TB 9-6625-2250-35

CHANGE 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR SPECTRUM ANALYZER AN/USM-489A

Headquarters, Department of the Army, Washington, DC
11 May 2005

TB 9-6625-2250-35, 28 October 2003, is changed as follows:

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

Remove Pages	Insert Pages
17 and 18	17 and 18
35 and 36	35 and 36

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

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0507402

Distribution:
To be distributed in accordance with IDN 343553, requirements for calibration procedure TB 9-6625-2250-35.

*TB 9-6625-2250-35

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Headquarters, Department of the Army, Washington, DC
28 October 2003

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 provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use https://amcom2028.redstone.army.mil.

*This bulletin supersedes TB 9-6625-2250-35, 14 July 2000.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. **Test Instrument Identification.** This bulletin provides instructions for the calibration of Spectrum Analyzer, AN/USM-489A. TM 11-6625-3250-40 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. There are at least 25 different AN/USM-489A versions fielded. While there are no operational differences between versions, there are internal differences that are maintenance significant. Therefore, the only internal adjustments included in this procedure are for the calibrator and power supply. Additional adjustments are contained in TM 11-6625-3250-40.

b. Time and Technique. The time required for this calibration is approximately 6 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
Calibrator output accuracy	Frequency: 300 MHz Accuracy: ±1.2 kHz Amplitude range: -10 dBm Accuracy: ±0.3 dB
Resolution bandwidth accuracy and selectivity	Range: 100 Hz Accuracy: <±30% Range: 300 Hz to 300 kHz Accuracy: <±10% Range: 1 MHz and 2 MHz Accuracy: <±25% Selectivity: 60 dB/3 dB bandwidth ratio: <15:1
Input attenuator accuracy	Range: 0 to 70 dB, referenced to 10 dB input attenuation Frequency range: 10 kHz to 22 GHz[1] Accuracy: <±1.8 dB/10 dB step, 3.5 dB maximum
IF gain uncertainty	Range: 0 to -80 dBm reference level, 10 dB input attenuation Accuracy: <±1.0 dB
Residual FM (zero span)	<50 Hz X N^2 p-p in 20 mS
Noise sidebands	Range: 2.5 GHz, -10 dBm 9 kHz offset Accuracy: <-70 dBc
Frequency readout accuracy	Frequency range: 9 kHz to 22 GHz[1] Accuracy: <±(center frequency X 4 X 10^{-6})+(5% of frequency span) +(15% of RES BW) + 250 Hz
Frequency count marker accuracy	Frequency range: 9 kHz to 22 GHz[1] Accuracy: <±(4 X 10^{-6} + 50 Hz X N^2 + 1 LSD)
Frequency span	Range: 0 Hz, 2.5 kHz X N^2 to 19.25 GHz[3] over the 10-division crt horizontal axis, variable in approximately 1% increments or in a 1,2,5, sequence Accuracy (span ≥10kHz): <±5%
Frequency response (10 dB input attenuation) Referenced to cal output (300 MHz)	Frequency range: 10 kHz to 19.7 GHz[1] <±6.1 dB
Displayed average noise level (no signal at input, 100 Hz RES BW, and 0 dB input attenuation)	Frequency Range (dBm) 10 kHz <-90 100 kHz <-100 1 MHz to 2.9 GHz <-121 2.9 to 6.46 GHz <-121 6.46 to 13 GHz <-110 13 to 19.7 GHz[1] <-105 19.7 to 22 GHz[1] <-100
Residual responses (no signal at input, 0 dB input attenuation)	Range: 200 kHz to 6.46 GHz Responses: <-90 dBm
Frequency drift	<50 Hz X N^2 per minute of sweep time spans <100 kHz <2 kHz X N^2 per minute of sweep time spans 101 kHz to <1 MHz

See footnotes at end of table.

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications	
Marker amplitude accuracy	Measured at 300 MHz	
	Reference levels (dBm)	Accuracy (<±dB)
	0	3.3
	-10	3.3
	-40	3.3
	-50	3.3

[1]Limited to 18.0 GHz due to N type input connector.
[2]N is the harmonic mixing mode.
[3]Procedure limits of 5 GHz

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-287. Alternate items may be used by the calibrating activity. 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 **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)	6 dB: Frequency range: 50 MHz to 18 GHz Accuracy: ±0.3 dB 10 dB: Frequency range: 50 MHz to 18 GHz Accuracy: ±0.5 dB 20 dB: Frequency range: 50 MHz to 18 GHz Accuracy: ±0.5 dB	Weinschel, Model 9918-6 dB (9918-6 dB), Model 9918-10 dB (9918-10 dB) and Model 9918-20dB (9918-20 dB)
ATTENUATOR NO. 1	Range: 0 to 12 dB Frequency: 50 MHz	Hewlett-Packard, Model 355C (7910807)
ATTENUATOR NO. 2	Range: 0 to 60 dB Frequency: 300 MHz Accuracy with correction report: ±0.825 dB	Hewlett-Packard, Model 355D (355D)

Table 2. Minimum Specifications of Equipment Required - Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
MEASURING RECEIVER	Frequency range: 300 MHz Accuracy: ±300 Hz dBm range: -9.7 to -10.3 Accuracy: ±0.075 dBm Frequency response: 10 MHz to 18 GHz (referenced to 300 MHz) at 10 dBm Accuracy:[1]	Hewlett-Packard, Model 8902A (8902A) w/sensor module Hewlett-Packard, Model 11722A (11722A), sensor module Hewlett-Packard, Model 11792A (11792A), microwave converter Hewlett-Packard, Model 11793A (11793A), and signal generator (SG-1219/U)
MULTIMETER	Range: 1000 Vdc Accuracy: ±2 Vdc	John Fluke, Model 8840A/AF-05 (AN/GSM-64D)
POWER SPLITTER	Frequency range: 10 MHz to 18 GHz Power range: -10 dBm Accuracy:[1]	Weinschel, Model 1870A (7916839)
SIGNAL GENERATOR	Frequency range: 10 MHz to 18 GHz Power range: 0 to -15 dBm Accuracy: ±1.525 dBm	Wiltron, Model 68369NV (68369NV)
SYNTHESIZER/LEVEL GENERATOR	Frequency range: 10 kHz to 50 MHz Amplitude range: -80 to +10 dBm Accuracy: ±0.02 dB per 10 dB step	Hewlett-Packard, Model 3335AOPT001-KO6 (MIS-35938)

