*TB 9-6625-2317-50

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR MODULATION METER ME-523( )/U

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

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. 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 bulletin supersedes TB 9-6625-2317-50, dated 26 May 1998, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Modulation Meter, ME-523( )/U. TM 9-6625-908-40 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 3 hours using the dc and low frequency technique.

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

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

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Internal reference oscillator	Frequency: 10 MHz [1] Accuracy stability: ±1 PPM Aging rate: 10 MHz Accuracy: [2]
Carrier frequency	Range: 150 kHz to 1.8 GHz Accuracy: Frequency standard accuracy ±3 counts of the least significant digit Sensitivity: -25 dBm between 500 kHz to 500 MHz -20 dBm between 500 MHz to 1 GHz -10 dBm between 1 GHz to 1.8 GHz
Amplitude modulation	Range: 150 kHz to 10 MHz[3] Rate: 30 Hz to 10 kHz Range: 10 MHz to 1.8 GHz Rate: 30 Hz to 50 kHz Depth: 0% to 99% Accuracy: ±2.5% + one count above 5% modulation Distortion: <0.3% between 5% to 49.9% modulation <0.6% between 50% to 95% modulation
Frequency modulation	Range: 250 kHz to 10 MHz [3] Rate: 30 Hz to 10 kHz Peak deviation: 40 kHz Range: 10 MHz to 1.8 GHz Rate: 30 Hz to 200 kHz Peak deviation: 400 kHz Accuracy: ±3% of reading + one count Distortion: Range: 10 MHz to 1.8 GHz Rate: 30 Hz to 20 kHz Deviation: Up to 100 kHz Accuracy: <0.15%

See footnotes at end of table.

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
Phase modulation	Range: 10 MHz to 1.8 GHz Rate: 300 Hz to 4 kHz Peak deviation: 50 radians Accuracy: ±3% of reading +3 counts
Audio frequency	Demodulation range: 30 Hz to 100 kHz Accuracy: Frequency standard accuracy ± one count
Power measurement	Range: +10 to +30 dBm [4] Accuracy: ±3 dB

[1]30 minute warm-up.

[2]0.3 ppm for 24 hour period after a 2 hour warm-up at a constant ambient temperature.

[3]Not verified with this procedure.

[4]+20 dBm (100 mW) maximum without pad. +30 dBm (1 W) maximum with 10 dB pad.

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 Reference Calibration Standards Set, NSN 4931-00-621-7878. 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.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
AUDIO ANALYZER	Source range: 1 kHz Range: 153 mV to 764 mV Analyzer distortion: <0.15%	Boonton, Model 1121 (1121)
CALIBRATION FIXTURE	No substitute	Hewlett-Packard Model 11715A (11715A)
CALIBRATOR	Range: 1 kHz to 30 MHz Accuracy: ±0.025% Range: 114.5 mV to 890 mV (+12 dBm) Accuracy: ±0.75 dBm	Fluke, Model 5720A (5700A/EP) (p/o MIS-35947; w/ac divider, Fluke, Model 7405A-4207 (7405A-4207)
FREQUENCY COUNTER	Range: 1 kHz to 1.5 GHz Accuracy: ±0.075 ppm	Fluke, Model PM6681/656 (PM6681/656)
MEASURING RECEIVER	Range: 12.5 MHz to 100 MHz Rate: 1000 Hz Deviation: 30 to 100 kHz Accuracy: ±.75% (±1%) Depth: 40% to 80% Accuracy: ±.625% (±1%) Deviation: 20 to 30 radians Accuracy: ±.75% (±1%)	Hewlett-Packard, Model 8902A w/sensor, HP Model 11722A (11722A)

Table 2. Minimum Specifications of Equipment Required - Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
POWER METER	Range: 160 kHz to 1.6 GHz Range: 0 to -25 dBm Accuracy: ±0.25 dB	Hewlett-Packard, Model 437B (13440045) w/power sensor Hewlett-Packard, Model 8482A (13440043)
POWER SPLITTER	Range: 150 kHz to 1.5 GHz Accuracy: ±0.5 dB	Weinschel, Model 1870A (7916839)
SIGNAL GENERATOR	Carrier frequency: Range: 150 kHz to 1.5 GHz Amplitude: 0 and -25 dBm Accuracy: Not required	(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 results 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. 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 with the performance check where applicable.

