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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR MICROWAVE PULSE COUNTER, TD-1338 (EIP, MODEL 451) AND AUTOHET FREQUENCY COUNTER EIP, MODEL 351D( )

Headquarters, Department of the Army, Washington, DC
5 July 2000

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*This bulletin supersedes TB 9-6625-1978-35, dated 5 July 1993.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Microwave Pulse Counter, TD-1338 (EIP, Model 451) and Autohet Frequency Counter, EIP, Model 351D( ). The manufacturers' manuals were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. The TD- 1338 is the military designator for EIP, Model 451.

b. Time and Technique. The time required for this calibration is approximately 2 hours per item, using the microwave 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
Time base	Frequency: 10 MHz Aging rate: <1 x 10^{-9} short term after 1 second
Sensitivity: Model TD-1338 (EIP, Model 451)	Band A (Opt P2): 300 to 950 MHz, -10 dBm peak Band B: 925 MHz to 10 GHz, -10 dBm peak 10 to 18 GHz, -5 dBm peak
Model 351D ( )	Band IA: 20 Hz to 135 MHz, 25 mV rms Band IB: 10 to 300 MHz, -20 dBm (22 mV rms) Band II: 100 to 150 MHz, -15 dBm (40 mV rms) 150 to 850 MHz, -20 dBm (22 mV rms) Band III: 825 MHz to 1.1 GHz, -25 dBm (12 mV rms) 1.1 to 12.4 GHz, -30 dBm (7 mV rms) 12.4 to 18 GHz, -25 dBm (12 mV rms)

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. 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)
FREQUENCY DIFFERENCE METER	Resolution: ±1 part in 10^9	Tracor, Model 527E (527E)
FUNCTION GENERATOR	Function: Sinewave, 50Ω Range: 20 Hz to 10 MHz Output: 1 to 71 mVp-p	(SG-1288/G)
MULTIMETER	Range: -5.19 to +12.01 V dc Accuracy: ±0.05%	John Fluke, Model 8840A/AF (AN/GSM-64D)
TIME/FREQUENCY WORKSTATION	Range: 1 MHz Accuracy: ±2.5 x 10^{-10}	Autek Systems Corp., Model 620 (MIS-38946)
SIGNAL GENERATOR	Range: 10 MHz to 18 GHz Output: -50 to -5 dBm	Wiltron, Model 68347M

SECTION III
CALIBRATION PROCESS FOR
MICROWAVE PULSE COUNTER, TD-1338
(EIP, MODEL 451)

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. 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 the 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. Remove TI protective cover.

b. Position controls as listed in (1) through (5) below:

(1) **SAMPLE RATE** control fully ccw.

(2) **RESOLUTION** switch to **1 ms GATE**.

(3) **BAND** select switch to **A 950 MHz**.

(4) **MANUAL SELECT/AUTO SWEEP** switch to **AUTO SWEEP**.

(5) **PRESET/START FREQUENCY** thumb-wheel switch to **00.0 GHz**.

c. Press **POWER** pushbutton to on and allow at least 1 hour for stabilization.

8. Input Sensitivity

a. Performance Check

(1) Connect signal generator **RF Output** to TI **BAND A 300-950 MHz** input.

(2) Set signal generator frequency to 300 MHz and level output to –50 dBm.

(3) Slowly increase signal generator level output until TI displays a stable count of applied frequency. Signal generator level output will not exceed -10 dBm.

(4) Repeat (2) and (3) above with signal generator frequency set to 500, 700, and 950 MHz.

(5) Disconnect signal generator **RF Output** from TI.

(6) Set TI **BAND** select switch to **B 18 GHz**.

(7) Connect signal generator **RF Output** to TI **BAND B 925 MHz – 18 GHz** input.

(8) Set signal generator frequency to 925 MHz and level output to –50 dBm.

(9) Slowly increase signal generator level output until TI displays a stable count of applied frequency. Signal generator level output will not exceed -10 dBm.