[1]Combined accuracy of measuring receiver and power splitter is ±1.525 dBm

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. Additional maintenance information is contained in TM 11-6625-3250-40.

d. Paragraph **18** provides an alternate technique if indications specified in paragraph **17** are not within tolerance. Do not perform paragraph **18** if indications in paragraph **17** are within tolerance.

e. When indications specified in paragraphs **8** through **21** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **21**. Do not perform power supply check if all other parameters are within tolerance.

f. 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.

a. Connect TI to 115 V ac power source.

b. Press **LINE** pushbutton to on and allow at least 30 minutes for TI to warm-up and stabilize.

NOTE

1. [ ] Denotes softkey on display.
2. Refer to C in figure 1 for softkey location.
3. [ ] Softkeys and keys will be referred to as keys in this procedure.

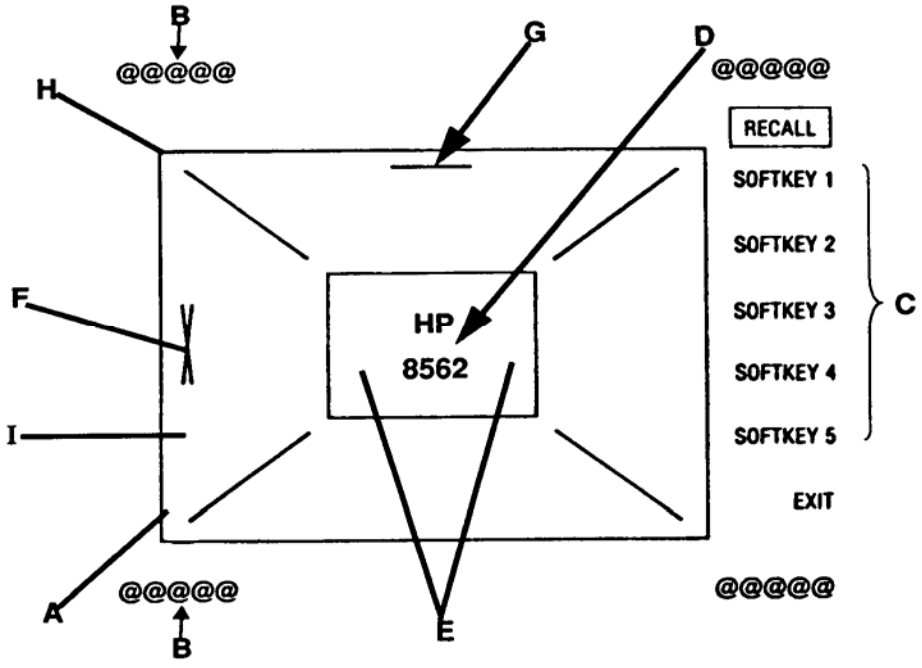

Figure 1. Crt adjustment pattern.

c. Press TI keys as listed in (1) through (3) below:

(1) **INSTRUMENT STATE RECALL**

(2) **[MORE]**

(3) **[CRT ADJ PATTERN]**

d. Adjust **TRACE ALIGN** (rear panel) until leftmost line of test pattern A (fig. 1) is parallel with crt bezel.

e. Adjust **X POSN** (rear panel) until leftmost @ characters B (fig. 1) and softkey labels C (fig. 1) appear just inside left and right edges of crt bezel.

f. Adjust **Y POSN** (rear panel) until the softkey labels C (fig. 1) align with the appropriate softkeys.

g. Press **INSTRUMENT STATE PRESET** key.

8. Calibrator Output Accuracy Test

a. Performance Check

NOTE

If necessary, perform measuring receiver and sensor module (11722A) ZERO and CALIBRATE.

(1) Connect measuring receiver sensor module input to TI **CAL OUTPUT.**

(2) Setup measuring receiver to measure frequency. If measuring receiver does not indicate between 299.9988 and 300.0012 MHz, perform **b** (1) below.

(3) Setup measuring receiver to measure RF power in dBm at 300 MHz. If measuring receiver does not indicate between -9.7 and -10.3 dBm, perform **b** (2) below.

(4) Disconnect sensor module from TI.

(5) Connect TI **CAL OUTPUT** to **INPUT 50Ω.**

(6) Press TI keys and enter values using the **DATA** keys as listed in (a) through (g) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.

(c) **SPAN** then **[SPAN WIDTH]** to **20 MHz**.

(d) **MARKER PEAK SEARCH**.

(e) **AMPLITUDE** then **[REF LVL]** to **-10 dBm**.

(f) **[MORE]**.

(g) **[REF LVL CAL]**.

(7) Adjust TI knob until **MKR** indication is between -9.83 and -10.17 dBm.

(8) Press **[STORE REF LVL]** key.

b. Adjustments

NOTE

Allow TI 30 minutes warm-up before performing the adjustment below.

(1) Adjust A15R306 (located on A15 board) for a measuring receiver indication between 299.99997 and 300.00003 MHz.

(2) Adjust A15R561 (located on A15 board) for a measuring receiver indication between -9.95 and -10.05 dBm.

