*TB 9-6625-2365-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR ELECTRONIC COUNTER ANRITSU, MODELS MF2414B AND MF2414B OPTION 003

Headquarters, Department of the Army, Washington, DC
2 October 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, U.S. 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 send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

*This bulletin supersedes TB 9-6625-2365-24, dated 4 January 2008.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Electronic Counter, Anritsu, Models MF2414B and MF2414B Option 003. 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. Variations among models are described in text.

b. Time and Technique. The time required for this calibration is approximately 2 hours, using the dc and low 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 in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Time base	Frequency: 10 MHz Stability: <2 X 10^{-8}/day (after 24 hour warm-up) <5 X 10^{-10}/day (after 48 hour warm-up) (option 003)
Input 2	Frequency range: 10 Hz to 1 GHz Accuracy: ±1 count ±time base accuracy X measurement frequency ±trigger error (10 Hz to 10 MHz) ±1 count ±time base accuracy X measurement frequency (10 MHz to 1 GHz) Sensitivity: 50 Ω: 10 MHz to 1 GHz, 25 mVrms 1MΩ: 10 Hz to 10 MHz, 25 mVrms
Input 1	Frequency range: 600 MHz to 40 GHz[1] Accuracy: ±1 count ±time base accuracy X measurement frequency ±Residual error 1(measurement frequency (GHz)/10 count (rms)) Sensitivity: −33 dBm (< 12.4 GHz) −28 dBm (<20 GHz) −25 dBm (<26.5 GHz) dBm = [0.741*f (GHz) -44.6] dBm to +10dBm (≤40 GHz)
Burst mode wave carrier frequency	Frequency range: 600 MHz to 40 GHz[1] Accuracy: ±1 count ±time base accuracy X measurement frequency ± trigger error ±Residual error 2 (measurement frequency (GHz)/2 count (rms)) ±1/Tgw
Width	Pulse width: 100 ns to 100 ms Accuracy: ±20 ns ±time base accuracy X measurement pulse width ± trigger error

[1]Not verified beyond 18 GHz due to standard limitations.

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 Sets 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 the calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
FREQUENCY DIFFERENCE METER	Range: 10 MHz Resolution: 1.25 part in 10^{-10} per day	Tracor, Model 527E (527E)
FUNCTION GENERATOR	Range: 10 Hz to 10 MHz Accuracy: ±0.00025 Hz of output frequency display Voltage: 25 mV rms	Agilent, Model 33250A (33250A)
POWER METER W/POWER SENSORS	Frequency range: 50 MHz to 18 GHz Power range: -19 to -33 dBm Accuracy: ±0.7 dB with test report	Agilent, Model 437B (13440045)
POWER SENSOR NO. 1	Frequency range: 100 kHz to 4.2 GHz	Agilent, Model 8482A (13440043)
POWER SENSOR NO. 2	Frequency range: 50 MHz to 18 GHz	Agilent, Model 8485D (8485D)
POWER SPLITTER	Frequency range: 50 MHz to 18 GHz Output port tracking: 50 MHz to 2 GHz: ±0.15 dB 2 to 8 GHz: ±0.2 dB 8 to 18 GHz: ±0.25 dB Insertion loss: -6 dB Accuracy: -0.2 + 1.5 dB	Weinschel, Model 1870A (7916839)
SYNTHESIZED SIGNAL GENERATOR	Frequency range: 10 MHz to 18 GHz Accuracy: ±0.025 Hz of output frequency display Power range: -33 to +4 dBm	Anritsu, Model 68369NV (68369NV)
TIME/FREQUENCY WORKSTATION	Frequency: 10 MHz Accuracy: 1.25 parts in 10^{-10} per day	Datum, Model ET6000-75 (13589305)

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. 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

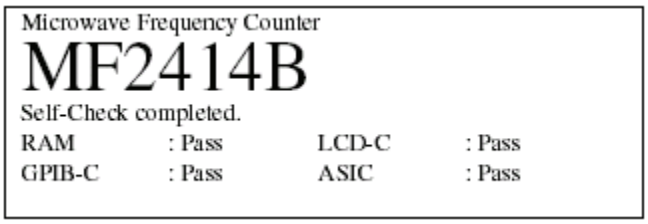
HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

a. Press TI power line switch (rear panel) to on (detent position).

