# *TB 9-6625-2339-24

**DEPARTMENT OF THE ARMY TECHNICAL BULLETIN**

# CALIBRATION PROCEDURE FOR SPECTRUM ANALYZERS AN/USM-677 (AGILENT, MODEL E4407B-H76) AND AGILENT MODELS E4407B, E4407B-E57, E4407B-H57 AND E4407B-1D51DR

Headquarters, Department of the Army, Washington, DC
5 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, 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.


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## SECTION I
## IDENTIFICATION AND DESCRIPTION

1. **Test Instrument Identification.** This bulletin provides instructions for the calibration of Spectrum Analyzers, AN/USM-677 (Agilent, Model E4407B-H76), and Agilent Models, E4407B, E4407B-E57, E4407B-H57 and E4407B-1D51DR. TM 43-6625-914-12 and 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.** Variations among models are described in text and tables.

**b. Time and Technique.** The time required for this calibration is approximately 9 hours, using the dc and low frequency and 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 |
|---|---|
| 10 MHz Reference Accuracy | |
| Model E4407B | Frequency: 10 MHz<br>Settability: $\pm 5 \times 10^{-7}$ |
| All other models | Frequency: 10 MHz<br>Settability: $\pm 1 \times 10^{-8}$ |

Table 1. Calibration Description – Continued

| Test instrument parameters | Performance specifications |
|---|---|
| Resolution Bandwidth Accuracy and Selectivity | Range: 1 Hz to 300 Hz<br>Accuracy: ±10%<br>Range: 1 kHz to 3 MHz<br>Accuracy: ±15%<br>Range: 5 MHz<br>Accuracy: ±30%<br>Selectivity: 60 dB/3 dB bandwidth ratio: ≤15:1 |
| Input Attenuator Accuracy | Range: 0 to 60 dB, referenced to 10 dB input attenuation<br>Accuracy: 0 to 5 dB, ±0.3 dB; 10 dB, reference; 15 dB to 60 dB, ±(0.1 dB + 0.01 X attenuator setting) |
| Reference Level Accuracy<br>Model E4407B<br><br><br>All other models | Range: -149.9 dBm to maximum mixer level + attenuator setting<br>Accuracy: -10 dBm to > -60 dBm, ± 0.3 dB<br>-60 dBm to > -85 dBm, ± 0.5 dB<br><br>Accuracy: -10 dBm to > -60 dBm, ± 0.3 dB<br>-60 dBm to > -85 dBm, ± 0.5 dB<br>-85 dBm to > -90 dBm, ± 0.7 dB |
| Residual FM<br>Model E4407B<br><br>All other models | <br>Accuracy: ≤150 Hz X N*[2](100 ms)<br><br>≤2 Hz peak to peak X N*[1] |
| Noise Sidebands<br>Model E4407B<br><br><br><br><br>All other models | <br>Range: 1.0 GHz, 0 dBm 10, 20, 30 and 100 kHz offset<br>Accuracy: ≤-90 dBc @ 10 kHz offset<br>≤-104 dBc @ 20 kHz offset<br>≤-110 dBc @ 30 kHz offset<br>≤-118 dBc @ 100 kHz offset<br><br>≤-98 dBc @ 10 kHz offset<br>≤-104 dBc @ 20 kHz offset<br>≤-110 dBc @ 30 kHz offset<br>≤-118 dBc @ 100 kHz offset |
| Frequency Readout Accuracy | Frequency range: 9 kHz to 26.5 GHz*[2]<br>Accuracy: ±[(Frequency indication X frequency error) + 0.5% of span + (Span ÷ sweep points – 1)) + 15% of RBW + 10 Hz + 1 Hz X N*[2]] |
| Marker Frequency Count Accuracy | Frequency range: 9 kHz to 26.5 GHz*[2]<br>Accuracy: ±[ (marker frequency **x** reference frequency error ) + counter resolution] |
| Frequency Span | Range: 100 Hz to 26.5 GHz*[2]<br>Accuracy: ±[0.5% X span = 2 X span /(sweep points – 1)] |
| Frequency Response (10 dB input attenuation)<br>Model E4407B<br><br><br><br><br><br>All other models | <br>Frequency range: 9 kHz to 3 GHz<br>Accuracy: ±0.46 dB<br>Frequency range: 3 GHz to 6.7 GHz<br>Accuracy: ±1.5 dB<br>Frequency range: 6.7 GHz to 26.5 GHz*[2]<br>Accuracy: ±2.0 dB<br><br>Frequency range: 10 kHz to 26.5 GHz*[2]<br>Accuracy: ±2.0 dB |

See footnotes at end of table.

Table 1. Calibration Description – Continued

| Test instrument parameters | Performance specifications | |
|---|---|---|
| Displayed Average Noise Level | Frequency Range | (dBm) |
| Model E4407B | 10 MHz to 2 GHz | ≤-116 |
| | 2 GHz to 6 GHz | ≤-112 |
| | 6 GHz to 12 GHz | ≤-111 |
| | 12 GHz to 22 GHz*2 | ≤-107 |
| | 22 GHz to 26.5 GHz*2 | ≤-106 |
| All other models | 10 MHz to 2 GHz | ≤-135 |
| | 2 GHz to 6 GHz | ≤-131 |
| | 6 GHz to 12 GHz | ≤-130 |
| | 12 GHz to 22 GHz*2 | ≤-126 |
| | 22 GHz to 26.5 GHz*2 | ≤-125 |
| Residual Responses (no signal at input, 0 dB input attenuation) | Range: 150 kHz to 6.7 GHz<br>Accuracy: <-90 dBm | |
| Absolute Amplitude Accuracy | Measured at 50 MHz | |
| | Reference level (dBm) | Accuracy (±dB) |
| | -20 | ±0.34 |

*1N is the harmonic mixing number.
*2Limited to 18.0 GHz due to N type input connector.

## 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-287 and 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 **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 (FIXED) | 10 dB:<br>Frequency range: 50 MHz to 18 GHz<br>Accuracy: ±0.3 dB | Weinschel, Model 9918-10 dB<br>(9918-( ) dB) |
| ATTENUATOR | Range: 0 to 12 dB<br>Frequency: 50 MHz | Hewlett-Packard, Model 355C<br>(7910807) |
| FREQUENCY COUNTER | Frequency range: 10 MHz<br>Resolution: 0.001 Hz | Fluke, Model PM6681/656<br>(PM6681/656) |

Table 2. Minimum Specifications of Equipment Required - Continued

| Common name | Minimum use specifications | Manufacturer and model (part number) |
|---|---|---|
| MEASURING RECEIVER | Frequency range: 300 MHz<br>Accuracy: ±300 Hz<br>dBm range: -9.7 to -10.3<br>Accuracy: ±0.075 dBm | Measuring receiver system N5530S consisting of: Spectrum Analyzer Agilent, Model E4440A (E4440A), Power meter, Agilent Model E4419B (E4419B), and Sensor module, Agilent Model 518 (518) |
| MULTIMETER | Range: 1000 Vdc<br>Accuracy: ±2 Vdc | Fluke, Model 8840A/AF05 (AN/GSM-64D) |
| POWER SPLITTER | Frequency range: 10 MHz to 18 GHz | Weinschel, Model 1870A (7916839) |
| SIGNAL GENERATOR | Frequency range: 1 GHz<br>Amplitude: 0 dBm | Aeroflex, Model 2023B (2023B) or (SG-1207/U) |
| SYNTHESIZED SIGNAL GENERATOR | Frequency range: 10 MHz to 18 GHz<br>Power range: 0 to -15 dBm<br>Accuracy: ±1.525 dBm | Anritsu, Model 68369NV (68369NV) |
| SYNTHESIZER/LEVEL GENERATOR | Frequency range: 10 kHz to 50 MHz<br>Amplitude range: -80 to +12 dBm<br>Accuracy: ±0.02 dB per 10 dB step | Hewlett-Packard, Model 3335AOPT 001-K06 (MIS-35938) |
| TIME/FREQUENCY WORKSTATION | Frequency: 10 MHz<br>Accuracy: ±0.0025 ppm | 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.

**d.** When indications specified in paragraphs **8** through **19** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **19**. Do not perform power supply check if all other parameters are within tolerance.

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

**NOTE**

Throughout this procedure soft keys are identified by the use of brackets **[ ]** around the key.

**NOTE**

Ensure proper calibration factors for sensor module being used are loaded into measuring receiver.

**a.** Connect TI to 115 V ac power source.

**b.** Connect equipment as shown in figure 1.

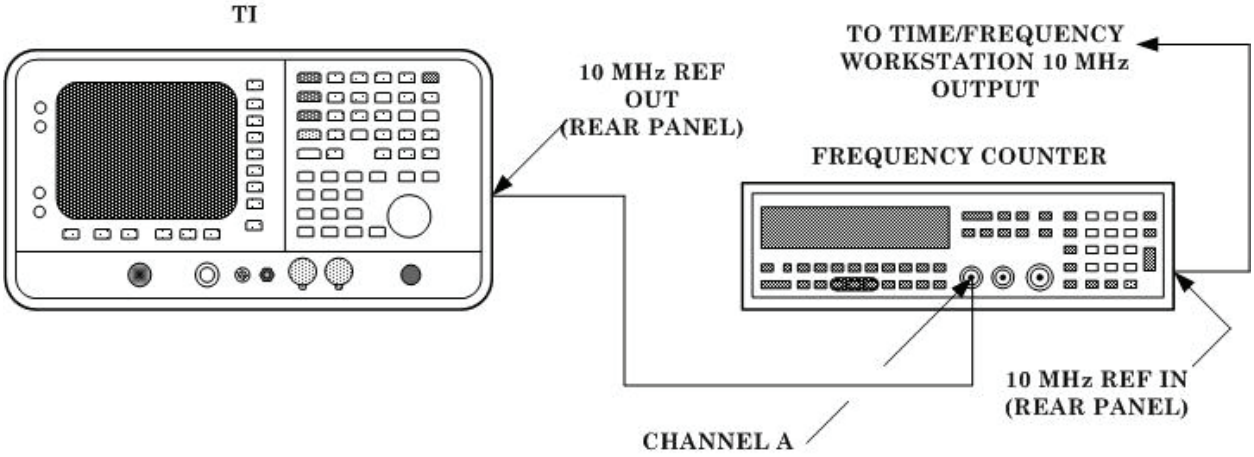


Figure 1. Frequency reference setup.

**c.** Press **LINE** pushbutton to **ON** and record the power on time.

**d.** Ensure TI is not in external reference mode.

**NOTE**

For model E4407B, perform **e** through **q** and **x** through **z** below. For all other models perform **r** through **w** and **x** through **z** below.

