

**PERFORMANCE REQUIREMENTS**  
**TYPE LE-T1 RADIO TRANSMITTER**  
**GENERAL EQUIPMENT REQUIREMENTS**  
**RADIO SYSTEMS**

**1. GENERAL**

**1.01** This section covers the performance requirements which Type LE-T1 Radio Transmitters installed by the Western Electric Company shall meet before turnover to the Telephone Company. It is expected that the tests will be made by the Telephone Company. Reference should be made to Section R10.250 of Bell System Practices for calibration curves. The services of a licensed radio operator are required for certain of the tests.

**1.02** Reference shall be made to Section 800-630-180 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements.

**1.03 Test Equipment:** The requirements are based on the use of the following test equipment, or its equivalent:

- 1—\*Analyzer—Weston Electrical Instrument Corporation, Model 772, Type 6, or Volt-Ohm-Milliammeter—Weston Electrical Instrument Corporation, Model 779, Type 1
- 1—\*19C Oscillator, Audio
- 1—\*5A Attenuator
- 1—D-170215C Resistor, Deposited Carbon—Glass Enclosed—660 Ohms  $\pm 5\%$ , When tested at One Watt—Maximum Dissipation is 300 Watts
- 2—Fuse Clips—Trumbull Electric Mfg. Co. No. 104A
- 1—P3P Cord, 6 feet long
- 1—Special W3U Cord, 4 feet long
- 3—305A Plugs, for above cords

1—Special 1002C Headset, consisting of:

- 2—509 Receivers
- 1—1B Headband
- 1—R2FG Cord, 3 feet, 6 inches long
- 1—289B Plug
- 1—122 Tool, 7/16-Inch End Wrench
- 1—Screwdriver, 3-1/2 Inch x 3/16 Inch Blade, Yankee No. 95
- 1—Key Set—"Vest Pack Kit", The Allen Mfg. Co. No. 605
- 1—Key Set—"Handi-Hex", The Allen Mfg. Co. 6075
- 1—Combination Right-angle Wrench—Goodell-Pratt Co. No. 199
- 1—367 Tool, 7/16-Inch Socket Wrench

**Note:** \*It is recommended that these items be ordered suitable for tropical service (specified as "tropicalized") if equipment is to be used in such an environment. Tropical environment may be defined for this purpose as one in which the lowest mean monthly temperature is 64°F. or above and the mean daily relative humidity is 75% or above for a period of a month or more.

**2. PRELIMINARY CHECK**

**2.01** A check should be made on whether all the vacuum tubes are installed in their sockets and that the ground is connected.

**Caution:** *Dangerous voltages are exposed after the power switches in 3.03 are made. Provide suitable protection. Extreme caution should be employed when working on components inside the transmitter cabinet. Always use the grounding probes for discharging components before touching such components.*

### 3. POWER TESTS

#### 3.01 Rectifier Resistance

- (1) Before the a-c power line is connected, measure the d-c resistance between the plate of one of the HF AMP 3 tubes and ground. This should be done with the lever-type interlocks D-107 and D-108 held open momentarily. This resistance should be 96,000 ohms  $\pm$  20%.
- (2) Measure the resistance between the plate terminals of the HF AMP 2 tube and ground. This should be done with the lever-type interlocks D-104 and D-106 held open momentarily. This resistance should be 52,000 ohms  $\pm$  20%.
- (3) The resistance measurements in (1) and (2) above should be less than 20 ohms each with the door interlocks D-105, D-106, D-107, and D-108 closed.

#### 3.02 A-c Power Tests

- (1) Connect the a-c power line to the transmitter.
- (2) Operate only the MAIN AC POWER toggle switch to ON. (This produces no high voltage inside the cabinet.) The heating lamps H101 and H102 should now be extinguished, the white indicator lamp MAIN AC POWER should light, and the blower should operate.
- (3) Using the Weston Model 779 analyzer or its equivalent, measure the a-c voltage across terminals 1 and 2 of transformer T711 located on the VF, LF and MF panel. The voltage reading should be between 109 and 121 volts.
- (4) Measure the voltage across terminals 6 and 8 of transformer T711. The voltage reading should be between 9.5 and 10.5 volts.
- (5) The MF crystal, Y703, should become warm, indicating that its heaters are operating.

