TB 9-6625-2327-35

CHANGE 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR FUNCTION/ARBITRARY WAVEFORM GENERATOR AGILENT, MODEL 33250A

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

TB 9-6625-2327-35, 6 November 2003, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove Pages	Insert Pages
3 and 4	3 and 4
9 and 10	9 and 10
15 and 16	15 and 16

2. File this change sheet in front of the publication for reference purposes.

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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 9-6625-2327-35, dated 6 May 2002.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Function/Arbitrary Waveform Generator, Agilent Model 33250A. 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 5 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. All adjustments that are made as a result of an out-of-tolerance condition are reportable. Any adjustments that are made as a result of the normal cyclic calibration are not reportable

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	Perform specifications
Frequency	Range: 1 μHz to 80 MHz Acccuracy: ± 1 ppm per year
Output amplitude (sine wave)	Range: 10 mV pp to 10 V pp (into 50Ω) Accuracy: ±1% of setting ±1 mV pp (at 1 kHz, >10 mV pp, autorange on)
Flatness (sine wave)	(Relative to 1 kHz, autorange on) <10 MHz .....±1% (0.1 dB) 10 MHz to 50 MHz ....±2% (0.2 dB) 50 to 80 MHz .....±5% (0.4 dB)
Distortion: Harmonic distortion: Total Harmonic Distortion:	< 3 V pp / ≥ 3 V pp DC to 1 MHz -60 dBc / -55 dBc 1 to 5 MHz -57 dBc / -45 dBc 5 to 80 MHz -37 dBc / -30 dBc <0.2% + 0.1 mV
Signal characteristics: Square wave: Pulse:	 Rise/fall time: <8 ns Overshoot: <5% Asymmetry: 1% of period + 1 ns Jitter: <2 MHz 0.01%+ 525 ps ≥2 MHz 0.1% + 75 ps Overshoot: <5%

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)
ATTENUATOR	10 dB with test report	Weinschel, Model 9918-10dB (9918-( ))
AUDIO ANALYZER	Distortion Range: 100 Hz to 19 kHz Capability: <0.2%	Boonton Model 1121 (1121)
FREQUENCY COUNTER	Range: 100 MHz to 80 MHz Accuracy: ±0.25 ppm	Fluke, Model PM6681/656 (PM6681/656)
MULTIMETER	Range: 9.546 mV rms to 7.07 V rms Accuracy: ± 0.25%	Hewlett-Packard, Model 3458A (3458A)
OSCILLOSCOPE	Range: 5.0 V at 100 ns Accuracy: ±3.0%	(OS-303/G)
POWER METER	Range: 100 kHz to 80 MHz 0 to 24 dBm Accuracy: ±0.25%	Hewlett-Packard, Model 437B (437B); w/ power sensor, Model 8482A (8482A) .
SPECTRUM ANALYZER	Range: 500 kHz to 75 MHz Capability: <-60 dBc	(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.

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

CAUTION

Before connecting TI to power source, make sure TI is set to the power source line voltage as shown on rear of TI.

b. Connect TI to 115 V ac power source.

c. Press power switch **Φ** to on and allow at least 1 hour for TI to warm-up and stabilize.

d. Press the **Utility** and **Test/Cal** keys.

NOTE

The factory default secure code is **AT33250A**. If the secure code has been changed and is now unknown, the manufacturer's manual, section 4, describes how to unsecure the instrument without a security code.

e. Enter the security code using the knob to change the displayed character, and the arrow keys to move to the next character.

f. Press the **Done** key.

8. Frequency Accuracy

a. Performance Check

(1) Connect TI **Output** to frequency counter channel A input and set the counter for a 50 Ω input on channel A.

(2) Press TI keys as listed in (a) through (d) below.

(a) **Sine**.

(b) **Ampl**, **1**, and **V pp**.

(c) **Freq**, **10**, **MHz**.

(d) **Output** to on.

(3) Set frequency counter to measure frequency on channel A.

(4) If the frequency counter does not indicate within limits listed in table 3, perform the alignment procedure in paragraph **13**.

(5) Set TI frequency to the next frequency listed in table 3, using the TI key pad and control knob, and repeat (4) above.

(6) Repeat (2) (c), (4) and (5) above for the remaining frequencies listed in table 3.

