*TB 9-6625-2311-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR RF MILLIVOLTMETER BOONTON, MODEL 9200B

Headquarters, Department of the Army, Washington, D. C.
19 February 2009

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, 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 send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

*This bulletin supersedes TB 9-6625-2311-35, dated 4 December 1995.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of RF Millivoltmeter Boonton, Model 9200B. The manufacturer's manual 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 and microwave 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		
RF millivoltmeter, Boonton Model 9200B	Frequency range: 10 kHz to 1.2 GHz Accuracy: ±(% of FS + % of reading)		
	Voltage	Frequency range	Tolerance
	Range 1	1 MHz	3% reading+ 3 μV
	0.200 to 1.000 mV	10 kHz to 100 MHz	4% reading+ 3 mV
		100 MHz to 1 GHz	6% reading+ 3 mV
		1 GHz to 1.2 GHz	10% reading+ 3 mV
	Range 2	1 MHz	2% reading+ 2 mV
	1.000 to 3.000 mV	10 kHz to 100 MHz	3% reading+ 2 mV
		100 MHz to 1 GHz	5% reading+ 2 mV
		1 GHz to 1.2 GHz	9% reading+ 2 mV
	Range 3	1 MHz	1% reading+ 10 mV
	3.00 to 30.00 mV	10 kHz to 100 MHz	2% reading+ 10 mV
		100 MHz to 1 GHz	4% reading+ 10 mV
		1 GHz to 1.2 GHz	8% reading+ 10 mV

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications		
RF millivoltmeter, Boonton Model 9200B	Range 4	1 MHz	1% reading +100 mV
	30.0 to 300.0 mV	10 kHz to 100 MHz	2% reading +100 mV
		100 MHz to 1 GHz	4% reading +100 mV
		1 GHz to 1.2 GHz	8% reading +100 mV
	Range 5	1 MHz	1% reading + 1 mV
	300 to 3000 mV	10 kHz to 100 MHz	2% reading + 1 mV
		100 MHz to 1 GHz	4% reading + 1 mV
		1 GHz to 1.2 GHz	8% reading + 1 mV

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 the 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)
AC DIVIDER	Range input: 1 to 10 V ac at 10 kHz Output voltage: 1 mV to 10 mV ac Combined accuracy with calibrator: $\pm$5%	Fluke, Model 7405A-4207 (7405A-4207)
CALIBRATOR	Frequency range: 1 MHz Voltage range: .220 to 3000 mV rms Stand-alone accuracy: $\pm$.258%	Fluke, Model 5720A (5700A/EP) (p/o MIS-35947); w amplifier, Fluke 5725A/AR (5725A/AR)

Table 2. Minimum Specifications of Equipment Required - Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
MEASURING RECEIVER	Frequency range: 100 kHz to 1.2 GHz mV range: 100 mV rms Accuracy: ±.258%	Measuring receiver system N5530S consisting of: Spectrum Analyzer, Agilent Model E4440A (E4440A), Power meter, Agilent Model E4419B (E4419B), and Sensor module, Agilent Model 504 (504)
MULTIMETER	Range: -15.2 to 15.2 V dc Accuracy: ±.038%	Hewlett-Packard, Model 3458A (3458A)
POWER SPLITTER	Frequency range: 100 kHz to 1.2 GHz	Weinschel, Model 1870A (7916839)
SIGNAL GENERATOR	Frequency range: 100 kHz to 1.2 GHz Output amplitude: 100 mV	(Aeroflex, Model 2023B (2023B) or SG-1207/U (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. Additional maintenance information is contained in the manufacturer's manual for this TI.

d. When indications specified in paragraph **8** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraph **8**. 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. Connect **RF PROBE** with the 50 Ω adapter (Model 91-8B 952002 supplied with TI) to **CHANNEL 1**.

b. Connect TI to a 115 V ac source.

c. Energize TI and allow 15 minutes for warm-up.

d. Perform (1) and (2) below with the TI keys:

(1) Press the **.** key.

(2) Press the **SELECT PROBE / . SN** key.

e. Verify that the last four digits of the **RF PROBE** are displayed on the TI.

f. Remove TI top cover as required for adjustment.

