

## 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.

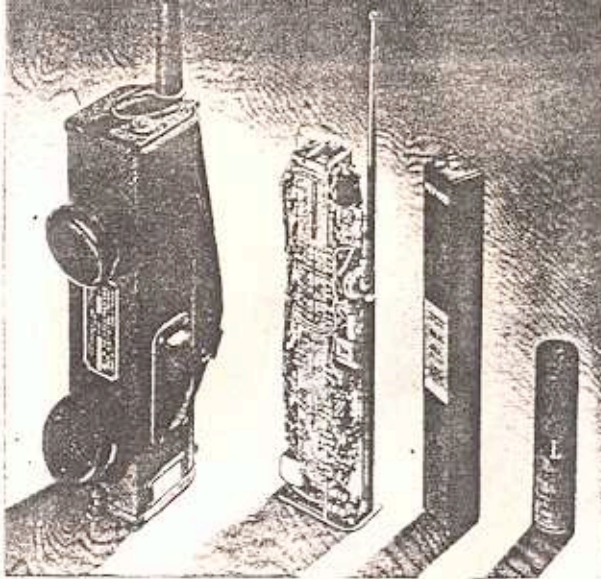
Motorola (then Galvin Mfg. Co.) designed and built the Handy-Talkie. They called it "the 'fightingest' radio set in the army!" because it was used primarily in the front lines. The set uses low filament voltage, miniature glass tubes of the sort developed for civilian portable radios just before the 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 ANTENNA SECTION TURNS KEY ON  
Antenna switch detail.



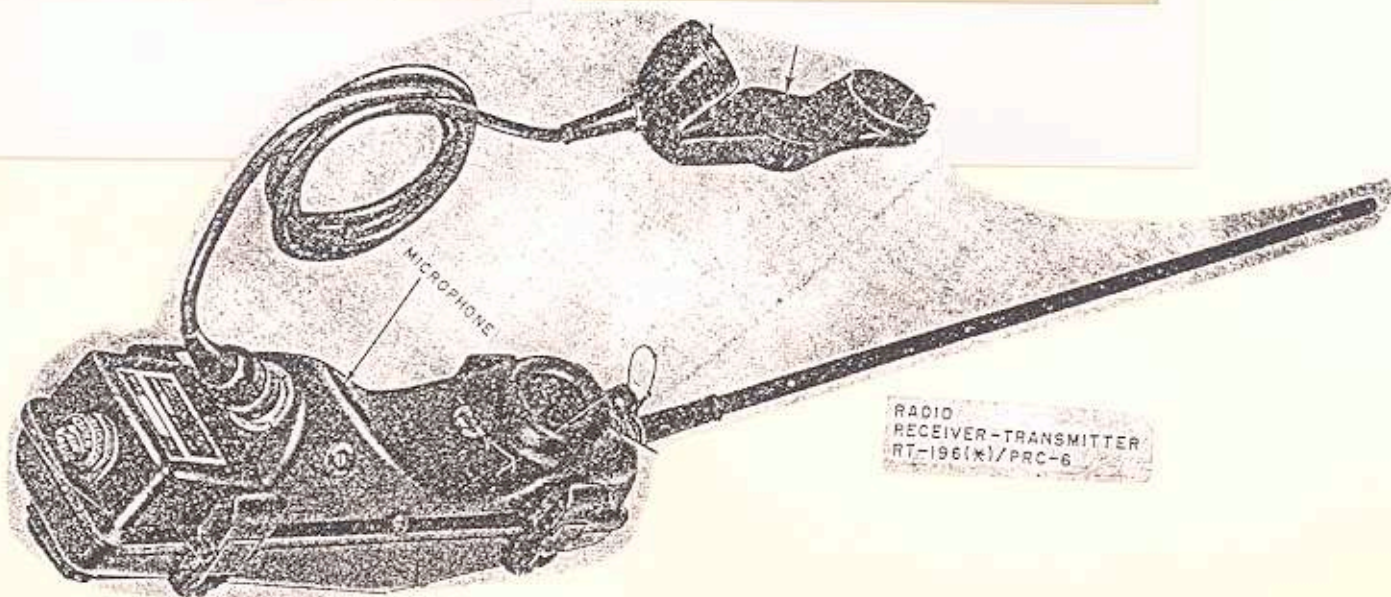
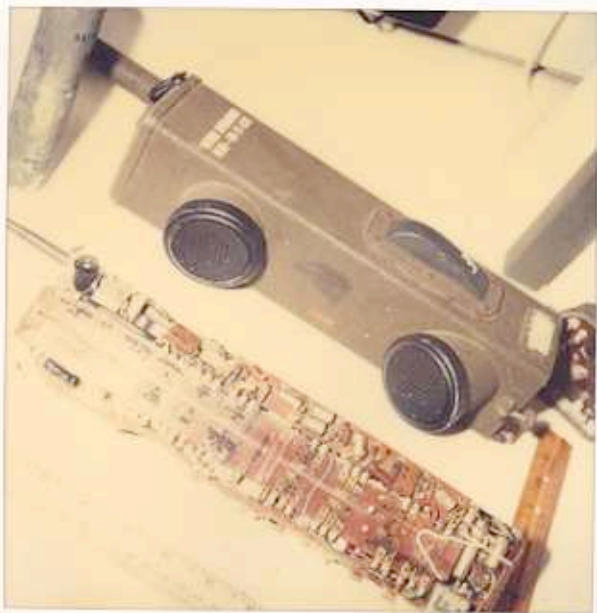
Handie-Talkie signals  
the **attack!**