- (6) The lamp OVEN OPR on the HF OSC panel should light periodically after an initial warmup period of about 3 minutes.
- (7) Check that the filaments of all vacuum tubes, except the RECT A, B, and C tubes, are lighted. (Check when visually possible.)

#### 3.03 D-c Power Tests

- (1) Operate the MAIN AC POWER, AC POWER, and RECTIFIERS switches to ON. (See **Caution** in 2.01.) Observe the HV RECT voltage by means of the DC METERING. After an interval of not less than 30 seconds, the time delay relay should operate and the high voltage rectifier voltage (approximately 1500 volts) should be indicated on the DC METERING meter.
- (2) Determine that the safety switches on each door are operating properly by noting that the high-voltage rectifier voltage is zero when either door is open and the MAIN AC POWER, AC POWER, and RECTIFIERS switches are ON.

**Caution:** *When opening either door the RECTIFIERS switch should be in the OFF position.*

- (3) Set the following controls to the positions indicated.
  - (a) HIGH VF EQUAL to minimum (fully counterclockwise).
  - (b) VF AMP GAIN to maximum (fully clockwise).
  - (c) TRS GAIN to minimum (fully counterclockwise).
  - (d) SWITCHING RATE to mid-position.
  - (e) PILOT AMPLITUDE to OFF.
  - (f) PRIVACY to OFF.
  - (g) HF CAR AMPLITUDE to maximum (fully clockwise).
  - (h) OSC E<sub>B</sub> switch to ON.
  - (i) Adjust HF AMP 2 BIAS control for a DC METERING meter reading of 70 (70 ma) in the HF AMP 2 1K position.

(j) Adjust the HF AMP 3 BIAS control for an average DC METERING meter reading of 20 (10 ma) in the two HF AMP 3 I<sub>K</sub> positions of the DC METERING switch.

**Note:** To make the adjustments given in (i) and (j) above it is necessary to open the right-hand cabinet door, set the control and then close the door. Be certain to operate the RECTIFIERS switch to OFF before opening the door.

(4) All controls should be set as described in paragraph (3) above. The tube currents and rectifier voltages shall lie within the following limits for the corresponding positions of the DC METERING switch:

Switch Position	Tube or Varistor	Reading on DC METERING Meter
LV RECT C		65-87
LV RECT B		131-172
LV RECT A		73-95
HV RECT		137-185
OSC E <sub>B</sub>	V714	90-126
MV E <sub>B</sub>	V715	90-126
RATE MV I <sub>K</sub>	V711	12-40*
SWITCHING MV I <sub>K</sub>	V712	19-60*
LF OSC A I <sub>K</sub>	V710	9-25
LF OSC B I <sub>K</sub>	V710	9-25
CAR A SW AMP I <sub>K</sub>	V706	7-28
CAR B SW AMP I <sub>K</sub>	V707	7-28
PILOT A SW AMP I <sub>K</sub>	V708	3-35
PILOT B SW AMP I <sub>K</sub>	V709	7-28
MF OSC I <sub>G</sub>	V713	0.2-10
MF OSC I <sub>K</sub>	V713	40-100
HF OSC I <sub>G</sub>	V401	3-40**
HF OSC I <sub>K</sub>	V401	10-100
HF HG DRIVER I <sub>K</sub>	V402	90-150
HF HG I <sub>K</sub>	V403	74-136

Switch Position	Tube or Varistor	Reading on DC METERING Meter
VF AMP 1 I <sub>K</sub>	V701	22-56
VF AMP 2 I <sub>K</sub>	V701	35-90
LF MOD CAR	RV701	45-65
LF AMP 1 I <sub>K</sub>	V702	26-64
MF MOD	RV702	30-200
MF AMP 1 I <sub>K</sub>	V703	26-64
MF AMP 2 I <sub>K</sub>	V704	26-64
MF AMP 3 I <sub>K</sub>	V705	32-80
HF MOD	RV401	0***
HF AMP 1 I <sub>K</sub>	V601	40-100
HF AMP 2 I <sub>K</sub>	V602	65-75
HF AMP 3 I <sub>G</sub>	V603, V604	0
HF AMP 3 I <sub>K</sub>	V603, V604	16-24