NOTE

Verify the proper Cal Factors are loaded for the measuring receiver power sensor module being utilized. Zero and calibrate measuring receiver power sensor module.

8. RF Millivoltmeter Accuracy

a. Performance Check

(1) Assure that no input signal is applied to the **RF PROBE**.

(2) Press the **ZERO** key on the TI and allow approximately 20 seconds for the TI to autozero.

NOTE

If the zero indication is not less than $\pm$50 counts, repeat (2) above until this is achieved.

(3) Remove 50 Ω adapter from the **RF PROBE**.

(4) Connect unterminated BNC adapter (Model 91-6C 952008 supplied with TI) to the **RF PROBE**.

(5) Connect ac divider input to calibrator **OUTPUT V OHM A HI** and **LO** terminals.

(6) Connect **RF PROBE** to the ac divider output.

(7) Press **MODE mV** pushbutton.

(8) Adjust calibrator controls for 1 V at 10 kHz. If TI does not indicate between 0.957 and 1.043 mV, perform **b** (1) through (8) below.

(9) Adjust calibrator controls for 3 V at 10 kHz. If TI does not indicate between 2.908 and 3.092 mV, perform **b** (9) through (16) below.

(10) Adjust calibrator controls for 10 V at 10 kHz. If TI does not indicate between 9.79 and 10.21 mV, perform **b** (17) through (24) below.

(11) Set calibrator to standby.

(12) Disconnect TI probe and ac divider from calibrator.

(13) Connect TI probe to calibrator **OUTPUT V OHM A HI** and **LO** terminals.

(14) Set calibrator to operate.

(15) Adjust calibrator controls for 30 mV at 10 kHz. If TI does not indicate between 29.39 and 30.61 mV, perform **b** (25) through (32) below.

(16) Adjust calibrator controls for 100 mV at 1 MHz. If TI does not indicate between 98.9 and 101.1 mV, perform **b** (33) through (40) below.

(17) Adjust calibrator controls for 300 mV at 1 MHz. TI will indicate between 296.9 and 303.1 mV.

(18) Adjust calibrator controls for 1000 mV at 1 MHz. If TI does not indicate between 989 and 1011 mV, perform **b** (41) through (48) below.

(19) Adjust calibrator controls for 3000 mV at 1 MHz. If TI does not indicate between 2969 and 3031 mV, perform **b** (49) through (56) below.

(20) Set calibrator to standby.

(21) Connect equipment as shown in figure 1.

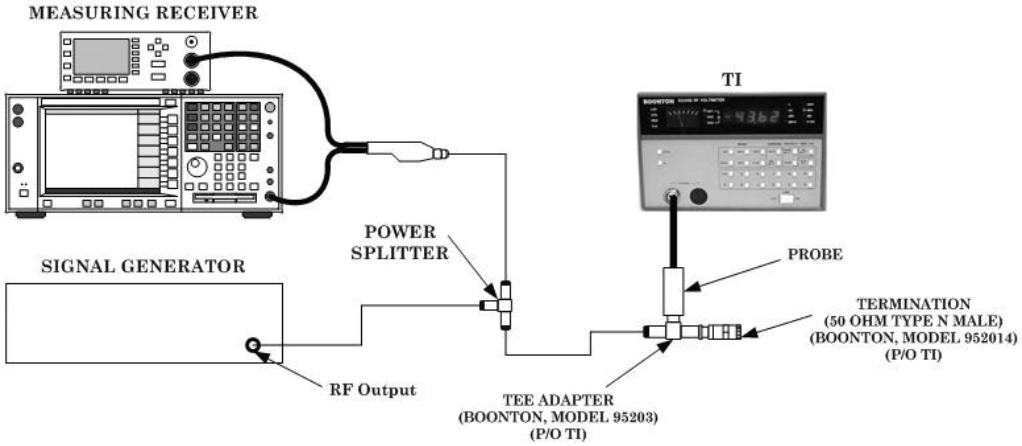

Figure 1. Frequency response - equipment setup.

(22) Set up measuring receiver to measure RF power in mV.

(23) Adjust signal generator frequency controls to frequency settings listed in table 3 below.

