DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR

TRACKING GENERATOR-COUNTER,

HEWLETT-PACKARD MODEL 8443A

Headquarters, Department of the Army, Washington, DC
8 November 1983

TB 9-6625-2044-35, 12 May 1982, 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
7 and 8	7 and 8

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*This bulletin supersedes TB 11-6625-2858-35, 17 February 1978, including all changes

SECTION I

IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Tracking Generator-Counter, Hewlett-Packard Model 8443A.
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 technique.

2. DA Form 2416 (Calibration Data Card)

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25-1. DA Form 2416 must be annotated in accordance with TB 750-25-1 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 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
Time base	Frequency: 1 MHz Stability: < 3 parts in 10-9 per day
Amplitude	Range: <-120 dBm to +10 dBm in 10 and 1 dB steps Accuracy: ±0.2 dB, 10 dB steps ±0.1 dB, 1 dB steps
Output flatness	±0.5 dB from 100 kHz to 110 MHz'
External input sensitivity	50 ohms from 10 kHz to 120 MHz -10 dBm minimum, +25 dBm maximum

[1] Procedure limitation: 1 to 110 MHz.

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. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. 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 listed in table 3 are issued as indicated in paragraph 4 above and are used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required

Item	Common name and/or (official nomenclature)	Minimum use specifications	Manufacturer, model, and (part number)
A1	ATTENUATION CALIBRATOR	Frequency: 10 to 110 MHz Accuracy: ±0.05 dB/10 dB steps ±0.025 dB/1 dB steps	Weinschel Engineering, Model VM-4A (VM-4A)
A2	AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ±1%	General Radio, Model W10MT3AS3 (7910809)
A3	DC VOLTMETER	Range: 0 to 180 V Accuracy: ±0.05%	Hewlett-Packard, Model 3490AOPT060 (3490AO-PT060)
A4	FREQUENCY DIFFERENCE METER	Range: 1 MHz Resolution: ±1 part in 10^{-10}	TRACOR, Model 527E (527E)
A5	POWER METER	Range: −7 dBm Accuracy: ±1% FS	Hewlett-Packard, Model E12-432A (MIS-30525) w/thermistor mount H-75-478A
A6	SIGNAL GENERATOR	Range: 10 to 120 MHz Accuracy: ±1 dB	Hewlett-Packard, Model 8640B-OPTH66 (MIS-28707 Type 1)
A7	SPECTRUM ANALYZER	Range: 1 to 110 MHz	Hewlett-Packard, Models 8553B, 8552B, 140T, or equivalent[1]
A8	STANDARD OSCILLATOR	Frequency: 1 MHz Accuracy: ±7 parts in 10^{-10}	Hewlett-Packard, Model 105A (MIS-10223)
A9	TEST OSCILLATOR	Range: 10 kHz to 10 MHz Output: −10 dBm	Hewlett-Packard, Model 652A (MIS-10224)
A10	VARIABLE ATTENUATOR	Range: 0 to 20 dB	Hewlett-Packard, Model 355D (355D)

[1] Must be supplied and be compatible with TI

Table 3. Accessories Required

Item	Common name and/or (official nomenclature)	Description and (part number)
B1	ADAPTER	BNC plug to BNC plug (MS35176-491B)
B2	ADAPTER	BNC plug to N jack (10519458)
B3	CABLE[1]	30-in., RG-58/U; BNC plug terminations (7907467)
B4	CABLE (INTERCONNECTING)	H-P 08443-60049 (furnished with TI)
B5	LEAD[1]	32-in., single banana plug to test hook (red) (7915941-1)

[1] Two required

SECTION III
PRELIMINARY OPERATIONS

6. Preliminary Instructions

a. The instructions outlined in this section are preparatory to the calibration process. Personnel should become familiar with the applicable sections before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

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

NOTE

When indications specified in paragraphs 8 through 11 are not within tolerance, perform the power supply check prior to making adjustments After adjustments are made, repeat paragraphs 8 through 11 Do not perform power supply check if all other parameters are within tolerance.