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 \*These readings will swing from a minimum to a maximum indication. The maximum indication should be between these two limits.  
 \*\*Rotate HF CRYSTAL knob to all positions in which crystals are mounted.  
 \*\*\*Set HF CRYSTAL to a blank position or remove a crystal.

**4. TRANSMISSION REQUIREMENTS**

**4.01 VF, LF and MF Tests**

- (1) **Test Circuit:** Remove plug PG101 from the OPERATE receptacle and insert it into the TEST POWER receptacle in the front of the transmitter.
- (2) **Adjustment of Low-Frequency Modulator Drive**

- (a) Set the DC METERING switch to LF MOD CAR RV701 and the PRIVACY switch to OFF.
- (b) Adjust the LF CAR A ADJ potentiometer for a reading of 55 on the DC METERING meter.
- (c) Set the PRIVACY switch to INV and adjust the LF CAR B ADJ potentiometer for a reading of 55 on the DC METERING meter.

(3) **Adjustment of Drive to Medium-Frequency Modulator:** Set the DC METERING meter to MF MOD RV702 and adjust the MF OSC TUNING control for a peak on the DC METERING meter.

(4) **VF Amplifier Gain and Equalizer**

- (a) Connect the voice-frequency test oscillator through the test attenuator to the VF AMP IN jacks. Turn the HIGH VF EQUAL potentiometer completely counterclockwise and the VF AMP GAIN potentiometer completely clockwise. Set the voice-frequency test oscillator to give 1 milliwatt at 1,000 cps. Adjust the test attenuator until the INPUT VOLUME meter reads 0 vu.

**Requirement:** The attenuator reading should be between 38 and 49 db.

- (b) With the test set-up as in (a), set the attenuator to 25 db and adjust the VF AMP GAIN until the INPUT VOLUME meter reads 0 vu. Set the voice-frequency test oscillator to give 1 milliwatt at 250 cps.

**Requirement:** The VU meter should read between +1.5 and -2.5 vu.

Set the voice-frequency test oscillator to give 1 milliwatt at 2500 cps with the test attenuator at 25 db.

**Requirement:** The VU meter should read between +2 and -2 vu.

- (c) Turn the HIGH VF EQUAL potentiometer completely clockwise. Set the voice-frequency test oscillator to give 1 milliwatt at 1000 cps. Set the attenuator to 25 db and adjust the

VF AMP GAIN until the INPUT VOLUME meter reads 0 vu. Set the voice-frequency test oscillator to give 1 milliwatt at 250 cps. Set the attenuator to 13 db.

**Requirement:** The VU meter should read between +3 and -3 vu.

Set the voice-frequency test oscillator to give 1 milliwatt at 2500 cps. Set the attenuator to 36 db.

**Requirement:** The VU meter should read between +3 and -3 vu.

(5) **Gain of Low-Frequency and Medium-Frequency Circuits**

- (a) Connect the voice-frequency test oscillator through the test attenuator to the VF AMP IN jacks and adjust the attenuator until the INPUT VOLUME meter reads -4 vu.

- (b) Operate the OSC EB switch on the HF OSC panel to the OFF position and set the DC METERING switch to position HF MOD RV401. Set the TRS GAIN control to maximum clockwise position.

**Requirement:** The meter reading indicating the HF MOD current should be greater than 20(0.10 ma).

(6) **Pilot Equalization:** Remove the voice-frequency input. Turn the PRIVACY switch to SW and the PILOT AMPLITUDE switch to 0 db. Turn the OSC EB switch on the HF OSC panel to the OFF position. Turn the DC METERING switch to the HF MOD position. By means of the TRS GAIN control, obtain an HF MOD current of 50 micro-amperes meter reading.

