*TB 9-6625-2287-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR ELECTRONIC VOLTMETERS AN/URM-145 (ME-247/U) AND AN/URM-145A (ME-247A/U) (BOONTON, MODEL 91CA)

Headquarters, Department of the Army, Washington, DC
15 October 2003

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help 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, U. S. Army Aviation and Missile Command, ATTN: 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*. 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.

*This technical bulletin supersedes TB 9-6625-2287-35 dated 16 November 1992.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Electronic Voltmeters, AN/URM-145 (ME-247/U) and AN/URM-145A (ME-247A/U) (Boonton, Model 91CA). The manufacturer's manual, TM 11-6625-524-15-1 and TM 11-6625-524-14 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. Variations among models are indicated in text.

b. Time and Technique. The time required for this calibration is approximately 4 hours, using the dc and low frequency 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 designated (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 parameter and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications[1]		
	Voltage ranges (V)	Range accuracy (FS)	Frequency response
AN/URM-145 (ME-247/U)	.003 to 3	±10% ±5%	20 to 50 kHz 50 kHz to 400 MHz
AN/URM-145A (ME-247A/U) (Boonton, Model 91CA)	.003 to 3	±5% ±10%	10 kHz to 200 MHz 200 to 400 MHz

[1]Verified to 100 MHz for all systems codes except COO; for COO, verify to 400 MHz.

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 Set 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.

5. Accessories Required. The accessories required for this calibration are common usage accessories issued as indicated in paragraph **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)
CALIBRATOR	Frequency range: 10 kHz to 1 MHz Voltage range: .20 mV to 3.15 V ac Accuracy: ±1.25	John Fluke, Model 5720A/CT (p/o MIS-35947); w/power amplifier, John Fluke 5725A (5725A)
MEASURING RECEIVER	Frequency range: 10 to 400 MHz mV range: 90 to 110 mV ac Accuracy: ±1.25	Hewlett-Packard, Model 8902A (8902A) w/sensor module, Model 11722A (11722A)
POWER SPLITTER	Frequency range: 10 to 400 MHz Port-to-port tracking accuracy: ±0.15 dB	Weinschel, Model 1870A (7916839)
SIGNAL GENERATOR	Range: 3 to 400 MHz Output amplitude variable from 90 to 110 mV	(SG-1207/U)

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 the procedure. Additional maintenance information is contained in the manufacturer's manual, TM 11-6625-524-15-1 and TM 11-6625-52414 for this TI.

d. 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. Mechanically zero TI meter.

b. Connect RF probe to PROBE jack.

NOTE

The RF probe authorized for use with TI must have serial numbers matching the TI serial numbers. If a new RF probe is calibrated with TI, annotate new RF probe with TI serial number. Do not use any RF probe not calibrated with TI.

c. Connect TI to a 115 V ac source.

d. Set **OFF-ON** switch to **ON**.

e. Set **RANGE-FULL-SCALE** switch to **.001 VOLTS**.

f. Replace RF probe tip with test adapter (50 Ω feedthrough termination.)

g. Adjust **BALANCE** control for minimum meter detection.

h. Replace test adapter (50 Ω feedthrough termination) with RF probe tip.

i. Allow TI and measuring receiver to warmup for 30 minutes.

8. Accuracy and Linearity

a. Performance Check

(1) Adjust calibrator for wideband operation.

(2) Connect calibrator **WIDEBAND OUTPUT** (without 50 Ω pad) to TI RF probe using 50 Ω feedthrough termination supplied with TI.

(3) Adjust calibrator frequency controls for 300 kHz output.

(4) Adjust calibrator voltage output controls for a TI meter indication specified in table 3. If calibrator does not indicate within the limits specified in table 3, perform **b** below.

(5) Repeat technique of (4) above for remaining **RANGE-FULL-SCALE VOLTS** setting listed in table 3.

(6) Set calibrator to standby.

(7) Disconnect RF probe from calibrator output.

