*TB 9-6625-2276-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR RF AMPLIFIER ST RESEARCH, MODEL AD 1300 (P/O 13335446)

Headquarters, Department of the Army, Washington, DC
30 September 2008

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, 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 9-6625-2276-35, dated 17 February 1992.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of RF Amplifier, ST Research, Model AD 1300 (P/O 13335446). 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 3 hours using the microwave 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 parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications[1]
Gain and gain flatness	Frequency range: 100 kHz to 1300 MHz Gain: Pre-amp: >25 dBm Power amp: 22 dBm ±1.5 dBm Gain flatness: ±1.5 dBm
Harmonic distortion	Pre-amp: -30 dBm for 0 dBm output Power amp: -30 dBm for +8 dBm output

[1]20 to 30°C.

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-286; 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 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)
ATTENUATOR	Frequency range: 100 kHz to 1300 MHz Attenuator range: 20 dBm	Hewlett-Packard, Model 355D (355D)
MEASURING RECEIVER	Flatness measurement: Frequency: 50 to 500 MHz Accuracy: ±0.188 dBm Frequency measurement: Range: 50 to 500 MHz Accuracy: ±0.5% Power measurement: Frequency: 250 and 300 MHz Range: +10 dBm to -80 dBm Accuracy: ±0.125 dBm	Measuring receiver system N5530S consisting of: Spectrum Analyzer Agilent, Model E4440A (E4440A), Power Meter Agilent, Model E4419B (E4419B), and Sensor module, Agilent Model N5532A opt. 504 (504)
SIGNAL GENERATOR	Frequency range: 100 kHz to 1300 MHz Level output range: -20 to +10 dBm	Aeroflex, Model 2023B (2023B) or SG-1207/U
SPECTRUM ANALYZER	Frequency range: 200 to 1200 MHz Capability: Able to view signals to -30 dBm	(AN/USM-677)

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. 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 within the performance check where applicable.

CAUTION

Do not exceed +10 dBm input to either amplifier input.

NOTE

Verify the proper cal factors are loaded for the power sensor module being utilized.

a. Measuring receiver setup

(1) Connect sensor module to the power reference output. Perform sensor zero and calibration.

(2) Configure measuring receiver to measure power.

b. Connect TI to 115 V ac source. Press power switch (located on rear panel) to the **ON** position and allow TI to warm-up for 1 hour.

8. Gain and Flatness Test

a. Performance Check

(1) Connect equipment as shown in figure 1.

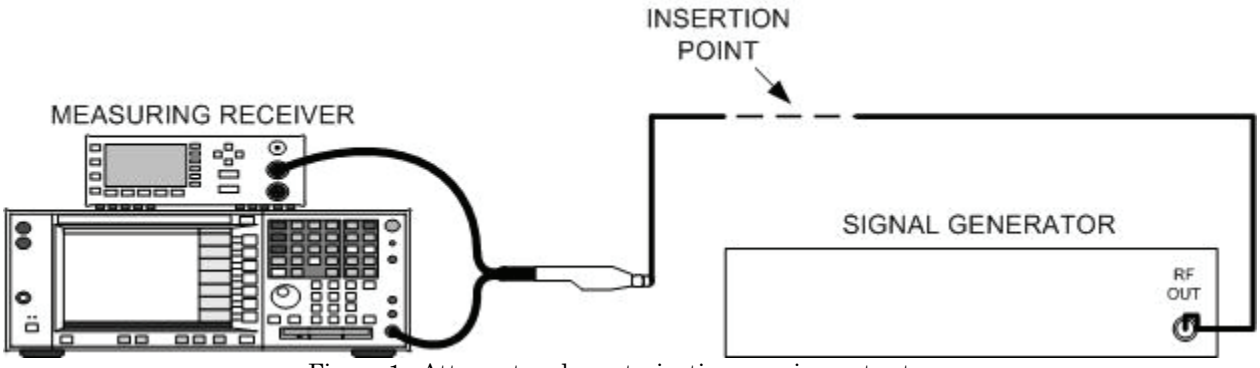

Figure 1. Attenuator characterization - equipment setup.

(2) Adjust signal generator amplitude controls for +10 dBm output and frequency controls to first test frequency setting listed in table 3.

(3) Adjust signal generator amplitude controls for a +10.0 dBm indication on the measuring receiver.

Table 3. Pre-amp Gain Worksheet

Test frequency settings (MHz)	Measuring receiver indication (dBm)	Attenuator actual value (dBm)[1]	Reference (dBm)	Raw gain (dBm)	**PRE-AMP** gain (dBm)
0.10					
1.0					
5.0					
10.0					

See footnote at end of table.