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.



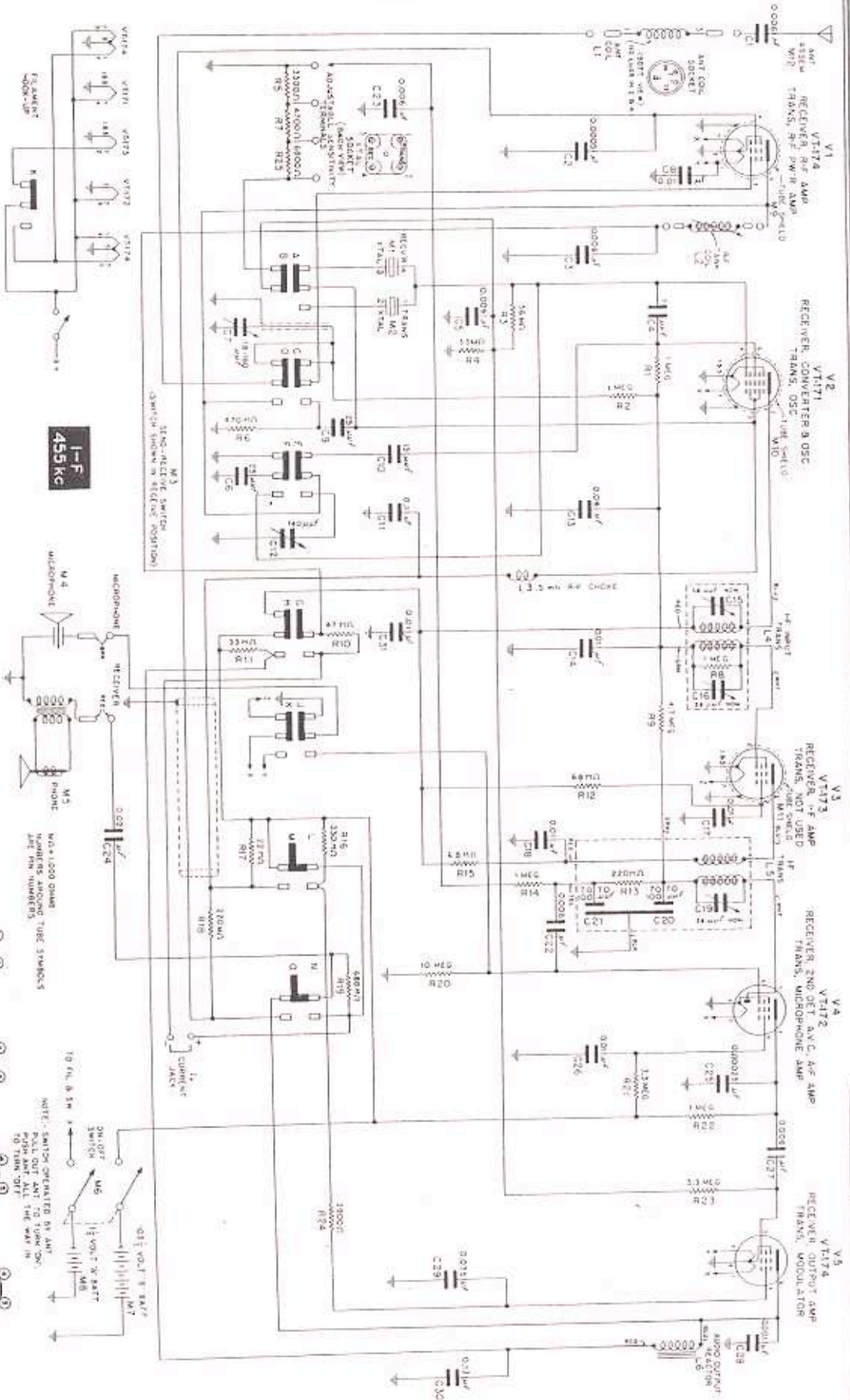
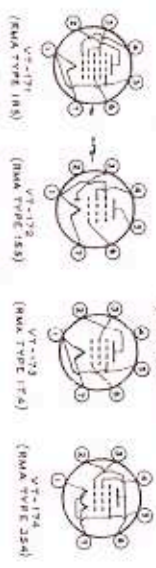


