INSTRUCTIONS

for

TEST EQUIPMENT IE-35-A

(Signal Corps Stock No. 3F3933-35A)

RESTRICTED

WESTERN ELECTRIC COMPANY

ES-695614

CONTENTS

RESTRICTED

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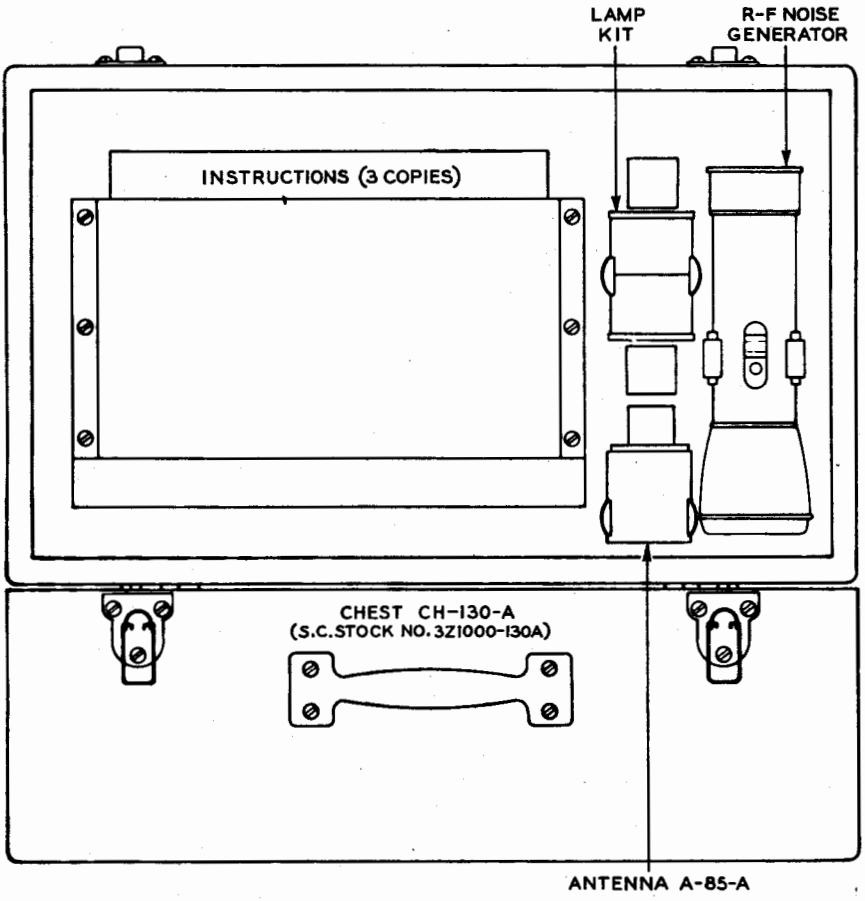

Fig. 1. Test Equipment IE-35-A: Cover Raised

SECTION I. TEST EQUIPMENT IE-35-A: DESCRIPTION

1. GENERAL

Test Equipment IE-35-A provides testing apparatus and tools which are used in the field maintenance and tuning of Radio Transmitter BC-950-A and Radio Receiver BC-942-A. The test equipment may also be used in the field maintenance of the m-f radio transmitters and radio receivers which are components of Radio Set SCR-274-N. Refer to Figs. 1 and 2 for illustrations and to Pars. 2-7 for brief descriptions of these test units and tools.