NOTE

Unless otherwise specified, all controls and control settings refer to the TI

7. Equipment Setup

a. Connect TI to 115-V ac source and allow 72 hours for warmup and stabilization.

NOTE

If TI has been deenergized for more than 72 hours, allow 7-day warmup period before beginning calibration

b. Remove protective covers from TI.

c. Connect autotransformer (A2) to a 115-V ac source and adjust for 115-V output.

d. Connect TI to autotransformer and allow one hour for restabilization.

SECTION IV
CALIBRATION PROCESS

NOTE

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 m this procedure Additional maintenance information is contained m the manufacturer's manual for this TI

8. Time Base

a. Performance Check

(1) Connect equipment as shown in figure 1.

(2) Adjust reference oscillator COARSE and FINE controls on A4 assembly (fig. 2) to obtain minimum frequency difference on frequency difference meter (A4).

(3) Allow 24 hours for reference oscillator stabilization. Frequency drift as indicated on frequency difference meter will be less than 3 parts in 10^{-9}.

b. Adjustments. No further adjustments can be made.

9. Amplitude Range

a. Performance Check

(1) Set controls of variable attenuator (A10) to 20 dB and connect equipment as shown in figure 3.

NOTE

Interconnect TI and spectrum analyzer IA7) rear connectors, using cable (B4), and leave connected for remainder of calibration.

(2) Position TI controls as listed in (a) through *(f) below:*

(a) MODE switch to MARKER.
(b) RESOLUTION switch to 1 kHz.
(c) TENS switch to + 10.
(d) UNITS switch to 0 (zero).
(e) TENTHS switch to 0 (zero).
(f) FUNCTION switch to TRACK ANALYZER.

NOTE

FUNCTION switch not included on some models

(3) Position controls of spectrum analyzer as listed in (a) through (h) below:

(a) FREQUENCY control to 30 MHz.
(b) BANDWIDTH switch to 50 Hz.
(c) SCAN WIDTH switch to ZERO.
(d) INPUT ATTENUATION switch to 0 (zero).
(e) SCAN TIME PER DIVISION switch to 1 MILLISECOND.
(f) LOG REF LEVEL switch to -40 dBm.