9. Displayed Average Noise Level Test

a. Performance Check

(1) Connect TI **CAL OUTPUT** to **INPUT 50Ω.**

(2) Press TI keys and enter values using the **DATA** keys as listed in (a) through (k) below:

(a) **INSTRUMENT STATE PRESET**.
(b) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.
(c) **SPAN** then **[SPAN WIDTH]** to **2.5 kHz**.
(d) **AMPLITUDE** then **[REF LVL]** to **-10 dBm**.
(e) **[ATTEN]** to **0 dB**.
(f) **CONTROL BW** then **[RES BW]** to **100 Hz**.
(g) **[VIDEO BW]** to **30 Hz**.
(h) **MARKER PEAK SEARCH**.
(i) **AMPLITUDE**.
(j) **[MORE]**.
(k) **[REF LVL CAL]**.

(3) Slowly adjust TI knob until **MKR** indication is between -9.83 and -10.17 dBm.

(4) Disconnect **CAL OUTPUT** from **INPUT 50Ω** and connect a 50 Ω termination to **INPUT 50Ω**.

(5) Press TI keys and enter values using **DATA** keys as listed in (a) through (h) below:

(a) **AMPLITUDE** then **[REF LVL]** to **- 50 dBm**.
(b) **SPAN** then **[ZERO SPAN]**.
(c) **FREQUENCY** then **[CENTER FREQ]** to **10 kHz**.
(d) **CONTROL BW** then **[VIDEO BW]** to **1 Hz**.
(e) **CONTROL TRIG**.
(f) **[SINGLE].**
(g) **[SINGLE]** wait for completion of sweep.

(h) **MARKER ON**.

(6) TI **MKR** amplitude indication will be <-90 dBm.

(7) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **99 kHz**.

(8) Press TI **CONTROL TRIG** key then **[SINGLE]** key. TI **MKR** amplitude indication will be <-100 dBm.

(9) Press TI keys and enter values using **DATA** keys as listed in (a) through (e) below:

(a) **FREQUENCY** and then **[START FREQ]** to **1 MHz**.

(b) **[STOP FREQ]** to **2.9 GHz**.

(c) **MARKER OFF**.

(d) **CONTROL BW** then **[RES BW]** to **1 MHz**.

(e) **[VIDEO BW]** to **10 kHz**.

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

(a) **CONTROL TRIG**.

(b) **[SINGLE]** wait for completion of sweep.

(c) **MARKER ON**.

(d) **[MKRNOISE ON]**.

(11) Adjust TI knob to position marker at the highest average noise level on TI crt.

(12) Press TI keys and enter values using **DATA** keys as listed in (a) through (h) below:

(a) **MARKER MKR→** then **[MARKER→ CF]**.

(b) **SPAN** then **[ZERO SPAN]**.

(c) **MARKER OFF**.

(d) **CONTROL BW** then **[RES BW]** to **100 Hz**.

(e) **[VIDEO BW]** to **1 Hz**.

(f) **CONTROL TRIG**.

(g) **[SINGLE]** wait for completion of sweep.

(h) **MARKER ON**.

(13) TI **MKR** amplitude indication will be <-121 dBm.

(14) Press TI keys and enter values using **DATA** keys as listed in (a) through (e) below:

(a) **FREQUENCY** then **[START FREQ]** to **2.9 GHz**.

(b) **[STOP FREQ]** to **6.46 GHz**.

(c) **MARKER OFF**.

(d) **CONTROL BW** then **[RES BW]** to **1 MHz**.

(e) **[VIDEO BW]** to **10 kHz**.

(15) Repeat (10) through (12) above. TI **MKR** amplitude indication will be <-121 dBm.

(16) Press TI keys and enter values using **DATA** keys as listed in (a) through (e) below:

(a) **FREQUENCY** then **[START FREQ]** to **6.46 GHz**.

(b) **[STOP FREQ]** to **13 GHz**.

(c) **MARKER OFF**.

(d) **CONTROL BW** then **[RES BW]** to **1 MHz**.

(e) **[VIDEO BW]** to **10 kHz**.

(17) Repeat (10) through (12) above. TI **MKR** amplitude indication will be <-110 dBm.

(18) Press TI keys and enter values using **DATA** keys as listed in (a) through (e) below:

(a) **FREQUENCY** then **[START FREQ]** to **13 GHz**.

(b) **[STOP FREQ]** to **18 GHz**.

(c) **MARKER OFF**.

(d) **CONTROL BW [RES BW]** to **1 MHz**.

(e) **[VIDEO BW]** to **10 kHz**.

(19) Repeat (10) through (12) above. TI **MKR** amplitude indication will be <-105 dBm.

b. Adjustments. No adjustments can be made.

10. Resolution Bandwidth Accuracy and Selectivity Test

a. Performance Check

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

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

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

(a) **FREQUENCY** to **40 MHz**.

(b) **AMPLITUDE** to **-3 dBm**.

(c) **AMPTD INCR** to **1 dB**.

(4) Press TI keys enter values using **DATA** keys as listed in (a) through (k) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **AMPLITUDE**.

(c) **[MORE]**.

(d) **[IF ADJUST]**.

(e) **[IF ADJ OFF]**.

(f) **FREQUENCY** then **[CENTER FREQ]** to **40 MHz**.

(g) **SPAN** then **[ZERO SPAN]**.

(h) **AMPLITUDE** then **[LOG dB/DIV]** to **1 dB**.

(i) **CONTROL BW** then **[RES BW]** to **2 MHz**.

(j) **[VIDEO BW]** to **300 Hz**.

(k) **CONTROL SWEEP** then **[SWEEP TIME]** to **50 ms**.

(5) Adjust synthesizer/level generator amplitude to position the signal 2 to 3 divisions (2 to 3 dB) below TI reference level.

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

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

(a) **AMPLITUDE**.

(b) **[MORE]**.

(c) **[IF ADJUST]**.

(d) **[ADJ CURR IF STATE]** wait for **IF ADJUST STATUS** messages to disappear.

(e) **SPAN** then **[ZERO SPAN]**.