Table 3. Frequency Resolution Accuracy

Test instrument center frequency	Microwave frequency counter indications	
	Min	Max
10.000000 MHz	9.999990 MHz	10.000010 MHz
20.000000 MHz	19.999980 MHz	20.000020 MHz
40.000000 MHz	39.999960 MHz	40.000040 MHz
80.000000 MHz	79.999920 MHz	80.000080 MHz
1.0000000 MHz	0.9999990 MHz	1.0000010 MHz
100.00000 kHz	99.99990 kHz	100.00010 kHz
10.000000 kHz	9.999990 kHz	10.000010 kHz
1.0000000 kHz	0.9999990 kHz	1.0000010 kHz
100.00000 Hz[1]	0.00999999 s	0.01000001 s
10.000000 Hz	0.09999990 s	0.10000010 s
1.000000 Hz	0.99999900 s	1.00000100 s
100.000 mHz	9.9999900 s	10.0000100 s

[1]Set TI to square wave, and frequency counter to measure period.

(7) Press **Output** to off.

(8) Disconnect microwave frequency counter from TI.

b. Adjustments. Perform entire alignment procedure listed in paragraph **13**.

9. Output Amplitude

a. Performance Check

(1) Connect multimeter to the TI **RF OUTPUT**.

(2) Set multimeter to measure volts ac.

(3) Press TI keys as listed in (a) through (e) below:

(a) **Sine**.
(b) **Utility**, **Output Setup**, **Load High Z** to highlight **High Z** and **Done.**
(c) **Freq**, **1**, **kHz**.
(d) **Ampl**, **10**, and **mV rms**.
(e) **Output** to on.

(4) If the multimeter does not indicate within minimum and maximum limits listed in table 4, perform the alignment procedure in paragraph **13**.

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

Table 4. Output Amplitude

Test instrument settings				Multimeter indications	
Amplitude		Frequency		Min	Max
10	mV rms	1	kHz	9.546	10.454
100	mV rms	1	kHz	98.646	101.354
200	mV rms	1	kHz	0.197646	0.202354
300	mV rms	1	kHz	0.296646	0.303354
400	mV rms	1	kHz	0.395646	0.404354
500	mV rms	1	kHz	0.494646	0.505354
600	mV rms	1	kHz	0.593646	0.606354
670.0	mV rms[1]	1	kHz	0.662946	0.677054
670.0	mV rms[2]	100	kHz	0.663300	0.676700
700	mV rms	1	kHz	0.692646	0.707354
800	mV rms	1	kHz	0.791646	0.808354
900	mV rms	1	kHz	0.890646	0.909354
1	V rms	1	kHz	0.989646	1.010354
2.000	V rms[3]	1	kHz	1.979646	2.020354
2.000	V rms[4]	100	kHz	1.980000	2.020000
7.000	V rms[5]	1	kHz	6.929646	7.070354
7.000	V rms[6]	100	kHz	6.930000	7.070000

[1]Record multimeter indication as 1kHz_0dB_reference in table 5.
[2]Record multimeter indication as 100kHz_0dB_reference in table 5.
[3]Record multimeter indication as 1kHz_10dB_reference in table 5.
[4]Record multimeter indication as 100kHz_10dB_reference in table 5.
[5]Record multimeter indication as 1kHz_20dB_reference in table 5.
[6]Record multimeter indication as 100kHz_20dB_reference in table 5.

b. Adjustments. Perform entire alignment procedure listed in paragraph **13**.

10. Flatness

a. Performance Check

(1) Calculate and fill in the remaining blanks in table 5.

Table 5. Flatness Values

Reference	Multimeter indication	Formula to calculate dB indication	Calculated dB indication
1kHz_0dB_reference		10 * Log(5.0 * multimeter indication^2)	
100kHz_0dB_reference		10 * Log(5.0 * multimeter indication^2)	
1kHz_10dB_reference		10 * Log(5.0 * multimeter indication^2)	
100kHz_10dB_reference		10 * Log(5.0 * multimeter indication^2)	
1kHz_20dB_reference		10 * Log(5.0 * multimeter indication^2)	
100kHz_20dB_reference		10 * Log(5.0 * multimeter indication^2)	

(2) Connect power sensor module to power meter, zero and calibrate the power meter.