(10) Repeat (8) and (9) above with signal generator frequency set to 1, 5, and 10 GHz.

(11) Set signal generator frequency to 15 GHz and level output to –50 dBm.

(12) Slowly increase signal generator level output until TI displays a stable count of applied frequency. Signal generator level output will not exceed -5 dBm.

(13) Repeat (11) and (12) above with signal generator frequency set to 18 GHz.

b. Adjustments. No adjustments can be made.

9. Power Supply

a. Performance Check

NOTE

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

(1) Connect multimeter between +12V test point (fig. 1) and chassis ground. If multimeter does not indicate between 11.99 and 12.01 V dc, adjust A107R7 (fig. 1).

(2) Connect multimeter between +5V test point (fig. 1) and chassis ground. If multimeter does not indicate between 4.99 and 5.01 V dc, adjust A107R15 (fig. 1).

(3) Connect multimeter between -12V test point (fig. 1) and chassis ground. If multimeter does not indicate between -11.99 and -12.01 V dc, adjust A107R21 (fig. 1).

(4) Connect multimeter between -5V test point (fig. 1) and chassis ground. If multimeter does not indicate between -5.19 and -5.21 V dc, adjust A107R31 (fig. 1).

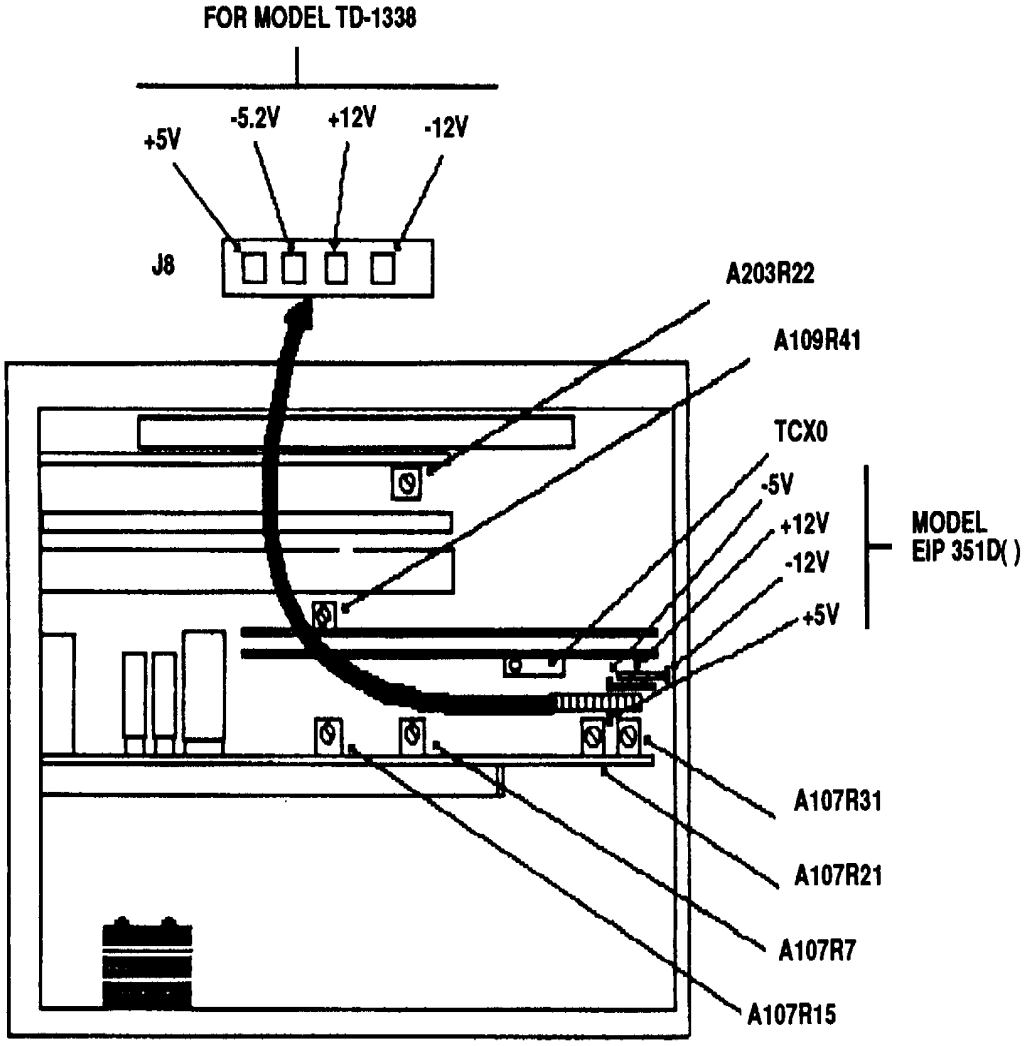

Figure 1. Test instrument - top view.

10. Final Procedure

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

b. Annotate and affix DA label/form in accordance with TB 750-25.

SECTION IV
CALIBRATION PROCESS FOR
AUTOHET FREQUENCY COUNTER
EIP, MODEL 351D( )

11. Preliminary Instructions

a. The instructions outlined in paragraphs **11** and **12** 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. When indications specified in paragraphs **13** through **16** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **13** through **16**. Do not perform the power supply check if all other parameters are within tolerance.

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

12. 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.

NOTE

If TI has been disconnected from line power for more than 24 hours, connect to 115 V ac source for at least 72 hours before beginning calibration.