(24) Adjust signal generator amplitude controls for a 100.0 mV indication on measuring receiver. Record TI indication under TI instrument indications No. 1 column in table 3.

(25) Repeat technique of (23) and (24) above for remaining signal generator frequency settings listed in table 3 below.

(26) Set signal generator output to off.

(27) Reverse the output port connections of the power splitter.

(28) Set signal generator output to on.

(29) Repeat technique of (23) and (24) above and record TI indication under TI indications No. 2 column in table 3 below.

NOTE

Refer to table 3 for (30) below.

(30) Add TI indications No. 1 value to TI indications No. 2 value and divide the sum by two. Record results in TI indications average column. Results recorded in TI indications average column will be within the limits specified in the minimum-maximum columns of table 3.

(31) Repeat (30) above for each row listed in table 3.

Table 3. Frequency Response

Signal generator frequency control settings (MHz)	Test instrument indications			Min (mV)	Max (mV)
	No. 1 (mV)	No. 2 (mV)	Average (mV)		
10.00				97.9	102.1
30.00				97.9	102.1
60.00				97.9	102.1
80.00				97.9	102.1
90.00				97.9	102.1
110.00				95.9	104.1
200.00				95.9	104.1
400.00				95.9	104.1
600.00				95.9	104.1
800.00				95.9	104.1
900.00				95.9	104.1
1100.00				91.9	108.1
1200.00				91.9	108.1

b. Adjustments

(1) Set calibrator to standby.

(2) Set internal switch S1 bit 2 in the open position (fig. 2).

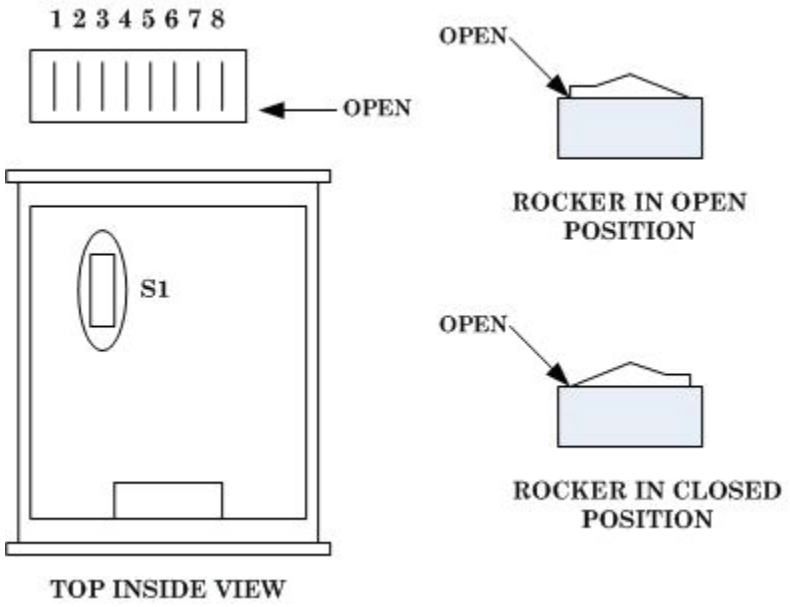

Figure 2. Boonton, Model 9200B switch S1 detail.

(3) Perform (a) through (f) below with the TI keys:

(a) Press **0**.

(b) Press **Z0**.

(c) Press **0**.

(d) Press **MODE dBV**.

(e) Press **MODE mV**.

(f) Press **ZERO**.

(4) Wait for zeroing process to complete. If the zero indication is not less than ±50 counts, repeat (3) (f) above until this is achieved.

(5) Adjust calibrator controls for an output of 0.7 V at 10 kHz.

(6) Perform (a) through (e) below with the TI keys:

(a) Press **0**.

(b) Press **MODE dBV**.

(c) Press **7, . , 0, 0, MODE dBmV** and wait for a stable reading.

(d) Press **AVERAGE SEL**.

(e) Press **REF LVL dB**.

(7) TI shall indicate approximately 5000.

(8) Set internal switch S1 bit 2 in the closed position (fig. 2).

(9) Set calibrator to standby.

(10) Set internal switch S1 bit 2 in the open position (fig. 2).

(11) Perform (a) through (f) below with the TI keys:

(a) Press **0**.