Fig. 7—Schematic—BC-611-A.



NOTE: SWITCH OPERATED BY AMP  
 PULL OUT AMP 100 VOLT 'A' BATT  
 TO TURN OFF

10 VOLT 'B' BATT  
 SWITCH

100-1000 OHM  
 VARIABLE RESISTOR  
 AND PIN NUMBERS

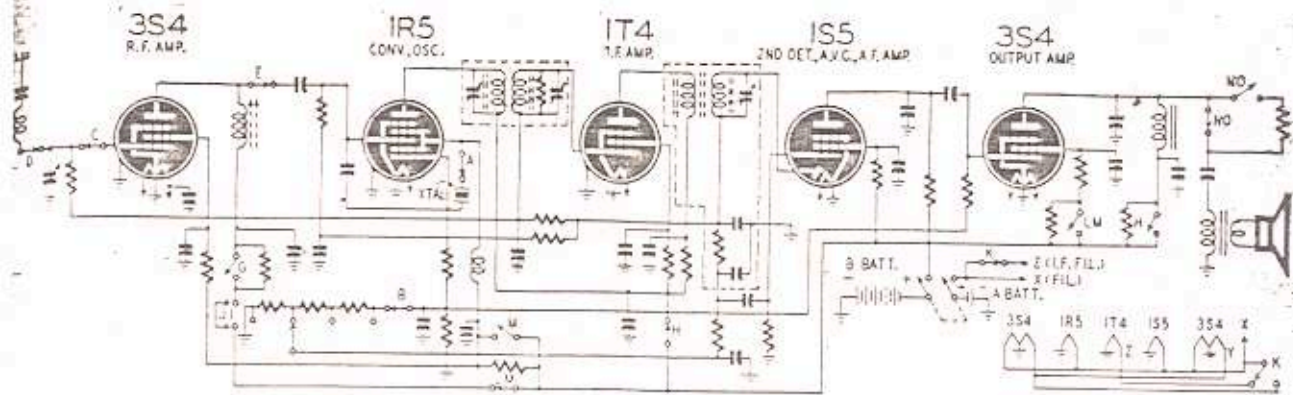


Fig. 1—Handie-Talkie switched to the "receive" position. Letters refer to switches shown in schematic form in the drawing below. Note that only one side of the two 3S4 filaments are heated when the set is used as a receiver. Tuning is controlled by the oscillator crystal.

