

# **\*TB 9-6625-2079-35**

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

## **CALIBRATION PROCEDURE FOR AM-FM MODULATION METER, BOONTON, MODEL 82AD, 82AD/S10, ME-525A, ME-525A/USM AND ME-525U**

Headquarters Department of the Army, Washington, DC  
11 June 2004

*Distribution Statement A: Approved for public release; distribution is unlimited.*

### **REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS**

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, US Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is [2028@redstone.army.mil](mailto:2028@redstone.army.mil). Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use <https://amcom2028.redstone.army.mil>.

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\*This bulletin supersedes TB 9-6625-2079-35, 24 July 1989, including all changes.

**SECTION I  
IDENTIFICATION AND DESCRIPTION**

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of AM-FM Modulation Meter, Boonton, Model 82AD, 82AD/S10, ME525A, ME525A/USM, and ME-525U. The manufacturer's manual and TM 11-6625-3059-24 were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

**a. Model Variations.** None.

**b. Time and Technique.** The time required for this calibration is approximately 3 hours, using the microwave technique.

**2. Forms, Records and Reports**

**a.** Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

**b.** Adjustments to be reported are denoted (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

**3. Calibration Description.** TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications		
Input sensitivity	Range:	≤10 mV rms (10 to 520 MHz)	
	Accuracy:	≤30 mV rms (520 MHz to 1.2 GHz)	
Dc output	Range:	1.00 V dc at 1000 counts on digital display	
	Accuracy:	±0.1%	
Frequency modulation	Range:	0 to 300 kHz Deviation	
	Accuracy:	±2% of reading (for modulation frequencies of 30 Hz to 100 kHz) <sup>1</sup>	
Amplitude modulation	Range:	10 to 90%	
	Accuracy:	±2% of reading (for modulation frequencies of 30 Hz to 100 kHz) <sup>2</sup>	
Audio frequency response filters and shape factor	Range:	High Pass	Low Pass      DE-EMPHASIS
		10 Hz	3 kHz      50 μs
		30 Hz	15 kHz    75 μs
		300 Hz	120 kHz   750 μs
		3000 Hz	200 kHz    6 dB/0 ct
			(reference 1 kHz)
	Accuracy:	All filters except 10 Hz and 200 kHz are three-pole Butterworth filters; DE-EMPHASIS time constant and 3 dB filter frequencies have accuracy of 4% (except 10 Hz is <3 dB).	

<sup>1</sup>Procedure limitation below 50 Hz.

<sup>2</sup>Procedure limitation of 50 Hz to 50 kHz.

**SECTION II  
EQUIPMENT REQUIREMENTS**

**4. Equipment Required.** Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Sets AN/GSM-287 or AN/GSM-705. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

**5. Accessories Required.** The accessories required for this calibration are common usage accessories, issued as indicated in 4 above, and are not listed in this calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
MEASURING RECEIVER	Range: 10 to 90% AM 10 to 270 kHz FM Accuracy: $\pm .5\%$ ( $1\% \pm 1$ digit)	Hewlett-Packard, Model 8902A w/sensor, Hewlett-Packard, Model 11722A (11722A)
MULTIMETER	Range: 0 to 15 V dc Accuracy: $\pm .025\%$	Hewlett-Packard, Model 3458A (3458A)
POWER SPLITTER	Range: 10 to 500 MHz Accuracy: $\pm .15$ dB	Weinschel, Model 1870A (7916839)
SYNTHESIZED SIGNAL GENERATOR	Range: 10 MHz to 1.2 GHz Output Level: +10 dBm Accuracy: $\pm 1.5$ dB	Wiltron, Model 68369NV (68369NV)

**SECTION III  
CALIBRATION PROCESS**

**6. Preliminary Instructions**

a. The instructions outlined in paragraphs 6 and 7 are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

c. Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer’s manual for this TI.

d. When indications specified in paragraphs 8 through 12 are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made,

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repeat paragraphs 8 through 12. Do not perform power supply check if all other parameters are within tolerance.

- e. Unless otherwise specified, all controls and control settings refer to the TI.

### 7. Equipment Setup

#### WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

- a. Remove TI protective cover as required for adjustment.
- b. Adjust level control to **AUTO** and press pushbuttons as listed in (1) through (6) below:
  - (1) **TUNING** to **AUTO**.
  - (2) **HIGH-PASS (Hz)** to **30**.
  - (3) **LOW-PASS (kHz)** to **15**.
  - (4) **PEAK** to **PK-PK divide by 2**.
  - (5) **RANGE** to **100**.
  - (6) **FUNCTION** to **kHz DEV**.
- c. Insure that line voltage card in TI power connector is set to 120.
- d. Connect TI to a 115 V ac power source.
- e. Set power switch to **ON** and allow sufficient time for equipment to warm-up.