a. Remove TI protective cover.

b. Press **POWER** pushbutton to on and allow at least 1 hour for stabilization.

13. Time Base Stability

a. Performance Check

(1) Disconnect external time base input, if applicable, from rear panel **10 MHz** jack of TI, and set **TIME BASE INT-EXT** switch to **INT.**

(2) Connect time/frequency workstation **OUTPUT 1 MHz** to frequency difference meter **REF INPUT**.

(3) Connect TI **TIME BASE 10 MHz** (rear panel) to frequency difference meter **SIG INPUT**.

(4) Adjust TCX0 (fig. 1) for frequency difference meter indication of less than 1 part in 10^9.

(5) Disconnect frequency difference meter from TI.

(6) Replace external time base input if removed in (1) above and set **TIME BASE INT-EXT** switch to **EXT.**

b. Adjustments. No further adjustments can be made.

14. Band I Input Sensitivity

a. Performance Check

(1) Position controls as listed in (a) through (c) below:

(a) **SAMPLE RATE** control fully ccw.

(b) **BAND SELECT** switch to **20 Hz - 135 MHz.**

(c) **RESOLUTION** pushbuttons as necessary.

(2) Connect function generator **Function Outputs Unbalanced** to TI **20 Hz - 135 MHz 1 MEG** input using a 50Ω feedthrough termination.

(3) Set function generator for a sinewave, 20 Hz, 71 mVp-p, 50Ω output. TI will display a stable count of applied frequency.

(4) Adjust function generator frequency from 20 Hz to 10 MHz. TI will display a stable count of applied frequency.

(5) Disconnect function generator and 50Ω feedthrough termination from TI.

(6) Connect signal generator **RF Output** to TI **20 Hz - 135 MHz 1 MEG** input using a 50Ω feedthrough termination.

(7) Set signal generator frequency to 10 MHz and level output to –19 dBm. TI will display a stable count of applied frequency.

(8) Adjust signal generator frequency from 10 to 135 MHz. TI will display a stable count of applied frequency.

(9) Disconnect signal generator and 50Ω feedthrough termination from TI.

(10) Set **BAND SELECT** switch to **10 MHz - 300 MHz**.

(11) Connect signal generator **RF Output** to TI **10 MHz - 300 MHz 50 OHM** input.