(b) Press **Z0**.

(c) Press **1**.

(d) Press **MODE dBV**.

(e) Press **MODE mV**.

(f) Press **ZERO**.

(12) Wait for zeroing process to complete. If the zero indication is not less than ±50 counts, repeat (11) (f) above until this is achieved.

(13) Adjust calibrator controls for an output of 2.1 V at 10 kHz.

(14) Perform (a) through (e) below with the TI keys:

(a) Press **1**.

(b) Press **MODE dBV**.

(c) Press **2, 1, . , 0, 0, MODE dBmV** and wait for a stable reading.

(d) Press **AVERAGE SEL**.

(e) Press **REF LVL dB**.

(15) TI shall indicate approximately 5000.

(16) Set internal switch S1 bit 2 in the closed position (fig. 2).

(17) Set calibrator to standby.

(18) Set internal switch S1 bit 2 in the open position (fig. 2).

(19) Perform (a) through (f) below with the TI keys:

(a) Press **0**.

(b) Press **Z0**.

(c) Press **2**.

(d) Press **MODE dBV**.

(e) Press **MODE mV**.

(f) Press **ZERO**.

(20) Wait for zeroing process to complete. If the zero indication is not less than ±50 counts, repeat (19) (f) above until this is achieved.

(21) Adjust calibrator controls for an output of 7.1 V at 10 kHz.

(22) Perform (a) through (e) below with the TI keys:

(a) Press **2**.

(b) Press **MODE dBV**.

(c) Press **7, 0, . , 0, 0, MODE dBmV** and wait for a stable reading.

(d) Press **AVERAGE SEL**.

(e) Press **REF LVL dB**.

(23) TI shall indicate approximately 5000.

(24) Set internal switch S1 bit 2 in the closed position (fig. 2).

(25) Set calibrator to standby.

(26) Set internal switch S1 bit 2 in the open position (fig. 2).

(27) Perform (a) through (f) below with the TI keys:

(a) Press **0**.

(b) Press **Z0**.

(c) Press **3**.

(d) Press **MODE dBV**.

(e) Press **MODE mV**.

(f) Press **ZERO**.

(28) Wait for zeroing process to complete. If the zero indication is not less than ±50 counts, repeat (27) (f) above until this is achieved.

(29) Adjust calibrator controls for an output of 24 mV at 10 kHz.

(30) Perform (a) through (e) below with the TI keys:

(a) Press **3**.

(b) Press **MODE dBV**.

(c) Press **2, 4, . , 0, 0, MODE dBmV** and wait for a stable reading.

(d) Press **AVERAGE SEL**.

(e) Press **REF LVL dB**.

(31) TI shall indicate approximately 5000.

(32) Set internal switch S1 bit 2 in the closed position (fig. 2).

(33) Set calibrator to standby.

(34) Set internal switch S1 bit 2 in the open position (fig. 2).

(35) Perform (a) through (f) below with the TI keys:

(a) Press **0**.

(b) Press **Z0**.

(c) Press **4**.

(d) Press **MODE dBV**.

(e) Press **MODE mV**.

(f) Press **ZERO**.

(36) Wait for zeroing process to complete. If the zero indication is not less than ±50 counts, repeat (35) (f) above until this is achieved.

(37) Adjust calibrator controls for an output of 100 mV at 1 MHz.

(38) Perform (a) through (e) below with the TI keys:

(a) Press **4**.

(b) Press **MODE dBV**.

(c) Press **9, 9, . , 9, 9, MODE dBmV** and wait for a stable reading.

(d) Press **AVERAGE SEL**.

(e) Press **REF LVL dB**.

(39) TI shall indicate approximately 5000.

(40) Set internal switch S1 bit 2 in the closed position (fig. 2).

(41) Set calibrator to standby.

(42) Set internal switch S1 bit 2 in the open position (fig. 2).

(43) Perform (a) through (f) below with the TI keys:

(a) Press **0**.

(b) Press **Z0**.

(c) Press **5**.

(d) Press **MODE dBV**.

(e) Press **MODE mV**.

(f) Press **ZERO**.

(44) Wait for zeroing process to complete. If the zero indication is not less than ±50 counts, repeat (43) (f) above until this is achieved.