Table 3. Range Accuracy and Linearity

RANGE-FULL-SCALE VOLTS scale setting	Test instrument meter indications (V)	Calibrator indications	
		Min	Max
.001	.0009	.80 mV	1.0 mV
.003	.001	.85 mV	1.15 mV
	.002	1.85 mV	2.15 mV
	.003	2.85 mV	3.15 mV
.01	.003	2.5 mV	11.5 mV
	.006	5.5 mV	21.5 mV
	.009	8.5 mV	31.5 mV
.03	.01	8.5 mV	11.5 mV
	.02	18.5 mV	21.5 mV
	.03	28.5 mV	31.5 mV

Table 3. Range Accuracy and Linearity - Continued

RANGE-FULL-SCALE VOLTS scale setting	Test instrument meter indications (V)	Calibrator indications	
		Min	Max
.1	.03	25.0 mV	35.0 mV
	.06	55.0 mV	65.0 mV
	.09	85.0 mV	95.0 mV
.3	.1	85.0 mV	115.0 mV
	.2	185.0 mV	215.0 mV
	.3	.285 V	.315 V
1	.3	.250 V	.350 V
	.6	.550 V	.650 V
	.9	.850 V	.950 V
3	1	.850 V	1.15 V
	2	1.85 V	2.15 V
	3	2.85 V	3.15 V

b. Adjustments. Perform (1) through (12) below for AN/URM-145 (ME-247/U). Perform (13) through (22) below for Boonton, Model 91CA with serial number below 2541. Perform (23) through (33) below for AN/URM-145A (ME-247A/U) (Boonton, Model 91CA) with serial number 2661 and above.

NOTE

Adjustment numbers 1 through 6 are located from front to rear on right side of TI cabinet.

NOTE

Calibrator operating frequency is 300 kHz.

NOTE

Ensure RF probe is connected to calibrator **WIDEBAND OUTPUT** before proceeding to (1) below.

(1) Set **RANGE-FULL-SCALE** switch to **1-VOLTS.** Adjust calibrator for 0.3 V ac output at 300 kHz and then adjust adjustment number 1 for TI meter indication between 0.25 and 0.35 (ideal 0.3 V ac).

(2) Adjust calibrator for 0.9 V ac output at 300 kHz and then adjust adjustment number 2 for TI meter indication between 0.85 and 0.95 (ideal 0.9 V ac).

(3) Set **RANGE-FULL-SCALE** switch to **3-VOLTS.** Adjust calibrator for 2.5 V ac output and then adjust adjustment number 3 for a TI indication between 2.35 and 2.65 V ac (ideal 2.5 V ac) (R).

(4) Set **RANGE-FULL-SCALE** switch to **.3-VOLTS.** Adjust calibrator for .25 V ac output and then adjust adjustment number 4 for a TI indication between .235 and .265 V ac (ideal .25 V ac) (R).

(5) Set **RANGE-FULL-SCALE** switch to **.1-VOLTS.** Adjust calibrator for 0.09 V ac output and then adjust adjustment number 5 for a TI indication between .085 and .095 V ac (ideal .09 V ac) (R).

(6) Set **RANGE-FULL-SCALE** switch to **.01-VOLTS.** Adjust calibrator for .003 V ac output and then adjust adjustment number 6 for a TI indication between .0025 and 0.0035 V ac (ideal .003 V ac) (R).

NOTE

Adjustment numbers 7 through 11 are located from rear to front on left side of TI cabinet.

(7) Adjust calibrator for .005 V ac output and then adjust adjustment number 7 for a TI indication between .0045 and 0.0055 V ac (ideal .005 V ac) (R).

(8) Adjust calibrator for .009 V ac output and then adjust adjustment number 8 for a TI indication between .0085 and 0.0095 V ac (ideal .009 V ac) (R).

(9) Set **RANGE-FULL-SCALE** switch to **.03-VOLTS.** Adjust calibrator for 0.025 V ac output and then adjust adjustment number 9 for a TI indication between .0235 and .0265 V ac (ideal .025 V ac) (R).