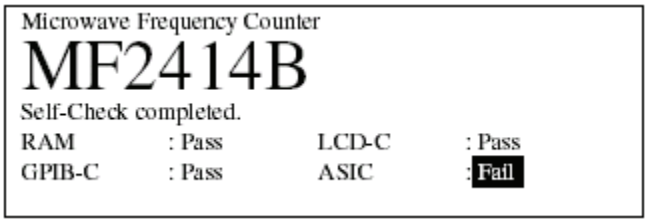
b. Press and hold **Enter** key and press **Stby On** key to **On** (LED lit) and observe self-check routine as discussed below.

(1) Upon power application, TI will perform a self-check and will display the following screen.

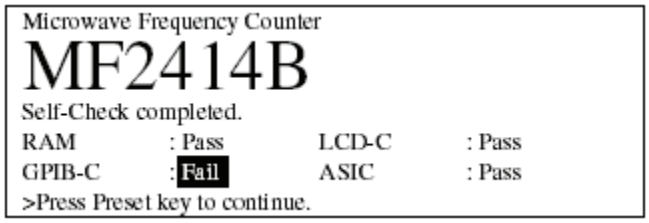
(2) If self-check is successfully completed, the following screen will be displayed for approximately one second and then the measurement screen will appear.



(3) If any of the self-checks fail, the results of the checks failing will be displayed in the following screen. Take corrective action before proceeding.



(4) If the only self-check failure is in the **GPIB-C** area, the following screen will be displayed. Continuation of operation is possible by pressing TI **Preset** key; however, the GPIB port is disabled.



c. Allow TI to warm-up 24 hours (48 hours for option 003) before proceeding to paragraph **8** below.

8. Time Base Stability

a. Performance Check

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

(2) Connect TI **REFERENCE OUTPUT** (rear panel) to frequency difference meter **SIG INPUT**.

(3) Adjust TI **FREQUENCY ADJUST** (side panel) for minimum difference indication on frequency difference meter.

(4) Allow at least 24 hours for stabilization. Frequency difference meter indication will remain within 2 parts in 10^{-8} (5 parts in 10^{-10} for option 003).

b. Adjustments. No further adjustments can be made.

9. Input 2 Sensitivity Test

a. Performance Check

(1) Connect equipment as shown in figure 1.

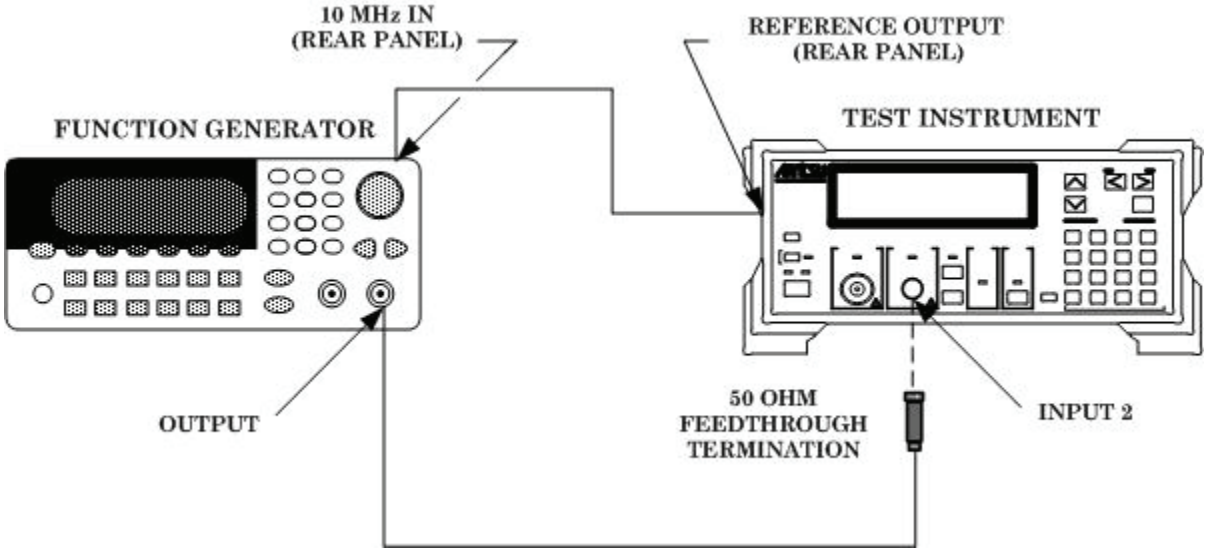


Figure 1. Input 2 sensitivity (1M Ω).