(3) Connect the power sensor to the TI **Output**.

(4) Press TI keys as listed in (a) through (e) below:

(a) **Sine**.

(b) **Utility**, **Output Setup**, **Load** and **Done**.

(c) **Ampl**, **670**, and **mVrms**.

(d) **Freq**, **100**, **kHz**.

(e) **Output** to on.

(5) Adjust the TI output level until the power meter indication matches the calculated 100kHz_0dB_reference in dB.

(6) Adjust the TI frequency to each of the frequencies listed in table 6. If the difference between the power meter indication and the calculated 1kHz_0dB_reference is not within the minimum/maximum limits listed in table 6, perform the alignment procedure in paragraph **13**.

Table 6. 0 dB Flatness

Test instrument frequency	Power meter indication 1kHz_0dB_reference difference	
	Min	Max
200 kHz	-0.086	+0.087
500 kHz	-0.086	+0.087
1.500 MHz	-0.086	+0.087
5.000 MHz	-0.086	+0.087
10.000 MHz	-0.086	+0.087
25.000 MHz	-0.172	+0.175
40.000 MHz	-0.172	+0.175
50.000 MHz	-0.172	+0.175
60.000 MHz	-0.424	+0.446
65.000 MHz	-0.424	+0.446
70.000 MHz	-0.424	+0.446
75.000 MHz	-0.424	+0.446
80.000 MHz	-0.424	+0.446

(7) Press TI **Freq**, **100**, and **kHz** keys, and adjust the TI output level until the power meter indication matches the calculated 100kHz_10dB_reference in dB.

(8) Adjust the TI frequency to each of the frequencies listed in table 7. If the difference between the power meter indication and the calculated 1kHz_10dB_reference is not within the minimum/maximum limits listed in table 7, perform the alignment procedure in paragraph **13**.

Table 7. 10 dB Flatness

Test instrument frequency	Power meter indication 1kHz_10dB_reference difference	
	Min	Max
200 kHz	-0.086	+0.087
500 kHz	-0.086	+0.087
1.500 MHz	-0.086	+0.087
5.000 MHz	-0.086	+0.087
10.000 MHz	-0.086	+0.087
25.000 MHz	-0.172	+0.175
40.000 MHz	-0.172	+0.175
50.000 MHz	-0.172	+0.175
60.000 MHz	-0.424	+0.446
65.000 MHz	-0.424	+0.446
70.000 MHz	-0.424	+0.446
75.000 MHz	-0.424	+0.446
80.000 MHz	-0.424	+0.446

NOTE

Use a 10 dB attenuator between TI and power meter. Measured value will take attenuator into consideration during calculations.

(9) Press TI **Freq**, **100**, and **kHz** keys, and adjust the TI output level until the power meter indication matches the calculated 100kHz_20dB_reference in dB minus the attenuator test report value in dB at 100 kHz.

(10) Adjust the TI frequency to each of the frequencies listed in table 8. If the difference between the power meter indication and the calculated 1kHz_20dB_reference minus the attenuator test report value in dB at the selected frequencies is not within the minimum/maximum limits listed in table 8 perform the alignment procedure in paragraph **13**.

Table 8. 20 dB Flatness

Test instrument frequency	Power meter indication 1kHz_20dB_reference difference	
	Min	Max
200 kHz	-0.086	+0.087
500 kHz	-0.086	+0.087
1.5 00 MHz	-0.086	+0.087
5.000 MHz	-0.086	+0.087
10.000 MHz	-0.086	+0.087
25.000 MHz	-0.172	+0.175
40.000 MHz	-0.172	+0.175
50.000 MHz	-0.172	+0.175
60.000 MHz	-0.424	+0.446
65.000 MHz	-0.424	+0.446
70.000 MHz	-0.424	+0.446
75.000 MHz	-0.424	+0.446
80.000 MHz	-0.424	+0.446

(11) Press **Output** to off and disconnect TI from power meter.

b. Adjustments. Perform entire alignment procedure listed in paragraph **13**.

11. Spectral Purity

a. Performance Check

(1) Connect TI **10 MHz In** to spectrum analyzer **10 MHz REF OUT**.