(8) Press synthesizer/level generator **FREQUENCY** key and adjust frequency to peak signal amplitude on TI.

NOTE

At 2 MHz setting, several minor peaks might be observed.
Select peak with highest amplitude.

(9) Press synthesizer/level generator **AMPLITUDE** key then **INCR** ⇓ key.

(10) Press TI **MARKER ON** key then **[MARKER DELTA]** key.

(11) Press synthesizer/level generator **INCR** ⇑ key.

(12) Press synthesizer/level generator **FREQUENCY** key and increase frequency for a TI **Δ MKR** indication between -0.02 and +0.02 dB. Record synthesizer/level generator frequency indication as upper 3 dB frequency.

(13) Decrease synthesizer/level generator frequency past TI signal peak amplitude until **Δ MKR** indicates between -0.02 and +0.02 dB. Record synthesizer/level generator frequency indication as lower 3 dB frequency.

(14) Subtract lower 3 dB frequency recorded in (13) above from upper 3 dB frequency recorded in (12) above. The result will be within the limits specified in table 3. Record the result as actual 3 dB bandwidth in table 3.

(15) Set synthesizer/level generator frequency to 40 MHz.

(16) Press TI **MARKER OFF** key.

Table 3. Resolution Bandwidth Accuracy

Test instrument **CONTROL BW** [**RES SW**] settings	3 dB Bandwidth Limits		Actual Bandwidth	
	Lower 3 dB frequency Min	Upper 3 dB frequency Max	3dB (14)	60 dB (27)
2 MHz	1.5 MHz	2.5 MHz		
1 MHz	750 kHz	1.25 MHz		
300 kHz	270 kHz	330 kHz		
100 kHz	90 kHz	110 kHz		
30 kHz	27 kHz	33 kHz		
10 kHz[1]	9 kHz	11 kHz		
3 kHz[1]	2.7 kHz	3.3 kHz		
1 kHz[1]	900 Hz	1.1 kHz		
300 Hz[1]	270 Hz	330 Hz		
100 Hz[1]	70 Hz	130 Hz		

[1]Press TI **CONTROL BW** key then **[VIDEO BW]** to 1 Hz.

NOTE

The 3 dB bandwidth recorded in table 3 will be used to determine shape factor in (28) below.

(17) Repeat technique of (4) (i) and (7) through (16) above for remaining **CONTROL BW [RES BW]** settings in table 3.

(18) Press TI keys and enter values using **DATA** keys as listed in (a) through (c) below:

(a) **AMPLITUDE** then **[LOG dB/DIV]** to **10 dB**.

(b) **CONTROL BW** then **[RES BW]** to **2 MHz**.

(c) **[VIDEO BW]** to **300 Hz**.

(19) Set synthesizer/level generator amplitude to -3 dBm and **AMPTD INCR** to **60 dB.**

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

(a) **AMPLITUDE**.

(b) **[MORE]**.

(c) **[IF ADJUST]**.

(d) **[ADJ CURR IF STATE]** wait for **IF ADJUST STATUS** messages to disappear.

(21) Press synthesizer/level generator **FREQUENCY** key and adjust frequency to peak signal amplitude on TI display.

NOTE

At 2 MHz setting, several minor peaks might be observed. Select peak with highest amplitude.

(22) Press synthesizer/level generator **AMPLITUDE** key then **INCR** ⇓ key.

(23) Press TI **MARKER ON** key then **[MARKER DELTA]** key.

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

(25) Press synthesizer/level generator **FREQUENCY** key and increase frequency for a TI **Δ MKR** indication between -0.02 and +0.02 dB. Record synthesizer/level generator frequency indication as upper 60 dB frequency.

(26) Decrease synthesizer/level generator frequency past TI signal amplitude peak amplitude until **Δ MKR** indicates between -0.02 and +0.02 dB. Record synthesizer/level generator frequency as lower 60 dB frequency.

(27) Subtract lower 60 dB frequency recorded in (26) above from upper 60 dB frequency recorded in (25) above. Record the result as actual 60 dB bandwidth in table 3.

(28) Divide the 60 dB bandwidth recorded in (27) above by the 3 dB bandwidth recorded in table 3 above. The result must be a shape factor of 15 or less.

(29) Set synthesizer/level generator frequency to 40 MHz.

(30) Press TI **MARKER OFF** key.

(31) Repeat technique of (18) (b) and (20) through (30) above for remaining **CONTROL BW [RES BW]** settings listed in table 3.

b. Adjustments. No adjustments can be made.

11. Input Attenuator Accuracy

a. Performance Check

(1) Connect equipment as shown in figure 2.

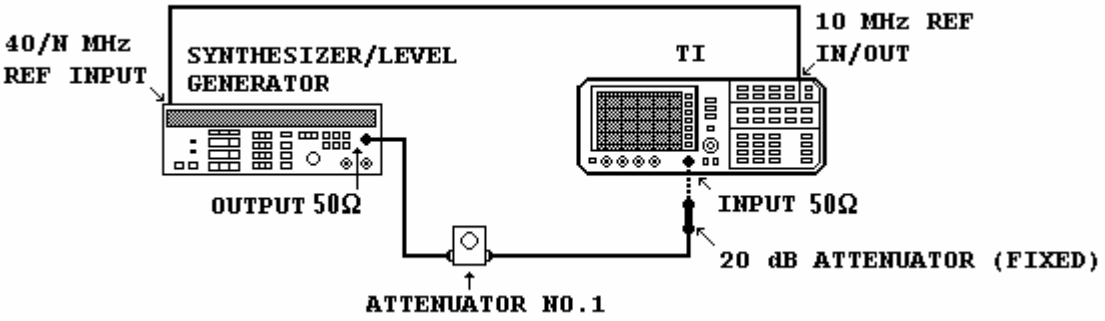

Figure 2. Input attenuator accuracy (50 MHz) - equipment setup.