a. Remove protective cover from TI only when necessary to make adjustments. Replace cover after completing the adjustments.

b. Connect TI to a 115 V ac source. Press **POWER** pushbutton to **ON** and allow at least 30 minutes for stabilization.

c. TI will automatically do a self-calibration. Upon completion, you should see the word **SEARCHING** displayed on the screen.

d. Press TI pushbuttons **#**, **0**, and **1**. All TI LEDs on front keys, the **FREQUENCY**, **LEVEL/DATA ENTRY**, and **Δ LEVEL** displays at top of front panel should be fully illuminated.

e. Press **CLEAR/LOCAL** pushbutton, the display should read **SEARCHING**. The TI is now ready for calibration.

8. Internal Reference Oscillator

a. Performance Check

(1) Connect frequency counter **A** input to TI **10 MHz REF INPUT/OUTPUT** (fig. 1), located on rear panel, using TI 10 dB ATTENUATOR (fig. 1.).

(2) Frequency counter indication will be 10 MHz ± 10 Hz; if not, perform **b** below.

b. Adjustments. After a 2 hour warm-up, adjust TI 10 MHZ FREQUENCY REFERENCE ADJ (fig. 1) for ± 3 Hz. Wait 24 hours and verify TI is within ± 3 Hz.

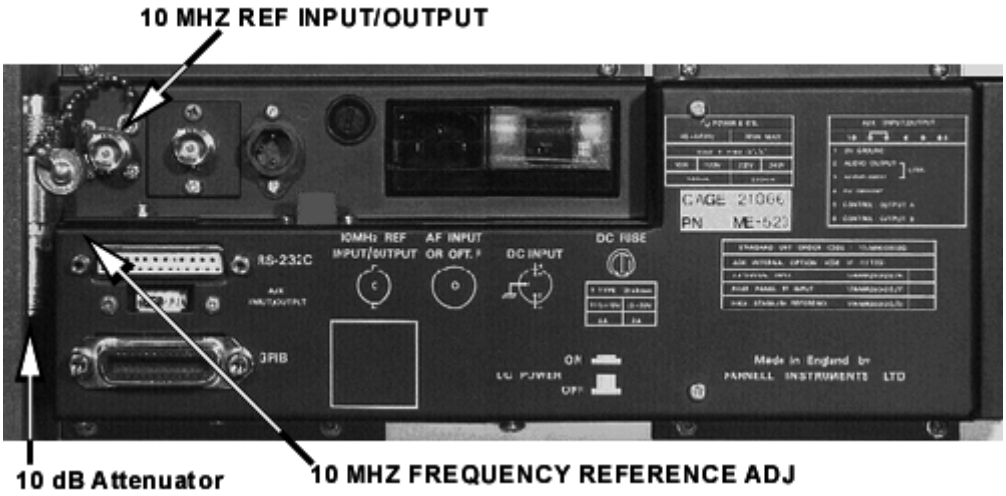

Figure 1. Rear panel.