(2) Connect TI **Output** to spectrum analyzer **INPUT 50 Ω**.

(3) Press TI keys as listed in (a) through (e) below:

(a) **Output** on.
(b) **Sine**.
(c) **Utility**, **Output Setup**, **Load** and **Done**.
(d) **Ampl**, **1**, and **V p-p**.
(e) **Freq**, **500**, **kHz**.

(4) Adjust spectrum analyzer controls to display 500 kHz fundamental. All harmonics will be less than the maximum indication listed in table 9.

NOTE

Lower test instrument frequencies require a lower video and resolution bandwidth. (Exp. RBW 300 Hz VBW 30 Hz.)

Table 9. Harmonic Distortion

Test instrument		Spectrum analyzer	
Frequency	Amplitude V p-p	Center frequency	Maximum indication
500 kHz	1	500 kHz	-60 dBc
900 kHz	1	900 kHz	-60 dBc
2 MHz	1	2 MHz	-57 dBc
4 MHz	1	4 MHz	-57 dBc
6 MHz	1	6 MHz	-37 dBc
75 MHz	1	75 MHz	-37 dBc
500 kHz	10	500 kHz	-55 dBc
900 kHz	10	900 kHz	-55 dBc
2 MHz	10	2 MHz	-45 dBc
4 MHz	10	4 MHz	-45 dBc
6 MHz	10	6 MHz	-30 dBc
75 MHz	10	75 MHz	-30 dBc

(5) Repeat technique of (3) and (4) above for the remaining settings listed in table 9.

(6) Press **Output** to off and disconnect TI from spectrum analyzer.

(7) Connect TI **Output** to audio analyzer **INPUT HIGH** using 50 Ω feedthrough termination.

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

(a) **Ampl**, **1**, and **Vrms**.
(b) **Freq**, **100**, **Hz**.
(c) **Output** to on.

(9) Set audio analyzer to measure distortion in percent (%). Audio analyzer indication will be less than the maximum limit listed in table 10.

Table 10. Total Harmonic Distortion

Test instrument settings		Audio analyzer maximum limit
Frequency	Amplitude	
100 Hz	1 V rms	<0.21%
19 kHz	1 V rms	<0.21%
19 kHz	3.536 V rms	<0.21%
100 Hz	3.536 V rms	<0.21%

(10) Repeat technique of (8) and (9) above for remaining settings listed in table 10.

(11) Press **Output** to off and disconnect equipment setup.

b. Adjustments. Perform entire alignment procedure listed in paragraph **13**.

12. Output Characteristics

a. Performance Check

(1) Connect TI **Output** to oscilloscope **Vertical 1** input.

(2) Press TI keys as listed in (a) through (e) below:

(a) **Square**.
(b) **Ampl**, **1**, and **Vrms**.
(c) **Freq**, **100**, **kHz**.
(d) **Utility**, **Output Setup**, **Load** and **Done**.
(e) **Output** on.

(3) Set oscilloscope **Vertical 1 Input** to **50 Ω** and measurement function as necessary to verify indications listed in table 11.

Table 11. Output Characteristics

Test instrument				Oscilloscope		
Function	Frequency	Amplitude	Pulse width	Function	Min indication	Max indication
Square	100 kHz	1 V rms		Risetime		≤8 ns
Square	100 kHz	1 V rms		Falltime		≤8 ns
Square	100 kHz	1 V rms		Overshoot		<5%
Square	1 kHz	1 V rms		Duty Cycle	49.5 %	50.5 %
Pulse	1 kHz	1 V rms	100 µS	Overshoot		<5%

(4) Set oscilloscope controls as necessary to verify the jitter on the frequencies and function listed in table 12.

Table 12. Output Jitter

Test instrument			Oscilloscope
Function	Frequency	Amplitude	Maximum indication
Square	100 kHz	1 V rms	<.01% + 525 ps
Square	10 MHz	1 V rms	< 0.1% + 75 ps

(5) Reduce all outputs to minimum.

(6) Disconnect equipment setup.

b. Adjustments. Perform entire alignment procedure listed in paragraph **13**.

13. Alignment

NOTE

If the adjustment procedure below has not been performed it must be done at this time.

NOTE

Press **Utility** and **Test/Cal** keys; if **Secure On** is highlighted, perform steps outlined in paragraph **6 d** through **f**.