**e.** Set up frequency counter to measure frequency to 0.1 Hz resolution.

**f.** Wait for frequency counter to stabilize and record reading as “Counter Reading 1”.

**g.** Press TI keys **System**, **[Alignments]**, **[Timebase]**, **[Fine]**.

**h.** Record the number in TI active function block as “Timebase Fine”.

**i.** Press TI ⇑ key.

**j.** Wait for frequency counter to stabilize and record reading as "Counter Reading 2".

**k.** Press TI ⇓ key twice.

**l.** Wait for frequency counter to stabilize and record reading as "Counter Reading 3".

**m.** Press **Preset** key (press the **Factory Preset** soft key if it is displayed).

**n.** Subtract "Counter Reading 1" from "Counter Reading 2" and record the difference as "Positive Frequency Change".

**o.** Subtract "Counter Reading 3" from "Counter Reading 1" and record the difference as "Negative Frequency Change".

**p.** Select the largest absolute value between "Positive Frequency Change" and "Negative Frequency Change" and record value as "Maximum Frequency Change".

**q.** Calculate settability by dividing "Maximum Frequency Change" value by 2. The calculated value will be ≤5 Hz.

**NOTE**

The analyzer must sit with the power off for at least 60 minutes before performing the following test. This adequately simulates a cold start.

**r.** Set up frequency counter to measure frequency to 0.001 Hz resolution.

**s.** Wait 5 minutes then record frequency counter reading to 0.001 Hz resolution as counter reading 1.

**t.** Wait 10 more minutes then record frequency counter reading to 0.001 Hz resolution as counter reading 2.

**u.** Wait 45 more minutes the record frequency counter reading to 0.001 Hz resolution as counter reading 3.

**v.** Calculate the 5 minute warm-up error (in ppm) by subtracting counter reading 3 from counter reading 1 and dividing the result by 10. The calculated value will be 0 ±0.1 ppm.

**w.** Calculate the 15 minute warm-up error (in ppm) by subtracting counter reading 3 from counter reading 2 and dividing the result by 10. The calculated value will be 0 ±0.01 ppm.

**x.** If time base is out of tolerance perform (1) through (9) below:

(1) Press **System** key.

(2) Press **[More 1 of 3]**.

(3) Press **[More 2 of 3]**.

(4) Press **[Service]**.

(5) Press **–2**, **0**, **1**, **0**, **Enter** keys.

(6) Press **[Service]**.

(7) Press **[Timebase]**.

(8) Press **[Course]** or **[Fine]** as needed and adjust rotary knob for a frequency counter indication as close to 10.00000000 MHz as possible.

(9) Press **[Save]**.

**y.** Disconnect equipment setup.

**z.** Connect TI **AMPTD REF OUT** to TI **RF INPUT 50Ω** and perform (1) through (5) below:

(1) Press **Preset** key (press the **Factory Preset** soft key if it is displayed).

(2) Press **System** key.

(3) Press **[Alignments]**.

(4) Press **[Align Now]**.

(5) Press **[All]**.

## 8. Frequency Readout and Marker Frequency Count Accuracy

### a. Performance Check

(1) Connect TI **10 MHz REF OUT** to synthesized signal generator **10 MHz REF IN**.

(2) Connect synthesized signal generator **RF Output** to TI **INPUT 50Ω**.

(3) Set synthesized signal generator frequency to 1.5 GHz and level output to –10 dBm.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **Sweep**, **[Points 401]**.

(d) **FREQUENCY**, **1**, **.**, **5**, **[GHz]**.

(e) **SPAN**, **2**, **0**, **[MHz]**.

(f) **Peak Search**.

(5) TI **Mkr1** frequency indication will be within the limits specified in the first row of table 3.

(6) Repeat technique of (4) (e) and (f) above for remaining TI settings listed in table 3. TI **Mkr1** frequency indications will be within the limits specified in table 3.

Table 3. Frequency Readout Accuracy @ 1.5 GHz

| Synthesized signal generator | Test instrument | | | |
|---|---|---|---|---|
| Frequency setting (GHz) | **FREQUENCY** (GHz) | **SPAN** (MHz) | **Mkr1** frequency indications (GHz) | |
| | | | Min | Max |
| 1.5 | 1.5 | 20 | 1.49983 | 1.50017 |
| 1.5 | 1.5 | 10 | 1.49991 | 1.50009 |
| 1.5 | 1.5 | 1 | 1.499991 | 1.500009 |

(7) Set synthesized signal generator frequency to 4 GHz.

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

(a) **FREQUENCY**, **4**, **[GHz]**.

(b) **SPAN**, **2**, **0**, **[MHz]**.

(c) **Peak Search**.

(9) TI **Mkr1** frequency indication will be within the limits specified in the first row of table 4.

(10) Repeat technique of (8) (b) and (c) above for remaining TI settings listed in table 4. TI **Mkr1** frequency indications will be within the limits specified in table 4.

Table 4. Frequency Readout Accuracy @ 4 GHz

| Synthesized signal generator | Test instrument | | | |
|---|---|---|---|---|
| Frequency setting (GHz) | **FREQUENCY** (**CENTER FREQ**) (GHz) | **SPAN** (MHz) | **Mkr1** frequency indications (GHz) | |
| | | | Min | Max |
| 4 | 4 | 20 MHz | 3.99983 | 4.00017 |
| 4 | 4 | 10 MHz | 3.99991 | 4.00009 |
| 4 | 4 | 1 MHz | 3.999991 | 4.000009 |

(11) Set synthesized signal generator frequency to 9 GHz.

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

(a) **FREQUENCY**, **9**, **[GHz]**.

(b) **SPAN**, **2**, **0**, **[MHz]**.

(c) **Peak Search**.

(13) TI **Mkr1** frequency indication will be within limits specified in first row of table 5.

(14) Repeat technique of (12) (b) and (c) above for remaining TI settings listed in table 5. TI **Mkr1** frequency indications will be within the limits specified in table 5.

Table 5. Frequency Readout Accuracy @ 9 GHz

| Synthesized signal generator | Test instrument | | | |
|---|---|---|---|---|
| Frequency setting (GHz) | **FREQUENCY** (**CENTER FREQ**) (GHz) | **SPAN** (MHz) | **Mkr1** frequency indications (GHz) | |
| | | | Min | Max |
| 9 | 9 | 20 MHz | 8.99983 | 9.00017 |
| 9 | 9 | 10 MHz | 8.99991 | 9.00009 |
| 9 | 9 | 1 MHz | 8.999991 | 9.000009 |

(15) Set synthesized signal generator frequency to 16 GHz.

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

(a) **FREQUENCY**, **1**, **6**, **[GHz]**.

(b) **SPAN**, **2**, **0**, **[MHz]**.

(c) **Peak Search**.

(17) TI **Mkr1** frequency indication will be within limits specified in first row of table 6.

(18) Repeat technique of (16) (b) and (c) above for remaining TI settings listed in table 6. TI **Mkr1** frequency indications will be within the limits specified in table 6.

Table 6. Frequency Readout Accuracy @ 16 GHz

| Synthesized signal generator | Test instrument | | | |
|---|---|---|---|---|
| Frequency setting (GHz) | **FREQUENCY** (**CENTER FREQ**) (GHz) | **SPAN** (MHz) | **Mkr1** frequency indications (GHz) | |
| | | | Min | Max |
| 16 | 16 | 20 MHz | 15.99983 | 16.00017 |
| 16 | 16 | 10 MHz | 15.99991 | 16.00009 |
| 16 | 16 | 1 MHz | 15.999991 | 16.000009 |

(19) Set synthesized signal generator frequency to 1.5 GHz.

(20) Press TI keys as listed in (a) through (h) below:

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **Sweep**, **[Points 401]**.

(d) **FREQUENCY**, **1**, **.**, **5**, **[GHz]**.

(e) **SPAN**, **2**, **0**, **[MHz]**.

(f) **BW/Avg**, **[Res BW]**, **1**, **0**, **0**, **[kHz]** (Man).

(g) **Freq Count**, **[Marker Count]** (On).

(h) **[Resolution]** (Man).

(21) Press **Peak Search** key, then wait for a count to be taken. TI **Cntr1** frequency indication will be within limits specified in first row of table 7.

(22) Repeat technique of (19), (20) (d) and (e) and (21) above for synthesized signal generator and TI **FREQUENCY** settings listed in table 7. TI **Cntr1** frequency indication will be within limits specified in table 7.

Table 7. Frequency Count Marker Accuracy

| Synthesized signal generator | Test instrument | | | |
|---|---|---|---|---|
| Frequency settings (GHz) | **FREQUENCY** (GHz) | **SPAN** (MHz) | **Cntr 1** frequency indications (MHz) | |
| | | | Min | Max |
| 1.5 | 1.5 | 20 | 1499.999998 | 1500.000002 |
| 1.5 | 1.5 | 1 | 1499.999998 | 1500.000002 |
| 4 | 4 | 1 | 3999.999998 | 4000.000002 |
| 4 | 4 | 20 | 3999.999998 | 4000.000002 |
| 9 | 9 | 20 | 8999.999997 | 9000.000003 |
| 9 | 9 | 1 | 8999.999997 | 9000.000003 |
| 16 | 16 | 1 | 15999.999995 | 16000.000005 |
| 16 | 16 | 20 | 15999.999995 | 16000.000005 |

(23) Set all outputs to minimum.

**b. Adjustments.** None.

**9. Frequency Span Accuracy**

**a. Performance Check**

(1) Connect TI **10 MHz REF OUT** to synthesized signal generator **10 MHz REF IN**.

(2) Connect synthesized signal generator **RF Output** to TI **INPUT 50Ω**.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **Sweep**, **[Points 401]**.

(d) **FREQUENCY**, **[Start Freq]**, **0**, **[Hz]**, **[Stop Freq]**, **3**, **[GHz]**.

(4) Set synthesized signal generator frequency to 300 MHz and level output to –10 dBm.

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

(a) **Single** (wait for completion of sweep).

(b) **Peak Search**.

(c) **Marker**, **[Delta]**.

(6) Set synthesized signal generator frequency to 2.700 GHz.

(7) Press TI **Single** key, wait for completion of sweep then press **Peak Search** key.

(8) TI **Mkr1 Δ** indication will be within limits specified in first row of table 8.

(9) Repeat technique of (3) (d) through (7) above for TI **Start**, **Stop** and synthesized signal generator frequency settings listed in table 8. TI **Mkr1 Δ** indications will be within limits specified in table 8.