9. Carrier Frequency

a. Performance Check

(1) Connect equipment as shown in figure 2**.**

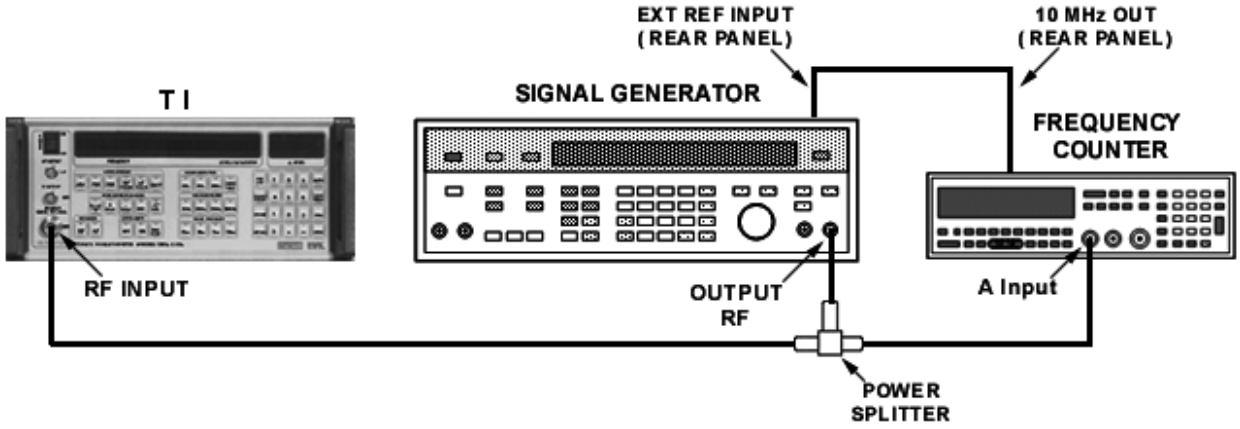

Figure 2. Carrier frequency.

(2) Press TI pushbuttons (on) as follows:

(a) **LEVEL DISPLAY FM**.
(b) **LEVEL DETECTOR MODE PK-PK/2**.
(c) **FREQ DISP RF**.
(d) **LEVEL UNITS ABS**.
(e) **HIGH PASS FILTER 50 HZ**.
(f) **LOW PASS FILTER 15 kHz**.

(3) Press frequency counter **PRESET** and then set for 50 Ω impedance.

(4) Adjust signal generator frequency to 150 kHz at 0 dBm as indicated on frequency counter.

(5) Press TI pushbuttons **CARR FREQ**, **.** (decimal), **1**, **5**, **0**, & **MHz**.

(6) TI front panel **FREQUENCY** display will indicate between 149.97 and 150.03 kHz RF.

(7) Repeat techniques (4) through (6) above, using settings in table 3. TI frequency will indicate within limits specified.

(8) On signal generator press **RF OFF/ON** pushbutton to **OFF**.

NOTE
TI may automatically select carrier frequency.

Table 3. Carrier Frequency

Signal Generator (0 dBm)	Test instrument indications	
	Min	Max
500 kHz	499.97 kHz	500.03 kHz
1 MHz	999.97 kHz	1.00003 MHz
10 MHz	9.99996 MHz	10.00004 MHz
50 MHz	49.99992 MHz	50.00008 MHz
100 MHz	99.99987 MHz	100.00013 MHz
200 MHz	199.99977 MHz	200.00023 MHz
500 MHz[1]	499.99947 MHz	500.00053 MHz
1 GHz	999.9987 MHz	1000.0013 MHz
1.5 GHz	1499.9982 MHz	1500.0018 MHz

[1] On frequency counter, move coax cable to **C** input. Set counter **FUNCTION** for Freq C with 50 Ω impedance.

b. Adjustments. No adjustments can be made.

10. Input Power

a. Performance Check

(1) Connect equipment as shown in figure 3.

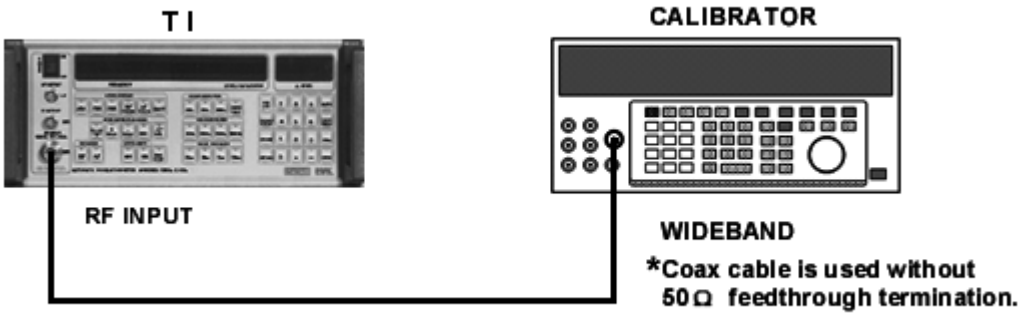

Figure 3. Input power.

(2) Set calibrator **WIDEBAND** output for 30 MHz frequency and amplitude of +12 dBm.

(3) Press TI pushbuttons **CARR FREQ**, **3**, **0**, & **MHz**.

(4) Press TI **LEVEL DISPLAY RF POWER** pushbutton (on). TI **LEVEL/DATA ENTRY** display will indicate between 9 and 15 dBm.

(5) Press calibrator **OPR/STBY** pushbutton to **STBY**.

b. Adjustments. No adjustments can be made.