### 8. Input Sensitivity

#### a. Performance Check

- (1) Connect synthesized signal generator **RF Output** to TI **RF IN**.
- (2) Set synthesized signal generator frequency controls for 10 MHz and set output level to -26.99 dBm. If TI LOCK annunciator does not stop flashing, perform **b** below.
- (3) Repeat (2) above at a synthesized signal generator frequency of 500 MHz.
- (4) Adjust synthesized signal generator frequency controls for 1.2 GHz and set output level to -17.45 dBm. If TI LOCK annunciator does not stop flashing, perform **b** below.

#### b. Adjustments

- (1) Remove RF assembly cover and adjust A3R27 (figure 1) until lock annunciator stops flashing (R).

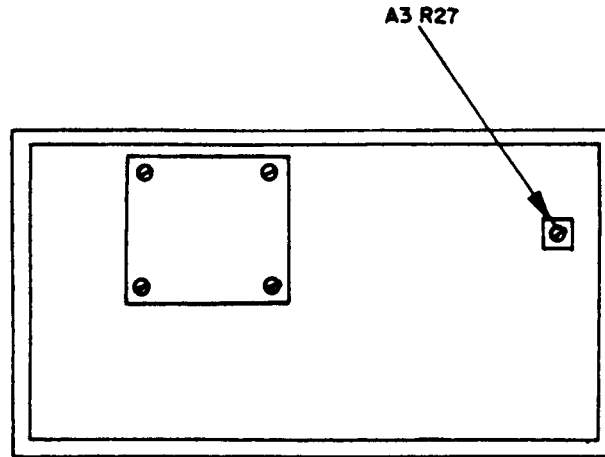


Figure 1. Test instrument left-side view - adjustment location.

- (2) Replace assembly cover.

## 9. Display Meter and Audio Circuits

### a. Performance Checks

- (1) Connect synthesized signal generator **RF Output** to **TI RF IN** and connect multimeter to **TI DC OUT** (rear panel of TI).
- (2) Position synthesized signal generator controls as listed in (a) through (e) below:
  - (a) Frequency Control set to 100 MHz.
  - (b) Level Control set to 0.0 dBm.
  - (c) FM to On.
  - (d) FM Rate set to 1 kHz.
  - (e) FM Deviation set to 100 kHz.
- (3) Set synthesized signal generator RF output on and adjust synthesized signal generator FM Deviation for TI display indication of 100.0 kHz. If multimeter does not indicate between .999 and 1.001 V dc, perform **b** (1) below.
- (4) Set synthesized signal generator FM Rate to 19 kHz. Record display indication.
- (5) Press **TI HIGH-PASS (Hz) 10** pushbutton. If TI does not indicate within  $\pm 1$  count of value recorded in (4) above, perform **b** (2) below.
- (6) Press TI pushbuttons as listed in (a) through (d) below:
  - (a) **HIGH-PASS (Hz)** to **3000**.
  - (b) **LOW-PASS (kHz)** to **3**.
  - (c) **PEAK** to **+**.
  - (d) **RANGE** to **300**.
- (7) Set synthesized signal generator FM off. If multimeter does not indicate between -0.0003 and +0.0003 V dc, perform **b** (3) below.
- (8) Press **PEAK -** pushbutton. If multimeter does not indicate between -0.0003 and +0.0003 V dc, perform **b** (4) below.

**b. Adjustments**

- (1) Adjust A8R9 (figure 2) until TI indication is same as multimeter indication (R).