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

(a) **Preset**.
(b) **Menu Input**.
(c) **Resolution <** or **>** until menu **Input CH** on the display is selected.
(d) **Enter** (**[Input 2]** selected).
(e) **Resolution <** or **>** until menu **Impd2** on the display is selected.
(f) **Enter** (**[1M Ω]** selected).
(g) **Resolution <** or **>** until menu **ATT2** on the display is selected.
(h) **Enter** (**[Off]** selected).
(i) **Return to Meas**.
(j) **Resolution >** (to 0.001Hz resolution).

(3) Set function generator square wave mode frequency to 10 Hz and amplitude controls for 25 mV rms output. TI will indicate within limits specified in first row of table 3.

(4) Repeat (3) above for remaining frequencies listed in table 3. TI will indicate within limits specified in table 3.

Table 3. Input 2 Sensitivity (10 Hz to 10 MHz)

Function/arbitrary generator		Test instrument indication limits	
Frequency	Amplitude (rms)	Min	Max
10 Hz	25 mV	9.999	10.001
100 Hz	25 mV	99.999	100.001
1 kHz	25 mV	999.999	1000.001
10 kHz	25 mV	9999.999	10000.001
100 kHz	25 mV	99999.999	100000.001
1 MHz	25 mV	999999.999	1000000.001
10 MHz	25 mV	9999999.999	10000000.001

(5) Connect equipment as shown in figure 2.

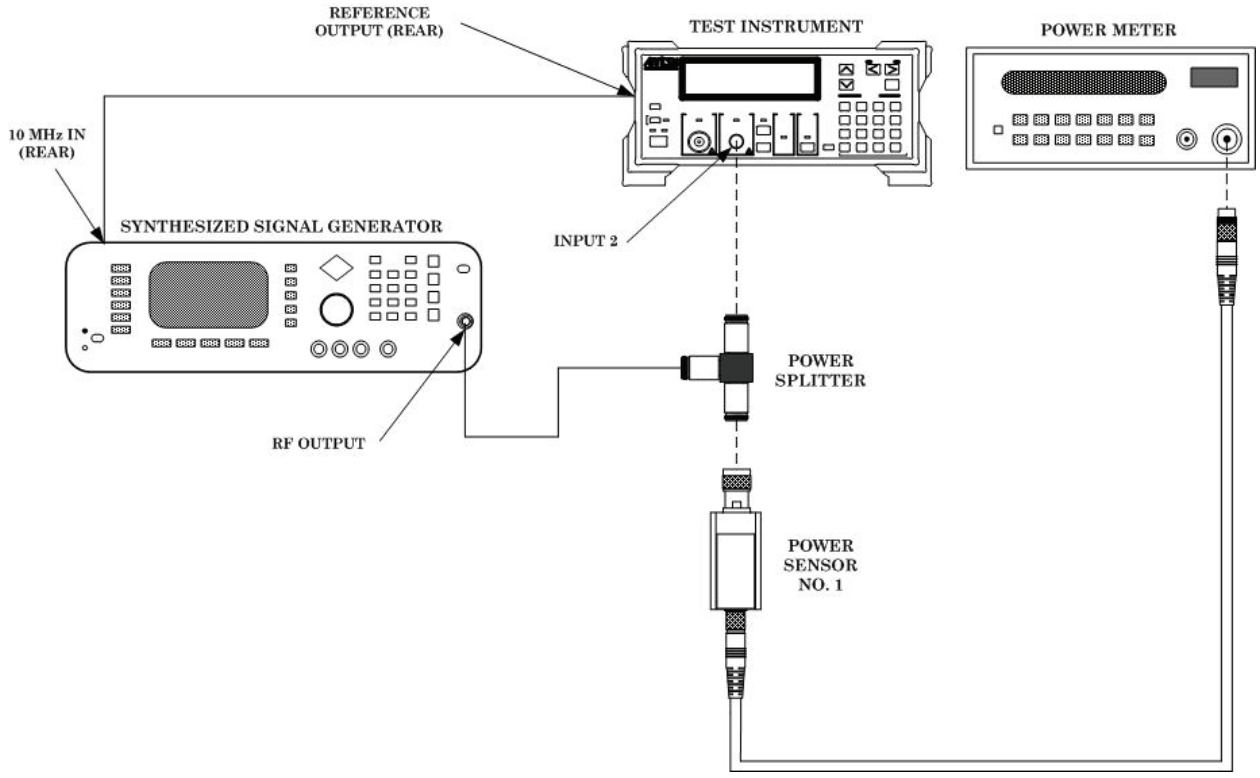


Figure 2. Input 2 sensitivity (50 Ω).