**Requirement:** The HF MOD meter reading should be between 45 and 55 on both pulses of the switched pilots. If the pulses are not within these limits, equalize them with the PILOT EQUALIZER control.

(7) **0 DB Pilot Suppression**

- (a) Turn the PILOT AMPLITUDE and PRIVACY switches OFF. Turn the OSC EB switch on the HF OSC panel to OFF

- position. Turn the DC METERING switch to the HF MOD position.
- (b) Connect the voice-frequency test oscillator through the test attenuator to the VF AMP IN jacks. Set the voice-frequency oscillator to give 1 milliwatt at 1000 cps. Adjust the attenuator until the INPUT VOLUME meter reads  $-4$  vu.
  - (c) Adjust the TRS GAIN control for an HF MOD current of 50 microamperes meter reading.
  - (d) Disconnect the 1000 cps tone and turn the PILOT AMPLITUDE switch to 0 db.
  - (e) By means of the PILOT AMPLITUDE ADJUST control, obtain an HF MOD current of 50 microamperes meter reading.
- (8) **Switching Rate:** With the circuit set-up as in (1) of 4.01, set the DC METERING switch to SWITCHING MV Ik and count the switches on the DC METERING meter over a 20-second interval. Adjust the SWITCHING RATE potentiometer until  $40 \pm 1$  switches occur in 20 seconds. Set the DC METERING switch to RATE MV Ik and count its rate on the DC METERING meter. It should be  $80 \pm 2$  in 20 seconds.
- (9) **MF AMP 3 Tuning and MF Suppression**
- (a) Set the circuit up as in (1) of 4.01.
  - (b) Operate the EB switch on the RF OSC panel to the OFF position. This switch removes plate voltage from the HF OSC V401 and changes the meter shunt for HF MOD RV401 so that the full scale reading is 1 ma.
  - (c) Connect the 19C oscillator through the 5A attenuator to the VF AMP IN jacks and adjust the 19C oscillator to 1 milliwatt at 1000 cps. Adjust the 5A attenuator so that the INPUT VOLUME meter reads  $-4$  vu.
  - (d) Adjust HF MOD TUNING to 32.0.
  - (e) Set the DC METERING switch to position HF MOD RV401.
  - (f) Set the TRS GAIN control to its maximum clockwise position.
  - (g) Adjust MF AMP 3 TUNING for peak on the DC METERING meter, reducing TRS GAIN as necessary to maintain the reading on scale.
  - (h) The HF MOD current, as indicated on the DC METERING meter, should read at least 20.
  - (i) Set the HF METERING meter to HF MOD output.
  - (j) Set HF MOD TUNING to 09.5.
  - (k) Throw the OSC EB switch to ON.
  - (l) Adjust MF SUPP on the HF Amplifier Panel apparatus side for minimum deflection on the HF METERING meter.
  - (m) Recheck tests (d) to (l) with the OSC EB switch OFF as required to eliminate the effects of interaction.

#### 4.02 Over-all Tests

##### (1) Initial Tune-up

- (a) This paragraph describes the procedure for completely tuning up the transmitter on an assigned frequency. For testing purposes described below, the frequency to which the transmitter is tuned is defined as the center of the sideband (mid-point between Pilots A and B) at the output terminals of the transmitter. Start this procedure with all controls set according to 3.03(3).
- (b) Connect the 660-ohm load resistor across the antenna terminals on top of the transmitter.
- (c) Set the HF RANGE switch to the correct position for the frequency used according to the following table:

<u>Position</u>	<u>HF RANGE, MC</u>
1	2.7-3.4
2	3.4-6
3	6-10
4	10-18
5	18-25

**Caution:** *Do not operate the range switch when the high voltage is ON.*

(d) Plug the 19C oscillator through the 5A attenuator into the VF AMP IN jacks. Set the 19C oscillator to give 1 milliwatt at 1000 cps. Adjust the attenuator until the INPUT VOLUME meter reads -4 vu. This is called *reference tone* at the output of the VF AMP.

