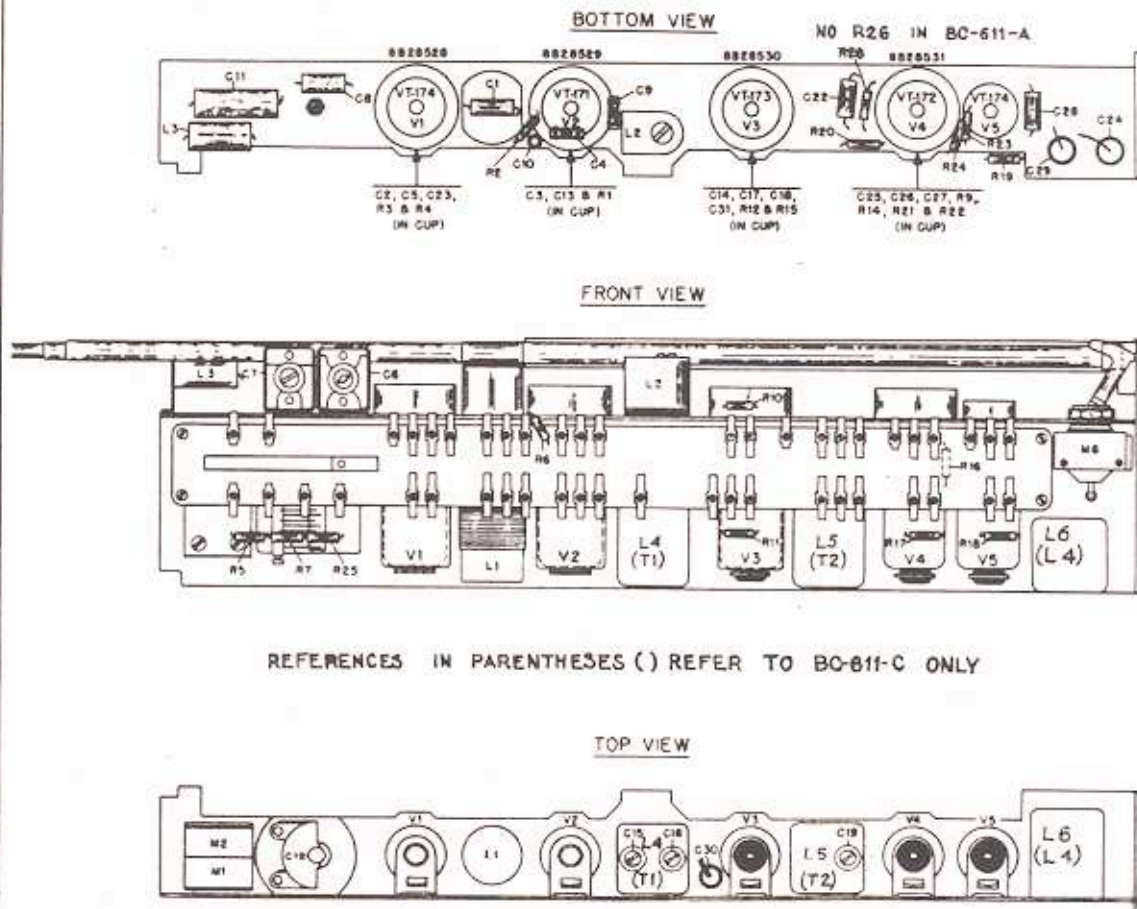


Fig. 6.—Parts layout.

RADIO RECEIVER & TRANSMITTER BC-611-(*)

COMMON FAULTS AND CORRECTIVE MEASURES

WATERPROOFING BC-611-(*)

1. The following method is recommended in cases where trouble is encountered due to moisture seepage.
 - a. Spread a small quantity of Permatex, aviation type, Permatex Co., N.Y., or equal, over the sealing rubber of both bottom and top covers.
 - b. Close bottom cover and press it firmly in place while tightening the hinged thumb screw. Be sure this screw is tight.
 - c. Insert a fiber washer under the screw which holds the top cover to the chassis. Close cover and tighten screw.
 - d. Remove cover of "Press to Talk" switch assembly. Spread a thin coating of Permatex over the rubber surface (side making contact with case) and replace the cover. Be sure the metal frame is snugly screwed down.
 - e. Remove bakelite cover from both mouth and ear pieces. Squeeze a small quantity of Duco cement, DuPont de Nemours Co., or equal, on the diaphragm of both pieces (dynamic type only) and spread out evenly with finger. Allow to dry several minutes and repeat with a second coat. Allow the cement to dry one-half ($\frac{1}{2}$) hour before replacing bakelite covers.
 - f. Remove the neoprene grommet from the antenna insulator. Fill the inside of the grommet with petroleum jelly, Chesebrough, or equal, and place back on the insulator.
2. Steps have been taken to procure and stock, at various Signal Corps Depots, kits comprised of the following materials suitable for the above outlined modification, which may be requisitioned through the regular channels:
 - 1 gross Washers, fiber, 5/16" O.D., 3/16" I.D., 1/16" thick, Pennsylvania Fiber & Specialty Co., or equal.
 - 8 ounce Permatex, aviation type, Permatex Co., N.Y., or equal.
 - 1 tube Cement, household, 5 $\frac{1}{4}$ fluid ounce, DuPont de Nemours Co., or equal.
 - 8 ounce Jelly, petroleum, Chesebrough Mfg. Co., or equal.
3. The above kit of materials is sufficient for maintenance of fifty (50) sets for one year.

OCSigO Maintenance Letter No. 13.

FAILURE OF C₂₉

Capacitor C₂₉ frequently short circuits. Remedy is replacement. If replacement is necessary, also check for damage to resistors R₁₆ and R₂₄. Replace them if necessary.