(6) Press TI keys as listed in (a) through (h) below.

(a) **Preset**.
(b) **Menu Input**.
(c) **Resolution <** or **>** until menu **Input CH** on the display is selected.
(d) **Enter** (**[Input 2]** selected).
(e) **Resolution <** or **>** until menu **ATT2** on the display is selected.
(f) **Enter** (**[Off]** selected).
(g) **Return to Meas**.

(h) **Resolution < >** (to 0.1Hz resolution).

(7) Set synthesized signal generator frequency to 10 MHz and RF output amplitude controls for a -19.0 dBm indication on power meter. TI will indicate within limits specified in first row of table 4.

(8) Repeat (7) above for remaining frequencies listed in table 4. TI will indicate within limits specified in table 4.

Table 4. Input 2 Sensitivity (10 MHz to 1 GHz)

Synthesized signal generator	Power meter	Test instrument indication limits (Hz)	
Frequency	Indication (dBm)	Min	Max
10 MHz	-19.0	9999999.9	10000000.1
100 MHz	-19.0	99999999.9	100000000.1
500 MHz	-19.0	499999999.9	500000000.1
1 GHz	-19.0	999999999.9	1000000000.1

(9) Reduce all outputs to minimum and disconnect equipment setup.

b. Adjustments. None.

10. Input 1 Sensitivity Test (600 MHz to 18 GHz)

a. Performance Check

(1) Connect equipment as shown in figure 3 below.

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

(a) **Preset**.
(b) **Menu Freq**.
(c) **Resolution <** or **>** until menu **Count** on the display is selected.
(d) **Enter** (**[Normal]** selected).
(e) **Return to Meas**.
(f) **Resolution <** or **>** (to 0.1 Hz resolution).

(3) Adjust synthesized signal generator frequency to 600 MHz and RF output amplitude controls for a -33 dBm indication on power meter. TI will indicate within limits in first row of table 5.