Table 8. Frequency Span Accuracy

| Synthesized signal generator | | Test instrument | | | |
|---|---|---|---|---|---|
| Frequency settings in (4) above | Frequency settings in (6) above | **FREQUENCY** start frequency | **FREQUENCY** stop frequency | **Mkr1 Δ** indications | |
| | | | | Min | Max |
| 300 MHz | 2.7 GHz | 0 Hz | 3 GHz | 2.370 GHz | 2.430 GHz |
| 20 MHz | 100 MHz | 10 MHz | 110 MHz | 79.0 MHz | 81.0 MHz |
| 10.01 MHz | 10.09 MHz | 10 MHz | 10.1 MHz | 79.0 kHz | 81.0 kHz |
| 810 MHz | 890 MHz | 800 MHz | 900 MHz | 79.0 MHz | 81.0 MHz |
| 800.01 MHz | 800.09 MHz | 800 MHz | 800.1 MHz | 79.0 kHz | 81.0 kHz |
| 1.410 GHz | 1.490 GHz | 1.4 GHz | 1.5 GHz | 79.0 MHz | 81.0 MHz |
| 1.49901 GHz | 1.49909 GHz | 1.499 GHz | 1.4991 GHz | 79.0 kHz | 81.0 kHz |

(10) Set all outputs to minimum and disconnect equipment setup.

**b. Adjustments**. None

**10. Noise Sidebands**

**a. Performance Check**

(1) Connect TI **10 MHz REF OUT** to signal generator external reference input connector.

(2) Connect signal generator RF output connector to TI **INPUT 50Ω**.

(3) Set signal generator for an output frequency of 1 GHz at an output level of 0 dBm.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **FREQUENCY**, **1**, **[GHz]**.

(d) **Sweep**, **[Points 401]**.

(e) **SPAN**, **1**, **0**, **[MHz]**.

(f) **AMPLITUDE**, **[Attenuation]**, **1**, **0**, **[dB]** (Man).

(g) **[More]**, **[Y Axis Units]** (or **Amptd Units**), **[dBm]**.

(h) **Peak Search** (or **Search**).

(i) **FREQUENCY**, **[Signal Track]** (On).

(j) **SPAN**, **5**, **0**, **[kHz]**.

(k) **BW/Avg**, **[Res BW]**, **1**, **[kHz]** (Man).

(l) **[Video BW]**, **3**, **0**, **[Hz]** (Man).

(m) **FREQUENCY**, **[Signal Track]** (Off).

(n) **Sweep**, **[Sweep Time]**, **5**, **[s]** (Man).

(o) **Single**. Wait for the completion of sweep.

(p) **Peak Search** (or **Search**).

(q) **Marker**, **[Delta]**.

(r) **[More]**, **[Function]**, **[Marker Noise** (or **Noise)]**.

(s) **Det/Demod**, **[Detector]**, **[Sample]**.

(t) **Amplitude**, **[Ref Level]**, **1**, **0**, **[–dBm]**.

(u) **FREQUENCY**, **[CF Step]**, **1**, **0**, **[kHz]**.

(v) **[Center Freq]**, ⇑.

(w) **SPAN**, **[Zero Span]**.

(x) **Single**.

(5) Wait for completion of sweep. TI **Mkr1 Δ Noise** indication will be within limit specified in first row of table 9.

(6) Press TI keys as listed in (a) and (b) below:

(a) **FREQUENCY**, ⇓, ⇓.

(b) **Single**.

(7) Wait for completion of sweep. TI **Mkr1 Δ Noise** indication will be within limit specified in second row of table 9.

(8) Press TI **FREQUENCY**, ⇑ keys.

(9) Repeat steps (4) (u) through (x) and (5) through (8) above for remaining center frequency step sizes listed in table 9. TI **Mkr1 Δ Noise** indications will be within limits specified in table 9.

Table 9. Noise Sidebands

| Center Frequency step size | **Mkr1 Δ Noise** indication limit |
|---|---|
| 10 kHz | ≤–90 dB/Hz*[1] |
| –10 kHz | ≤–90 dB/Hz*[1] |
| 10 kHz | ≤–98 dB/Hz*[2] |
| –10 kHz | ≤–98 dB/Hz*[2] |
| 20 kHz | ≤–104 dB/Hz |
| –20 kHz | ≤–104 dB/Hz |

See footnotes at end of table.

Table 9. Noise Sidebands - Continued

| Center Frequency step size | **Mkr1 Δ Noise** indication limit |
|---|---|
| 30 kHz | ≤–110 dB/Hz |
| –30 kHz | ≤–110 dB/Hz |
| 100 kHz | ≤–118 dB/Hz |
| –100 kHz | ≤–118 dB/Hz |

*[1]Model E4407B only
*[2]All other models

(10) Set all outputs to minimum.

**b. Adjustments**. None

**11. Residual FM**

**a. Performance Check**

(1) Connect signal generator RF output connector to TI **INPUT 50Ω**.

(2) Set signal generator frequency to 1.0 GHz and level output to -10 dBm.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **Sweep**, **[Points 401]**.

(d) **FREQUENCY**, **1**, **[GHz]**.

(e) **SPAN**, **1**, **[MHz]**.

(f) **AMPLITUDE**, **[Ref Level]**, **9**, **[–dBm]**.

(g) **[Scale/Div]**, **2**, **[dB]**.

(h) **BW/Avg**, **[Res BW]**, **1**, **[kHz]** (Man).

(i) **Peak Search** (or **Search**).

(j) **SPAN**, **[Span Zoom]**, **5**, **[kHz]**. Wait for the **SPAN 5 kHz** message to appear.

(k) **Peak Search** (or **Search**), **Marker→**, **[Marker →Ref Level]**, **Marker**, **[Off]**.

(l) **Single**. Wait for sweep to finish.

(m) **Peak Search** (or **Search**).

(n) **[Meas Tools]**, **[Delta]**.

(4) Adjust TI RPG knob ccw until the **Mkr1 Δ** amplitude indicates between -7.7 and -8.3 dB and press **[Delta]** key.

(5) Adjust TI RPG knob ccw for a **Mkr1 Δ** indication between -3.7 and -4.3 dB.

(6) Divide **Mkr1 Δ** frequency (in Hz) by **Mkr1 Δ** amplitude (in dB) to obtain slope of resolution bandwidth filter and record result.

EXAMPLE: If **Mkr1 Δ** frequency is 380 Hz and **Mkr1 Δ** amplitude is 3.92 dB,
slope would be: 380 Hz ÷ 3.92 dB = 96.94 Hz/dB

(7) Press TI keys as listed in (a) through (d) below:

(a) **Marker**, **[Off]**.

(b) **Peak Search** (or **Search**).

(c) **[Meas Tools]**.

(d) **Delta]**.

(8) Adjust TI RPG knob ccw for a **Mkr1 Δ** indication between -10.3 and -9.7 dB.

(9) Press TI keys as listed in (a) through (g) below:

(a) **Marker**, **[Normal]**.

(b) **Marker→**, **[Mkr→CF]**.

(c) **Single**.

(d) **BW/Avg**, **[Video BW]** (Man), **1**, **[kHz]**.

(e) **SPAN**, **[Zero Span]**.

(f) **Sweep**, **[Sweep Time]**, **1**, **0**, **0**, **[ms]**.

(g) **Single**.

**NOTE**

If displayed trace is not approximately 5 divisions below the reference level, press **Sweep, Sweep** (Cont) keys and then **FREQUENCY** key. Adjust the RPG knob to place displayed trace approximately 5 divisions below reference level. Press **Single**.

(10) Press **Peak Search** (or **Search**) key then **[Pk-Pk Search]** key.

(11) Record absolute value of **Mkr1 Δ** amplitude indication.

(12) Multiply value recorded in (6) above by value recorded in (11) above. Result will be ≤ 150 Hz for model E4407B and ≤ 100 Hz for all other models.

**NOTE**

If calibrating model E4407B stop here and proceed to paragraph **12**. For all other models complete steps (13) through (19) below.

(13) Press TI keys as listed in (a) through (o) below:

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **Sweep**, **[Points 401]**.

(d) **FREQUENCY**, **1**, **[GHz]**.

(e) **SPAN**, **1**, **[MHz]**.

(f) **AMPLITUDE**, **[Ref Level]**, **9**, **[–dBm]**.

(g) **[Scale/Div]**, **2**, **[dB]**.

(h) **Peak Search** (or **Search**).

(i) **SPAN**, **[Span Zoom]**, **5**, **[kHz]**. Wait for the **SPAN 5 kHz** message to appear.

(j) **BW/Avg**, **[Res BW]**, **1**, **0**, **[Hz]** (Man).

(k) **SPAN**, **1**, **0**, **0**, **[Hz]**.

(l) **Peak Search** (or **Search**), **Marker →**, **[ Marker →Ref Level]**, **Marker**, **[Off]**.

(m) **Single.** Wait for sweep to finish.

(n) **Peak Search** (or **Search**).

(o) **[Meas Tools]**, **[Delta]**.

(14) Adjust TI RPG knob ccw until the **Mkr1 Δ** amplitude indicates between -9.7 and -10.3 dB.

(15) Press TI keys as listed in (a) through (g) below:

(a) **Marker**, **[Normal]**.

(b) **Marker→**, **[Mkr→CF]**.

(c) **Single**.

(d) **BW/Avg**, **[Video BW]**, **1**, **0**, **[Hz]** (Man).

(e) **SPAN**, **[Zero Span]**.

(f) **Sweep**, **[Sweep Time]**, **2**, **0**, **[ms]**.

(g) **Single**.

**NOTE**

If displayed trace is not approximately 5 divisions below the reference level, press **Sweep**, **Sweep** (Cont) key and then **FREQUENCY** key. Adjust the RPG knob to place displayed trace approximately 5 divisions below reference level. Press **Single**.

(16) Press **Peak Search** (or **Search**) key then **[Pk-Pk Search]** key.

(17) Record absolute value of **Mkr1 Δ** amplitude indication.

(18) Multiply value recorded in (17) above by 0.426 Hz/dB. Result will be ≤ 2 Hz.

(19) Set all outputs to minimum and disconnect equipment setup.

**b. Adjustments.** None

**12. Input Attenuator Accuracy**

**a. Performance Check**

(1) Connect equipment as shown in figure 2.