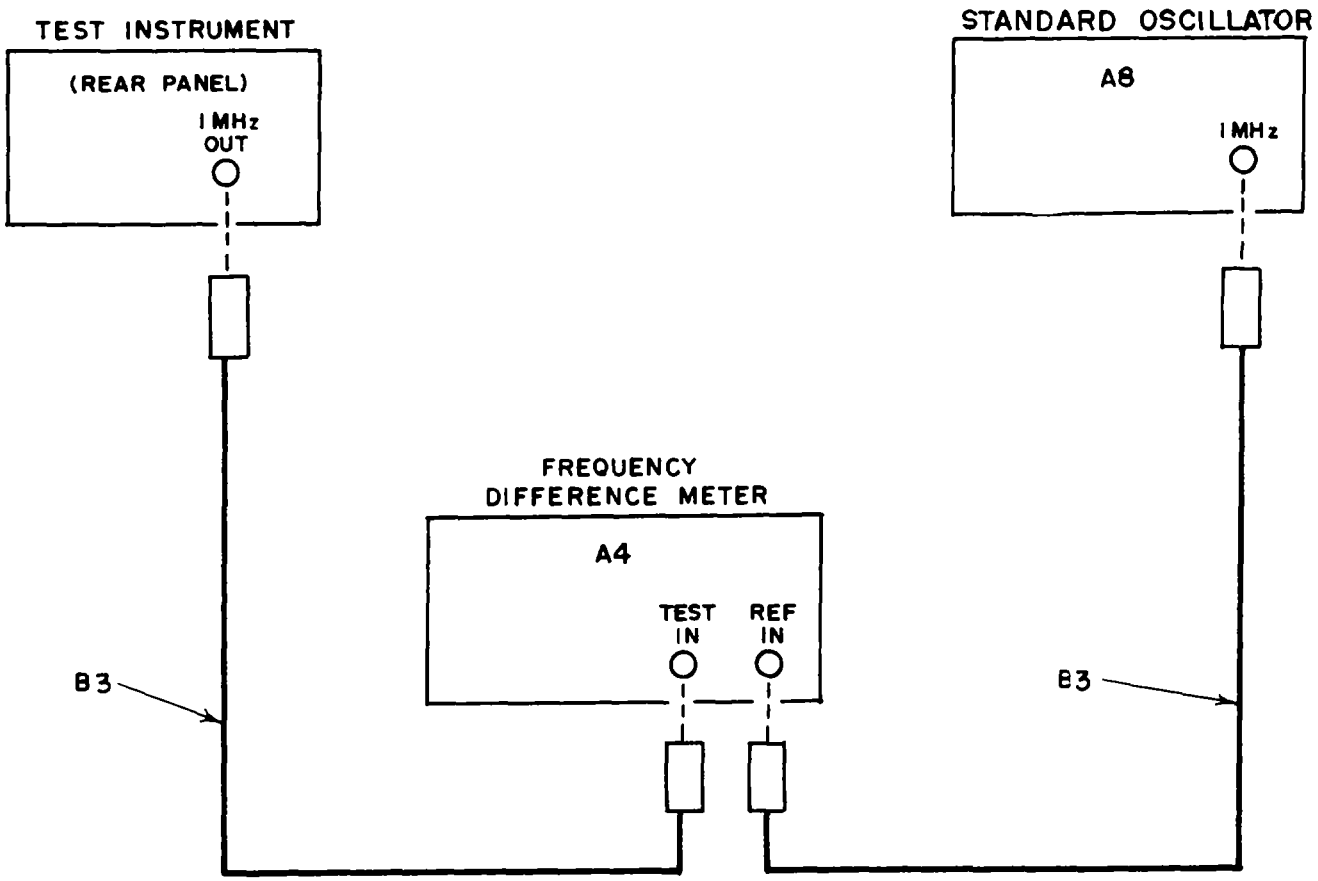

Figure 1. Time base check-equipment setup

(*g*) LOG REF LEVEL vernier control to 0 (zero).

(h) LOG/LINEAR switch to LOG.

(4) Readjust spectrum analyzer FREQUENCY control, if required, to obtain 30-MHz indication on TI.

(5) Adjust controls of attenuation calibrator (A1) for MANUAL MODE, single channel operation at 30 MHz, and note reference measurement.

(6) Set TI TENS switch to 0 (zero). Attenuation calibrator will indicate a change of between 9.8 and 10.2 dB.

(7) Repeat technique of (6) above for TI switch settings and indications listed in table 4.