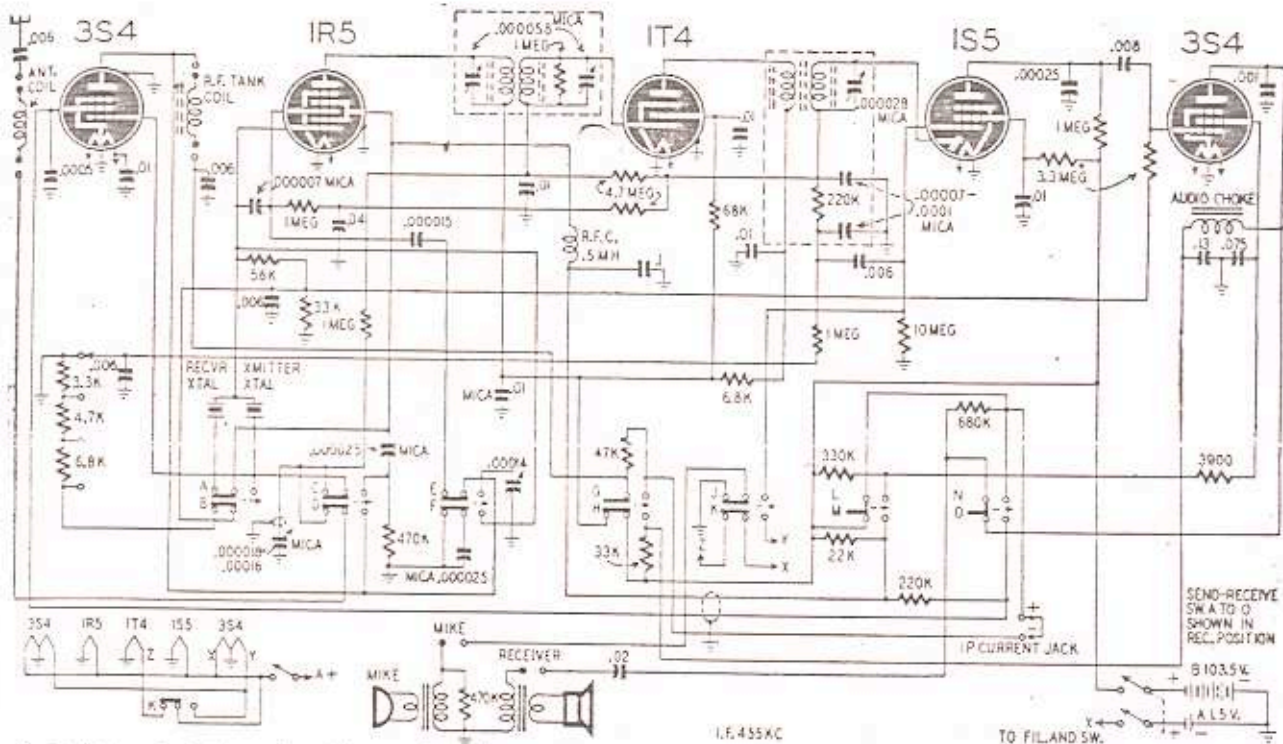
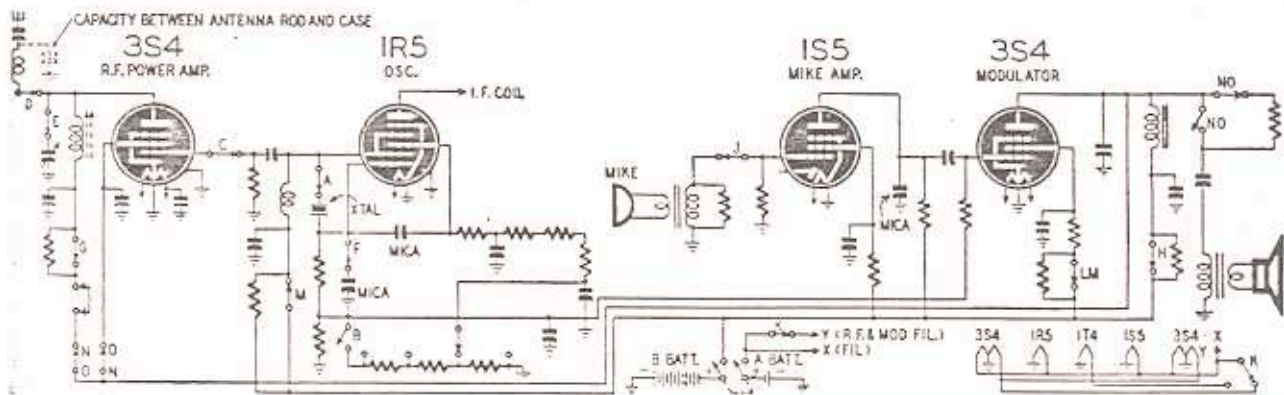