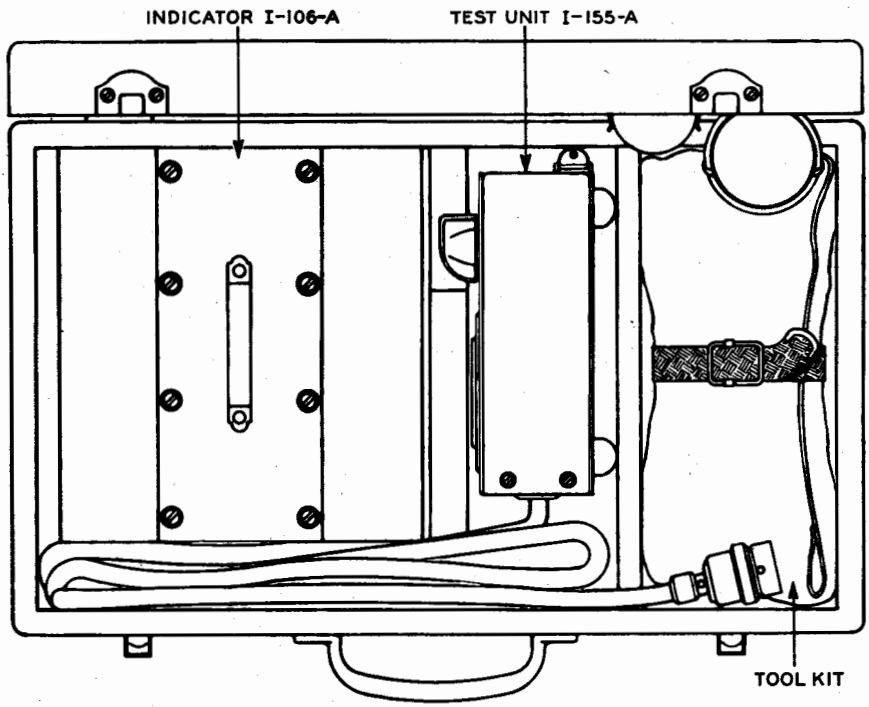

Fig. 2. Test Equipment IE-35-A: Inside of Cover

2. ANTENNA A-85-A (Signal Corps Stock No. 2A275-85A)

Antenna A-85-A comprises three lamps (interchangeable with Signal Corps Lamp LM-38), connected in parallel and mounted in a housing equipped with a coaxial plug. It provides a load of approximately 50 ohms at 12 watts.

When attached to the output receptacle of a v-h-f radio transmitter, the antenna provides a convenient visual aid in tuning. With the transmitter properly adjusted and tuned, the lamps will light.

3. LAMP KIT (per W.E.Co. Drawing ES-694921)

The lamp kit consists of six spare lamps for Antenna A-85-A, secured in a heavy cardboard container.

4. R-F NOISE GENERATOR (per W.E.Co. Specification D-150975)

The r-f noise generator is used as a source of r-f noise when adjusting or tuning a v-h-f radio receiver. It comprises a small adjustable buzzer, mounted in a tubular flashlight case to hold its associated battery. This unit is shipped without batteries. Two unit cells, Battery BA-30 or equivalent, are required for operation.

5. INDICATOR I-106-A (Signal Corps Stock No. 2A5390-106A)

Indicator I-106-A is a device for the detection of radiation from a v-h-f antenna energized by a radio transmitter operating in the frequency band of 100 to 156 megacycles.

Essentially it comprises a telescopic antenna coupled to a parallel-tuned circuit which, in turn, is connected to a silicon-crystal rectifier and a d-c microammeter. The scale of the variable air capacitor which resonates the tuned circuit is calibrated to read directly in megacycles; hence the indicator may be used as an approximate frequency meter.

After a v-h-f radio transmitter has been tuned, the indicator is placed 10 to 20 feet away from the transmitting antenna and the dial is turned until a maximum deflection is obtained on the microammeter. The dial reading of the indicator will approximate the carrier frequency, and hence show whether the transmitter has been properly tuned.

Since both the crystal and the microammeter are sensitive, care should be taken not to expose the instrument to strong r-f fields. Moreover, the antenna should never be extended farther than is necessary to obtain the required sensitivity of measurement. A spare crystal is carried in a clip inside the indicator.

6. TEST UNIT I-155-A (Signal Corps Stock No. 3F4470-155A)

Test Unit I-155-A used in tuning Radio Transmitter BC-950-A incorporates a 0-100 scale d-c meter (1.0 milliampere per full scale deflection) together with a seven-position rotary switch, six resistors, and a cord and plug for attachment to test receptacle J307 on the front of the transmitter. A tuning wrench for use with this transmitter is contained in the pocket under the snapslide. The normal meter readings are indicated on the bottom of the test unit.