11. Carrier Level Sensitivity

a. Performance Check

(1) Connect equipment as shown in figure 4.

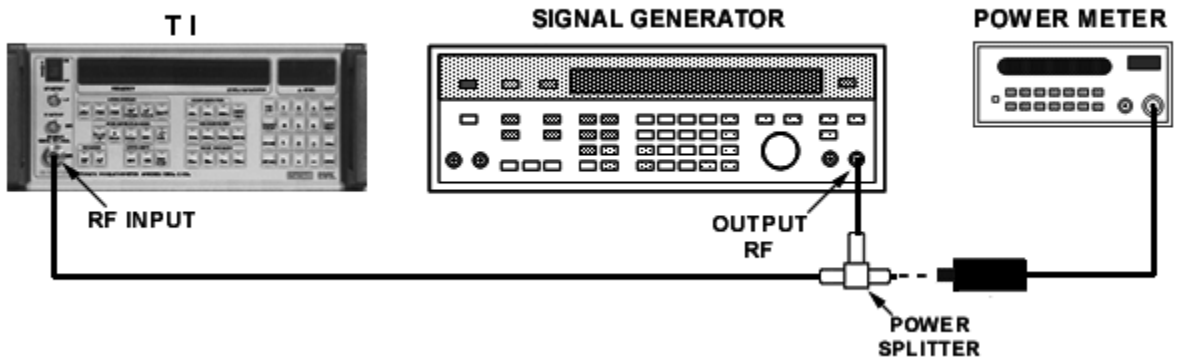

Figure 4. Input sensitivity.

(2) Set power meter to measure power in dBm.

(3) Set signal generator output to 600 kHz and amplitude of -25 dBm as indicated on power meter.

NOTE
On power meter, set frequency and cal factors accordingly.

(4) Press TI pushbuttons **CARR FREQ**, **.** (decimal), **6**, **0**, **0**, & **MHz**.

(5) TI front panel **FREQUENCY** display will indicate 600 kHz RF and **LEVEL/DATA ENTRY** display will indicate <-10 dBm RF.

NOTE
If **FREQUENCY** and **LEVEL/DATA ENTRY** display message "**RF input level low or off tune**," proceed to troubleshooting procedure.

(6) Repeat techniques of (3) through (5) above, using settings and indications in table 4. TI front panel **FREQUENCY** and **LEVEL/DATA ENTRY** displays will indicate frequency and RF level of input signal.

(7) On signal generator press **RF OFF/ON** pushbutton to **OFF**.

b. Adjustments. No adjustments can be made.

Table 4. Sensitivity

Signal generator frequency indication RF	Power meter indication	Test instrument **CARR FREQ** (pushbuttons)
1 MHz	- 25 dBm	1 MHz
10 MHz		10 MHz
50 MHz		50 MHz
100 MHz		100 MHz
200 MHz		200 MHz
400 MHz		400 MHz
600 MHz	-20 dBm	600 MHz
900 MHz		900 MHz
1.2 GHz	-10 dBm	1200 MHz
1.6 GHz		1600 MHz

12. AM Accuracy and Distortion

a. Performance Check

(1) On measuring receiver, calibrate **AM** and **FM** functions, using low frequency sensor module.

(2) Connect equipment as shown in figure 5, CONNECTION A.