Fig. 2—Schematic of the war's most famous piece of communications equipment. Made by Galvin Motorola for the Signal Corps, it was used "in the air, on land and on the sea." Each set employs two crystals ground to frequencies 455 kc apart. The IR5 acts as a Pierce oscillator in both transmitting and receiving circuits. The 14-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.



All photos and diagrams courtesy the Signal Corps and Galvin Mfg. Co.

Fig. 3—As a transmitter, the Handie-Talkie is a four-tube set. The IR5 functions as master oscillator in a Pierce circuit, driving one of the 3S4's as r.f. power output tube. The IS5 and the other 3S4 are speech amplifier and modulator, Heising system being used.

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



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*RESTRICTED*

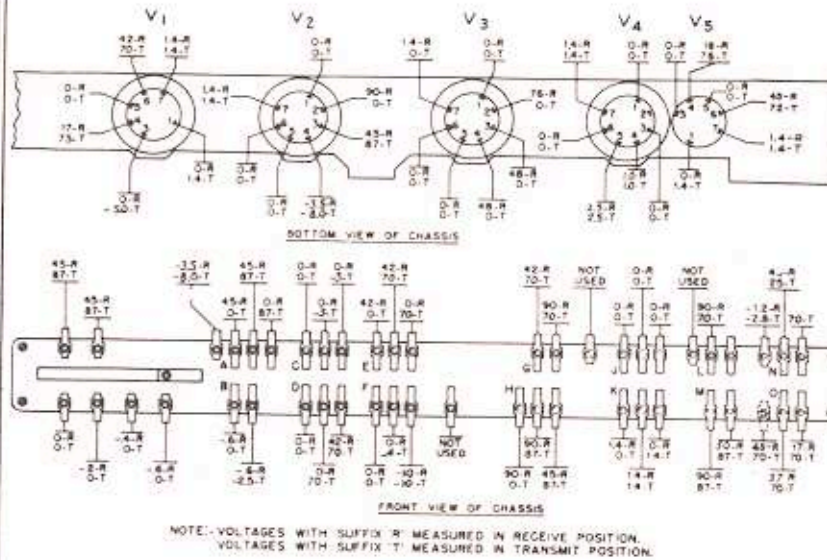
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# RADIO RECEIVER & TRANSMITTER BC-611-(\*)

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

Part of: SCR-536-(\*)

Reference:  
TM 11-235



VOLTAGES - POINT TO POINT

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

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.