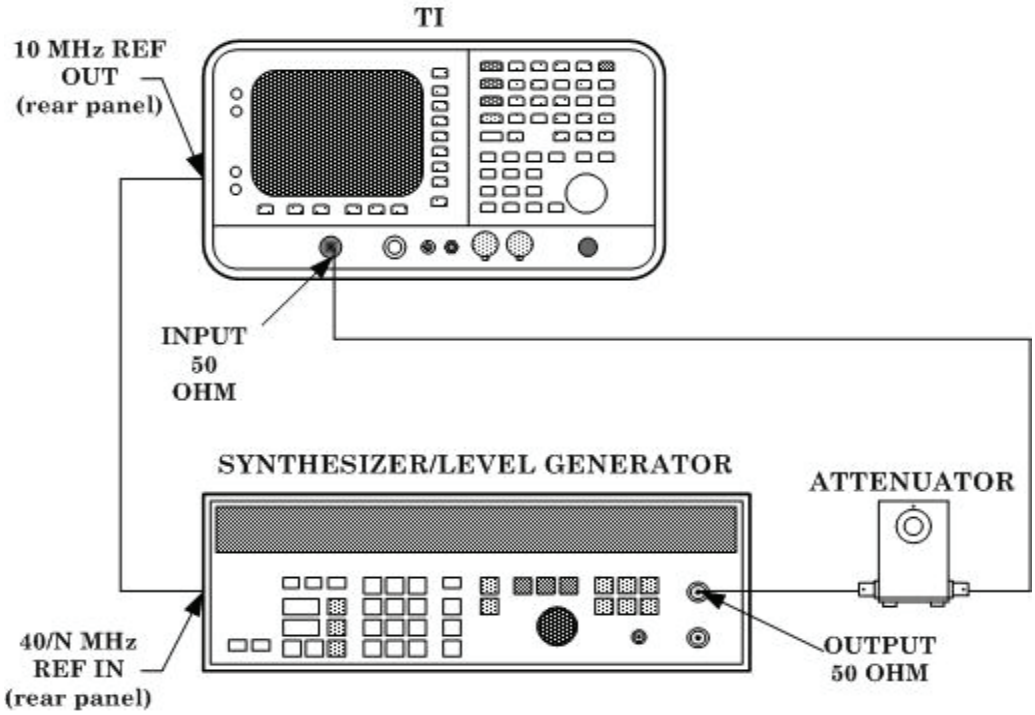


Figure 2. Input attenuator accuracy equipment setup.

(2) Set synthesizer/level generator output frequency to 50 MHz and output amplitude to –50 dBm.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **System**, **[Alignments]**, **[Auto Align]**, **[Off]**.

(d) **Sweep**, **[Points 401]**.

(e) **FREQUENCY**, **5**, **0**, **[MHz]**.

(f) **SPAN**, **1**, **0**, **0**, **[kHz]**.

(g) **AMPLITUDE**, **[Ref Level]**, **5**, **5**, **[–dBm]**.

(h) **[Attenuation]**, **1**, **0**, **[dB]**.

(i) **[Scale/Div]**, **2**, **[dB]**.

(j) **BW/Avg**, **[Res BW]**, **3**, **0**, **[kHz]**.

(k) **[Video BW]**, **1**, **0**, **0**, **[Hz]**.

(4) Set attenuator to 5 dB.

(5) Adjust attenuator to position signal peak 2 to 3 divisions below TI reference level.

(6) Press TI **Peak Search** (or **Search**), **Marker**, **[Delta]** keys.

(7) Set synthesizer/level generator to **–60 dBm**.

(8) Press TI **AMPLITUDE**, **[Ref Level]**, **6**, **5**, **[–dBm]** then **[Attenuation]**, **0**, **[dB]**.

(9) Press TI **Single**, then **Peak Search** (or **Search**). TI **Mkr1 Δ** indication will be within limits specified in first row of table 10.

(10) Repeat (7) through (9) above for remaining synthesizer/level generator amplitude, TI **Ref Level** and **Atten** settings listed in table 10. TI **Mkr1 Δ** indication will be within limits specified in table 10.

Table 10. Input Attenuator Accuracy

| Synthesizer/level generator | Test instrument | | | |
|---|---|---|---|---|
| Amplitude settings (dBm) | **Ref Level** settings (dBm) | **Atten** settings (dB) | **Mkr1 Δ** indications (dB) | |
| | | | Min | Max |
| -60 | -65 | 0 | –10.3 | –9.7 |
| -55 | -60 | 5 | –5.3 | –4.7 |
| -45 | -50 | 15 | 4.7 | 5.3 |
| -40 | -45 | 20 | 9.7 | 10.3 |
| -35 | -40 | 25 | 14.65 | 15.35 |
| -30 | -35 | 30 | 19.6 | 20.4 |
| -25 | -30 | 35 | 24.55 | 25.45 |
| -20 | -25 | 40 | 29.5 | 30.5 |
| -15 | -20 | 45 | 34.45 | 35.55 |
| -10 | -15 | 50 | 39.4 | 40.6 |
| -5 | -10 | 55 | 44.35 | 45.65 |
| 0 | -5 | 60 | 49.3 | 50.7 |
| 5 | 0 | 65 | 54.25 | 55.75 |

(11) Set all outputs to minimum and disconnect equipment setup.

**b. Adjustments.** None

**13. Reference Level Accuracy**

**a. Performance Check**

(1) Connect equipment as shown in figure 3.

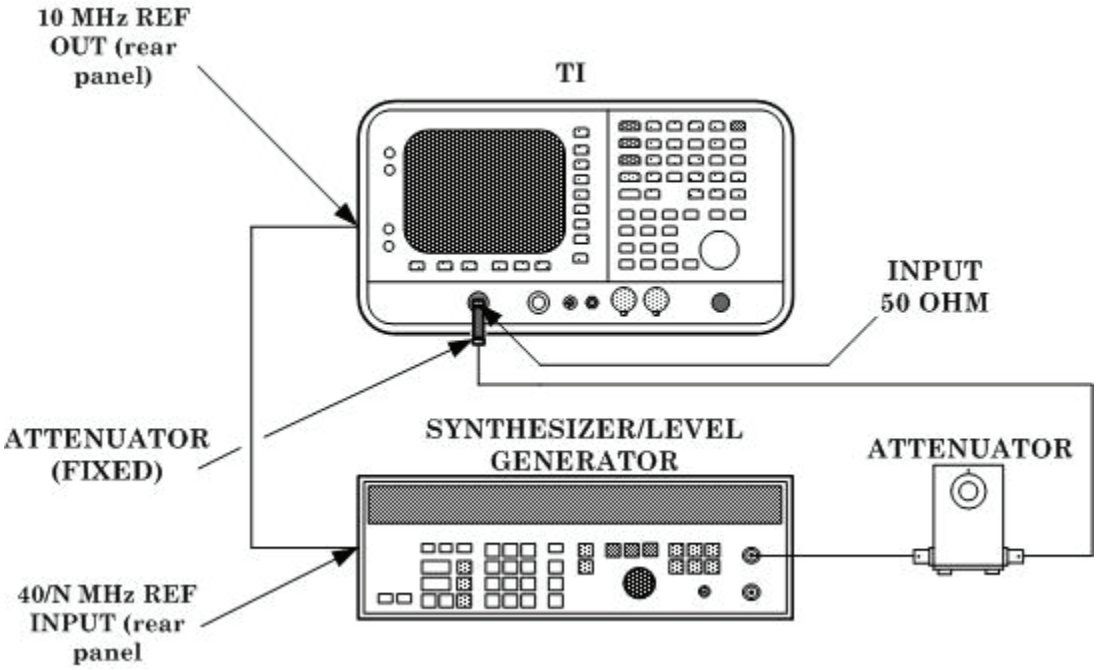


Figure 3. Reference level accuracy equipment setup.

(2) Press synthesizer/level generator keys to values as listed in (a) through (c) below:

(a) **FREQUENCY** to **50 MHz**.

(b) **AMPLITUDE** to **+12 dBm**.

(c) **AMPTD INCR** to **10 +dBm**.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **System**, **Alignments**, **[Auto Align]**, **[Off]**.

(d) **Sweep, [Points**, **401]**.

(e) **FREQUENCY**, **5**, **0**, **[MHz]**.

(f) **AMPLITUDE**, **[Ref Level]**, **0**, **[dBm]**.

(g) **[Attenuation]**, **1**, **0**, **[dB]** (Man).

(h) **[Scale/Div]**, **1**, **[dB]**.

(i) **SPAN**, **5**, **0**, **[kHz]**.

(j) **BW/Avg**, **[Res BW]**, **3**, **[kHz]**.

(k) **[Video BW]**, **3**, **0**, **[Hz]**.

(4) Set attenuator to 5 dB.

(5) Adjust attenuator to position signal peak 2 to 3 dB (2 to 3 divisions) below TI reference level.

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

(a) **Single**.

(b) **Peak Search** (or **Search**).

(c) **Marker**, **[Delta]**.

(7) Press synthesizer/level generator **AMPLITUDE** key.

(8) Press synthesizer/level generator **INCR** ⇓ key.

(9) Press TI **AMPLITUDE**, **[Ref Level]**, **1**, **0**, **[–dBm]** keys.

(10) Press TI **Single** key and wait for completion of sweep.

(11) Press TI **Peak Search** (or **Search**) key.

(12) TI **Mkr1 Δ** indication will be within limits specified in first row of table 11.

(13) Repeat technique of (8) through (11) above for synthesizer/level generator amplitude and TI **Ref Level** settings listed in table 11. TI **Mkr1 Δ** indications will be within limits specified in table 11.

Table 11. Log Mode, Analog Bandwidths

| Synthesizer/level generator | Test instrument | | |
|---|---|---|---|
| Amplitude settings (dBm) | **Ref Level** settings (dBm) | **Mkr1 Δ** indications (dB) | |
| | | Min | Max |
| +2 | -10 | -9.7 | -10.3 |
| -8 | -20 | -19.7 | -20.3 |
| -18 | -30 | -29.7 | -30.3 |
| -28 | -40 | -39.7 | -40.3 |
| -38 | -50 | -49.5 | -50.5 |
| -48 | -60 | -59.5 | -60.5 |
| -58 | -70 | -69.5 | -70.5 |
| -68 | -80 | -79.5 | -80.5 |
| -78 | -90*[1] | -89.3 | -90.7 |

*[1]All models except E4407B

(14) Set synthesizer/level generator amplitude to +12 dBm.

(15) Press TI keys as listed in (a) through (g) below:

(a) **AMPLITUDE**, **[Ref Level]**, **0**, **[dBm]**.

(b) **SPAN**, **1**, **5**, **0**, **[Hz]**.

(c) **BW/Avg**, **[Res BW]**, **1**, **0**, **[Hz]**.

(d) **[Video BW]**, **1**, **[Hz]**.

(e) **Single**.

(f) **Peak Search** (or **Search**).

(g) **Marker**, **[Delta]**.

(16) Press synthesizer/level generator **AMPLITUDE** key.

(17) Press synthesizer/level generator **INCR** ⇓ key.

(18) Press TI **AMPLITUDE**, **[Ref Level]**, **1**, **0**, **[–dBm]** keys.