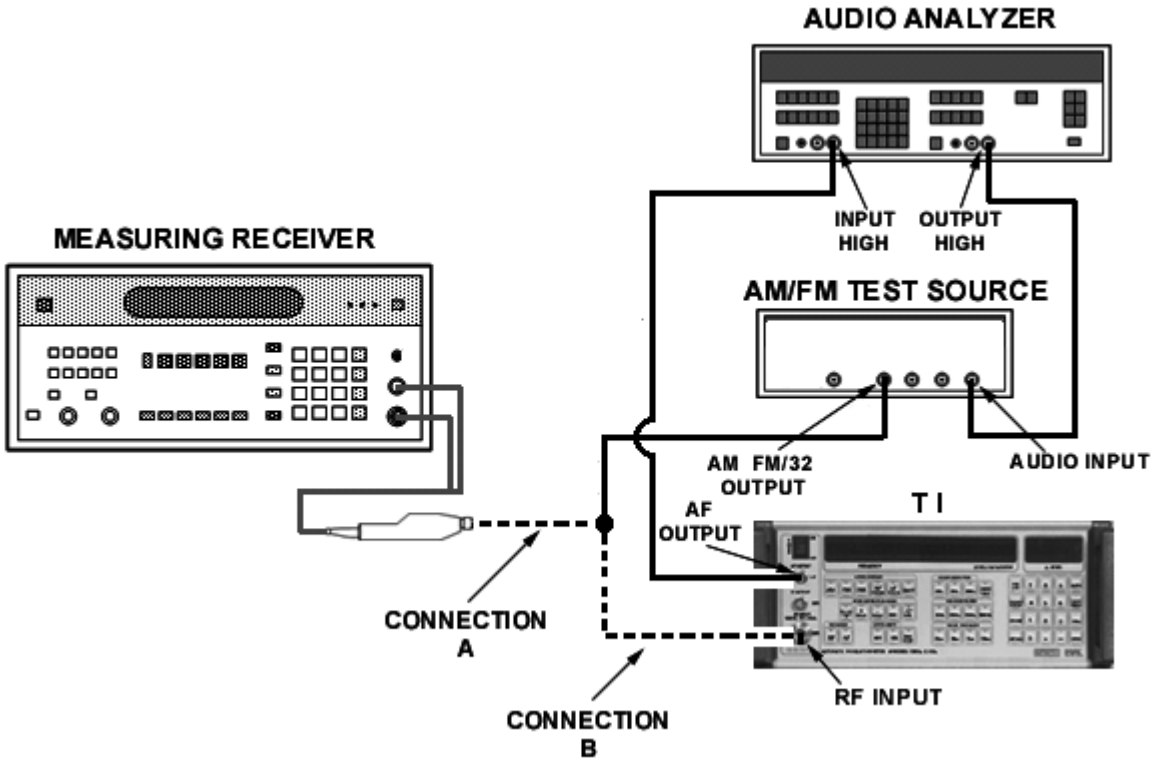

Figure 5. AM accuracy

(3) Press TI pushbuttons (on) as indicated in (a) through (h) below:

(a) **CARR FREQ** then **1**, **2**, **.** (decimal), **5 MHZ**.
(b) **LEVEL DISPLAY** to **AM**.
(c) **LEVEL UNITS** to **ABS**.
(d) **LEVEL DETECTOR MODE** to **+ PEAK**.
(e) **HIGH PASS FILTER** to **50 Hz**.
(f) **LOW PASS FILTER** to **15 kHz**.
(g) **FREQ DISP** to **RF**.
(h) Data keyboard, press **#**, **0**, **7** to perform self-calibration of **AM** and **FM** (this requires approximately 20 seconds).

(4) On audio analyzer, press pushbuttons as indicated in (a) through (d) below:

(a) **SOURCE FREQ** to **1000 Hz**.
(b) **SOURCE LEVEL** to **246 mV**.
(c) **SPCL 75**.
(d) **ANALYZER DIST** (on).

(5) On measuring receiver press **FREQ** pushbutton.

(6) On AM/FM test source, set **TEST MODE** switch to **AM** and adjust **CARRIER FREQUENCY TUNE** control for **12.5 MHz** display indication on measuring receiver.

(7) On measuring receiver, press **AM** pushbutton and record amplitude modulation displayed indication.

(8) Connect equipment as shown in figure 5, CONNECTION B.

(9) TI **LEVEL/DATA ENTRY** display will indicate within ±2.5% + one count of the recorded value in (7) above.

(10) Audio analyzer display will indicate <0.3% distortion.

(11) Connect equipment as shown in figure 5, CONNECTION A.

(12) On audio analyzer, press **SOURCE LEVEL** pushbuttons to 492 mV.

(13) On measuring receiver, record amplitude modulation displayed indication.

(14) Connect equipment as shown in figure 5, CONNECTION B.

(15) TI **LEVEL/DATA ENTRY** display will indicate within ±2.5% + one count of the recorded value in (13) above.

(16) Audio analyzer display will indicate < 0.6% distortion.

b. Adjustments. No adjustments can be made.

13. FM Accuracy and Distortion

a. Performance Check

(1) Connect equipment as shown in figure 6, CONNECTION A.