7. TOOL KIT (per W.E.Co. Specification D-150976)

The tool kit, Fig. 3, comprises a tool case (Item 1) per ES-694919 which contains two each of the following tools:

Item	S.C. Stock No.	Description	W.E. Drawing
2	6RF1200	Extractor for receiver tubes	ES-696299
3	6RF2203	Receiver tuning wrench, fits Allen No. 6 hexagon socket-head cap screws	ES-693794
4	6RF2204	Transmitter tuning wrench	ES-693997
5	6R15490	Screwdriver for Phillips head screws	WE-8020
6	--	Wrench for Allen No. 8 hexagon socket-head cap screws	ES-694745
7	6RF2202	Wrench for Bristo No. 6 4-spline set screws	ES-694746
8	6R57400-6	Wrench for Allen No. 6 hexagon socket set screws	ES-694747

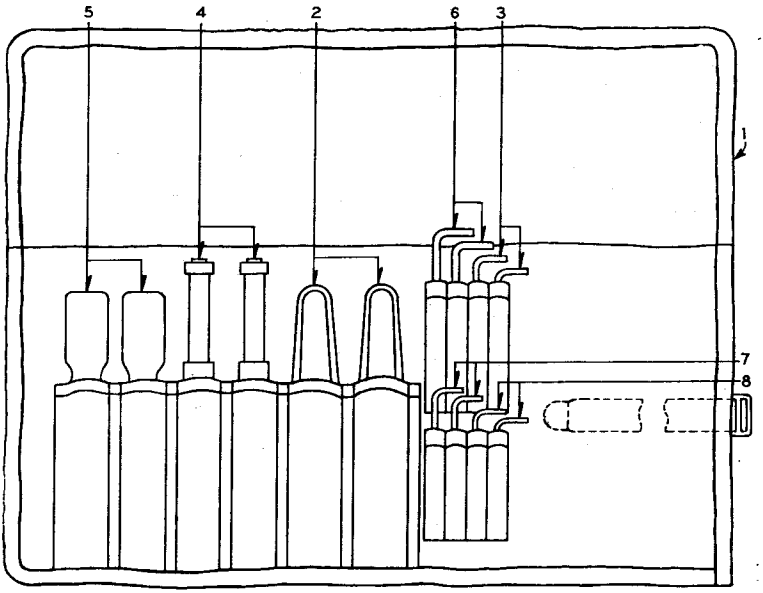

Fig. 3. Tool Kit: Arrangement of Tools

SECTION II. TUNING RADIO RECEIVER BC-942-A

1. GENERAL

The procedure outlined below assumes that the radio receiver has been properly aligned and that tuning it to four channels is all that is required.

2. APPARATUS REQUIRED

a. Screwdriver
b. Tuning wrench per ES-693794
c. Buzzer-type r-f noise generator

3. PROCEDURE

a. Preparation

Remove the receiver from its rack. Remove the outer right-side cover and insert crystals of the desired frequencies. Replace the cover and restore the receiver to the rack. Turn the MVC-OFF-AVC switch to the MVC position. Turn the volume control to give maximum sensitivity. Allow 30 seconds for the tubes to heat up.

b. Tuning

Operate the channel selector to A by depressing push-button A. Open the door on the front of the receiver and unlock the A selector cam by turning the locking screw one full turn counterclockwise, using the receiver tuning wrench clipped to the inside of the door. (Additional wrenches of this type are furnished with the tool kit.) Do not remove the wrench from the locking screw until the cam has been adjusted and locked.

Turn the manual tuning dial at the top of the receiver to the approximate frequency of Channel A. Then, while listening to the background noise in the headset, rock the manual tuning dial until a maximum of background noise is heard. Lock the A selector cam by turning the locking screw in a clockwise direction.

If necessary, reduce the sensitivity by turning the volume control knob.

Repeat this procedure for Channels B, C, and D.