(19) Press TI **Single** key and wait for completion of sweep.

(20) Press TI **Peak Search** (or **Search**) key.

(21) TI **Mkr1 Δ** indication will be within limits specified in first row of table 12.

(22) Repeat technique of (17) through (20) above for synthesizer/level generator amplitude and TI **Ref Level** settings listed in table 12. TI **Mkr1 Δ** indications will be within limits specified in table 12.

Table 12. Log Mode, Digital Bandwidths

| Synthesizer/level generator | Test instrument | | |
|---|---|---|---|
| Amplitude settings (dBm) | **Ref Level** settings (dBm) | **Mkr1 Δ** indications (dB) | |
| | | Min | Max |
| +2 | -10 | -9.7 | -10.3 |
| -8 | -20 | -19.7 | -20.3 |
| -18 | -30 | -29.7 | -30.3 |
| -28 | -40 | -39.7 | -40.3 |
| -38 | -50 | -49.5 | -50.5 |
| -48 | -60 | -59.5 | -60.5 |
| -58 | -70 | -69.5 | -70.5 |
| -68 | -80 | -79.5 | -80.5 |
| -78 | -90*[1] | -89.3 | -90.7 |

*[1]All models except E4407B

(23) Set synthesizer/level generator amplitude to +12 dBm.

(24) Press TI keys as listed in (a) through (h) below:

(a) **AMPLITUDE**, **[Ref Level]**, **0**, **[dBm]**.

(b) **[Scale Type]** (lin).

(c) **[More]**, **[Y axis Units]** (or **Amptd Units**), **[dBm]**.

(d) **SPAN**, **5**, **0**, **[kHz]**.

(e) **BW/Avg**, **[Res BW]**, **3**, **[kHz]**.

(f) **[Video BW]**, **3**, **0**, **[Hz]**.

(g) **Sweep**, **[Sweep]** (Cont**)**.

(h) **Marker**, **[Off]**.

(25) Adjust attenuator to position signal peak 2 to 3 dB (2 to 3 divisions) below TI reference level.

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

(a) **Single**.

(b) **Peak Search** (or **Search**).

(c) **Marker**, **[Delta]**.

(27) Press synthesizer/level generator **AMPLITUDE** key.

(28) Press synthesizer/level generator **INCR ⇓** key.

(29) Press TI **AMPLITUDE**, **[Ref Level]**, **1**, **0**, **[–dBm]** keys.

(30) Press TI **Single** key and wait for completion of sweep.

(31) Press TI **Peak Search** (or **Search**) key.

(32) TI **Mkr1 Δ** indication will be within limits specified in first row of table 13.

(33) Repeat technique of (28) through (31) above for synthesizer/level generator amplitude and TI **Ref Level** settings listed in table 13. TI **Mkr1 Δ** indications will be within limits specified in table 13.

Table 13. Linear Mode, Analog Bandwidths

| Synthesizer/level generator | Test instrument | | |
|---|---|---|---|
| Amplitude settings (dBm) | **Ref Level** settings (dBm) | **Mkr1 Δ** indications (dB) | |
| | | Min | Max |
| +2 | -10 | -9.7 | -10.3 |
| -8 | -20 | -19.7 | -20.3 |
| -18 | -30 | -29.7 | -30.3 |
| -28 | -40 | -39.7 | -40.3 |
| -38 | -50 | -49.5 | -50.5 |
| -48 | -60 | -59.5 | -60.5 |
| -58 | -70 | -69.5 | -70.5 |
| -68 | -80 | -79.5 | -80.5 |
| -78 | -90*[1] | -89.3 | -90.7 |

*[1]All models except E4407B

(34) Set synthesizer/level generator amplitude to +12 dBm**.**

(35) Press TI keys as listed in (a) through (g) below:

(a) **AMPLITUDE**, **[Ref Level]**, **0**, **[dBm]**.

(b) **SPAN**, **1**, **5**, **0**, **[Hz]**.

(c) **BW/Avg**, **[Res BW]**, **1**, **0**, **[Hz]**.

(d) **[Video BW]**, **1**, **[Hz]**.

(e) **Single**.

(f) **Peak Search** (or **Search**).

(g) **Marker**, **[Delta]**.

(36) Press synthesizer/level generator **AMPLITUDE** key.

(37) Press synthesizer/level generator **INCR** ⇓ key.

(38) Press TI **AMPLITUDE**, **[Ref Level]**, **1**, **0**, **[–dBm]** keys.

(39) Press TI **Single** key and wait for completion of sweep.

(40) Press TI **Peak Search** (or **Search**) key.

(41) TI **Mkr1 Δ** indication will be within limits specified in first row of table 14.

(42) Repeat technique of (37) through (40) above for synthesizer/level generator amplitude and TI **Ref Level** settings listed in table 14. TI **Mkr1 Δ** indications will be within limits specified in table 14.

Table 14. Linear Mode, Digital Bandwidths

| Synthesizer/level generator | Test instrument | | |
|---|---|---|---|
| Amplitude settings (dBm) | **REF LEVEL** settings (dBm) | **Mkr1 Δ** indications (dB) | |
| | | Min | Max |
| +2 | -10 | -9.7 | -10.3 |
| -8 | -20 | -19.7 | -20.3 |
| -18 | -30 | -29.7 | -30.3 |
| -28 | -40 | -39.7 | -40.3 |
| -38 | -50 | -49.5 | -50.5 |
| -48 | -60 | -59.5 | -60.5 |
| -58 | -70 | -69.5 | -70.5 |
| -68 | -80 | -79.5 | -80.5 |
| -78 | -90*[1] | -89.3 | -90.7 |

*[1]All models except E4407B

(43) Press TI keys as listed in (a) through (d) below:

(a) **Preset**.

(b) **System**.

(c) **[Alignments]**.

(d) **[Auto Align]**, **[All]**.

(44) Set all outputs to minimum and disconnect equipment setup.

**b. Adjustments.** None

**14. Resolution Bandwidth Switching Uncertainty**

**a. Performance Check**

(1) Connect TI **AMPTD REF OUT** to **RF INPUT 50Ω**.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **Sweep**, **[Points 401]**.

(d) **Input/Output** (or **Input**), **[Amptd Ref Out]** (On).

(e) **FREQUENCY**, **5**, **0**, **[MHz]**.

(f) **SPAN**, **5**, **[kHz]**.

(g) **AMPLITUDE**, **[More]**, **[Y Axis Units]** (or **Amptd Units**), **[dBm]**.

(h) **AMPLITUDE**, **[Ref Level]**, **1**, **9**, **[–dBm]**.

(i) **[Scale/Div]**, **1**, **[dB]**.

(j) **BW/Avg**, **[Res BW]**, **1**, **[kHz]** (Man).

(k) **[Video BW]**, **1**, **[kHz]** (Man).

(3) Press **AMPLITUDE** and adjust RPG knob to place the displayed signal 5 divisions below the reference level.

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

(a) **Peak Search** (or **Search**).

(b) **Marker→**, **[Mkr→CF]**.

(c) **Marker**, **[Delta]**.

(5) Set TI **RES BW** and **SPAN** for the first values listed in table 15.

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

(a) **Peak Search** (or **Search**).

(b) **Marker→**, **[Mkr→CF]**.

(c) **Peak Search** (or **Search**).

(7) TI **Mkr1 Δ** indication will be within the limits specified in table 15 for the **RES BW** and **SPAN** settings under test.

(8) Repeat technique of (5) through (7) above for the remaining **RES BW** and **SPAN** settings listed in table 15.

Table 15. Resolution Bandwidth Switching Uncertainty

| Test instrument*[1] | | | |
|---|---|---|---|
| **RES BW** | **SPAN** | **Mkr1 Δ** indication (dB) | |
| | | Min | Max |
| 3 kHz | 10 kHz | -0.3 | 0.3 |
| 9 kHz | 50 kHz | -0.3 | 0.3 |
| 10 kHz | 50 kHz | -0.3 | 0.3 |
| 30 kHz | 100 kHz | -0.3 | 0.3 |
| 100 kHz | 500 kHz | -0.3 | 0.3 |
| 120 kHz | 500 kHz | -0.3 | 0.3 |
| 300 kHz | 1 MHz | -0.3 | 0.3 |
| 1 MHz | 5 MHz | -0.3 | 0.3 |
| 3 MHz | 10 MHz | -0.3 | 0.3 |
| 5 MHz | 25 MHz | -0.6 | 0.6 |
| 300 Hz*[2] | 1 kHz | -0.3 | 0.3 |
| 200 Hz*[2] | 1 kHz | -0.3 | 0.3 |
| 100 Hz*[2] | 500 Hz | -0.3 | 0.3 |
| 30 Hz*[2] | 100 Hz | -0.3 | 0.3 |
| 10 Hz*[2] | 100 Hz | -0.3 | 0.3 |
| 3 Hz*[2] | 100 Hz | -0.3 | 0.3 |
| 1 Hz*[2] | 100 Hz | -0.3 | 0.3 |

*[1]Signal may need to be re-centered due to drift when using narrow frequency span settings.
*[2]Perform for all models except E4407B.

(9) Disconnect equipment setup.

**b. Adjustments.** None

**15. Absolute Amplitude Accuracy**

**a. Performance Check**

**NOTE**

If necessary, perform measuring receiver and sensor module ZERO and CALIBRATE.

(1) Connect synthesizer/level generator **OUTPUT 50Ω** to measuring receiver power sensor.

(2) Set synthesizer/level generator output frequency to 50 MHz and output amplitude to -20 dBm.

(3) Configure measuring receiver to measure power in dBm at 50 MHz.

(4) Adjust synthesizer/level generator power level for a measuring receiver indication of -20 dBm.

(5) Record measuring receiver indication in Actual power column of table 16 below.

(6) Connect TI **AMPTD REF OUT** to **RF INPUT 50Ω**.

(7) Press TI keys as listed in (a) through (l) below:

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **System**, **[Alignments]**.

(d) **[Align Now]**, **[All]** (wait for alignment to finish).

(e) **◄Return**, **[Auto Align]**, **[Off]**.

(f) **FREQUENCY**, **[Center Freq]**, **5**, **0**, **[MHz]**.

(g) **SPAN**, **2 [kHz]**.

(h) **BW/Avg**, **[Res BW]** (Man), **1**, **[kHz]**.

(i) **[Video BW Man]**, **1**, **[kHz]**.

(j) **Sweep**, **[Points 401]**, **Enter**.

(k) **Amplitude**, **[Ref Level]**, **2**, **0**, **[–dBm]**, **[Attenuation]** (Man), **1**, **0**, **[dB]**, **[Scale Type]** (Log).