(e) **HF Carrier Amplitude and Frequency:**

Turn the HF CRYSTAL switch to the position corresponding to the desired operating frequency. Tune the HF HG TUNING control for maximum HF MOD RV401 current. To locate the proper resonance, set the HF HG TUNING at zero and slowly increase the dial reading until maximum current is indicated. Under this condition the harmonic generator is tuned to the fundamental crystal frequency. By rotating the HF HG TUNING dial to higher numbers, a second resonance may be found and this is the second harmonic frequency of the crystal frequency. For transmitter output frequencies below 15.6018125 mc the harmonic generator should be tuned to the fundamental crystal frequency. For frequencies above 15.6018125 the harmonic generator should be tuned to the second harmonic of the crystal frequency. After adjusting the HF HG TUNING control to the proper setting, adjust the HF MOD rectified current to a reading of 20 (10 ma) by means of the HF CAR AMPLITUDE control.

(f) **HF MOD TUNING:** Set the HF METERING meter to the HF MOD OUT position and adjust HF MOD TUNING for peak on the HF METERING meter. To locate the proper resonance, set HF MOD TUNING at zero and slowly increase the dial reading until a maximum deflection is obtained. Set the TRS GAIN control to maximum and rotate the HF MOD TUNING either clockwise or counterclockwise, depending on whether the

assigned transmitter output frequency is above or below 10 mc, until a second peak reading is obtained on the HF METERING meter. Tuning the HF MOD TUNING clockwise tunes this circuit to the sum frequency, that is, the sum of the HF carrier frequency and the MF signal frequency. Tuning counterclockwise tunes this circuit to the difference of these two frequencies. When the assigned transmitter output frequency is low, the change in dial setting required to find either the sum or difference frequency will be large. When the assigned transmitter output frequency is high, the change in dial setting will be small.

(g) **HF AMP 1 TUNING:** Set the HF METERING meter to HF AMP 1 PLATE. Tune the HF AMP 1 TUNING control until a maximum is reached in the HF AMP 1 PLATE voltage. To locate the proper resonance, start with the HF AMP 1 TUNING dial set at zero and slowly increase the dial reading until maximum voltage is indicated.

**Caution:** *Keep the meter reading below 65 (6.5 volts) by using the TRS GAIN CONTROL.*

(h) **HF AMP 2 TUNING:** Observe the plate current of one of the output tubes, for instance, V603 in the HF AMP 3 1K position of the DC METERING switch. Tune the HF AMP 2 TUNING control until a maximum is reached in the HF AMP 3 plate current. The dial reading should be approximately the same as that for HF AMP 1 TUNING.

**Caution:** *Keep the meter reading below 100 (100 ma) with the TRS GAIN CONTROL.*

(i) **HF AMP 3 TUNING:** Set the HF METERING meter to HF AMP 3 PLATE. Tune the HF AMP 3 TUNING control until a maximum is reached in the HF AMP 3 PLATE voltage, keeping the HF METERING meter reading under 200 (400 volts) as well as the HF AMP 3 1K current under 100 (100 ma) with the TRS GAIN control. To locate the proper resonance, start with the HF AMP 3 TUNING dial set at zero and slowly increase the dial reading until a maximum is reached in the HF AMP 3 PLATE voltage.

(j) **Output Circuit:** Turn the HF METERING switch to the OUTPUT BALANCE position and minimize the voltage appearing there with the OUTPUT BALANCE control. Return the HF METERING switch to the HF AMP 3 PLATE position. Tune the HF AMP 3 tuning control for maximum HF AMP 3 PLATE voltage. Adjust the TRS GAIN control until the HF AMP 3 Ik meter reading is 100 (100 ma) and adjust the ANT MATCHING control until the HF AMP 3 PLATE voltage meter reading is 160 (320 volts) or is as high as possible. Readjust HF AMP 3 TUNING for changed peak. Recheck the OUTPUT BALANCE. The above procedure may have to be repeated in order to obtain readings of 100 for the HF AMP 3 Ik current and 160 for the HF AMP 3 PLATE voltage. This adjustment is termed *reference tone* at the output of the transmitter. When operating into a low transmission line impedance at some frequencies, it may not be possible to obtain a reading as high as 160 on the HF METERING meter. In these cases the adjustments should be such as to give the highest possible reading on the HF METERING meter. Read the HF AMP 3 OUTPUT voltage on the HF METERING meter.