(1) Connect TI **Output** to frequency counter channel A input and set the counter for a 50Ω input on channel A.

(2) Press the **Utility**, **Test/Cal**, **Perform Cal**, and **BEGIN** keys. Wait for cal to end.

(3) When **Setup # 2** is displayed press the **BEGIN** key.

(4) Using the numerical keypad, adjust the displayed **Meas'd Freq** at each setup to match the measured frequency, then press the **ENTER VALUE** key, for each setup listed in table 13.

Table 13. Adjustment Setup 2 Through 5

Test instrument indications			Typical test requirements
Setup #	Frequency	Amplitude	
2	<10 MHz	1 V pp	Frequency is slightly less than 10 MHz
3	>10 MHz	1 V pp	Frequency is slightly more than 10 MHz
4	~10 MHz	1 V pp	Frequency should be near 10 MHz
5	10 MHz	1 V pp	Frequency should be 10 MHz ±1 ppm

(5) Disconnect frequency counter from TI and connect equipment as shown in figure 1 below.

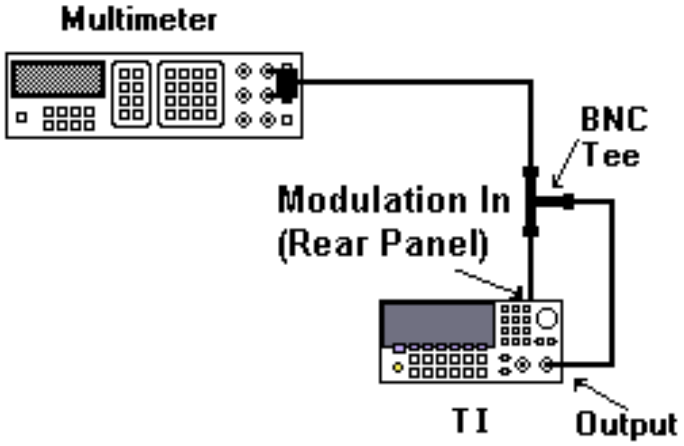

Figure 1. ADC adjustment hookup.

(6) Set the multimeter to display 5 ½ digits and dc volts measurement.

(7) With **Setup # 6** highlighted press the **BEGIN** key then using the numerical keypad, adjust the displayed **Meas'd Voltage** to match the multimeter dc volt indication, then press the **ENTER VALUE** key.

(8) Disconnect cable from the rear panel **Modulation In** and with **Setup # 7** highlighted press the **BEGIN** key.

(9) Set the multimeter to measure offset-compensated, four-wire ohms, with 100 NPLC integration. Connect equipment as shown in figure 2.

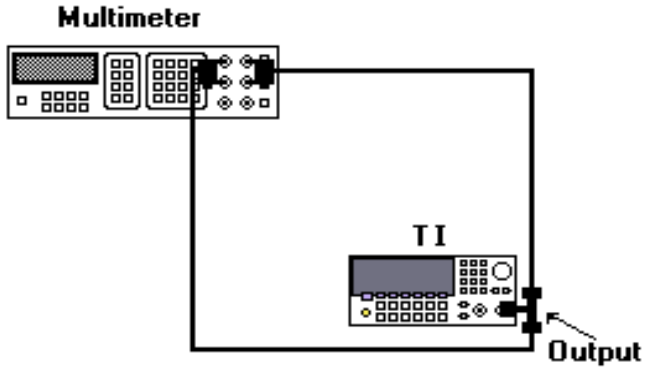

Figure 2. Output impedance adjustment hook-up.

(10) Using the numerical keypad, adjust the displayed **Meas'd Imped** at each setup to match the measured impedance then press the **ENTER VALUE** key. Repeat this technique for each setup listed in table 14.

Table 14. Adjustment Setup #8 Through #17

Step #	Typical test requirements
8	-30 dB range with distortion filter
9	-20 dB range with distortion filter
10	-10 dB range with distortion filter
11	0 dB range with distortion filter
12	+10 dB range with distortion filter
13	-30 dB range without distortion filter
14	-20 dB range without distortion filter
15	-10 dB range without distortion filter
16	0 dB range without distortion filter
17	+10 dB range without distortion filter

(11) Disconnect the four-wire ohms connection and reconnect the TI **Output** to the multimeter **INPUT HI** and **LO**. Set the multimeter to measure DCV.