(10) Set **RANGE-FULL-SCALE** switch to **.003-VOLTS**. Adjust calibrator for 0.0025 V ac output and then adjust adjustment number 10 for a TI indication between .00235 and .00265 V ac (ideal .0025 V ac) (R).

(11) Set **RANGE-FULL-SCALE** switch to **.001-VOLTS**. Adjust calibrator for .0009 V ac output and then adjust adjustment number 11 for a TI indication between .0008 and 0.001 V ac (ideal .0009 V ac) (R).

(12) Disconnect RF probe from calibrator.

NOTE

Perform (13) through (22) below for Boonton, Model 91CA with serial number below 2541.

NOTE

Calibrator operating frequency is 300 kHz.

NOTE

Adjustment numbers 1 through 6 are located from front to rear on right side of TI cabinet.

NOTE

Ensure RF probe is connected to calibrator **WIDEBAND OUTPUT** before proceeding to (13) below.

(13) Set **RANGE-FULL-SCALE** switch to **1-VOLTS.** Adjust calibrator for 0.9 V ac output at 300 kHz and then adjust adjustment number 1 for TI meter indication between 0.85 and 0.95 (ideal 0.9 V ac).

(14) Set **RANGE-FULL-SCALE** switch to **3-VOLTS.** Adjust calibrator for 2.5 V ac output and then adjust adjustment number 2 for a TI indication between 2.35 and 2.65 V ac (ideal 2.5 V ac) (R).

(15) Set **RANGE-FULL-SCALE** switch to **.3-VOLTS.** Adjust calibrator for .28 V ac output and then adjust adjustment number 3 for a TI indication between .265 and .295 V ac (ideal .28 V ac) (R).

(16) Set **RANGE-FULL-SCALE** switch to **A-VOLTS**. Adjust calibrator for 0.03 V ac output and then adjust adjustment number 4 for a TI indication between .025 and .035 V ac (ideal .03 V ac) (R).

(17) Adjust calibrator for 0.09 V ac output and then adjust adjustment number 5 for a TI indication between .085 and .095 V ac (ideal .09 V ac) (R).

(18) Set **RANGE-FULL-SCALE** switch to **.03-VOLTS**. Adjust calibrator for .028 V ac output and then adjust adjustment number 6 for a TI indication between .0265 and .0295 V ac (ideal .028 V ac) (R).

NOTE

Adjustment numbers 7 through 9 are located from rear to front on left side of TI cabinet.

(19) Set **RANGE-FULL-SCALE** switch to **.01-VOLTS.** Adjust calibrator for .009 V ac output and then adjust adjustment number 7 for a TI indication between .0085 and 0.0095 V ac (ideal .009 V ac) (R).

(20) Set **RANGE-FULL-SCALE** switch to **.003-VOLTS.** Adjust calibrator for 0.0028 V ac output and then adjust adjustment number 8 for a TI indication between .00265 and .00295 V ac (ideal .0028 V ac:) (R).

(21) Set **RANGE-FULL-SCALE** switch to **.001-VOLTS.** Adjust calibrator for 0.0009 V ac output and then adjust adjustment number 9 for a TI indication between .0008 and .001 V ac (ideal .0009 V ac) (R).

(22) Disconnect RF probe from calibrator.

NOTE

Perform (23) through (33) below for AN/URM-145A (ME-247A/U) (Boonton, Model 91CA) with serial number 2661 and above.

NOTE

Adjustment numbers 1 through 6 are located from front to rear on right side of TI cabinet.

NOTE

Calibrator operating frequency is 300 kHz.

NOTE

Ensure RF probe is connected to calibrator **WIDEBAND OUTPUT** before proceeding to (23) below.

(23) Set **RANGE-FULL-SCALE** switch to **1-VOLTS**. Adjust calibrator for 0.3 V ac output at 300 kHz and then adjust adjustment number 1 for TI meter indication between 0.25 and 0.35 (ideal 0.3 V ac).