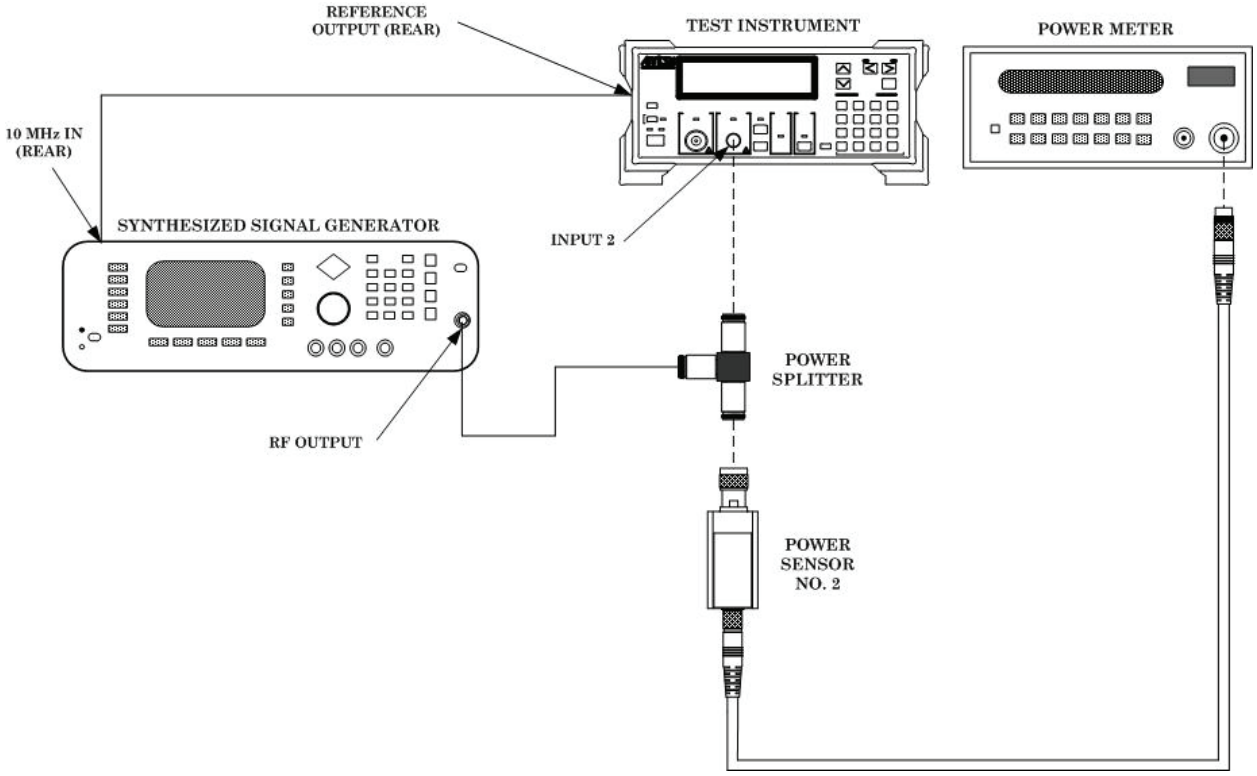


Figure 3. Input 1 sensitivity (600 MHz to 18 GHz).

(4) Repeat (3) above for synthesized signal generator frequencies and power meter indications listed in table 5. TI will indicate within limits specified in table 5.

Table 5. Input 1 Sensitivity (600 MHz to 18 GHz)

Synthesized signal generator	Power meter	Test instrument indication limits (Hz)	
Frequency	Indication (dBm)	Min	Max
600 Hz	-33.0	599999999.9	600000000.1
1 GHz	-33.0	999999999.9	1000000000.1
5 GHz	-33.0	4999999999.8	5000000000.2
10 GHz	-33.0	9999999999.8	10000000000.2
12.5 GHz	-28.0	12499999999.8	12500000000.2
5 GHz	-28.0	14999999999.7	15000000000.3
18 GHz	-28.0	17999999999.7	18000000000.3

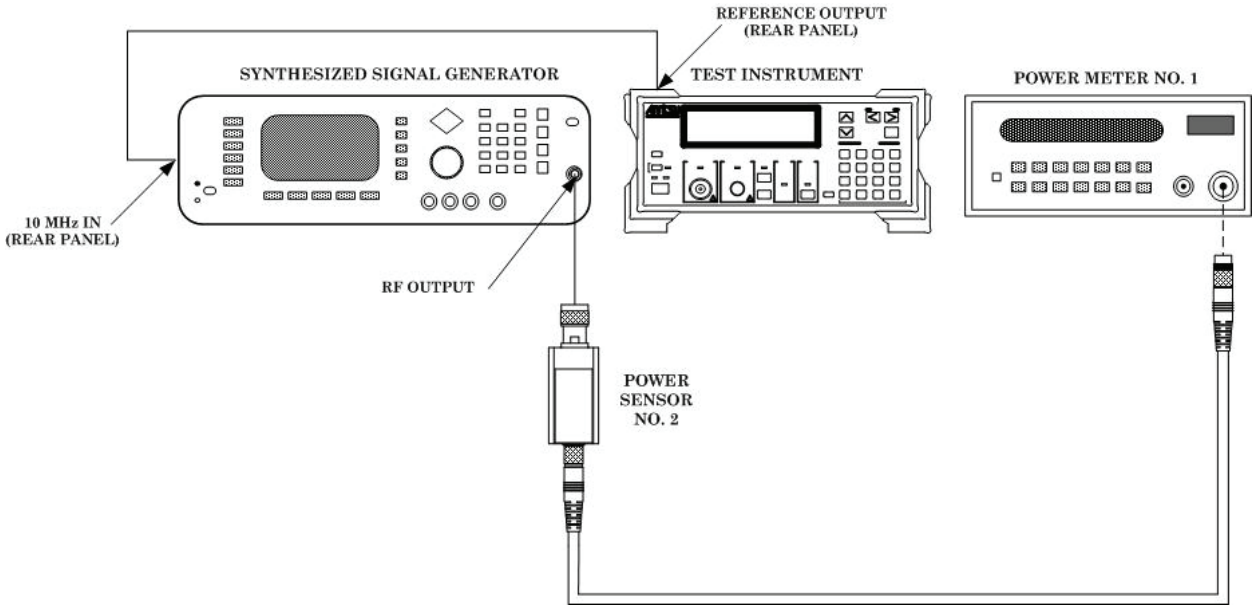
(5) Reduce all outputs to minimum and disconnect equipment setup.

b. Adjustments. None.