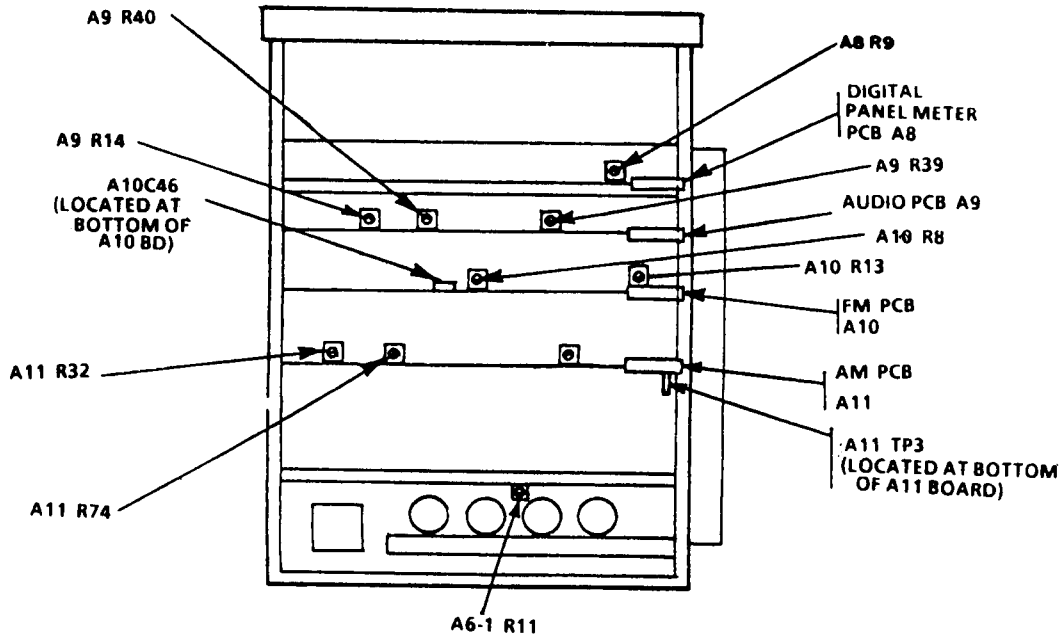


Figure 2. Test instrument top view - adjustment location.

- (2) Adjust A9R14 (figure 2) for same TI display recorded in a (5) above (R).
- (3) Adjust A9R39 (figure 2) for a 0.0000 indication on multimeter (R).
- (4) Adjust A9R40 (figure 2) for a 0.0000 indication on multimeter (R).

**10. Frequency Modulation Accuracy**

**NOTE**

Prior to performing this paragraph, the measuring receiver must be checked in the FM mode of operation against its built-in calibrator with FM calibration factors (17.1 SPCL) enabled.

**a. Performance Check**

- (1) Connect equipment as shown in figure 3.
- (2) Press TI pushbuttons as listed in (a) through (e) below:
  - (a) **HIGH-PASS (Hz)** to 30.
  - (b) **LOW-PASS (kHz)** to 15.
  - (c) **PEAK** to **PK-PK/2**.
  - (d) **RANGE** to 10.
  - (e) **FUNCTION** to **kHz DEV**.