(l) **[More]**, **[Y Axis Units]** (or **Amptd Units**), **[Volts]**, **Det/Demod**, **[Detector]**, **[Sample]**, **◄Return**.

(8) Disconnect synthesizer/level generator **OUTPUT 50Ω** from power sensor.

(9) Disconnect TI **AMPTD REF OUT** from **RF INPUT 50Ω**.

(10) Connect synthesizer/level generator **OUTPUT 50Ω** to TI **RF INPUT 50Ω**.

(11) Press TI **Peak Search** (or **Search**) key.

(12) Convert the marker amplitude reading (**Mkr1**) from volts to dBm using the following equation and record value in table 16.

50Ω Input Marker Amptd (dBm) = 10 X Log(Mkr ($V^2$ / 0.05))

Marker Amptd (dBm) _____ dBm

(13) Subtract the measuring receiver reading recorded in step (5) above from the marker amplitude calculated in step (12) above and record in table 16 as absolute amplitude accuracy (Log). Verify the difference recorded in table 16 is within the limits specified.

(14) Press TI **AMPLITUDE**, **[Scale Type]** (Lin) and **Peak Search** (or **Search**) keys.

(15) Convert the marker amplitude reading (**Mkr1**) from volts to dBm using the equation in step (12) above and record value in table 16.

(16) Subtract the measuring receiver reading recorded in step (5) above from the marker amplitude calculated in step (15) above and record in table 16 as absolute amplitude accuracy (Lin). Verify the difference recorded in table 16 is between the limits specified.

Table 16. Absolute Amplitude Accuracy

| Measuring Receiver | Test instrument | | | Absolute Amplitude Accuracy | | |
|---|---|---|---|---|---|---|
| Actual power (dB) | **Mkr1** amplitude (volts) | **Scale type** | Converted marker amplitude (dB) | Accuracy = converted marker amplitude (dB) – measuring receiver reading (dB) | Min (dB) | Max (dB) |
| | | Log | | | -0.34 | 0.34 |
| | | Lin | | | -0.34 | 0.34 |

(17) Press TI keys as listed in (a) though (d) below:

(a) **Preset**. Press the **Factory Preset** soft key if it is displayed.

(b) **System**.

(c) **[Alignments]**.

(d) **[Auto Align]**, **[All]**.

(18) Set all outputs to minimum and disconnect equipment setup.

**b. Adjustments.** None

**16. Resolution Bandwidth Accuracy**

**a. Performance Check**

(1) Connect TI **10 MHz Ref Out** to synthesizer/level generator **40/N MHz REF** and synthesizer/level generator **OUTPUT 50 Ω** to TI **RF INPUT 50 Ω**.

(2) Set synthesizer/level generator output frequency to 50 MHz and output amplitude to -5 dBm.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **System, [Alignments]**, **[Auto Align]**, **[Off]**.

(d) **Sweep, [Points 401]**.

(e) **FREQUENCY**, **5**, **0**, **[MHz]**.

(f) **SPAN**, **7**, **.**, **5**, **[MHz]**.

(g) **AMPLITUDE**, **[Scale/Div]**, **1**, **[dB]**.

(h) **[More]**, **[Y Axis Units]** (or **Amptd Units**), **[dBm]**.

(i) **BW/Avg**, **[Res BW]**, **5**, **[MHz]**.

(j) **[Video BW]**, **3**, **0**, **[Hz]**.

(4) Press TI **Peak Search** (or **Search**), **[Meas Tools]**, **[Mkr → CF]**.

(5) Adjust synthesizer/level generator amplitude to position the signal for a marker amplitude reading of -5 dBm +/- 0.2 dB.

(6) Set synthesizer/level generator **AMPTD INCR** to **3 dB**.

(7) Press TI **Peak Search** (or **Search**), **Marker**, **[Delta]**.

(8) Press synthesizer/level generator **AMPLITUDE** key then **INCR** ⇑ key.

(9) Press TI **Marker** key, then lower the marker frequency by adjusting the RPG knob (ccw) until the marker delta amplitude is 0 +/- 0.05 dB.

(10) Record the marker frequency readout as the lower 3 dB frequency in table 17.

(11) Raise the TI marker frequency by adjusting the RPG knob (cw) until the marker delta amplitude is 0 +/- 0.05 dB.

(12) Record the marker frequency readout as the upper 3 dB frequency in table 17.

(13) Subtract the lower 3 dB frequency recorded in (10) above from the upper 3 dB frequency recorded in (12) above. The result will be within the limits specified in table 17.

(14) Press synthesizer/level generator **AMPLITUDE** key.

(15) Press synthesizer/level generator **INCR** ⇓ key.

(16) Press TI **Marker**, **[Normal]** keys. TI **Mkr1 Δ** indication will be within limits specified in first row of table 17.

(17) Repeat technique of (3) (f) and (i) and (4) through (16) above for the TI **BW** and **SPAN** settings listed in table 17. TI **Mkr1 Δ** indications will be within limits specified in table 17.

Table 17. 3 dB Resolution Bandwidth Accuracy

| Test instrument | | | | | |
|---|---|---|---|---|---|
| **SPAN** settings | **BW** settings | **Mkr1 Δ** indications (MHz) | | | |
| (MHz) | (MHz) | Lower marker frequency | Upper marker frequency | Min (MHz) | Max (MHz) |
| 7.5 | 5 | | | 3.5 | 6.5 |
| 4.5 | 3 | | | 2.55 | 3.45 |
| 1.5 | 1 | | | 0.85 | 1.15 |
| 0.450 | 0.300 | | | 0.255 | 0.345 |
| 0.150 | 0.100 | | | 0.085 | 0.115 |
| 0.045 | 0.030 | | | 0.0255 | 0.0345 |

Table 17. 3 dB Resolution Bandwidth Accuracy - Continued

| Test instrument | | | | | |
|---|---|---|---|---|---|
| **SPAN** settings | **BW** settings | **Mkr1 Δ** indications (MHz) | | | |
| (MHz) | (MHz) | Lower marker frequency | Upper marker frequency | Min (MHz) | Max (MHz) |
| 0.015 | 0.010 | | | 0.0085 | 0.0115 |
| 0.0045 | 0.003 | | | 0.00255 | 0.00345 |
| 0.0015 | 0.001 | | | 0.00085 | 0.00115 |

(18) Set synthesizer/level generator **AMPLITUDE** to **-7 dBm**.

(19) Press TI **BW/Avg**, **[Res BW]**, **1**, **2**, **0**, **[kHz]** and **SPAN**, **1**, **8**, **0**, **[kHz]** keys.

(20) Press TI **Peak Search** (or **Search**), **[Meas Tools]**, **[Mkr → CF]**.

(21) Adjust synthesizer/level generator amplitude to position the signal for a marker amplitude reading of -7 dBm +/- 0.2 dB.

(22) Set synthesizer/level generator **AMPTD INCR** to **6 dB**.

(23) Press TI **Peak Search** (or **Search**), **Marker**, **[Delta]** keys.

(24) Press synthesizer/level generator **AMPLITUDE** key then **INCR** ⇑ key.

(25) Press TI **Marker** key. Then lower the marker frequency by adjusting the RPG knob (ccw) until the marker delta amplitude is 0 +/- 0.05 dB.

(26) Record the marker frequency readout as the lower 6 dB frequency in table 18.

(27) Raise the TI marker frequency by adjusting the RPG knob (cw) until the marker delta amplitude is 0 +/- 0.05 dB.

(28) Record the marker frequency readout as the upper 6 dB frequency in table 18.

(29) Subtract the lower 6 dB frequency recorded in (26) above from the upper 3 dB frequency recorded in (28) above. The result will be within the limits specified in table 18.

(30) Press synthesizer/level generator **AMPLITUDE** key.

(31) Press synthesizer/level generator **INCR** ⇓ key.

(32) Press TI **Marker**, **[Off]** keys. TI **Mkr1 Δ** indications will be within limits specified in first row of table 18.

(33) Repeat technique of (19) through (32) above for the TI **BW** and **SPAN** settings listed in table 18. TI **Mkr1 Δ** indications will be within limits specified in table 18.

Table 18. 6 dB Resolution Bandwidth Accuracy

| Test instrument | | | | | |
|---|---|---|---|---|---|
| **SPAN** settings | **BW** settings | **Δ Mkr1** indications MHz | | | |
| (kHz) | (kHz) | Lower marker frequency | Upper marker frequency | Min (kHz) | Max (kHz) |
| 180 | 120 | | | 102 | 138 |
| 13.5 | 9 | | | 7.65 | 10.35 |

(34) Press TI keys as listed in (a) through (d) below:

(a) **Preset** (**Factory Preset** soft key if it is displayed).
(b) **System**.
(c) **[Alignments]**.
(d) **[Auto Align]**, **[All]**.

(36) Set all outputs to minimum and disconnect equipment setup.

**b. Adjustments.** None

**17. Frequency Response**

**a. Performance Check**

**NOTE**
If necessary, perform measuring receiver and sensor module ZERO and CALIBRATE.

(1) Connect equipment as shown in figure 4.

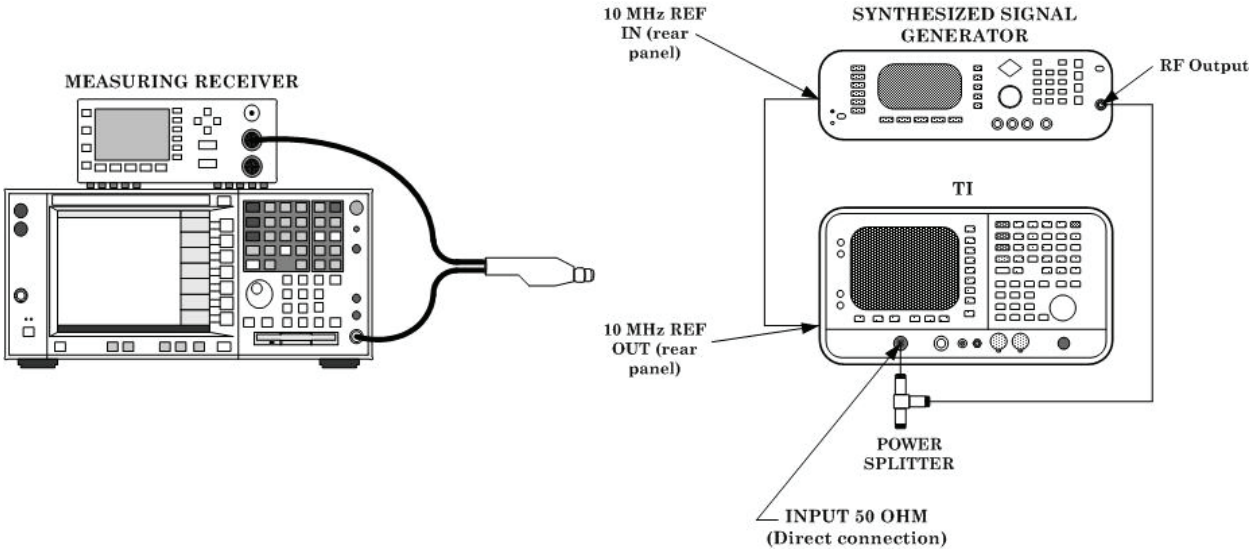


Figure 4. Frequency response equipment setup.