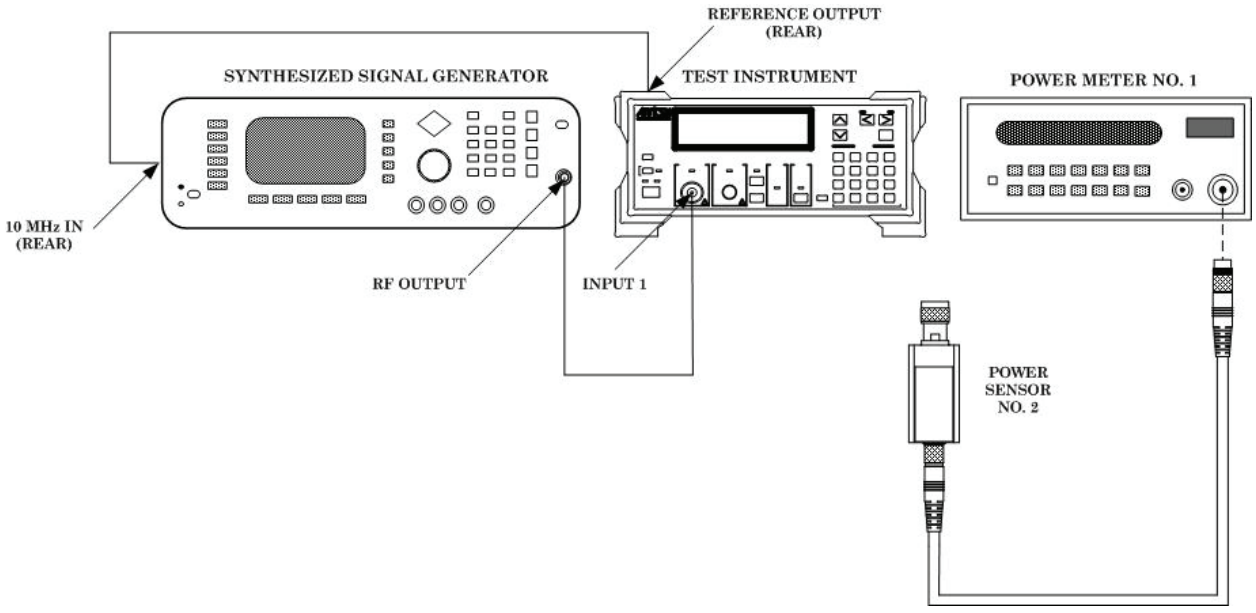
11. Burst Mode Test (600 MHz to 18 GHz)

a. Performance Check

(1) Connect equipment as shown in figure 4 connection A below.



Connection A.



Connection B.

Figure 4. Burst mode (600 MHz to 18 GHz)

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

(a) **Preset**.
(b) **Menu Burst**.
(c) **Resolution <** or **>** (until **Width** is selected).
(d) **Enter** (**Narrow** selected).
(e) **Return to Meas**.
(f) **Resolution <** or **>** (to set resolution to 1 MHz).

(3) Adjust synthesized signal generator frequency to 600 MHz and RF output amplitude controls for a -33 dBm indication on power meter.

(4) Set synthesized signal generator **RF OUTPUT** to off (do not change output setting) and connect equipment as shown in figure 4 connection B.

(5) Press TI keys as listed in (a) through (i) below.

(a) **Menu Freq**.
(b) **Resolution <** or **>** (until **Mode** is selected).
(c) **Enter** (**Manual** selected).
(d) **Resolution <** or **>** (until **Count** is selected).
(e) **Enter** (**Normal** selected).
(f) **Resolution <** or **>** (until **Set Freq** is selected).
(g) **Enter** (**Manual Freq:** highlighted).
(h) **Menu 6**, **0**, **0**, **MHz**.
(i) **Return to Meas**.