Table 3. Pre-amp Gain Worksheet Continued

Test frequency settings (MHz)	Measuring receiver indication (dBm)	Attenuator actual value (dBm)[1]	Reference (dBm)	Raw gain (dBm)	**PRE-AMP** gain (dBm)
100.0					
300.0					
500.0					
700.0					
900.0					
1100.0					
1300.0					

[1]Treat as positive value.

(4) Set attenuator to 20 dBm (attenuator remains set at 20dBm throughout procedure).

(5) Turn signal generator RF output off, connect attenuator at the insertion point as shown in figure 1 and turn signal generator RF output on.

(6) Record measuring receiver indication in the measuring receiver indication column in table 3.

(7) Algebraically subtract measuring receiver indication value recorded in table 3 from +10.0 dBm. Record difference in attenuator actual value column in table 3.

(8) Turn signal generator RF output off, remove attenuator from equipment setup.

(9) Repeat (1) through (8) above for remaining test frequency settings listed in table 3.

(10) Algebraically add -40 dBm to attenuator actual value recorded in table 3 for test frequency setting of 0.10 MHz. Record sum in reference column in table 3.

NOTE

Treat attenuator actual value as a measuring receiver positive number for (10) above.

(11) Repeat (10) above for each test frequency setting listed in table 3.

(12) Connect equipment as shown in figure 1.

(13) Adjust signal generator amplitude controls for a measuring receiver indication equal to reference recorded in table 3 for test frequency setting of 0.10 MHz.

(14) Turn signal generator RF output off; connect equipment as shown in figure 2.

(15) Turn signal generator RF output on and record measuring receiver indications in raw gain column in table 3.

(16) Turn signal generator RF output off and disconnect TI from equipment setup.

(17) Repeat technique of (12) through (16) above for remaining test frequency settings listed in table 3.

(18) Algebraically subtract raw gain value for 0.10 MHz row from -40 dBm. Record difference in **PRE-AMP** gain column in table 3.

NOTE
Disregard sign of difference determined in (18) above.

(19) Repeat (18) above for remaining test frequency settings listed in table 3. **PRE-AMP** gain for test frequencies listed in table 3 will be greater than 25 dBm.

NOTE
(For information only)
Typical **PRE-AMP** gain is between 28.5 and 31.5 dBm.

(20) Add highest and lowest **PRE-AMP** gain recorded in table 3 and then divide sum by two. Highest and lowest **PRE-AMP** gain values will be within ±1.5 dBm of calculated average.

(21) Disconnect TI from equipment setup.

(22) Transcribe reference column values recorded in table 3 to reference column in table 4.

(23) Connect equipment as shown in figure 1.

(24) Adjust signal generator frequency controls to frequency setting listed in table 4 and amplitude controls for a measuring receiver indication equal to reference recorded in table 4.

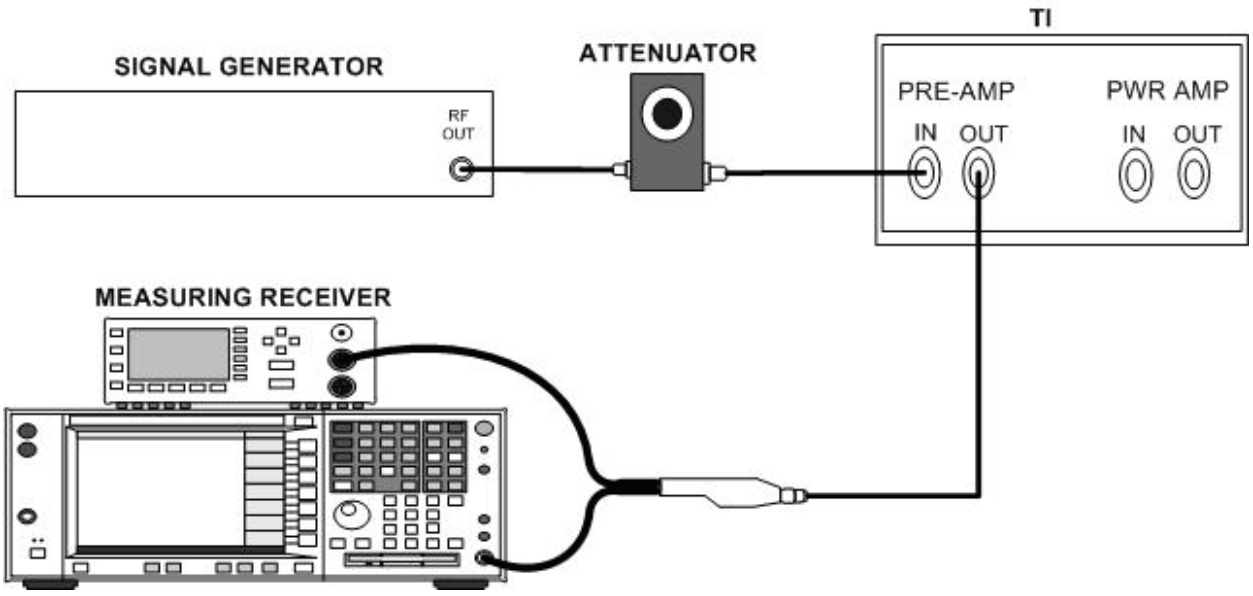

Figure 2. Gain - equipment setup.