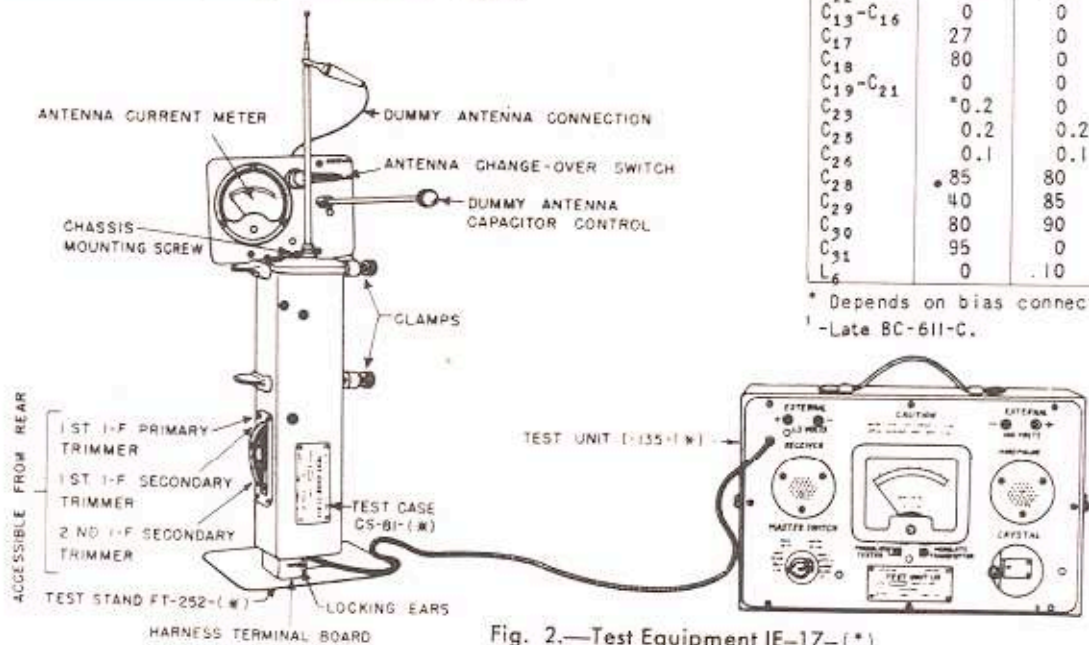


Fig. 2.—Test Equipment IE-17-(\*)

\* Depends on bias connection.

<sup>1</sup>-Late BC-611-C.



**RADIO RECEIVER & TRANSMITTER BC-611-(\*)**

**PRESETTING AND ALIGNMENT**

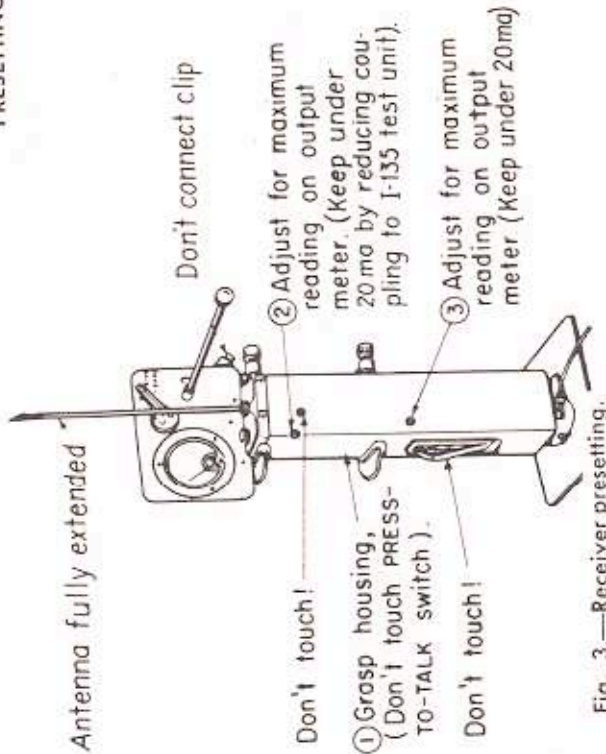


Fig. 3.—Receiver presetting.