(45) Adjust calibrator controls for an output of 700 mV at 1 MHz.

(46) Perform (a) through (e) below with the TI keys:

(a) Press **5**.

(b) Press **MODE dBV**.

(c) Press **7, 0, . , 0, 0, MODE dBmV** and wait for a stable reading.

(d) Press **AVERAGE SEL**.

(e) Press **REF LVL dB**.

(47) TI shall indicate approximately 5000.

(48) Set internal switch S1 bit 2 in the closed position (fig. 2).

(49) Set calibrator to standby.

(50) Set internal switch S1 bit 2 in the open position (figure 2).

(51) Perform (a) through (f) below with the TI keys:

(a) Press **0**.

(b) Press **Z0**.

(c) Press **6**.

(d) Press **MODE dBV**.

(e) Press **MODE mV**.

(f) Press **ZERO**.

(52) Wait for zeroing process to complete. If the zero indication is not less than ±50 counts, repeat (51) (f) above until this is achieved.

(53) Adjust calibrator controls for an output of 700 mV at 1 MHz.

(54) Perform (a) through (e) below with the TI keys:

(a) Press **6**.

(b) Press **MODE dBV**.

(c) Press **3 , 0 , . , 0, 0 , MODE dBmV** and wait for a stable reading.

(d) Press **AVERAGE SEL**.

(e) Press **REF LVL dB**.

(55) TI shall indicate approximately 5000.

(56) Set internal switch S1 bit 2 in the closed position (fig 2).

9. Power Supply

NOTE

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

a. Performance Check

(1) Place TI on its top and remove the bottom cover.

(2) Connect multimeter between common and TP3 located on the power supply board (fig. 3). If multimeter does not indicate between 5.202 and 5.198 V dc, perform **b** (1) below.

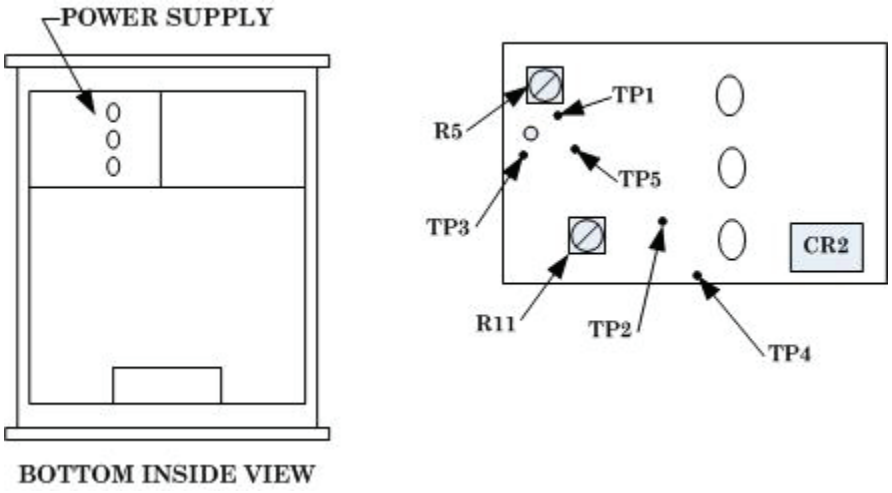

Figure 3. Power Supply, Boonton, Model 9200B.

(3) Connect multimeter between TP2 and TP4 located on the power supply board (fig. 3). If multimeter does not indicate between 140 and 160 mV dc (the polarity of the reading will depend on how the test probes are connected), perform **b**(2) below.

(4) Connect multimeter between common and TP1 located on the power supply board (fig. 3). Multimeter will indicate between +14.4 and +15.6 V dc.

(5) Connect multimeter between common and TP5 located on the power supply board (fig. 3). Multimeter will indicate between -14.4 and -15.6 V dc.

b. Adjustments

(1) Adjust R5 (fig. 3) for a 5.200 ±.002 V dc multimeter indication (R).

(2) Adjust R11 (fig. 3) for a 150 ±10 mV dc multimeter indication (R).

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:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0719034

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344575, requirements for calibration procedure TB 9-6625-2311-24.

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.