(12) Press the **BEGIN** key, using the numerical keypad, adjust the displayed **Meas'd Voltage** to match the multimeter indication, then press the **ENTER VALUE** key. Repeat this technique for each setup listed in table 15. (Entered values are rounded to the nearest 100 μV.)

Table 15. Adjustment Setup #18 Through #33.

Step #	Nominal DC level	Typical test requirements
18	+0.015 V	Output of –30 dB range
19	-0.015 V	Output of –30 dB range
20	+0.05 V	Output of –20 dB range
21	-0.05 V	Output of –20 dB range
22	+0.15 V	Output of –10 dB range
23	-0.15 V	Output of –10 dB range
24	+0.50 V	Output of 0 dB range
25	-0.50 V	Output of 0 dB range
26	+0.15 V	Output of –10 dB range (Amplifier in)
27	-0.15 V	Output of –10 dB range (Amplifier in)
28	+0.50 V	Output of 0 dB range (Amplifier in)
29	-0.50 V	Output of 0 dB range (Amplifier in)
30	+1.5 V	Output of +10 dB range (Amplifier in)
31	-1.5 V	Output of +10 dB range (Amplifier in)
32	+5 V	Output of +20 dB range (Amplifier in)
33	-5 V	Output of +20 dB range (Amplifier in)

(13) Set the multimeter to measure V rms.

(14) Press the **BEGIN** key, using the numerical keypad, adjust the displayed **Meas'd Vrms** to match the multimeter indication, then press the **ENTER VALUE** key. Repeat this technique for each setup listed in table 16.

Table 16. Adjustment Setup #34 Through #43.

Test instrument indications			Typical test requirements
Setup #	Frequency	Nominal amplitude	
34	1 kHz	0.56 Vrms	Flatness for 0 dB, Elliptical Filter
35	100 kHz	0.56 Vrms	Flatness for 0 dB, Elliptical Filter
36	1 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
37	100 kHz	0.56 Vrms	Flatness for 0 dB, Linear Phase Filter
38	1 kHz	1.7 Vrms	Flatness for +10 dB, Elliptical Filter
39	100 kHz	1.7 Vrms	Flatness for +10 dB, Elliptical Filter
40	1 kHz	5.6 Vrms	Flatness for +20 dB, Elliptical Filter
41	100 kHz	5.6 Vrms	Flatness for +20 dB, Elliptical Filter
42	1 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter
43	100 kHz	5.6 Vrms	Flatness for +20 dB, Linear Phase Filter

(15) Disconnect multimeter from TI and connect power meter to TI **Output**.

(16) Press the **BEGIN** key, using the numerical keypad; adjust the displayed **Meas'd dBm** level to match the power meter indication, then press the **ENTER VALUE** key. Repeat this technique for each setup listed in table 17.

Table 17. Adjustment Setup #44 Through #101

Test instrument indications				Typical test requirements
Setup #	Frequency	Nominal amplitude		
44	100 kHz	0.28 Vrms	2 dBm	Power meter reference for 0 dB range
45	200 kHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
46	500 kHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
47	1.5 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
48	5 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
49	10.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
50	25.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
51	200 kHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
52	500 kHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
53	1.5 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
54	5 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
55	10.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
56	25.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
57	40.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
58	50.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
59	60.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
60	65.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
61	70.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
62	75.1 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
63	79.9 MHz	0.28 Vrms	2 dBm	Flatness for 0 dB, Elliptical Filter
64	25.1 MHz	0.15 Vrms	-4 dBm	Flatness reference measurement
65	79.9 MHz	<0.15Vrms	-4 dBm	Flatness high frequency measurement
66	100 kHz	0.9 Vrms	12 dBm	Power meter reference for +10 dB range
67	200 kHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
68	500 kHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter

Table 17. Adjustment Setup #44 Through #101 - Continued

Test instrument indications				Typical test requirements
Setup #	Frequency	Nominal amplitude		
69	1.5 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
70	5 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
71	10.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
72	25.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
73	40.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
74	50.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
75	60.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
76	65.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
77	70.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
78	75.1 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter
79	79.9 MHz	0.9 Vrms	12 dBm	Flatness for +10 dB, Elliptical Filter

(17) Place a 10 dB attenuator between the TI and the power meter.

