

# \*TB 9-6625-2303-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

## CALIBRATION PROCEDURE FOR RADIO FREQUENCY POWER TEST SET AN/URM-213

Headquarters, Department of the Army, Washington, DC  
11 February 2005

*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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**SECTION I  
IDENTIFICATION AND DESCRIPTION**

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of Radio Frequency Power Test Set, AN/URM-213. TM 11-6625-3276-14&P was used as the prime data source 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 4 hours, using the dc and low frequency technique and microwave frequency techniques.

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

Table 1. Calibration Description

Test instrument parameters	Performance specifications	
Wattmeter mainframe	Audio frequency range: 900 to 1100 Hz	
	Factor	Accuracy
	100	± 1%
	30	± 1%
	10	± 1%
	3	± 1%
	1	± 1%
	0.3	± 1.5%
0.1	± 1.5%	
Plug-in element 4410-8	Test frequencies: 200, 400, 750, and 1000 MHz Applied power: 8 Watts Accuracy: ± 5% FS (± 0.5 W)	
Plug-in element 4410-6	Test frequencies: 50, 100, and 200 MHz Applied power: 8 Watts Accuracy: ± 5% FS (± 0.5 W)	
Plug-in element 4410-5	Test frequencies: 25, 60, and 80 MHz Applied power: 8 Watts Accuracy: ± 5% FS (± 0.5 W)	
Plug-in element 4410-4	Test frequencies: 2, 10, and 30 MHz Applied power: 25 Watts Accuracy: ± 5% FS (± 1.5 W)	
Plug-in element 4410-2	Test frequencies: 450 kHz, 1 and 2.5 MHz Applied power: 80 Watts Accuracy: ± 5% FS (± 5 W)	

**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 and 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 paragraph 4 above, and are not listed in this calibration procedure. The following peculiar accessories are required for this calibration: Calibration Element, Bird Electronic Corporation, Model 4410-070, and 50 Ω termination supplied with TI.

Table 2. Minimum Specifications of Equipment Required

Common name (official nomenclature)	Minimum use specifications	Manufacturer and model (part number)
AUDIO ANALYZER	Audio frequency: Between 900 and 1100 Hz Output voltage: Between 0.05 and 1.6 V rms into 600 Ω (resistive)	Boonton, Model 1121 (1121)
LOW PASS FILTERS	Cutoff frequency: <u>MHz</u>	
LOW PASS FILTER NO. 1	14	TLC 14-3EF
LOW PASS FILTER NO. 2	30	TLC 30-4EF7
LOW PASS FILTER NO. 3	45	TLC 45-4EF
LOW PASS FILTER NO. 4	75	TLC 75-6EF1
LOW PASS FILTER NO. 5	125	TLC 125-6EF1
LOW PASS FILTER NO. 6	450	TLC 450-6EF
LOW PASS FILTER NO. 7	700	TLC 700-6EF1
LOW PASS FILTER NO. 8	1225	TLS 1225-5EF1
LOW PASS FILTER NO. 9	80 W, 50 Ω Attenuation at 960 kHz; <60 dB	AR Kalmus Corp. 1-60-564-001 (13440004-1)
LOW PASS FILTER NO. 10	80 W, 50 Ω Attenuation at 2280 kHz: <60 dB	AR Kalmus Corp. 1-60-564-002 (13440004-2)
LOW PASS FILTER NO. 11	80 W, 50 Ω Attenuation at 4800 kHz: <60 dB	AR Kalmus Corp. 1-60-564-003 (13440004-3)
LOW PASS FILTER NO. 12	80 W, 50 Ω Attenuation at 8160 kHz: <60 dB	AR Kalmus Corp. 1-60-564-004 (13440004-4)
MULTIMETER	Range: 0 to 10 V dc Accuracy: ± 0.01% Audio frequency: 900 to 1100 Hz Voltage range: 0.05025 to 1.5915 V rms Accuracy: ± 0.01% Ohmmeter range: 48 Ω to 52 Ω Accuracy: ± 1%	Fluke, Model 8840A/AF05 (AN/GSM-64D)