(12) Set signal generator frequency to 10 MHz and level output to –20 dBm. TI will display a stable count of applied frequency.

(13) Adjust signal generator frequency from 10 to 300 MHz. TI will display a stable count of applied frequency.

b. Adjustments. No adjustments can be made.

15. Band II Input Sensitivity

a. Performance Check

(1) Set **BAND SELECT** switch to **100 MHz - 850 MHz.**

(2) Connect signal generator **RF Output** to TI **100 MHz - 850 MHz 50 OHM** input.

(3) Set signal generator frequency to 100 MHz and level output to –50 dBm.

(4) Slowly increase signal generator level output until TI displays a stable count of applied frequency. If signal generator level output exceeds -15 dBm, perform **b** below.

(5) Repeat (3) and (4) above with signal generator frequency set to 150 MHz.

(6) Set signal generator frequency to 850 MHz and level output to –50 dBm.

(7) Slowly increase signal generator level output until TI displays a stable count of applied frequency. If signal generator level output exceeds -20 dBm and no adjustment was previously made, perform **b** below.

b. Adjustments

(1) Set signal generator frequency to 100 MHz and level output to -15 dBm.

(2) Adjust A109R41 (fig. 1) until TI displays a stable count of applied frequency (R).

(3) Slowly reduce signal generator level output until TI display becomes erratic.

(4) Readjust Al09R41 (fig. 1) until TI indication drops to all zeros.

16. Band III Input Sensitivity

a. Performance Check

(1) Set **BAND SELECT** switch to **825 MHz - 18 GHz**.

(2) Connect signal generator **RF Output** to TI **825 MHz - 18 GHz 50 OHM** input

(3) Set signal generator frequency to 825 MHz and level output to –50 dBm.

(4) Slowly increase signal generator level output until TI displays a stable count of applied frequency. If signal generator level output exceeds -25 dBm, perform **b** below.

(5) Repeat (3) and (4) above with signal generator frequency set to 1.1 GHz.

(6) Set signal generator frequency to 8 GHz and level output to –50 dBm.

(7) Slowly increase signal generator level output until TI displays a stable count of applied frequency. If signal generator level output exceeds -30 dBm, perform **b** below.

(8) Repeat (6) and (7) above with signal generator frequency set to 12.4 GHz.

(9) Set signal generator frequency to 18 GHz and level output to –50 dBm.

(10) Slowly increase signal generator level output until TI displays a stable count of applied frequency. If signal generator level output exceeds -25 dBm, perform **b** below.

b. Adjustments

(1) Set signal generator frequency to 8 GHz and level output to -20 dBm.

(2) Slowly reduce signal generator level output while pressing **RESET** switch until TI no longer accurately displays applied frequency.

(3) Adjust A203R22 (fig. 1) until TI again displays a stable indication of applied frequency (R).

(4) Repeat (2) and (3) above until TI displays a stable indication of applied frequency at -30 dBm or less input level.

NOTE

Optimum setting of A203R22 (fig. 1) provides stable display of applied frequency at -30 dBm or less and an indication of 0 below the threshold level.

17. Power Supply

NOTE

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

a. Performance Check

(1) Connect multimeter between -5.2V test point (fig. 1) and chassis ground. If multimeter does not indicate between -5.19 and -5.21 V dc, adjust A107R31 (fig. 1).

(2) Connect multimeter between -12V test point (fig. 1) and chassis ground. If multimeter does not indicate between -11.99 and -12.01 V dc, adjust A107R21 (fig. 1).

(3) Connect multimeter between +12V test point (fig. 1) and chassis ground. If multimeter does not indicate between 11.99 and 12.01 V dc, adjust A107R7 (fig. 1).

(4) Connect multimeter between +5V test point (fig. 1) and chassis ground. If multimeter does not indicate between 4.99 and 5.01 V dc, adjust A107R15 (fig. 1).

18. 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:

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