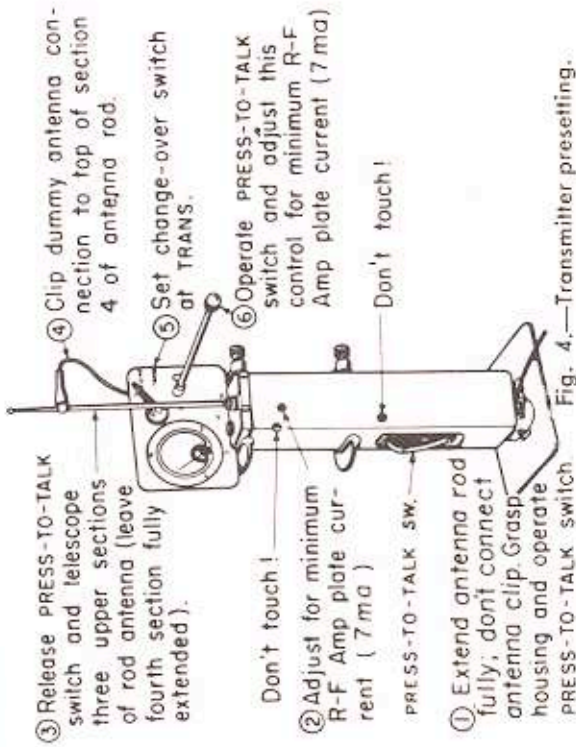


Fig. 4.—Transmitter presetting.

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		PRESS Mod TO TALK Trans SWITCH	I-135 METER READING	REMARKS
			Magter Switch	Crystal Activity			
Crystal Activity Check	Tester	Tester	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	BA-37 0-3v	OFF		1.35 (min)	
	Tester	Set	BA-37 0-600ma	OFF		250	
	Tester	Set	BA-38 0-150v	OFF		85 (min)	
Receiver Presetting	Tester	Set	BA-38 0-60ma	ON		Keep under 20	See Fig. 3 above for steps.
	Tester	Set	OUTPUT	ON		1.35 (min)	See Fig. 2. Adjust in order for max. Repeat.
I-F Alignment (if needed)	Tester	Set	BA-37 0-3v	OFF	Press	275-300	Antenna fully extended. Test clip off.
	Tester	Set	BA-37 0-600ma	OFF	Press	75 (min)	
	Tester	Set	BA-38 0-150v	OFF	Press	26-30	
Transmitter Presetting	Tester	Tester	PWR AMP	OFF	Press	7	See Fig. 4 for steps. Ant current 15ma or more.
	Tester	Tester	PWR AMP	ON	Press	7	Ant current should increase at least 6 percent.
Modulation Check	Tester	Tester	BA-37 0-3v	OFF	Press	31.35-1.5	Disconnect internal batteries, install BA-37 and BA-38 in I-135. Ant fully extended. Test clip off.
	Tester	Tester	BA-38 0-150v	OFF	Press	57.5-103.5	
BA-37, BA-38 Battery Test	Tester	Tester	BA-37 0-3v	OFF	Press	7	IMPORTANT
Tester	Tester	Tester	BA-38 0-150v	OFF	Press	7	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. DON'T FORGET TO REPLACE PLATE CURRENT JUMPER!  
 3 Both batteries should be replaced if either is low. Lower limits - 1.25v and 70v.