Under some circumstances it may be found that the level of background noise in the headset is not sufficiently high to provide a convenient tuning guide. If this is the case, use the buzzer-type r-f noise generator. Place it near the antenna receptacle of the receiver. It may be necessary to remove the antenna connection at the receiver. If increased pick-up is required, insert a piece of wire several inches long into the receptacle. After the receiver has been tuned, replace the antenna connection.

NOTE: If the selector cam locking screws are not sufficiently tight, the drag of the relay latch may cause the cam to slip on the shaft. In this case the depressing of a channel-selecting push button (A, B, C, or D) causes the tuning motor to run continuously. To correct this condition: 1, turn the receiver OFF; 2, turn the manual tuning dial until the loose locking screw is in line with the hole; 3, depress the push button for the channel under consideration; 4, turn the receiver ON to re-energize the selector relay; 5, insert the wrench; 6, retune the channel as described; and 7, tighten the locking screw.

This trouble condition should not be mistaken for a different cause of motor "run away" which results from push-button 1 or 2 being operated before the selection of a channel has been completed, after the prior operation of a channel-selecting push-button A, B, C, or D.

SECTION III. TUNING RADIO TRANSMITTER BC-950-A

1. GENERAL

The procedure outlined here covers a complete retuning of a v-h-f radio transmitter installed in an aircraft. If the transmitter has already been tuned on the bench to the four frequencies desired, Pars. 3a to 3h may be omitted, since it is then necessary merely to adjust the final tuned circuit and the antenna coupling capacitor to the particular transmission line and aircraft antenna.

2. APPARATUS REQUIRED

a. One Crystal Unit DC-30 for each frequency to which the transmitter is to be tuned.
b. Test Unit I-155-A
c. Tuning wrench per ES-693997
d. Antenna A-85-A
e. Indicator I-106-A
f. Screwdriver

3. PROCEDURE

a. Preparation

Remove the radio transmitter from the rack. Remove the bottom cover plate and insert Crystal Units DC-30 in their proper sockets. Be sure that the frequencies of the crystal units correspond to the channel carrier frequencies as shown on the label on the inside of the cover plate. Replace the bottom cover plate and reinsert the transmitter in the rack. If the rack has space for more than one transmitter, the v-h-f transmitter must be inserted in the left-hand position. Reattach the lower right-hand receptacle which connects to the control box. Remove the cap marked CAUTION HIGH VOLTAGE from the lower left-hand receptacle and attach the cord of Test Unit I-155-A. Connect Antenna A-85-A in place of the coaxial transmission line to the aircraft antenna. Set the TONE-CW-VOICE switch on the radio control

box to VOICE. Operate the push button for Channel A on the radio control box and observe that A appears on the CHANNEL INDICATOR in the front panel of the transmitter. Allow the transmitter to warm up for 30 seconds before proceeding further. Then operate the push button on the microphone only as long as required to make each measurement or adjustment.

b. Crystal Check

Turn the meter switch on Test Unit I-155-A to position 1; the meter now measures the grid current of the oscillator tube. Observe that this is between 4 and 70 scale divisions for each of the four channels by operating the control box push buttons B, C, and D in turn. A reading outside these limits indicates trouble; probably a defective crystal.

c. Oscillator Output Circuit

Turn the meter switch to position 2. Insert the tuning wrench in opening 2 on the right-hand side of the transmitter and adjust the inductor in the oscillator plate circuit (L302) until a maximum deflection of the meter is obtained. Ordinarily, this should be between 25 and 90 scale divisions, indicating 1.5 to 5.4 milliamperes grid current in the first harmonic generator tube.

d. First Harmonic Generator Output Circuit

With the meter switch still in position 2, insert the tuning wrench in opening 3-A on the right-hand side of the transmitter, and adjust the tuning of the first harmonic generator plate circuit (L303). It will be noted that as this circuit is tuned, a major dip (usually 5 per cent or more) will occur in the meter deflection. Under some conditions one or more smaller dips may also be observed. Adjust the tuning to the bottom of the major dip, that is, to a minimum meter deflection.