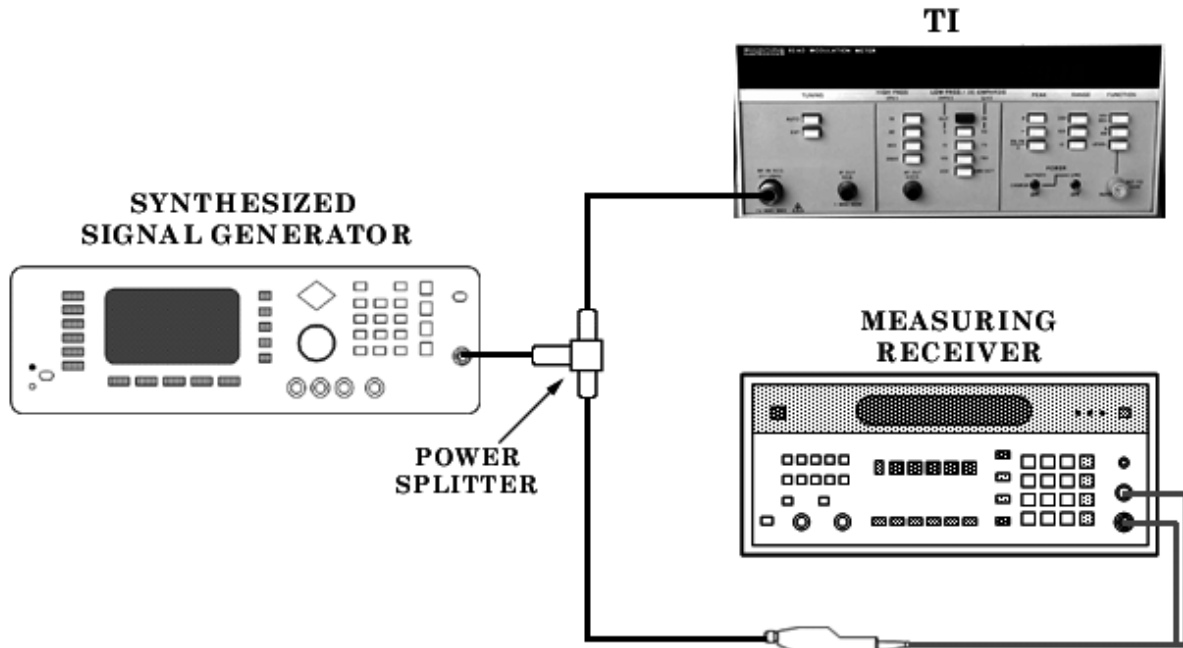


Figure 3. AM and FM accuracy – equipment setup.

- (3) Position synthesized signal generator controls as listed in (a) through (e) below:
  - (a) Frequency Control set to 10 MHz.
  - (b) Level Control set to +10.0 dBm.
  - (c) FM to Off.
  - (d) FM Rate set to 1 kHz.
  - (e) FM Deviation set to 10 kHz.
- (4) Set measuring receiver to measure FM Deviation.
- (5) Set RF output on (do not turn FM on at this time).
- (6) Record TI display indication (residual FM).
- (7) Set synthesized signal generator FM on. Record TI display indication.
- (8) Subtract value recorded in (6) above from value recorded in (7) above.
- (9) Enter value calculated in (8) above on keyboard of measuring receiver and press **RATIO** pushbutton (for % reading in display). If measuring receiver display does not indicate between 98% and 102%, perform **b** (1) through (3) below.
- (10) Set synthesized signal generator frequency to 100 MHz output and set FM Deviation to 100 kHz.
- (11) Press pushbuttons **HIGH-PASS (Hz) 10** and **RANGE 100; LOW PASS, 200 (kHz)**.
- (12) Set synthesized signal generator FM to off and repeat technique of (6) through (9) above.

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(13) Repeat technique of (5) and (12) above for synthesized signal generator FM Rate frequencies of 50, 100, 300, 10,000, and 100,000 Hz.

(14) Set synthesized signal generator frequency to 500 MHz, FM Rate to 10 kHz, FM Deviation to 200 kHz, and set FM to off.

(15) Press **RANGE 300** pushbutton.

(16) Repeat technique of (6) through (9).

(17) Repeat technique of (16) above for FM Deviation of 300 kHz.

### **b. Adjustments**

(1) Repeat a (3) through (6) above.

(2) Set synthesized signal generator FM to on and adjust synthesized signal generator controls for a 10-kHz FM Deviation indication on the measuring receiver.

(3) Adjust A10R8 (figure 2) for a TI indication of 10 kHz + (residual FM recorded in a (6) above) (R).

## **11. Amplitude Modulation Accuracy and Frequency Response**

### **a. Performance Check**

#### **NOTE**

Prior to performing this paragraph, the measuring receiver must be checked in the AM mode of operation against its built-in calibrator with AM calibration factors (16.1 SPCL) enabled.

(1) Connect equipment as shown in figure 3.

(2) Press TI pushbuttons as listed in (a) through (f) below:

(a) **HIGH-PASS (Hz)** to **10**.

(b) **LOW-PASS (kHz)** to **15**.

(c) **PEAK** to **PK-PK/2**.

(d) **RANGE** to **100**.

(e) **FUNCTION** to **LEVEL**.

(f) **LEVEL** control to **AUTO**.

(3) Position synthesized signal generator controls as listed in (a) through (d) below:

(a) Frequency Control set to 100 MHz.

(b) Level Control set to 0 dBm.

(c) AM to On.

(d) AM Rate set to 10 kHz.

(4) Adjust measuring receiver controls to measure RF level.

(5) Adjust synthesized signal generator output for a 1 mW (0 dBm) indication on measuring receiver.

(6) Set measuring receiver controls for AM modulation measurement and adjust synthesized signal generator AM Depth setting for a 40 percent AM indication on measuring receiver.



(7) If TI display does not indicate an RF level of between 9.99 and 10.01, perform **b (1)** below.

(8) Press **TI FUNCTION % AM** pushbutton.

(9) Adjust synthesized signal generator AM Depth setting for a TI MODULATION display indication of 50%.

(10) Enter TI display value into keyboard of measuring receiver and press **RATIO** pushbutton (for % reading in display). If measuring receiver does not indicate between 98 and 102 percent, perform **b (2)** and **(3)** below.