(6) Set synthesized signal generator for pulse modulation with a pulse width of 100 ns and a period of 500 ns.

(7) Press TI **Meas Mode Burst CW** key (Burst LED lit). TI frequency indication will be within limits specified in first row of table 7.

(8) Set synthesized signal generator pulse modulation to off.

(9) Repeat technique of (1), (3), (4), (5) (a), (g), (h), (i), (6), (7) and (8) above for synthesized signal generator frequencies and power meter indications listed in table 7. TI frequency indication will be within limits specified in table 7.

Table 7. Burst Frequency (600 MHz to 18 GHz)

Synthesized signal generator	Power meter	Test instrument indication limits (MHz)	
Frequency	Indication (dBm)	Min	Max
600 MHz	-33.0	599	601
1 GHz	-33.0	998	1002
5 GHz	-33.0	4996	5004
10 GHz	-33.0	9994	10006
12.5 GHz	-28.0	12493	12507
15 GHz	-28.0	14991	15009
18 GHz	-28.0	17990	18010

(10) Connect equipment as shown in figure 4 connection A and adjust synthesized signal generator (pulse modulation off), frequency to 600 MHz and RF output amplitude controls for a -33 dBm indication on power meter.

(11) Set synthesized signal generator **RF OUTPUT** to off (do not change output setting) and connect equipment as shown in figure 4 connection B.

(12) Press TI keys as listed in (a) through (j) below.

(a) **Menu Burst**.
(b) **Resolution <** or **>** (until **Mode** is selected).
(c) **Enter** (**Mode [Freq/Width/Period]** is displayed).
(d) **Resolution <** or **>** (until **Width** is highlighted).
(e) **Enter** (**Mode [Width]** is selected).
(f) **Menu Freq**.
(g) **Resolution <** or **>** (until **Set Freq** is selected).
(h) **Enter** (**Manual Freq:** is displayed).
(i) **Menu**, **6**, **0**, **0**, **MHz**.
(j) **Return to Meas**.

(13) Set synthesized signal generator for pulse modulation with a pulse width of 100 ns and period of 1.1 µs. TI burst width indication will be within limits specified in first row of table 8.

(14) Turn synthesized signal generator **RF OUTPUT** off.

(15) Repeat technique of (10), (11), (12) (f) through (j), (13) and (14) above for synthesized signal generator frequencies, pulse widths, periods and power meter indications listed in table 8. TI burst width indication will be within limits specified in table 8.

Table 8. Burst Width (600 MHz to 18 GHz)

Synthesized signal generator			Power meter	Test instrument indication limits	
Frequency	Width	Period	Indication (dBm)	Min	Max
600 MHz	100 ns	1.1 µs	-33.0	0.080 µs	0.120 µs
600 MHz	1 µs	2 µs	-33.0	0.980 µs	1.02 µs
600 MHz	10 µs	11 µs	-33.0	9.08 µs	10.02 µs
600 MHz	100 µs	101 µs	-33.0	99.08 µs	100.02 µs
600 MHz	1 ms	1.001 ms	-33.0	999.08 µs	1000.02 µs
600 MHz[1]	10 ms	10.001 ms	-33.0	9999.08 µs	10000.02 µs
600 MHz[1]	100 ms	100.001 ms	-33.0	99999.08 µs	100000.02 µs
18 GHz	100 ns	1.1 µs	-28.0	0.080 µs	0.120 µs
18 GHz	1 µs	2 µs	-28.0	0.980 µs	1.02 µs
18 GHz	10 µs	11 µs	-28.0	9.08 µs	10.02 µs
18 GHz	100 µs	101 µs	-28.0	99.08 µs	100.02 µs
18 GHz	1 ms	1.001 ms	-28.0	999.08 µs	1000.02 µs
18 GHz	10 ms	10.001 ms	-28.0	9999.08 µs	10000.02 µs
18 GHz	100 ms	100.001 ms	-28.0	99999.08 µs	100000.02 µs

[1]Switch synthesized signal generator from L RF to H RF output in the pulse modulation menu.

(16) Reduce all outputs to minimum.

b. Adjustments. None.

12. 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:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0821706

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344834, requirements for calibration procedure TB 9-6625-2365-24.

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.