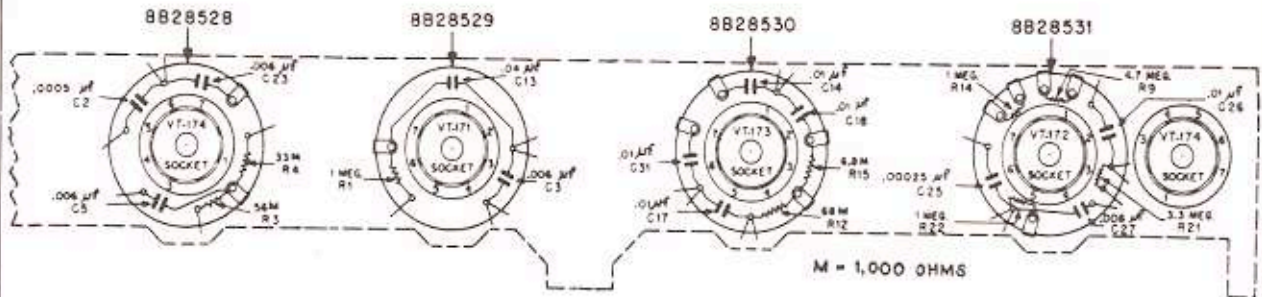
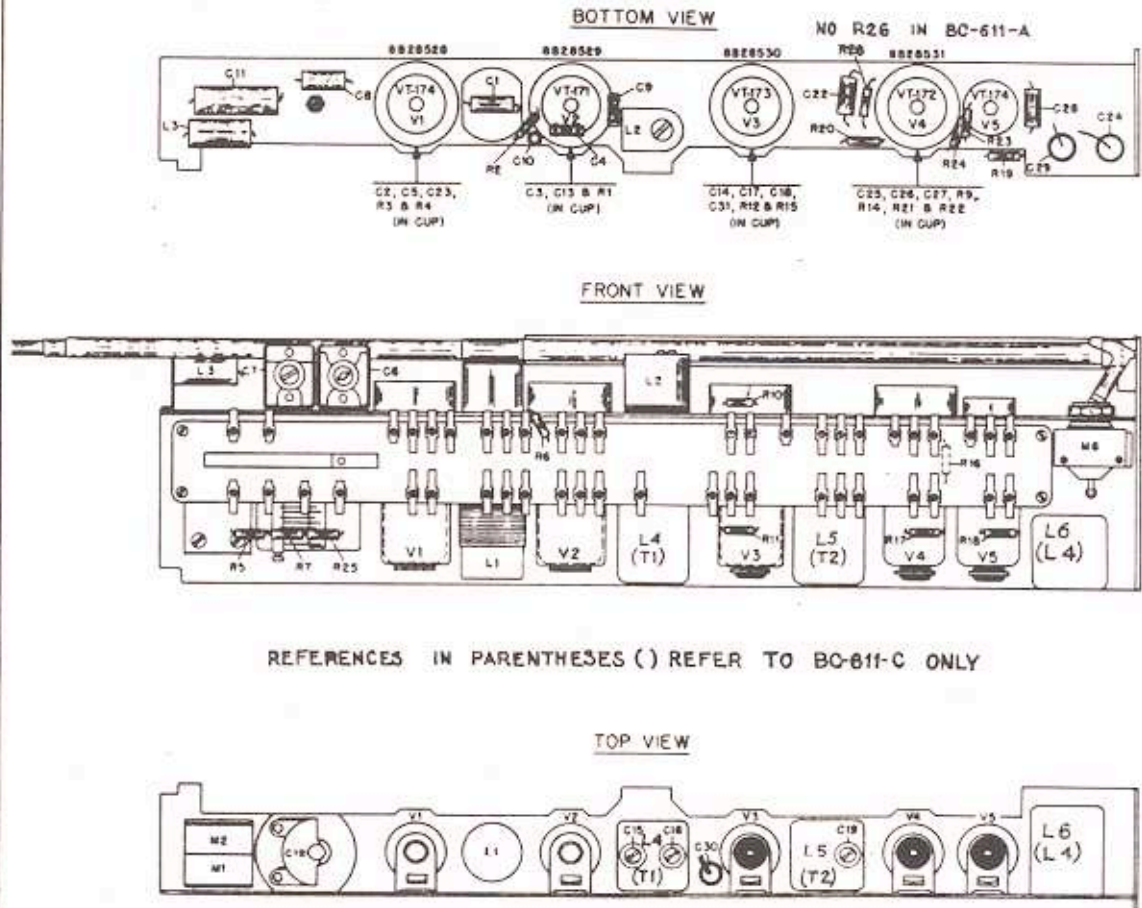


Fig. 5.—Resistor-capacitor cup schematic.



REFERENCES IN PARENTHESES ( ) REFER TO BC-611-C ONLY

Fig. 6.—Parts layout.

## 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 C<sub>29</sub>

Capacitor C<sub>29</sub> frequently short circuits. Remedy is replacement. If replacement is necessary, also check for damage to resistors R<sub>16</sub> and R<sub>24</sub>. Replace them if necessary.