Table 2. Minimum Specifications of Equipment Required - Continued

Common name (official nomenclature)	Minimum use specifications	Manufacturer and model (part number)
RF POWER AMPLIFIER	Frequency range: 450 kHz to 1000 MHz Power range: 0 to 80 W Accuracy of monitoring equipment	Antenna Research Associates Inc., Model 757LC (757LC) (MIS-45845)
RF POWER METER	Frequency range: 450 kHz to 1000 MHz Power range: 7.5 to 85 W Accuracy: ( $\pm$ 4%)	Bird, Model 4421 (4421) w/ directional power sensors, model 4021, 4022, and 4025 (4021, 4022, 4025)
SIGNAL GENERATOR	Frequency range: 450 kHz to 1000 MHz Power output range: 100 mW	(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 this procedure.
- 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. Set **LINE** switches on audio analyzer, frequency counter, RF power amplifier, RF power meter, RF power generator, signal generator, and digital multimeter to **ON** position and allow equipment 30 minutes to warm-up.
- b. Set factor switch to **OFF** position and mechanically zero TI meter.
- c. Insert calibration element into TI and rotate in any direction until it stops.
- d. Connect digital multimeter (ohms mode) between center conductor and outer shield of TI 50  $\Omega$  termination (part of TI). Digital multimeter will indicate between 48  $\Omega$  and 52  $\Omega$ .

- e. Set factor switch to **100** and allow TI to warm-up for 5 minutes.
- f. Set factor switch to **BAT** position; if meter pointer is not well within the battery test region, replace TI battery. Allow an additional 5 minute warm-up after replacing the battery.

**8. Wattmeter Linearity Test**

**a. Performance Check**

- (1) Connect male end of a BNC T connector to calibration element.

**NOTE**

Use 50 Ω cable no longer than 3 feet for step (2) and (3) below.

- (2) Connect one BNC T connector female end to audio analyzer output.
- (3) Connect other end of BNC T connector to multimeter (ac mode).
- (4) Adjust audio analyzer frequency controls for 1000 Hz.
- (5) Set TI factor switch to **100**.
- (6) Adjust audio analyzer amplitude output controls so that meter pointer will rest at 1 on the uppermost scale. Multimeter will indicate 1.575 and 1.607 Vac. If not, perform **b** below.
- (7) Repeat (6) above for the remaining TI factor switch settings listed in table 3. Multimeter will indicate within limits indicated.
- (8) Remove calibration element from T1.

Table 3. Wattmeter Mainframe Calibration

Test instrument factor switch settings	Multimeter indications (Vac)		
	Min	Max	Ideal
30	0.8861	0.9040	0.8950
10	0.4980	0.5080	0.5030
3	0.2802	0.2858	0.2830
1	0.1575	0.1607	0.1591
.3	0.0882	0.0908	0.0895
.1	0.0495	0.0511	0.0503

**b. Adjustments**

- (1) Remove four screws from side of TI and pull back cover straight off.

**NOTE**

Ensure male end of BNC T connector is connected to calibration element.

- (2) Connect one BNC T connector female end to audio analyzer output.

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- (3) Connect other end of BNC T connector to frequency counter.
- (4) Adjust audio analyzer frequency controls for a frequency counter indication 1000 Hz.
- (5) Disconnect frequency counter from BNC T connector.
- (6) Connect end of BNC T connector to multimeter (ac mode).
- (7) Set factor switch to 1.
- (8) Adjust audio analyzer amplitude output controls for a digital multimeter indication between 0.1591 V rms,  $\pm 0.00005$  V rms.
- (9) Locate access hole to R26 (fig. 1).
- (10) Pierce paper strip covering R26 (fig. 1) adjustment.
- (11) Adjust R26 (fig. 1) until meter pointer rests on 1 on the uppermost scale.
- (12) Replace back cover and four screws removed in **b** (l) above.
- (13) Remove calibration element from TI.