(24) Set **RANGE-FULL-SCALE** switch to **3-VOLTS.** Adjust calibrator for 2.5 V ac output and then adjust adjustment number 2 for a TI indication between 2.35 and 2.65 V ac (ideal 2.5 V ac) (R).

(25) Set **RANGE-FULL-SCALE** switch to **1-VOLTS.** Adjust calibrator for 0.9 V ac output at 300 kHz and then adjust adjustment number 3 for TI meter indication between 0.85 and 0.95 (ideal 0.9 V ac).

(26) Set **RANGE-FULL-SCALE** switch to **.3-VOLTS.** Adjust calibrator for .28 V ac output and then adjust adjustment number 4 for a TI indication between .265 and .295 V ac (ideal .28 V ac) (R).

(27) Set **RANGE-FULL-SCALE** switch to **.1-VOLTS.** Adjust calibrator for 0.03 V ac output and then adjust adjustment number 5 for a TI indication between .025 and .035 V ac (ideal .03 V ac) (R).

(28) Adjust calibrator for 0.09 V ac output and then adjust adjustment number 6 for a TI indication between .085 and .095 V ac (ideal .09 V ac) (R).

NOTE

Adjustment numbers 7 through 9 are located from rear to front on left side of TI cabinet.

(29) Set **RANGE-FULL-SCALE** switch to **.03-VOLTS**. Adjust calibrator for .028 V ac output and then adjust adjustment number 7 for a TI indication between .0265 and .0295 V ac (ideal .028 V ac) (R).

(30) Set **RANGE-FULL-SCALE** switch to **.01-VOLTS**. Adjust calibrator for .009 V ac output and then adjust adjustment number 8 for a TI indication between .0085 and 0.0095 V ac (ideal .009 V ac) (R).

(31) Set **RANGE-FULL-SCALE** switch to **.003-VOLTS**. Adjust calibrator for 0.0028 V ac output and then adjust adjustment number 9 for a TI indication between .00265 and 00295 V ac (ideal .0028 V ac) (R).

(32) Set **RANGE-FULL-SCALE** switch to **.001-VOLTS**. Adjust calibrator for 0.0009 V ac output and then adjust adjustment number 10 for a TI indication between .0008 and .001 V ac (ideal .0009 V ac) (R).

(33) Disconnect RF probe from calibrator.

9. Frequency Response

a. Performance Check

(1) Connect calibrator **WIDEBAND OUTPUT** (without 50 Ω pad) to TI RF probe using 50 Ω feedthrough termination supplied with TI.

(2) Set **RANGE-FULL-SCALE** switch to **.1-VOLTS**.

(3) Adjust calibrator frequency controls to value listed in calibrator frequency limits specified in table 4.

(4) Adjust calibrator output voltage controls for .1 V indication on TI meter. Calibrator voltage output will be within the limits specified in table 4.

(5) Repeat technique of (3) and (4) above for remaining calibrator frequency settings listed in table 4.

Table 4. Frequency Response

Calibrator frequency settings	Calibrator output voltage indications[1] (mV)		Calibrator output voltage indications[2] (mV)	
(kHz)	Min	Max	Min	Max
10	- - -	- - -	95	105
20	90	110	95	105
50	90	110	95	105
100	95	105	95	105
150	95	105	95	105
500	95	105	95	105
1000	95	105	95	105

[1]AN/URM-145 (ME-247/U).

[2]AN/URM-145A(ME-247A/U) (Boonton, Model 91CA).

(6) Connect equipment as shown in figure 1.