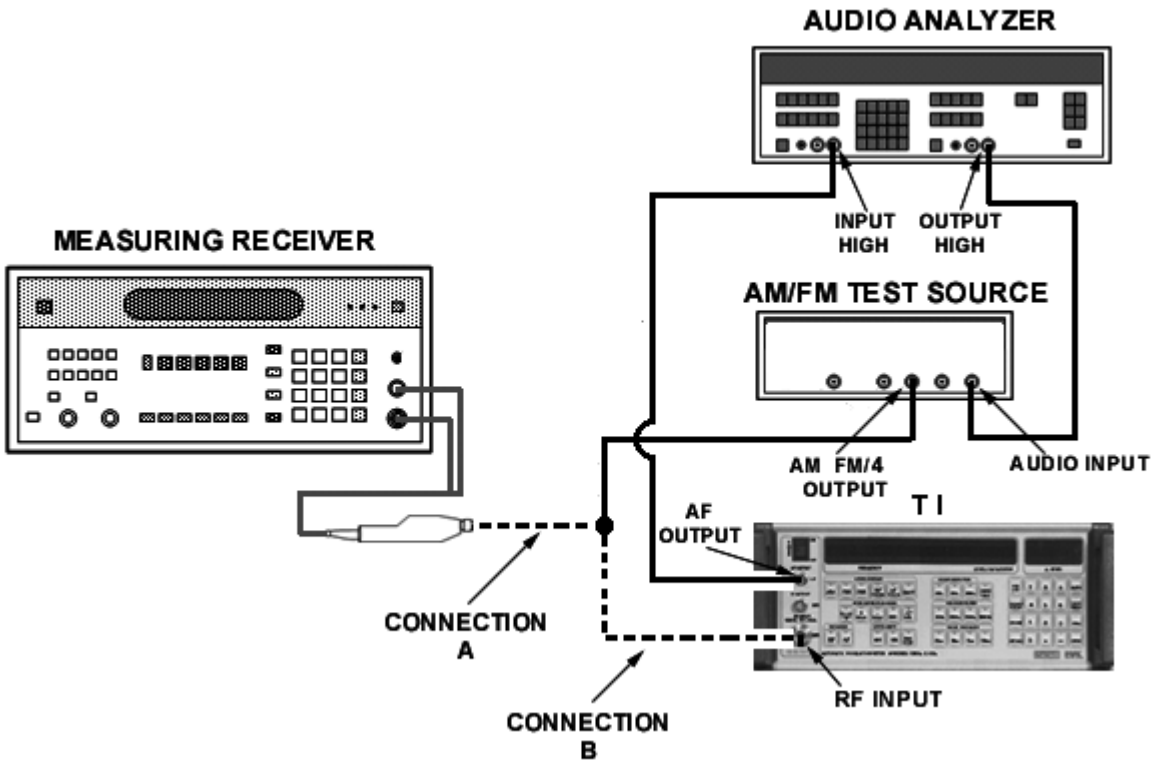

Figure 6. FM and PM accuracy.

(2) On AM/FM test source, set **TEST MODE** switch to **FM**.

(3) Set audio analyzer **SOURCE LEVEL** to 229 mV and **LP FILTER** to 80.

(4) On measuring receiver, press **FREQ** pushbutton.

(5) On AM/FM test source, adjust **CARRIER FREQUENCY TUNE** control for 100 MHz displayed indication on measuring receiver.

(6) On measuring receiver, press **FM** pushbutton and record frequency modulation displayed indication.

NOTE

Add filters on measuring receiver as necessary to indicate a stable reading.

(7) Connect equipment as shown in figure 6, CONNECTION B.

(8) Press TI pushbuttons (on) as indicated in (a) through (d) below:

(a) **CARR FREQ** then **1**, **0**, **0**, **MHz**.
(b) **LEVEL DISPLAY** to **FM**.
(c) **LEVEL DETECTOR MODE** to **PK-PK/2**.
(d) **LOW PASS FILTER** to **300 kHz**.

(9) TI **LEVEL/DATA ENTRY** display will indicate within ±3% + one count of the recorded value in (6) above.

(10) Connect equipment as shown in figure 6, CONNECTION A.

(11) Set audio analyzer **SOURCE LEVEL** to 764 mV.

(12) On measuring receiver, record frequency modulation displayed indication.

(13) Connect equipment as shown in figure 6, CONNECTION B.