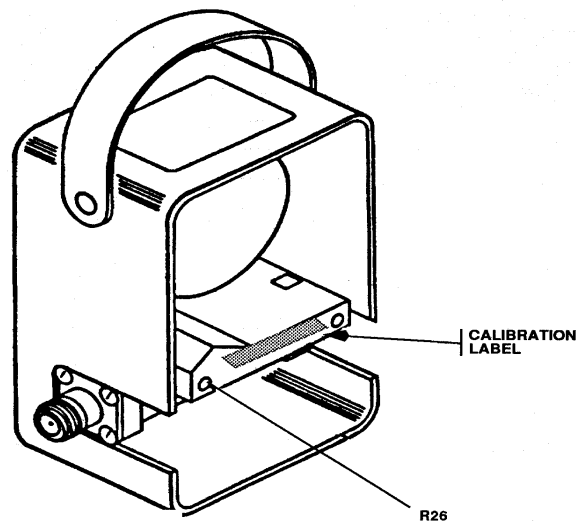


Figure 1. Calibration label and adjustment location.

## 9. Plug-in Elements 4410-8

### a. Performance Check

- (1) Connect equipment as shown in figure 2.
- (2) Insert plug-in element into wattmeter and rotate it until the arrow points in the direction of 50  $\Omega$  termination.
- (3) Set factor switch to 1 position and allow equipment to warm-up for 5 minutes.
- (4) Adjust RF power generator frequency controls for a frequency counter indication of 1000 MHz.

- (5) Adjust RF power generator amplitude controls for a TI wattmeter indication of 8 W. RF power meter will indicate between 7.5 and 8.5 W.
- (6) Repeat (4) and (5) above for 750, 400, and 200 MHz.
- (7) Remove TI from wattmeter.

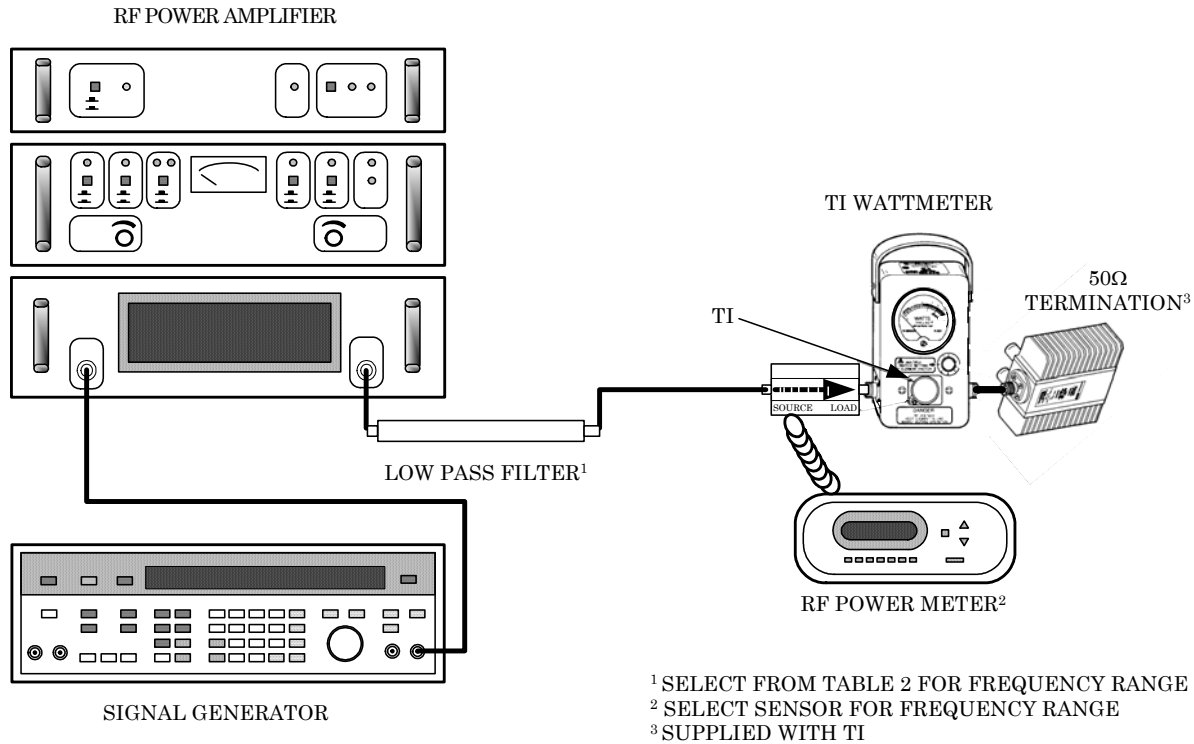


Figure 2. Plug-in element calibration - equipment setup.