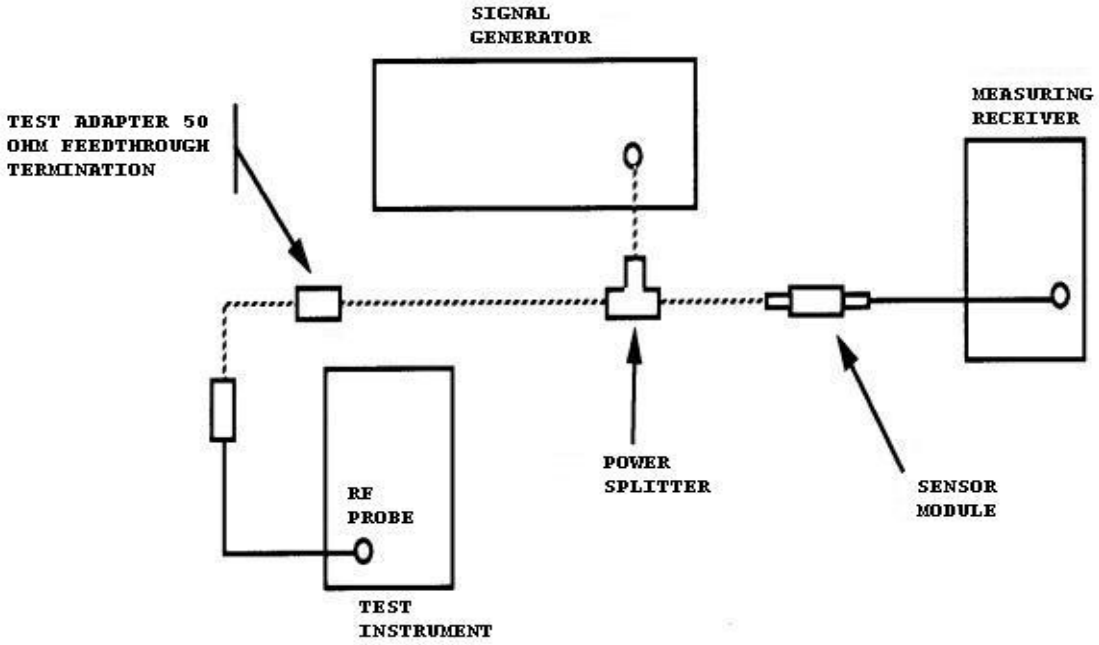


Figure 1. Frequency response - equipment setup.

(7) Adjust signal generator frequency controls to value listed in signal generator frequency settings listed in table 5.

(8) Press measuring receiver keys as listed in (a) through (c) below:

(a) Switch the measuring receiver from **STBY** to **ON**.
(b) Press the **RF POWER** key.
(c) Press the blue **SHIFT** key and the (**5**) key to measure output in mV.

(9) Adjust signal generator output voltage controls for .1 V indication on TI meter. Measuring receiver indication will be within limits specified in table 5.

(10) Adjust signal generator for remaining frequency settings listed in table 5. Measuring receiver indication for remaining frequency settings will be within limits specified in table 5.

Table 5. Frequency Response[1]

Signal generator frequency settings (MHz)	Measuring receiver indications[2] (mV)		Measuring receiver indications[3] (mV)	
	Min	Max	Min	Max
3	95	105	95	105
5	95	105	95	105
7	95	105	95	105
10	95	105	95	105
20	95	105	95	105
50	95	105	95	105
100	95	105	95	105
175	95	105	95	105
200	95	105	90	110
300	95	105	90	110
400	95	105	90	110

[1]Verified to 100 MHz for all systems codes except COO; for COO, verify to 400 MHz.
[2]AN/URM-145 (ME-247/U).
[3]AN/URM-145A (ME-247A/U) (Boonton, Model 91CA).

10. Final Procedure

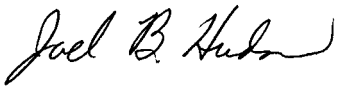
a. Deenergize and disconnect all equipment.

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

By Order of the Secretary of the Army:

Official:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff



JOEL B. HUDSON
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0323003

Distribution:
To be distributed in accordance with IDN 344467, requirements for calibration procedure TB 9-6625-2287-35.

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
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.

PIN: 070749-000