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

(a) **FREQUENCY** to **50 MHz**.
(b) **AMPLITUDE** to **-50 dBm**.
(c) **AMPTD INCR** to **10 dB**.

(3) Press TI keys and enter values using **DATA** keys as listed in (a) through (k) below:

(a) **INSTRUMENT STATE PRESET**.
(b) **[REALIGN LO & IF]** wait for **ADJUST STATUS** messages to disappear.
(c) **INSTRUMENT STATE RECALL**.
(d) **[MORE]**.
(e) **[FACTORY PRSEL PK]**.
(f) **FREQUENCY** then **[CENTER FREQ]** to **50 MHz**.
(g) **SPAN** then **[ZERO SPAN]**.
(h) **AMPLITUDE** then **[REF LVL]** to **-70 dBm**.
(i) **[LOG dB/DIV]** to **1 dB**.
(j) **CONTROL BW** then **[RES BW]** to **3 kHz**.
(k) **[VIDEO BW]** to **1 Hz**.

(4) Set attenuator No. 1 to 0 dB.

NOTE

Attenuator (fixed) listed in table 2 may be substituted in equipment setup as necessary to obtain TI reference level in (5) and (17) below.

(5) Adjust attenuator No. 1 to position signal peak 2 to 3 divisions below TI reference level.

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

(a) **CONTROL TRIG**.
(b) **[SINGLE]**.
(c) **[SINGLE].**
(d) **MARKER ON**.
(e) **[MARKER DELTA]**.

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

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

(9) Press TI **AMPLITUDE** key then **[REF LVL]** to **-60 dBm** and **[ATTEN]** to **20 dB**.

(10) Press TI **CONTROL TRIG** key then **[SINGLE]** key and wait for completion of sweep. TI **Δ MKR** indication will be within limits specified in table 4. Record **Δ MKR** indication as actual **Δ MKR** indication in table 4.

Table 4. Input Attenuator Accuracy

Synthesizer/level generator amplitude settings (dBm)	Test instrument				
	(REF LVL) settings (dBm)	**[ATTEN]** settings (dB)	**Δ MKR** indications (dB)		
			Min	Max	Actual
-40	-60	20	+6.5	+13.5	
-30	-50	30	+16.5	+23.5	
-20	-40	40	+26.5	+33.5	
-10	-30	50	+36.5	+43.5	
0	-20	60	+46.5	+53.5	
+10	-10	70	+56.5	+63.5	

(11) Repeat (8) through (10) above for remaining synthesizer/level generator amplitude, TI **[REF LVL]** and **[ATTEN]** settings listed in table 4.

(12) Calculate the step-to-step accuracy for TI **[ATTEN]** 20 dB setting by subtracting 10 dB from the actual **Δ MKR** indication recorded in table 4 for **[ATTEN]** 20 dB setting. Difference will be between -1.8 and +1.8 dB.

(13) Calculate the step-to-step accuracy for TI **[ATTEN]** 30, 40, 50, 60 and 70 dB settings by subtracting previous **[ATTEN]** setting actual **Δ MKR** indication recorded in table 4 from the current **[ATTEN]** setting actual **Δ MKR** indication recorded in table 4 and then subtract 10 dB from the results. Difference will be between -1.8 and +1.8 dB for each setting.

EXAMPLE:

		(Current)		(Previous)
30 dB step-to-step accuracy	=	TI **[ATTEN]** 30 dB (actual **Δ MKR** indication	-	TI **[ATTEN]** 20 dB actual **Δ MKR** indication) - 10 dB

(14) Set synthesizer/level generator amplitude to +10 dBm and **AMPTD INCR** to **5 dB.**

(15) Press TI keys and enter values using **DATA** keys as listed in (a) through (i) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **[REALIGN LO & IF]** wait for **ADJUST STATUS** messages to disappear.

(c) **FREQUENCY** then **[CENTER FREQ]** to **50 MHz**.

(d) **SPAN** then **[ZERO SPAN]**.

(e) **AMPLITUDE** then **[REF LVL]** to **-10 dBm**.

(f) **[LOG dB/DIV]** to **1 dB**.

(g) **[ATTEN]** to **0 dB**.

(h) **CONTROL [RES BW]** to **1 kHz**.

(i) **[VIDEO BW]** to **1 Hz**.

(16) Set attenuator No. 1 to 5 dB and replace 20 dB attenuator (fixed) in equipment setup with 10 dB attenuator (fixed).

(17) Adjust attenuator No. 1 to position trace 2 to 3 divisions below TI reference level.

(18) Press TI **MARKER ON** key then **[MARKER DELTA]** key.

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

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

(21) Press TI **AMPLITUDE** key then **[REF LVL]** to **–15 dBm**. Record actual **Δ MKR** indication for TI **[REF LVL]** –15 dBm setting in table 5.

(22) Subtract ideal **Δ MKR** value from actual **Δ MKR** indication listed in table 5 and record difference as **IF GAIN DEVIATION** in table 5.

Table 5. IF Gain Deviation

Synthesizer/level generator amplitude settings (dBm)	Test instrument			**IF GAIN DEVIATION** (dB)
	[REF LVL] settings (dBm)	**Δ MKR** indications		
		Actual (dB)	Ideal (dB)	
+10	-10	0 (ref)	0 (ref)	0 (ref)
+5	-15		-5	
0	-20		-10	
-5	-25		-15	
-10	-30		-20	
-15	-35		-25	
-20	-40		-30	
-25	-45		-35	
-30	-50		-40	
-35	-55		-45	
-40	-60		-50	
-45	-65		-55	
-50	-70		-60	
-55	-75		-65	
-60	-80		-70	
-65	-85		-75	
-70	-90		-80	
-75	-95		-85	
-80	-100		-90	

(23) Repeat (20) through (22) above for remaining synthesizer/level generator amplitude and TI **[REF LVL]** settings listed in table 5.