a. **Adjustments.** No adjustments can be made.

## 10. Plug-in Element 4410-6

a. **Performance Check**

- (1) Connect equipment as shown in figure 2.
- (2) Insert TI into wattmeter and rotate TI until the arrow points in the direction of 50  $\Omega$  termination.
- (3) Set factor switch to 1 position and allow equipment to warm up for 5 minutes.
- (4) Adjust RF power generator frequency controls for a frequency counter indication of 200 MHz.

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(5) Adjust RF power generator amplitude controls for an RF power meter indication of 8 W. TI will indicate between 7.5 and 8.5 W.

(6) Repeat (4) and (5) above for 100 and 50 MHz.

(7) Remove TI from wattmeter.

**b. Adjustments.** No adjustments can be made.

### **11. Plug-in Element 4410-5**

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

(1) Connect equipment as shown in figure 2.

(2) Insert TI into wattmeter and rotate TI until the arrow points in the direction of 50  $\Omega$  termination.

(3) Set factor switch to **1** position and allow equipment to warm-up for 5 minutes.

(4) Adjust RF power generator frequency controls for a frequency counter indication of 80 MHz.

(5) Adjust RF power generator amplitude controls for an RF power meter indication of 8 W. TI will indicate between 7.5 and 8.5 W.

(6) Repeat (4) and (5) above for 60 and 25 MHz.

(7) Remove TI from wattmeter.

**b. Adjustments.** No adjustments can be made.

### **12. Plug-in Element 4410-4**

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

(1) Connect equipment as shown in figure 2.

(2) Insert TI into wattmeter and rotate TI until the arrow points in the direction of 50  $\Omega$  termination.

(3) Set factor switch to **0.1** position and allow equipment to warm-up for 5 minutes.

(4) Adjust RF power generator frequency controls for a frequency counter indication of 30 MHz.

(5) Adjust power generator amplitude controls for a TI indication of 8.0 W. Power meter will indicate between 7.5 and 8.5 W.

(6) Set factor switch to **1** position and allow equipment to warm-up for 5 minutes.

(7) Adjust signal generator frequency controls to 10 MHz and amplitude controls for an 80 W indication on TI wattmeter. RF power meter will indicate between 75 and 85 W.



(8) Adjust signal generator frequency controls to 2 MHz and amplitude controls for an 80 W indication on TI wattmeter. RF power meter will indicate between 75 and 85 W.

**b. Adjustments.** No adjustments can be made.

### **13. Plug-in Element 4410-2**

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

(1) Connect equipment as shown in figure 2.

(2) Insert TI into wattmeter and rotate TI until the arrow points in the direction of 50  $\Omega$  termination.

(3) Set factor switch to **1** position and allow equipment to warm-up for 5 minutes.

(4) Adjust signal generator frequency controls to 2.5 MHz.

(5) Adjust signal generator amplitude controls for a TI wattmeter indication of 80 W. RF power meter will indicate between 75 and 85 W.

(6) Adjust signal generator frequency controls to 1.0 MHz and amplitude controls for an 80 W indication on TI wattmeter. RF power meter will indicate between 75 and 85 W.

(7) Adjust signal generator frequency controls to 450 kHz and amplitude controls for an 80 W indication on TI wattmeter. RF power meter will indicate between 75 and 85 W.

**b. Adjustments.** No adjustments can be made.

### **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:

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0434908

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344514, requirements for calibration procedure TB 9-6625-2303-35.



## 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.