e. Second Harmonic Generator Input Circuit

Turn the meter switch to position 3 and adjust the input circuit of the second harmonic generator (L305) through opening 3-B on the left-hand side of the transmitter. Adjust for maximum meter deflection. Then, with the meter switch still in position 3, go back to opening 3-A and make any necessary final readjustment of L303 to obtain a maximum meter reading. This should be between 25 and 90, corresponding to 1.5 to 5.4 milliamperes grid current in the second harmonic generator tube.

f. Second Harmonic Generator Output Circuit

Turn the meter switch to position 4. Insert the tuning wrench in opening 4 and adjust the inductor in the output circuit of the second harmonic generator (L308) to get a maximum deflection of the meter. This should be between 20 and 80, indicating a grid current in the r-f amplifier of 1.2 to 4.8 milliamperes.

g. R-F Amplifier Output Circuit and Antenna Coupling

Set the meter switch in position 5; the meter now indicates the total space current (cathode current) of the r-f amplifier tube. Insert the tuning wrench in the opening marked ANT COUPLING in the front panel; turn this control to the limit of counterclockwise rotation to obtain minimum coupling.

With the wrench in the opening marked RF AMP TUNING, adjust the r-f amplifier output circuit (L311) until a steady reading of the meter is obtained over several turns of the adjusting nut. Note this reading as "detuned space current". Then readjust for maximum dip (minimum current) as observed on the meter; the meter should read between 30 and 45 scale divisions (30 to 45 milliamperes).

Increase the antenna coupling by turning clockwise in small steps until the space current reaches approximately 90 per cent of the detuned space current noted above. On

each step, after changing the coupling, readjust the r-f amplifier tuning for maximum dip. The final meter reading should be between 40 and 55. Note that the lamps of Antenna A-85-A light.

h. Channels B, C, and D

Repeat steps b to h for channels B, C, and D. All circuits of the transmitter are now properly tuned and matched to Antenna A-85-A. However, they are not necessarily matched to the transmission line and antenna of the aircraft.

j. Antenna Matching

Remove the artificial antenna and reconnect the transmission line and aircraft antenna. Operate the channel selecting push-button A and check that A appears on the CHANNEL INDICATOR on the front panel of the radio transmitter. See that the meter switch of Test Unit I-155-A is in position 5 (r-f amplifier space current). Reduce the ANT COUPLING to minimum by turning this control in a counterclockwise direction as in Par. 3g.

Repeat the adjustment procedure of Par. 3g, but with the aircraft's transmission line and antenna connected in place of the artificial Antenna A-85-A. Repeat for Channels B, C, and D.

NOTE: At some frequencies and with a particular installation, it may be found that minimum antenna coupling will occur at some setting other than full counterclockwise rotation of the ANT COUPLING control, and the direction of rotation of the control required to increase the antenna coupling may be reversed. In any case, a setting should be found which results in a space current (with the RF AMP TUNING adjusted for maximum dip) equal to 90 per cent of the detuned space current.

k. Radiation Check

With Indicator I-106-A on the ground or the wing of the aircraft about 10 or 20 feet from the antenna, turn the tuning dial until the maximum reading of the meter is obtained, while the transmitter is being operated on Channel A. The dial setting of the indicator should correspond to the frequency assigned for Channel A. Repeat on Channels B, C, and D. If a large error in frequency is observed, it is probable that inductor L303 in the plate circuit has been tuned to a minor dip rather than to the major dip referred to in step d. In this case repeat step d and the subsequent tuning procedure.

4. RECAPITULATION OF TEST UNIT I-155-A MEASUREMENTS

Switch Position	Quantity Measured	Operating Range	Corresponding Value
1	OSC grid current	4—70	0.07— 1.2 ma
2	1st H-G grid current	25—90	1.5 — 5.4 ma
3	2nd H-G grid current	25—90	1.5 — 5.4 ma
4	R-F AMP grid current	20—80	1.2 — 4.8 ma
5	R-F AMP space current	40—55	40.0 —55.0 ma
6	Heater circuit voltage	54	27 volts
7	Plate voltage	53—55	530—550 volts

All readings and values correspond to 28 volts at the battery.