(14) TI **LEVEL/DATA ENTRY** display will indicate within ±3% + one count of the recorded value in (12) above.

(15) Audio analyzer display will indicate <0.15% distortion.

b. Adjustments. No adjustments can be made.

14. PM Deviation Accuracy

a. Performance Check

(1) Connect equipment as shown in figure 6, CONNECTION A.

(2) Set audio analyzer **SOURCE LEVEL** to 153 mV.

(3) On measuring receiver, press **PM** pushbutton and record phase modulation displayed indication.

NOTE

Add filters on measuring receiver as necessary to indicate a stable reading.

(4) Connect equipment as shown in figure 6, CONNECTION B.

(5) Press TI **LEVEL DISPLAY PM** pushbutton (on).

(6) TI **LEVEL/DATA ENTRY** display will indicate within ±3% + three counts of the recorded value in (3) above.

(7) Connect equipment as shown in figure 6, CONNECTION A.

(8) Set audio analyzer **SOURCE LEVEL** to **229 mV**.

(9) On measuring receiver, record phase modulation displayed indication.

(10) Connect equipment as shown in figure 6, CONNECTION B.

(11) TI **LEVEL/DATA ENTRY** display will indicate within ±3% + three counts of the recorded value in (9) above.

b. Adjustments. No adjustments can be made.

15. AF Accuracy

a Performance Check

(1) Connect equipment as shown in figure 7.

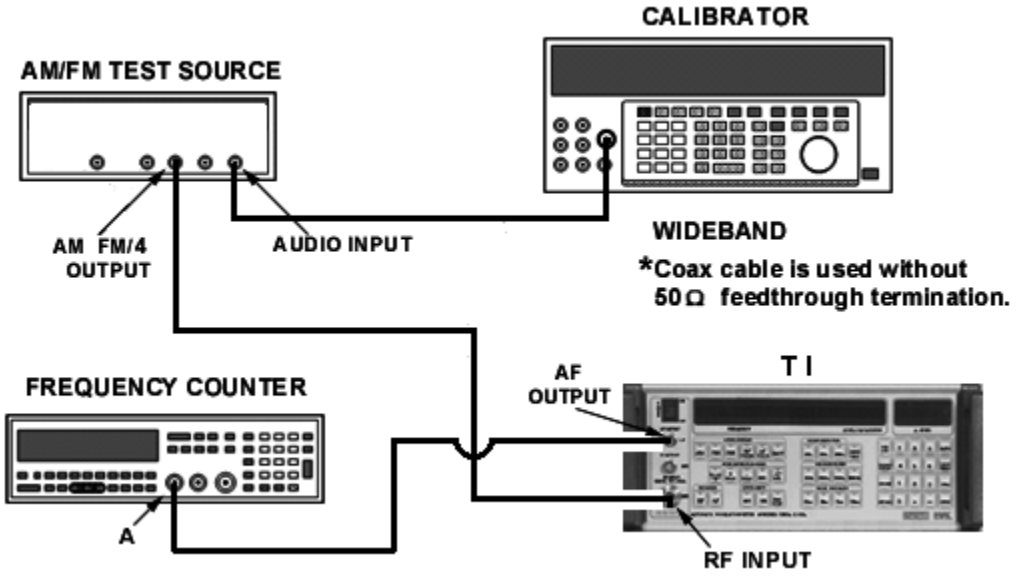

Figure 7. AF accuracy.

(2) Set calibrator **WIDEBAND** output to 1 kHz at 114.5 mV.

(3) Set frequency counter to FREQ A with a 50Ω impedance.

(4) Press TI pushbuttons (on) as indicated in (a) through (c) below:

(a) **LEVEL DISPLAY FM**.
(b) **LOW PASS FILTER 75 kHz**.
(c) **FREQ DISP AF**.

(5) Frequency counter display will indicate between 999 to 1001 Hz.

(6) Set calibrator **WIDEBAND** output to 4 kHz.

(7) Frequency counter display will indicate between 3990 to 4010 Hz.

(8) Press calibrator **OPR/STBY** pushbutton to **STBY**.

b. Adjustments. No adjustments can be made.

16. 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:

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

Official

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0434301

Distribution:

To be distributed in accordance with Std IDS No. RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-6625-2317-50.

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.milT
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.