(18) Press the **BEGIN** key, using the numerical keypad; adjust the displayed **Meas'd dBm** level to match the power meter indication plus the attenuator test report value, then press the **ENTER VALUE** key. Repeat this technique for each setup listed in table 18.

Table 18. Adjustment Setup #80 Through #101

Test instrument indications				Typical test requirements
Setup #	Frequency	Nominal amplitude		
80	100 kHz	2.8 Vrms	22 dBm	Power meter reference for 20 dB range
81	200 kHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
82	500 kHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
83	1.5 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
84	5 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
85	10.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
86	25.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
87	40.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
88	50.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
89	60.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
90	65.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
91	70.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
92	75.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
93	79.9 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Elliptical Filter
94	200 kHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
95	500 kHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
96	1.5 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
97	5 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
98	10.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
99	25.1 MHz	2.8 Vrms	22 dBm	Flatness for +20 dB, Linear Phase Filter
100	60.1 MHz	3.4 Vrms	24 dBm	Flatness reference measurement
101	79.9 MHz	~3.4 Vrms	23 dBm	Flatness high frequency measurement

(19) Disconnect power meter from TI and connect oscilloscope **Vertical 1** input to TI **Output**.

(20) Set the oscilloscope to measure the pulse width.

(21) Press the **Begin** key, using the numerical keypad, adjust the displayed **Meas'd Time** to match the measured pulse width, then press the **ENTER VALUE** key. Repeat this technique for each setup listed in table 19.

Table 19. Adjustment Setup #102 and #103

Setup #	Frequency	Amplitude	Nominal pulse width	Typical test requirements
102	8 MHz	1 V pp	30 ns	Narrow pulse width
103	8 MHz	1 V pp	42 ns	Wide pulse width

(22) Setup the oscilloscope for a 50Ω input and to measure the rise time.

(23) Press the **Begin** key, using the numerical keypad, adjust the displayed **Meas'd Time** to match the measured rise time, then press the **ENTER VALUE** key. Repeat this technique for each setup listed in table 20.

Table 20. Adjustment Setup #104 Through #114

Setup #	Frequency	Amplitude	Nominal rise time	Typical test requirements
104	100 Hz	1 V pp	3.2 ns	Fastest transition range 0
105	100 Hz	1 V pp	4.5 ns	Mid transition range 0
106	100 Hz	1 V pp	64 ns	Slowest transition range 0
107	100 Hz	1 V pp	8 ns	Fastest transition range 1
108	100 Hz	1 V pp	241 ns	Slowest transition range 1
109	100 Hz	1 V pp	161 ns	Fastest transition range 2
110	100 Hz	1 V pp	4.9 µs	Slowest transition range 2
111	100 Hz	1 V pp	2.6 µs	Fastest transition range 3
112	100 Hz	1 V pp	82 µs	Slowest transition range 3
113	100 Hz	1 V pp	57 µs	Fastest transition range 4
114	100 Hz	1 V pp	1.75 ms	Slowest transition range 4

(24) Setup the oscilloscope for a 50Ω input and to measure the duty cycle.

(25) Press the **Begin** key, using the numerical keypad, adjust the displayed **Meas'd Duty Cycle** to match the measured duty cycle, then press the **ENTER VALUE** key. This step and typical values are listed in table 21.

Table 21. Adjustment Setup #115

Setup #	Frequency	Amplitude	Nominal duty cycle	Typical test requirements
115	25.1 MHz	1 V pp	50%	Fastest transition range 0

NOTE

The factory default secure code is **AT33250A**. If the secure code has been changed and is now unknown the manufacturer's manual, section 4, describes how to unsecure the instrument without a security code.

(26) Enter the secure code using the knob to change the displayed character, and the arrow keys to move to the next character.

(27) Press **Secure** key and **Done** key.

(28) Perform paragraphs **8 a** through **12 a** to verify that alignment was successful.

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:

Official:

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

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army

0325402

Distribution:

To be distributed in accordance with IDN 344729, requirements for calibration procedure TB 9-6625-2327-35.

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.