**Requirement:** The reading of the HF METERING meter in the HF AMP 3 OUTPUT position shall be at least 67 volts.

(k) **Meter Readings for Reference Tone:**

Meter readings obtained with the transmitter operating with 1000 cps reference tone input and all circuits adjusted for reference tone output shall be within the limits shown:

DC METERING

<u>Switch Position</u>	<u>Limits</u>
LV RECT C	65-87
LV RECT B	131-172
LV RECT A	70-107
HV RECT	131-174
OSC E <sub>B</sub> V714	90-126

DC METERING (Cont'd.)

<u>Switch Position</u>	<u>Limits</u>
MV E <sub>B</sub> V715	90-126
RATE MV I <sub>K</sub> V711	12-40*
SWITCHING MV I <sub>K</sub> V12	19-60*
LF OSC A I <sub>K</sub> V710	9-25
LF OSC B I <sub>K</sub> V710	9-25
CAR A SW AMP I <sub>K</sub> V706	7-28
CAR B SW AMP I <sub>K</sub> V707	7-28
PILOT A SW AMP I <sub>K</sub> V708	3-35
PILOT B SW AMP I <sub>K</sub> V709	7-28
MF OSC I <sub>G</sub> V713	0.2-10
MF OSC I <sub>K</sub> V713	40-100
HF OSC I <sub>G</sub> V401	3-40
HF OSC I <sub>K</sub> V401	10-100
HF HG DRIVER I <sub>K</sub> V402	10-150
HF HG I <sub>K</sub> V403	10-136
VF AMP 1 I <sub>K</sub> V701	22-56
VF AMP 2 I <sub>K</sub> V701	35-90
LF MOD CAR RV701	45-65
LF AMP 1 I <sub>K</sub> V702	26-64
MF MOD RV702	30-200
MF AMP 1 I <sub>K</sub> V703	26-64
MF AMP 2 I <sub>K</sub> V704	26-64
MF AMP 3 I <sub>K</sub> V705	32-80
HF MOD RV401	15-25
HF AMP 1 I <sub>K</sub> V601	40-100
HF AMP 2 I <sub>K</sub> V602	70-90
HF AMP 3 I <sub>G</sub> V603, V604	0-20
HF AMP 3 I <sub>K</sub> V603, V604	90-110

\*These readings will swing from a minimum to a maximum indication. The limits for the maximum value are shown.

HF METERING

<u>Switch Position</u>	<u>Limits</u>
HF MOD OUTPUT	2-10
HF AMP 1 PLATE	35-65
HF AMP 3 PLATE	120-165
HF AMP 3 OUTPUT	67-112
OUTPUT BALANCE	0-5

(1) The tune-up procedure outlined in (1) above should be repeated for each frequency on which the transmitter is to operate.

(2) **Frequency Response**

- (a) Tune up the transmitter to an operating frequency and adjust for reference tone at the transmitter output as described in subparagraph (1) above.
- (b) Adjust the TRS GAIN control for a reading of 80 (160 volts) on the HF METERING meter in the HF AMP 3 PLATE voltage position.
- (c) Slowly change the frequency of the 19C oscillator over the range 250 to 3250 cps and observe the reading of the HF METERING meter in the HF AMP 3 PLATE voltage position. Maintain the output of the 19C oscillator at 1 milliwatt for all observations.

**Requirement:** For any frequency in the range 250 to 3250 cps the reading of the HF METERING meter in the HF AMP 3 PLATE voltage position shall be in the range 50 to 94 (100 to 188 volts).