(24) Calculate the **IF GAIN CORRECTION** for **[ATTEN]** 20 dB setting in table 6 by subtracting the **IF GAIN DEVIATION** value recorded for **[REF LVL]** –40 dBm setting in table 5 from the **IF GAIN DEVIATION** value recorded for **[REF LVL]** –50 dBm setting in table 5 as in EXAMPLE below. Record difference as **IF GAIN CORRECTION** in table 6.

EXAMPLE:

(a) If the **IF GAIN DEVIATION** values in table 5 are: **[REF LVL]** -50 dBm = +0.2 dB
[REF LVL] -40 dBm = -0.3 dB

(b) **IF GAIN CORRECTION** formula listed in table 6 is: (-50) - (-40) =

(c) Substitute table 5 **IF GAIN DEVIATION** values for **[REF LVL]** settings into formula: (-50) - (-40) = (+0.2) - (-0.3) = +0.5

(d) Then +0.5 would be recorded as **IF GAIN CORRECTION** (dB) factor in table 6 for **[ATTEN]** 20 dB setting. **NOTE**: Do not record EXAMPLE in table 6.

Table 6. Input Attenuator Accuracy (18 GHz)

Test instrument				
[**ATTEN**] settings (dB)	**Δ MKR** indications (dB)	**IF GAIN CORRECTION** (dB)	Corrected **Δ MKR** indications (dB)	Step-to-step accuracy (dB)
10	0 (ref)	0 (ref)	0 (ref)	0 (ref)
20		(-50) - (-40) =		
30		(-60) - (-40) =		
40		(-70) - (-40) =		
50		(-80) - (-40) =		
60		(-90) - (-40) =		
70		(-100) - (-40) =		

(25) Repeat (24) above for each remaining **IF GAIN CORRECTION** listed in table 6.

(26) Connect equipment as shown in figure 3.

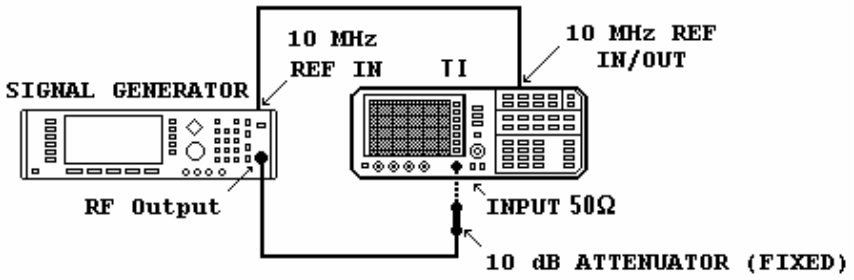

Figure 3. Input attenuator accuracy (18 GHz) - equipment setup.

(27) Press TI keys and enter values using **DATA** keys as listed in (a) through (d) below:

(a) **FREQUENCY** then **[CENTER FREQ]** to **18 GHz**.

(b) **AMPLITUDE** then **[REF LVL]** to **-10 dBm**.

(c) **AMPLITUDE** then **[ATTEN]** to **10 dB**.

(d) **MARKER OFF**.

(28) Set signal generator frequency to 18 GHz and level output to 0 dBm.

NOTE

If 18 GHz signal marker does not appear in (29) and (30) below, repeat paragraph **8 a** (1) and (2) above and perform adjustment in **8 b** (1) above.

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

(a) **MARKER PEAK SEARCH**.

(b) **INSTRUMENT STATE MIXER INT**.

(c) **[PRESEL AUTO PK]** wait for **PEAKING** message to disappear.

(30) Adjust signal generator level output for a TI **MKR** indication between -12.95 and -13.05 dBm.

(31) Press TI keys and enter values using **DATA** keys as listed in (a) through (c) below:

(a) **MARKER ON**.

(b) **[MARKER DELTA]**.

(c) **AMPLITUDE** then **[ATTEN]** to **20 dB**.

(32) Wait for completion of sweep. Record **Δ MKR** indication for TI **[ATTEN]** 20 dB setting in table 6.

(33) Repeat technique of (31) (c) and (32) above for remaining TI **[ATTEN]** settings listed in table 6.

(34) Subtract **IF GAIN CORRECTION** from **Δ MKR** indication and record results as corrected **Δ MKR** indication for each **[ATTEN]** setting listed in table 6. The corrected **Δ MKR** indication will be between –3.5 and +3.5 dB for each setting.

(35) The step-to-step accuracy for TI **[ATTEN]** 20 dB setting is equal to the **[ATTEN]** 20 dB setting corrected **Δ MKR** indication recorded in table 6. The corrected **Δ MKR** indication will be between -1.8 and +1.8 dB.

(36) Calculate the step-to-step accuracy for TI **[ATTEN]** 30, 40, 50, 60 and 70 dB settings by subtracting previous **[ATTEN]** setting corrected **Δ MKR** indication recorded in table 6 from the current **[ATTEN]** setting corrected **Δ MKR** indication recorded in table 6. Difference will be between -1.8 and +1.8 dB for each setting.

EXAMPLE:

		(Current)		(Previous)
30 dB step-to-step		TI **[ATTEN]** 30 dB		TI **[ATTEN]** 20 dB
accuracy	=	(actual **Δ MKR** indication	-	actual **Δ MKR** indication)

b. Adjustments. No adjustments can be made.

12. IF Gain Uncertainty

a. Performance Check

(1) Connect equipment as shown in figure 4.