(11) Repeat technique of (9) and (10) above for TI display indications of 8 and 92 percent. Measuring receiver will indicate between 95 and 105 percent.

(12) Press **LOW-PASS (kHz) 200** pushbutton.

(13) Repeat technique of (9) and (10) above for synthesized signal generator AM Rate frequencies of .05, .1, 10, 15, 30, and 50 kHz.

#### **b. Adjustments**

(1) Adjust A11R32 (figure 2) for a TI display indication of 10.00 (R).

(2) Adjust measuring receiver controls to measure 100% AM modulation.

(3) Adjust A11R74 (figure 2) until TI display and measuring receiver display agree (R).

### **12. Audio Frequency Response, High-Pass, DE-EMPHASIS, Low-Pass, and 200 kHz Filters**

#### **a. Performance Check**

(1) Remove measuring receiver and power splitter from setup and connect synthesized signal generator **RF Output** to **TI RF IN**.

(2) Position TI controls as listed in (a) through (e) below:

(a) **LEVEL** control to **AUTO**.

(b) **HIGH-PASS (Hz)** pushbutton to **10**.

(c) **LOW-PASS (kHz)** pushbutton to **120**.

(d) **FUNCTION** pushbutton to **kHz DEV**.

(e) **RANGE** pushbutton to **100**.

(3) Position synthesized signal generator controls as listed in (a) through (e) below:

(a) Frequency Control set to 100 MHz.

(b) Level Control set to 0 dBm.

(c) FM to On.

(d) FM Rate set to 10 kHz.

(e) FM Deviation set to 100 kHz.

(4) Adjust synthesized signal generator FM Deviation setting for 100 kHz Deviation as indicated on TI display.

(5) Set synthesized signal generator FM Rate to 10 Hz. TI will indicate >70.7 kHz.

(6) Set synthesized signal generator FM Rate to 10 kHz.

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- (7) Press **HIGH-PASS 30** pushbutton. If necessary, adjust synthesized signal generator FM Deviation for a TI indication of 100 kHz.
- (8) Set synthesized signal generator FM Rate to 30 Hz. TI will indicate between 66.3 and 74.7 kHz.
- (9) Press **HIGH-PASS (Hz) 10** pushbutton.
- (10) Set synthesized signal generator FM Rate to 300 Hz. If necessary, adjust synthesized signal generator FM Deviation for a TI indication of 100 kHz.
- (11) Press **HIGH-PASS (Hz) 300** pushbutton. TI will indicate between 66.3 and 74.7 kHz.
- (12) Press **HIGH-PASS (Hz) 10** pushbutton and repeat (10) above for FM Rate of 3 kHz.
- (13) Press **HIGH-PASS (Hz) 3000** pushbutton. TI will indicate between 66.3 and 74.7 kHz.
- (14) Press **HIGH-PASS 10** and **LOW-PASS (kHz) 15** pushbuttons.
- (15) Repeat (10) above for FM Rate of 3.183 kHz.
- (16) Press **DE-EMPHASIS** (green pushbutton) and **50  $\mu$ s** pushbuttons. TI will indicate between 69.3 and 72.1 kHz.
- (17) Release **DE-EMPHASIS** and press **LOW-PASS (kHz) 15** pushbuttons.
- (18) Repeat (10) above for FM Rate of 2.122 kHz.
- (19) Press **DE-EMPHASIS** and **75  $\mu$ s** pushbuttons. TI will indicate between 69.3 and 72.1 kHz.
- (20) Repeat (17) above.
- (21) Repeat (10) above for FM Rate of 212.2 Hz.
- (22) Press **DE-EMPHASIS** and **750  $\mu$ s** pushbuttons. TI will indicate between 69.3 and 72.1 kHz.
- (23) Repeat (17) above.
- (24) Repeat (10) above for FM Rate of 1.0 kHz.
- (25) Press **DE-EMPHASIS** and **6 dB/OCT** pushbuttons. TI will indicate between 96.0 and 104.0 kHz.
- (26) Disable outputs and connect equipment as shown in figure 3.
- (27) Adjust measuring receiver controls as necessary to measure FM modulation with **PEAK+ DETECTOR**.
- (28) Release TI **DE-EMPHASIS** pushbutton and press pushbuttons as listed in (a) through (c) below:
  - (a) **HIGH-PASS (Hz) to 30.**
  - (b) **LOW-PASS (kHz) to 3.**
  - (c) **RANGE to 10.**
- (29) Adjust synthesized signal generator FM Rate to 3.0 kHz and FM Deviation for a 16.5 kHz deviation indication on measuring receiver.