- (3) **Pilot Equalization:** Tune up the transmitter on an operating frequency as in subparagraph (1) above. Obtain reference tone at output. Remove the voice-frequency input. Turn the PRIVACY switch to SW and the PILOT AMPLITUDE switch to 0 db.

**Requirement:** The HF AMP 3 PLATE voltage should be between 155 and 165 meter reading on both pulses of the switched pilots. If the pulses are not within these limits, perform the tests outlined in paragraph 4.01 (6).

(4) **Pilot Suppression, 0 db.**

- (a) Turn the PILOT AMPLITUDE AND PRIVACY switches OFF.
- (b) Tune up the transmitter on an operating frequency as in subparagraph (1) above. Obtain reference tone at the output.
- (c) Remove the 1000 cps tone input. Turn the PILOT AMPLITUDE switch to 0 db.

**Requirement:** The HF AMP 3 PLATE voltage meter reading should not differ by more than 5 per cent from the reading obtained with reference output. If the difference is greater than 5 per cent, perform the tests outlined in paragraph 4.01(7).

(5) **Pilot Suppression, -10 db**

- (a) Turn the PILOT AMPLITUDE and PRIVACY switches OFF.
- (b) Tune up the transmitter on an operating frequency as in subparagraph (1) above. Obtain reference tone at the output.
- (c) Increase the voice-frequency attenuator reading by 10 db and obtain a suitable output with the pilot by turning up the TRS GAIN control.
- (d) Remove the 1000 cps tone input and turn the PILOT AMPLITUDE switch to -10 db.

**Requirement:** The HF AMP 3 PLATE voltage meter reading obtained with 1000 cps tone input down 10 db from reference tone should not differ from the reading obtained with -10 db pilot by more than 10 per cent.

5. CALIBRATION WITH ANTENNA CONNECTED

5.01 Remove the dummy load and connect the antenna transmission line to the antenna binding posts at the top of the cabinet.

5.02 Connect the 19C oscillator through the 5A attenuator to terminals 9 and 10 on terminal strip TS104 of the cabinet equipment. Set the oscillator to give 1 milliwatt at 1000 cps and set the attenuator so that the output of the attenuator is equal to the amplitude of reference tone which will be received from the control terminal. For example, if the amplitude of 1000 cps reference tone received from the control terminal is -10 dbm, set the 5A attenuator at 10 db. Adjust the VF AMP GAIN control until the INPUT VOLUME meter reads -4 vu.

5.03 Tune up the entire transmitter, following the procedure of 4.02(1). Tune the transmitter to each assigned frequency and record the settings of each dial. Transfer this calibration information to the FREQ CALIBRATION drum. A celluloid shield covers the white paper on the FREQ CALIBRATION drum and must be removed to mark the proper control settings on the drum paper. Three screws hold a vertical bar in place on the drum, which in turn holds the celluloid shield and calibration paper in place. Rotate the drum until this bar is accessible from the right

side of the cabinet. Remove the three holding screws and the bar. Remove the celluloid shield. The information to be placed on the drum should correspond to the following designations:

CALL  
 FREQ KC  
 HF RANGE  
 HF CRYSTAL  
 HF HG BIAS  
 TRS GAIN  
 HF HG TUNING  
 HF MOD TUNING  
 HF AMP 1 TUNING  
 HF AMP 2 TUNING  
 HF AMP 3 TUNING  
 ANT MATCHING  
 OUTPUT BALANCE

*Note:* If the transmitter is properly matched into a balanced transmission line with an

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impedance ranging between 200 and 800 ohms, the reading of the HF METERING meter in the HF AMP 3 OUTPUT position for reference tone output will be between 40 and 120 (40 and 120 volts). A reading above or below these limits indicates that the transmission line impedance is outside the recommended range of 200 to 800 ohms.

**5.04** Disconnect the 5A attenuator and 19C oscillator, and connect the VF line from the control terminal to terminals 9 and 10 on terminal strip TS104. Turn the PILOT AMPLITUDE switch to the -10 db position. The transmitter is now ready to send radio telephone signals to a distant point, employing the synchro-switched privacy, inverted speech, or straight speech.