Table 4. Power Amp Gain

Test frequency settings (MHz)	Reference (dBm)	Raw gain (dBm)	**POWER AMP** gain (dBm)
0.10			
1.0			
5.0			
10.0			
100.0			
300.0			
500.0			
700.0			
900.0			
1100.0			
1300.0			

(25) Turn signal generator RF output off, connect equipment as shown in figure 2 with the following exceptions: Move **PRE-AMP IN** connection to **POWER AMP IN** and move **PRE-AMP OUT** connection to **POWER AMP OUT**.

(26) Turn signal generator RF output on and record measuring receiver indication in raw gain column in table 4.

(27) Turn signal generator RF output off and repeat technique of (23) through (26) above for remaining test frequency settings listed in table 4.

(28) Algebraically subtract raw gain recorded for 0.10 MHz test frequency setting from -40 dBm. Record difference in **POWER AMP** gain column of table 4.

NOTE
Disregard sign of difference determined in (29) above.

(29) Repeat (29) above for remaining test frequency settings listed in table 4.

(30) **POWER AMP** gain values recorded in table 4 will be between 20.5 and 23.5 dBm.

(31) Disconnect TI from equipment setup.

b. Adjustments. No adjustments can be made.

9. Distortion Check

a. Performance Check

(1) Connect sensor module to the power reference output. Perform sensor zero and calibration.

(2) Configure measuring receiver to measure power.

(3) Connect signal generator **INPUT 50 Ω** to **PRE-AMP IN**.

(4) Connect **PRE-AMP OUT** to measuring receiver power sensor.

NOTE
Use cable for (4) above.

(5) Adjust signal generator frequency controls for 200 MHz output frequency and amplitude controls for -30 dBm output.

(6) Adjust signal generator level controls for a 0.0 dBm indication on measuring receiver.

(7) Turn signal generator RF output off disconnect cable at measuring receiver power sensor and connect cable to **INPUT 50 Ω** of spectrum analyzer, then turn signal generator RF output on.

(8) Adjust spectrum analyzer controls to view TI fundamental, second, and third harmonic signals on spectrum analyzer display. Second and third harmonic amplitudes will be less than or equal to -30 dBm (30 dBm below carrier level indicated on spectrum analyzer display.)

(9) Turn signal generator RF output off, disconnect cable from **INPUT 50 Ω** of spectrum analyzer and connect cable to measuring receiver power sensor, then turn signal generator RF output on.

(10) Adjust signal generator frequency controls for 400 MHz output and amplitude controls for a measuring receiver indication of 0.0 dBm.

(11) Repeat (7) and (8) above.

(12) Turn signal generator RF output off, disconnect cable connected to **PRE-AMP IN** and reconnect to **POWER AMP IN**.

(13) Disconnect cable connected to **PRE-AMP OUT** and reconnect to **POWER AMP OUT**, then turn signal generator RF output on.

(14) Adjust signal generator frequency controls for 200 MHz output.

(15) Adjust signal generator amplitude controls for a measuring receiver indication of +8.0 dBm.

(16) Turn signal generator RF output off, disconnect cable from of measuring receiver power sensor and connect cable to **INPUT 50 Ω** of spectrum analyzer, then turn signal generator RF output on.

(17) Adjust spectrum analyzer controls as necessary to view fundamental, second and third harmonic signals on spectrum analyzer display. Second and third harmonic amplitudes will be less than or equal to -30 dBm (30 dBm below carrier level indicated on spectrum analyzer display).

(18) Turn signal generator RF output off, disconnect cable from **INPUT 50 Ω** of spectrum analyzer and connect cable to of measuring receiver power sensor, then turn signal generator RF output on.

(19) Adjust signal generator frequency controls for 400 MHz output.

(20) Adjust signal generator amplitude controls for a measuring receiver indication of +8.0.

(21) Repeat (17) and (18) above.

(22) Disconnect all cables from TI.

b. Adjustments. No adjustments can be made.

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:

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Secretary of the Army
0822602

Distribution:
To be distributed in accordance with the initial distribution number (IDN) 343514 requirements for calibration procedure TB 9-6625-2276-24.

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.