- (30) TI will indicate between 10.98 and 12.37 kHz.
  - (31) Adjust synthesized signal generator FM Rate to 15.0 kHz and FM Deviation for a 36.0 kHz deviation indication on measuring receiver.
  - (32) Press **LOW-PASS (kHz) 15** and **RANGE 100** pushbuttons. TI will indicate between 23.9 and 27.0 kHz.
  - (33) Adjust synthesized signal generator FM Rate to 120.0 kHz and FM Deviation for a 290.0 kHz deviation indication on measuring receiver.
  - (34) Press **LOW-PASS (kHz) 120** and **RANGE 300** pushbuttons. Record TI indication.
  - (35) Set synthesized signal generator FM to Off. Subtract TI indication from indication recorded in (34) above. Difference will be between 191 and 216 kHz.
  - (36) Set synthesized signal generator FM to On, and set FM Rate to 200.0 kHz.
  - (37) Set synthesized signal generator FM Rate to 200.0 kHz, and FM Deviation for a 160.3 kHz deviation indication on measuring receiver.
  - (38) Press **LOW-PASS 200 kHz** pushbutton. Record TI indication.
  - (39) Set synthesized signal generator FM to Off. Record TI indication.
  - (40) Subtract value recorded in (39) above from value recorded in (38) above. If difference is not between 96.12 and 117.5 kHz, perform **b** below.
- b. Adjustments.** Adjust A10C46 (figure 2) for a TI display indication of 113.4 kHz plus value recorded in (39) above (R).

**13. Power Supply**

**NOTE**

Do not perform power supply check if all other parameters are within tolerance.

**a. Performance Check**

- (1) Connect multimeter to +15 V TP (figure 4) and chassis ground, using two leads. If multimeter does not indicate between +14.95 and +15.05 V dc, perform **b** below.

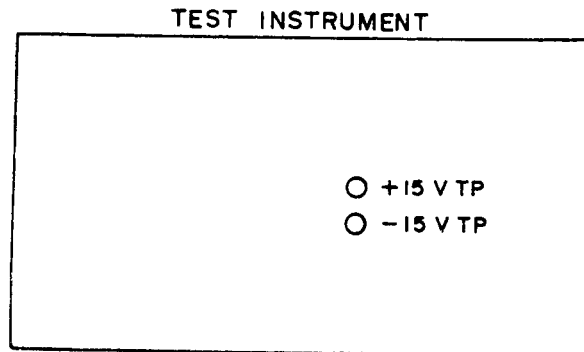


Figure 4. Boonton, model 82AD - bottom view.

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(2) Move lead from +15 V TP and connect to -15 V TP (figure 4). Multimeter will indicate between -14.95 and -15.05 V dc.

**b. Adjustments.** Adjust A6-1 R11 (figure 2) for a +15 V dc indication on multimeter (R).

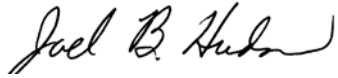
**14. Final Procedure**

**a.** Deenergize and disconnect all equipment.

**b.** Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

Official:



**JOEL B. HUDSON**  
*Administrative Assistant to the  
Secretary of the Army*

**PETER J. SCHOOMAKER**

*General, United States Army  
Chief of Staff*

0410501

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342221,  
requirements for calibration procedure TB 9-6625-2079-35.



### Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" [whomever@redstone.army.mil](mailto:whomever@redstone.army.mil)  
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From:** Joe Smith
2. **Unit:** home
3. **Address:** 4300 Park
4. **City:** Hometown
5. **St:** MO
6. **Zip:** 77777
7. **Date Sent:** 19-OCT -93
8. **Pub no:** 55-2840-229-23
9. **Pub Title:** TM
10. **Publication Date:** 04-JUL-85
11. **Change Number:** 7
12. **Submitter Rank:** MSG
13. **Submitter FName:** Joe
14. **Submitter MName:** T
15. **Submitter LName:** Smith
16. **Submitter Phone:** 123-123-1234
17. **Problem:** 1
18. **Page:** 2
19. **Paragraph:** 3
20. **Line:** 4
21. **NSN:** 5
22. **Reference:** 6
23. **Figure:** 7
24. **Table:** 8
25. **Item:** 9
26. **Total:** 123
27. **Text**

This is the text for the problem below line 27.