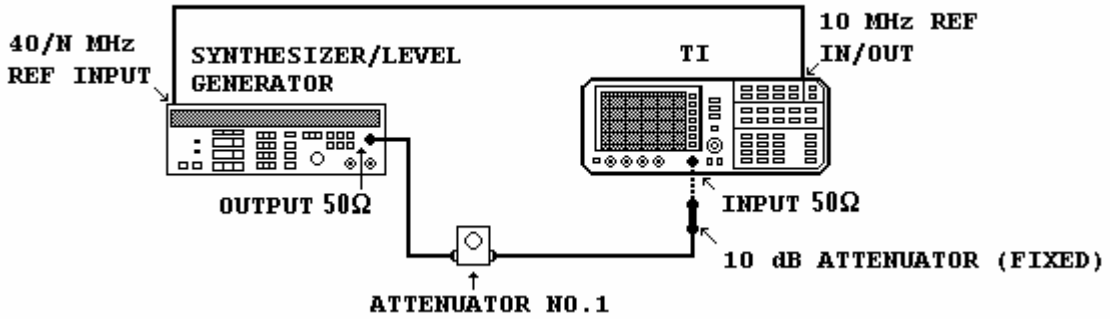

Figure 4. IF gain uncertainty - equipment setup.

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

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

(b) **AMPLITUDE** to **+10 dBm**.

(c) **AMPTD INCR** to **10 dB**.

(3) Press TI keys and enter values using **DATA** keys as listed in (a) through (g) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **[REALIGN LO & IF]** wait for **ADJUST STATUS** messages to disappear.

(c) **FREQUENCY** then **[CENTER FREQ]** to **50 MHz**.

(d) **SPAN** then **[ZERO SPAN]**.

(e) **AMPLITUDE** then **[LOG dB/DIV]** to **1 dB**.

(f) **CONTROL BW** then **[RES BW]** to **10 kHz**.

(g) **[VIDEO BW]** to **1 Hz**.

(4) Set attenuator No. 1 to 0 dB.

(5) Press TI **MARKER ON** key.

NOTE

Attenuator (fixed) listed in table 2 may be substituted in equipment setup as necessary to obtain TI reference level in (6), (16) and (26) below.

(6) Adjust attenuator No. 1 to position signal peak 2 to 3 dB (2 to 3 divisions) below TI reference level.

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

(a) **CONTROL TRIG**.

(b) **[SINGLE]**.

(c) **[SINGLE]**

(d) **MARKER ON**.

(e) **[MARKER DELTA]**.

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

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

(10) Press TI **AMPLITUDE** then **[REF LVL]** to **-10 dBm**.

(11) Press TI **CONTROL TRIG** key then **[SINGLE]** key and wait for completion of sweep.

(12) TI **Δ MKR** indication will be between –9 and –11 dB.

(13) Repeat technique of (9) through (11) above for synthesizer/level generator amplitude and TI **AMPLITUDE [REF LVL]** settings listed in table 7. TI **Δ MKR** indications will be within limits specified in table 7.

Table 7. Log Gain Uncertainty (10 dB Steps)

Synthesizer/level generator amplitude settings (dBm)	Test instrument		
	AMPLITUDE (**REF LVL**) settings (dBm)	**Δ MKR** indications (dB)	
		Min	Max
-10	-20	-21	-19
-20	-30	-31	-29
-30	-40	-41	-39
-40	-50	-51	-49
-50	-60	-61	-59
-60	-70	-71	-69
-70	-80	-81	-79

(14) Set synthesizer/level generator amplitude to +10 dBm and **AMPTD INCR** to **1 dB**.

(15) Press TI keys and enter values using **DATA** keys as listed in (a) though (c) below:

(a) **MARKER MKR→** then **[MARKER NORMAL]**.

(b) **AMPLITUDE** then **[REF LVL]** to **0 dBm**.

(c) **CONTROL TRIG** then **[CONT]**.

(16) Adjust attenuator No. 1 to position signal peak 2 to 3 dB (2 to 3 divisions) below TI reference level.

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

(a) **CONTROL TRIG**.

(b) **[SINGLE]**.

(c) **[SINGLE]**.

(d) **MARKER ON**.

(e) **[MARKER DELTA]**.

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

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

(20) Press TI **AMPLITUDE** key then **[REF LVL]** to **-1 dBm**.

(21) Press TI **CONTROL TRIG** key then **[SINGLE]** key and wait for completion of sweep.

(22) TI **Δ MKR** indication will be between 0 and -2 dB.

(23) Repeat technique of (19) through (21) above for synthesizer/level generator amplitude and TI **AMPLITUDE [REF LVL]** settings listed in table 8. TI **Δ MKR** indications will be within limits specified in table 8.

Table 8. Log Gain Uncertainty (1 dB Steps)

Synthesizer/level generator amplitude settings (dBm)	Test instrument		
	AMPLITUDE (**REF LVL**) settings (dBm)	**Δ MKR** indications (dB)	
		Min	Max
+8	-2	-3	-1
+7	-3	-4	-2
+6	-4	-5	-3
+5	-5	-6	-4
+4	-6	-7	-5
+3	-7	-8	-6
+2	-8	-9	-7
+1	-9	-10	-8
0	-10	-11	-9
-1	-11	-12	-10
-2	-12	-13	-11

(24) Set synthesizer/level generator amplitude to +10 dBm and **AMPTD INCR** to **10 dB**.

(25) Press TI keys to values using **DATA** keys as listed in (a) through (e) below:

(a) **MARKER MKR→** then **[MARKER NORMAL]**.

(b) **AMPLITUDE** then **[REF LVL]** to **0 dBm**.

(c) **[LINEAR]** then **[MORE]**.

(d) **[UNITS]** then **[dBm]**.

(e) **CONTROL TRIG** then **[CONT]**.

(26) Adjust attenuator No. 1 to position signal peak 2 to 3 dB (2 to 3 divisions) below TI reference level.

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

(a) **CONTROL TRIG**.

(b) **[SINGLE]**.

(c) **[SINGLE]**.

(d) **MARKER ON**.

(e) **[MARKER DELTA]**.

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

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

(30) Press TI **AMPLITUDE** key then **[REF LVL]** to **-10 dBm**.