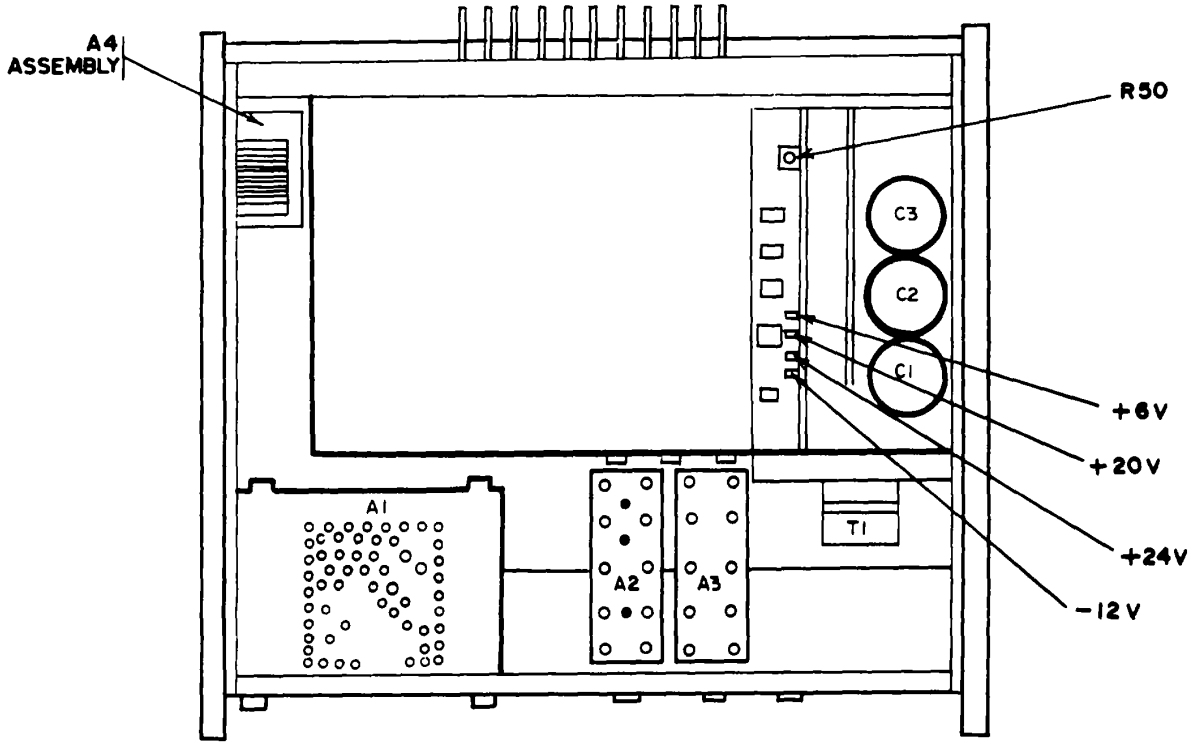

Figure 2. Top chassis view - component location.

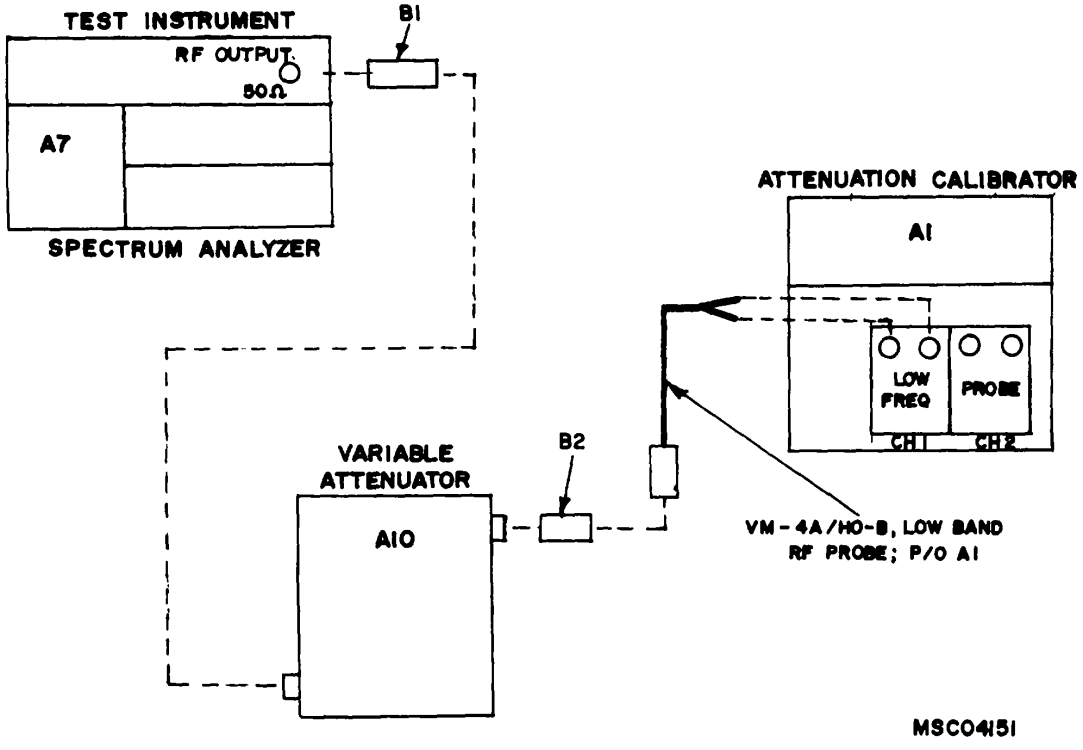

Figure 3. Amplitude range - equipment setup.