(2) Connect measuring receiver power sensor input to the open end of the power splitter.
(3) Press TI keys as listed in (a) through (k) below:
(a) **Preset**.
(b) **Factory Preset** soft key if it is displayed.
(c) **System**, **[Alignments]**, **[Auto Align]**, **[Off]**.
(d) **Sweep, [Points 401]**.
(e) **FREQUENCY**, **5**, **0**, **[MHz]**.
(f) **SPAN**, **2**, **0**, **[kHz]**.
(g) **AMPLITUDE**, **[Ref Level]**, **5**, **[–dBm]**.

(h) **[Attenuation]**, **1**, **0**, **[dB]** (Man).

(i) **[Scale/Div]**, **1**, **[dB]**.

(j) **BW/Avg**, **[Resolution BW]**, **3**, **[kHz]** (Man).

(k) **[Video BW]**, **3**, **[kHz]** (Man).

(4) Set synthesized signal generator frequency to 50 MHz and level output to -5 dBm.

(5) Configure measuring receiver to measure power in dBm at 50 MHz.

(6) Adjust synthesized signal generator power level for a measuring receiver indication of -10 +/- 0.05 dBm.

(7) Press TI **Single** key.

(8) Press TI **Peak Search** (or **Search**) key.

(9) Record TI **Mkr1** indication.

(10) Set synthesized signal generator to 18 GHz.

(11) Press TI **FREQUENCY**, **1**, **8**, **[GHz]** keys.

(12) Adjust synthesized signal generator power level for a measuring receiver indication of -10 +/- 0.05 dBm.

(13) Press TI **Single** key.

(14) Press TI **Peak Search** (or **Search**) key.

(15) TI **Mkr1** indication will be within limits listed for appropriate model in table 19 of the indication recorded in (9) above.

(16) Repeat (10) through (15) above for the remaining signal generator frequency and TI **FREQUENCY** settings listed in table 19.

Table 19. Frequency Response > 50 MHz

| Signal generator | Test instrument | | |
|---|---|---|---|
| Frequency settings | **FREQUENCY** | Model E4407B **Mkr1** limits (dB) | All other models **Mkr1** limits (dB) |
| 18.0 GHz | 18.0 GHz | ± 2.0 | ± 2.0 |
| 17.5 GHz | 17.5 GHz | ± 2.0 | ± 2.0 |
| 17.0 GHz | 17.0 GHz | ± 2.0 | ± 2.0 |
| 16.5 GHz | 16.5 GHz | ± 2.0 | ± 2.0 |
| 16.0 GHz | 16.0 GHz | ± 2.0 | ± 2.0 |
| 15.5 GHz | 15.5 GHz | ± 2.0 | ± 2.0 |
| 15.0 GHz | 15.0 GHz | ± 2.0 | ± 2.0 |
| 14.5 GHz | 14.5 GHz | ± 2.0 | ± 2.0 |
| 14.0 GHz | 14.0 GHz | ± 2.0 | ± 2.0 |
| 13.5 GHz | 13.5 GHz | ± 2.0 | ± 2.0 |
| 13.0 GHz | 13.0 GHz | ± 2.0 | ± 2.0 |
| 12.5 GHz | 12.5 GHz | ± 2.0 | ± 2.0 |
| 12.0 GHz | 12.0 GHz | ± 2.0 | ± 2.0 |
| 11.5 GHz | 11.5 GHz | ± 2.0 | ± 2.0 |
| 11.0 GHz | 11.0 GHz | ± 2.0 | ± 2.0 |

Table 19. Frequency Response > 50 MHz - Continued

| Signal generator | Test instrument | | |
|---|---|---|---|
| Frequency settings | **FREQUENCY** | Model E4407B **Mkr1** limits | All other models **Mkr1** limits |
| 10.5 GHz | 10.5 GHz | ± 2.0 | ± 2.0 |
| 10.0 GHz | 10.0 GHz | ± 2.0 | ± 2.0 |
| 9.5 GHz | 9.5 GHz | ± 2.0 | ± 2.0 |
| 9.0 GHz | 9.0 GHz | ± 2.0 | ± 2.0 |
| 8.5 GHz | 8.5 GHz | ± 2.0 | ± 2.0 |
| 8.0 GHz | 8.0 GHz | ± 2.0 | ± 2.0 |
| 7.5 GHz | 7.5 GHz | ± 2.0 | ± 2.0 |
| 7.0 GHz | 7.0 GHz | ± 2.0 | ± 2.0 |
| 6.5 GHz | 6.5 GHz | ± 1.5 | ± 2.0 |
| 6.0 GHz | 6.0 GHz | ± 1.5 | ± 2.0 |
| 5.5 GHz | 5.5 GHz | ± 1.5 | ± 2.0 |
| 5.0 GHz | 5.0 GHz | ± 1.5 | ± 2.0 |
| 4.5 GHz | 4.5 GHz | ± 1.5 | ± 2.0 |
| 4.0 GHz | 4.0 GHz | ± 1.5 | ± 2.0 |
| 3.5 GHz | 3.5 GHz | ± 1.5 | ± 2.0 |
| 3.0 GHz | 3.0 GHz | ± 1.5 | ± 2.0 |
| 2.5 GHz | 2.5 GHz | ±0.46 | ± 2.0 |
| 2.0 GHz | 2.0 GHz | ±0.46 | ± 2.0 |
| 1.5 GHz | 1.5 GHz | ±0.46 | ± 2.0 |
| 1.0 GHz | 1.0 GHz | ±0.46 | ± 2.0 |
| 500 MHz | 500 MHz | ±0.46 | ± 2.0 |
| 100 MHz | 100 MHz | ±0.46 | ± 2.0 |
| 50 MHz (Ref) | 50 MHz | ±0.46 | ± 2.0 |

(17) Disconnect signal generator from TI.

(18) Connect TI **10 MHz REF OUT** to synthesizer/level generator **40/N MHz REF INPUT**.

(19) Connect synthesizer/level generator **OUTPUT 50Ω** to TI **INPUT 50Ω**.

(20) Press TI **FREQUENCY**, **5**, **0**, **[MHz]** keys.

(21) Press synthesizer/level generator keys to values as listed in (a) through (c) below:

(a) **FREQUENCY** to **50 MHz**.

(b) **AMPLITUDE** to **-4 dBm**.

(c) **AMPTD INCR** to **0.1 dB**.

(22) Press TI **Peak Search** key.

(23) Slowly adjust synthesizer/level generator amplitude until TI **Mkr1** indication is as close as possible to the indication recorded in (9) above.

(24) Set synthesizer/level generator frequency to 20 MHz.

(25) Press TI **FREQUENCY**, **2**, **0**, **[MHz]** keys.

(26) Press TI **Peak Search** key.

(27) TI **Mkr1** indication will be within limits listed for appropriate model in table 19 of indication recorded in (9) above.

(28) Repeat (24) through (27) above for synthesizer/level generator frequency and TI **FREQUENCY** settings listed in table 20.

Table 20. Frequency Response < 50MHz

| Signal generator | Test instrument | | |
|---|---|---|---|
| Frequency settings | **FREQUENCY** | Model E4407B **Mkr1** limits | All other models **Mkr1** limits |
| 20 MHz | 20 MHz | ±0.46 | ± 2.0 |
| 10 MHz | 10 MHz | ±0.46 | ± 2.0 |
| 5 MHz | 5 MHz | ±0.46 | ± 2.0 |
| 1 MHz | 1 MHz | ±0.46 | ± 2.0 |
| 500 kHz | 500 kHz | ±0.46 | ± 2.0 |
| 100 kHz | 100 kHz | ±0.46 | ± 2.0 |
| 75 kHz | 75 kHz | ±0.46 | ± 2.0 |
| 50 kHz | 50 kHz | ±0.46 | ± 2.0 |
| 20 kHz | 20 kHz | ±0.46 | ± 2.0 |
| 9 kHz | 9 kHz | ±0.46 | ± 2.0 |

(29) Set all outputs to minimum and disconnect equipment setup.

**b. Adjustments.** None

**18. Displayed Average Noise**

**a. Performance Check**

(1) Connect TI **AMPTD REF OUT** to **INPUT 50Ω**.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **Sweep**, **[Points 401]**.

(d) **Input/Output** (or **Input**), **[Amptd Ref Out]** (On).

(e) **FREQUENCY**, **5**, **0**, **[MHz]**.

(f) **SPAN**, **2**, **[kHz]**.

(g) **AMPLITUDE**, **[Ref Level]**, **2**, **0**, **[–dBm]**.

(h) **[Attenuation]**, **1**, **0**, **[dB]**.

(i) **BW/Avg**, **[Res BW]**, **1**, **[kHz]**.

(j) **[Video BW]**, **1**, **[kHz]**.

(k) **Det/Demod**, **[Detector]**, **[Sample]**, **◄Return**.

(l) **Single**.

(m) **Peak Search** (or **Search**).

(3) Record the TI **MARKER** amplitude reading as reading 1.

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

(a) **AMPLITUDE**, **[Attenuation]**, **0**, **[dB]**.

(b) **SPAN**, **2**, **0**, **[kHz]**.

(c) **BW/Avg**, **[Res BW]**, **1**, **[kHz]**.

(d) **[Video BW]**, **3**, **0**, **[Hz]**.

(e) **Single**.

(f) **Peak Search** (or **Search**).

(5) Record the TI **MARKER** amplitude reading as reading 2.

(6) Calculate reference level offset by subtracting reading 2 from reading 1. If the calculated reference level offset is greater than 0.05 dB or less than –0.05 dB, record as Ref Level Offset (1 kHz RBW) value, otherwise, enter 0.

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

(a) **AMPLITUDE**, **[Attenuation]**, **0**, **[dB]**.

(b) **SPAN**, **5**, **0**, **0**, **[Hz]**.

(c) **BW/Avg**, **[Res BW]**, **1**, **0**, **[Hz]**.

(d) **[Video BW]**, **1**, **[Hz]**.

(e) **Single**.