Table 4. TENS Attenuator Accuracy

Test instrument TENS switch settings (dBm)	Attenuation calibrator change indications (dB)	
	Min	Max
−10	19.8	20.2
−20	29.8	30.2
−30	39.8	40.2
−40	49.8	50.2
−50	59.8	60.2
−60[1]	69.8	70.2

Attenuator settings above −60 dB are combinations of certified positions listed in table 4 Normally it is not necessary to certify remaining positions

(8) Set TI TENS switch to +10 and note reference measurement set in (5) above.

(9) Set TI UNITS switch to -1. Attenuation calibrator (A1) will indicate a change of between .90 and 1.1 dB.

(10) Repeat technique of (9) above for TI switch settings and indications listed in table 5.

Table 5. UNITS Attenuator Accuracy

Test instrument UNITS switch settings	Attenuation calibrator change indications (dB)	
	Min	Max
−2	1.90	2.1
−3	2.90	3 1
−4	3.90	4.1
−5	4.90	5.1
−6	5.90	6 1
−7	6.90	7.1
−8	7.90	8.1
−9	8.90	9.1
−10	9.90	10 1
−11	10.90	11.1
−12	11 90	12.1

b. Adjustments. No adjustments can be made.

10. Output Flatness

a. Performance Check

(1) Position TI controls as listed in (a) through *(d) below:*

(a) Attenuator switches to 0 dB.

(b) MODE switch to SCAN HOLD.

(c) MARKER POSITION control fully ccw.

(d) FUNCTION switch to TRACK ANALYZER.

NOTE

FUNCTION switch not included on some models

(2) Connect TI RF OUT to power meter (A5), using adapter (B2) and thermistor mount (H75-478A) with cable

(3) Set spectrum analyzer (A7) SCAN MODE switch to MAN and adjust frequency for 1-MHz indication on TI.

(4) Adjust TI output attenuation for a 0-dB reference on power meter

(5) Slowly tune spectrum analyzer through range of 1 MHz to 110 MHz while observing power meter. Power meter will indicate 0 dB +0.5 dB throughout frequency range.

b. Adjustments. No adjustments can be made.

11. External Input Sensitivity

a. Performance Check

(1) Set TI MODE switch to EXTERNAL.

(2) Connect test oscillator (A9) to TI COUNTER INPUT connector, using cable (B3).

(3) Adjust test oscillator frequency to 10 kHz and amplitude to minimum.

(4) Slowly increase test oscillator amplitude until TI displays a stable indication of applied frequency Test oscillator output will not exceed -10 dBm.

(5) Repeat technique of (3) and (4) above at test oscillator frequencies of 100 kHz, 1 MHz, and 10 MHz.

(6) Substitute signal generator (A6) for test oscillator.

(7) Repeat technique of (3) and (4) above at signal generator frequencies of 30, 50, 100, and 120 MHz.

b. Adjustments. No adjustments can be made

12. Power Supply

NOTE

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

a. Performance Check. Connect dc voltmeter (A3) to +24 V test point (fig. 2) and chassis ground, using two leads (B5). If dc voltmeter does not indicate between 23.990 and 24.010 V, perform b below.

b. Adjustments. just R50 (fig 2) for a 24.00-V indication on dc voltmeter (R).

13. Final Procedure

a. Deenergize and disconnect all equipment and reinstall protective cover on TI.

b. When all parameters are within tolerance, annotate and affix DA Label 80 (US Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (US Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (US Army Calibration System Rejected Instrument) and inform the owner/user accordingly In accordance with TB 750-25-1.

By Order of the Secretary of the Army:

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Chief of Staff

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ROBERT M. JOYCE
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The Adjutant General

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