(f) **Peak Search** (or **Search**).

(8) Record the TI **MARKER** amplitude reading as reading 3.

(9) Calculate reference level offset by subtracting reading 3 from reading 1. If the calculated reference level offset is greater than 0.05 dB or less than –0.05 dB, record as Ref Level Offset (10 Hz RBW) value, otherwise, enter 0.

(10) Press TI keys as listed in (a) and (b) below:

(a) **Input/Output**, **[Amptd Ref Out]** (Off).

(b) **AMPLITUDE**, **[More]**, **[Ref Level Offst]**, (enter reading 2 value).

(11) Disconnect equipment setup.

(12) Connect 50 Ω termination to TI **INPUT 50Ω**.

(13) Press TI keys as listed in (a) through (n) below:

(a) **Auto Couple**.

(b) **AMPLITUDE**, **[Ref Level]**, **7**, **0**, **[–dBm]**.

(c) **[Attenuation]**, **0**, **[dB]**.

(d) **[More]**, **[Ref Level Offset]** (enter value calculated in (6) above).

(e) **BW/Avg**, **[Res BW]**, **1**, **[MHz]**.

(f) **[Video BW]**, **1**, **0**, **[kHz]**.

(g) **FREQUENCY**, **[Start Freq]**, **1**, **0**, **[MHz]**.

(h) **[Stop Freq]**, **1**, **[GHz]**.

(i) **Sweep**, **[Sweep]** (Cont).

(j) **[Sweep Time]** (Auto).

(k) **Single**.

(l) **View/Trace**, **[Trace 1]**, **[Clear Write]**.

(m) **BW/Avg**, **[Avg Type]**, **[Video Avg]**, **[Average]**, **3**, **Enter**.

(n) **Single**.

(14) Wait until **Vavg 3** is displayed to the left of graticule lines then press TI keys as listed in (a) through (e) below:

(a) **Peak Search**.

(b) **BW/Avg**, **[Average]** (Off).

(c) **Marker→**, **[Marker→CF]**.

(d) **Span**, **2**, **0**, **[kHz]**.

(e) **BW/Avg**, **[Res BW]**, **1**, **[kHz]**, **[Video BW]**, **3**, **0**, **[Hz]**.

(15) Press TI **Single** key and wait for sweep completion.

(16) Press TI **Display** and **[Display Line]** (On) keys.

(17) Using TI rotary knob, adjust TI display line to center it on average trace noise. TI display line indication will be within limits specified in first row of table 21.

(18) Press TI **[Display Line]** (Off) key.

(19) Repeat technique of (13) (e) through (18) above for remaining frequencies listed in table 21. TI display line indication will be within limits specified in table 21.

Table 21. Displayed Average Noise Level (1 kHz RBW)

| Test instrument | | | | |
|---|---|---|---|---|
| Start frequency | Stop frequency | Resolution BW | Video BW | Display line indication |
| | | | | Max (dBm) |
| 10 MHz | 1 GHz | 1 kHz | 30 Hz | –116 |
| 1 GHz | 2 GHz | 1 kHz | 30 Hz | –115 |
| 2 GHz | 3 GHz | 1 kHz | 30 Hz | –112 |
| 3 GHz | 6 GHz | 1 kHz | 30 Hz | –112 |
| 6 GHz | 12 GHz | 1 kHz | 30 Hz | –110 |
| 12 GHz | 18 GHz | 1 kHz | 30 Hz | –107 |

**NOTE**

If calibrating model E4407B stop here and proceed to step (27) below. For all other models complete steps (20) through (27) below.

(20) Press TI keys as listed in (a) through (k) below:

(a) **AMPLITUDE**, **[More]**, **[Ref Level Offset]** (enter value calculated in (9) above).

(b) **BW/Avg**, **[Res BW]**, **1**, **[MHz]**.

(c) **[Video BW]**, **1**, **0**, **[kHz]**.

(d) **FREQUENCY**, **[Start Freq]**, **1**, **0**, **[MHz]**.

(e) **[Stop Freq]**, **1**, **[GHz]**.

(f) **Sweep**, **[Sweep]** (Cont).

(g) **[Sweep Time]** (Auto).

(h) **Single**.

(i) **View/Trace**, **[Trace 1]**, **[Clear Write]**.

(j) **BW/Avg**, **[Avg Type]**, **[Video Avg]**, **[Average]**, **3**, **Enter**.

(k) **Single**.

(21) Wait until **Vavg 3** is displayed to the left of graticule lines then press TI keys as listed in (a) through (e) below:

(a) **Peak Search**.

(b) **BW/Avg**, **[Average]** (Off).

(c) **Marker→**, **[Marker→CF]**.

(d) **Span**, **5**, **0**, **0**, **[Hz]**.

(e) **BW/Avg**, **[Res BW]**, **1**, **0**, **[Hz]**, **[Video BW]**, **1**, **[Hz]**.

(22) Press TI **Single** key and wait for sweep completion.

(23) Press TI **Display** and **[Display Line]** (On) keys.

(24) Using TI rotary knob, adjust TI display line to center it on average trace noise. TI display line indication will be within limits specified in first row of table 22.

(25) Press TI **[Display Line]** (Off) key.

(26) Repeat technique of (20) (b) through (25) above for remaining frequencies listed in table 22. TI display line indication will be within limits specified in table 22.

Table 22. Displayed Average Noise Level (10 Hz RBW)

| Test instrument | | | | |
|---|---|---|---|---|
| Start frequency | Stop frequency | Resolution BW | Video BW | Display line indication |
| | | | | Max (dBm) |
| 10 MHz | 1 GHz | 10 Hz | 1 Hz | –135 |
| 1 GHz | 2 GHz | 10 Hz | 1 Hz | –134 |
| 2 GHz | 3 GHz | 10 Hz | 1 Hz | –131 |
| 3 GHz | 6 GHz | 10 Hz | 1 Hz | –131 |
| 6 GHz | 12 GHz | 10 Hz | 1 Hz | –129 |
| 12 GHz | 18 GHz | 10 Hz | 1 Hz | –126 |

(27) Press TI **Preset** key and disconnect equipment setup.

**b. Adjustments.** None

**19. Residual Responses**

**a. Performance Check**

(1) Connect 50 Ω termination to TI **INPUT 50Ω**.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **FREQUENCY**, **[Start Freq]**, **1**, **5**, **0**, **[kHz]**.

(d) **[Stop Freq]**, **1**, **[MHz]**.

(e) **AMPLITUDE**, **[Ref Level]**, **6**, **0**, **[–dBm]**.

(f) **[Attenuation]**, **0**, **[dB]**.

(g) **BW/Avg**, **[Res BW]**, **3**, **[kHz]**.

(h) **[Video BW]**, **1**, **[kHz]**.

(i) **Display**, **[Display line]** (On), **9**, **0**, **[–dBm]**.

(j) **Single**.

(3) When sweep is finished, look for any residual responses at or above TI display line.

**NOTE**

If a residual is suspected, press TI **Single** key again. A residual response will persist on successive sweeps, but a noise peak will not.

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

(a) **Preset**.

(b) **Factory Preset** soft key if it is displayed.

(c) **FREQUENCY**, **5**, **.** , **9**, **[MHz]**.

(d) **[CF Step]**, **9**, **.**, **9**, **[MHz]**.

(e) **SPAN**, **1**, **0**, **[MHz]**.

(f) **AMPLITUDE**, **[Ref Level]**, **6**, **0**, **[–dBm]**.

(g) **[Attenuation]**, **0**, **[dB]**.

(h) **BW/Avg**, **[Res BW]**, **1**, **0**, **[kHz]**.

(i) **[Video BW]**, **3**, **[kHz]**.

(j) **Display**, **[Display Line]** (On), **90**, **[–dBm]**.

(5) Press TI **Single** key. When sweep is finished, look for any residual responses at or above TI display line.

(6) Press TI **FREQUENCY** and ⇑ keys.

(7) Repeat technique of (5) and (6) above up to 6.7 GHz. Residuals will not be above TI display line.

(8) Disconnect equipment setup.

**b. Adjustments.** None

**20. Power Supply**

**NOTE**

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

**a. Performance Check**

(1) Press TI power **STANDBY** pushbutton.

(2) Disconnect TI power cord.

(3) Remove TI outer case and inner shield.

(4) Plug TI power supply test board into any available slot, except the slot for the processor board.

(5) Connect TI power cord.

(6) Press TI power **ON** pushbutton.

(7) Observe LED's on power supply test board.

**NOTE**

Power supply test board LED's will be illuminated if voltages are within 10 percent of their specified value.

(8) Connect multimeter to test points as listed in table 23 and verify voltages are within limits specified.

Table 23. Power Supply Voltages

| Test instrument | | Multimeter indication (Vdc) | |
|---|---|---|---|
| Test point | Common | Min | Max |
| TP4 or TP10 | TP13 (ACOM) | –15.22 | –14.78 |
| TP5 or TP11 | TP13 (ACOM) | –5.07 | –4.93 |
| TP3 or TP9 | TP13 (ACOM) | 4.93 | 5.07 |
| TP2 or TP8 | TP12 (DCOM) | 5.1 | 5.3 |
| TP1 or TP7 | TP13 (ACOM) | 14.78 | 15.22 |
| TP6 | TP13 (ACOM) | 26.04 | 29.96 |

(9) Connect multimeter to TI probe power connector (fig. 5) and verify voltages are within limits specified in table 24.

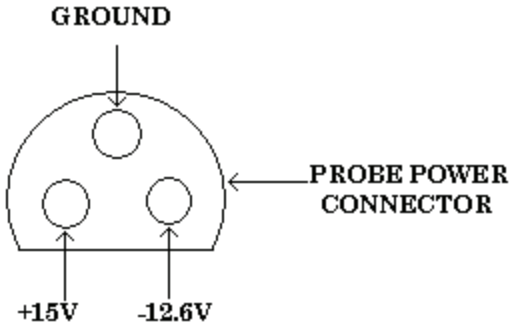


Figure 5. Probe power connector.

Table 24. Probe Power Connector Voltages

| Test instrument connector voltage | Multimeter indication (Vdc) | |
|---|---|---|
| | Min | Max |
| –12.6 V | –13.86 | –11.3 |
| +15 V | 13.95 | 16.05 |

(10) Disconnect equipment setup.

(11) Press TI power **STANDBY** pushbutton.

(12) Disconnect TI power cord.

(13) Reinstall TI inner shield and outer case.

(14) Connect TI power cord.

(15) Press TI power **ON** pushbutton.

**b. Adjustments.** None

**21. 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*

0819108

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344787, requirements for calibration procedure TB 9-6625-2339-24.

## 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.