(31) Press TI **CONTROL TRIG** key then **[SINGLE]** key and wait for completion of sweep.

(32) TI **Δ MKR** indication will be between –9 and –11 dB.

(33) Repeat technique of (29) through (31) above for synthesizer/level generator and TI **AMPLITUDE [REF LVL]** settings listed in table 9. TI **Δ MKR** indications will be within limits specified in table 9.

Table 9. Linear IF Gain Uncertainty

Synthesizer/level generator amplitude settings (dBm)	Test instrument		
	AMPLITUDE (**REF LVL**) settings (dBm)	**ΔMKR** indications (dB)	
		Min	Max
-10	-20	-21	-19
-20	-30	-31	-29
-30	-40	-41	-39
-40	-50	-51	-49
-50	-60	-61	-59
-60	-70	-71	-69
-70	-80	-81	-79

b. Adjustments. Refer to paragraph **1 a**.

13. Residual FM

a. Performance Check

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

(2) Set signal generator frequency to 2.5 GHz and level output to -10 dBm.

(3) Press TI keys and enter values using **DATA** keys listed in (a) through (v) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **2.5 GHz**.

(c) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(d) **AMPLITUDE** then **[REF LEVEL]** to **-10 dBm**.

(e) **[LOG dB/DIV]** to **1 dB**.

(f) **CONTROL BW** then **[RES BW]** to **3 kHz**.

(g) **MARKER PEAK SEARCH**.

(h) **[SIG TRK ON]**.

(i) **SPAN** then **[SPAN WIDTH]** to **10 kHz**.

(j) **CONTROL BW** then **[RES BW]** to **1 kHz**.

(k) **MARKER ON**.

(l) **[SIG TRK OFF]**.

(m) **MARKER PEAK SEARCH**.

(n) **MARKER MKR→**.

(o) **[MARKER→ CF]**.

(p) **[MARKER→ REF LVL]**.

(q) **MARKER OFF**.

(r) **CONTROL TRIG**.

(s) **[SINGLE]**.

(t) **[SINGLE]** wait for completion of sweep.

(u) **MARKER PEAK SEARCH**.

(v) **[MARKER DELTA]**.

(4) Adjust TI knob ccw for a **Δ MKR** indication between -0.9 and -1.1 dB and press **[MARKER DELTA]** key.

(5) Adjust TI knob ccw for a **Δ MKR** indication between -3.9 and -4.1 dB.

(6) Divide **Δ MKR** frequency (in Hz) by **Δ MKR** amplitude (in dB) to obtain slope of **[RES BW]** filter and record result.

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

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

(a) **MARKER OFF**.

(b) **MARKER PEAK SEARCH**.

(c) **[MARKER DELTA]**.

(8) Adjust TI knob ccw for a **Δ MKR** indication between -2.9 and -3.1 dB.

(9) Press TI keys and enter values using **DATA** keys as listed in (a) through (g) below:

(a) **MARKER MKR→**.

(b) **[MARKER NORMAL]**.

(c) **[MARKER→ CF]**.

(d) **SPAN** then **[ZERO SPAN]**.

(e) **CONTROL SWEEP** then **[SWEEP TIME]** to **200 mS**.

(f) **CONTROL TRIG**.

(g) **[SINGLE]**.

NOTE

If displayed trace is not approximately 3 divisions below the reference level, press **[CONT]** key and then **FREQUENCY** key. Adjust displayed trace approximately 3 divisions below reference level with TI knob.

(10) Press **CONTROL TRIG** key then **[SINGLE]** key.

(11) Press **MARKER ON** key and adjust TI knob to position marker on horizontal division with greatest amplitude deviation.

(12) Press **[MARKER DELTA]** key and adjust TI knob to position marker at lowest amplitude in the same horizontal division. Record absolute value of **Δ MKR** amplitude indication.

(13) Multiply value recorded in (6) above by value recorded in (12) above. Result will be less than 100 Hz.

b. Adjustments. No adjustments can be made.

14. Noise Sidebands

a. Performance Check

(1) Connect TI **CAL OUTPUT** to **INPUT 50Ω**.

(2) Press TI keys and enter values using **DATA** keys as listed in (a) through (w) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.

(c) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(d) **AMPLITUDE** then **[REF LVL]** to **-10 dBm**.

(e) **[ATTEN]** to **0 dB**.

(f) **MARKER PEAK SEARCH**.

(g) **[SIG TRK ON]**.

(h) **SPAN** then **[SPAN WIDTH] 10 kHz** and wait for completion of at least two sweeps.

(i) **MARKER ON**.

(j) **[SIG TRK OFF]**.

(k) **CONTROL BW** then **[RES BW]** to **300 Hz**.

(l) **SPAN** then **[ZERO SPAN]**.

(m) **CONTROL BW** then **[VIDEO BW]** to **1 Hz**.

(n) **MARKER MKR→** then **[MARKER→ REF LVL]**.

(o) **CONTROL TRIG**.

(p) **[SINGLE]**.

(q) **[SINGLE]** wait for completion of sweep.

(r) **MARKER ON**.

(s) **[MARKER DELTA]**.

(t) **FREQUENCY** then **[CF STEP]** to **9 kHz**.

(u) **[CENTER FREQ]**.

(v) **STEP ⇑**.

(w) **CONTROL TRIG**.

NOTE

Using the **CAL OUTPUT** signal as the source, the checks must pass with at least a 6 dB margin (added in (3) and (5) below) for results to be valid. This is due to the phase-coherency of the **CAL OUTPUT** signal and the internal local oscillators.

(3) Press TI **[SINGLE]** key and wait for completion of sweep. TI **Δ MKR** amplitude indication will be less than -76 dBc.

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

(a) **FREQUENCY**.

(b) **STEP ⇓**.

(c) **STEP ⇓**.

(d) **CONTROL TRIG**.

(5) Press TI **[SINGLE]** key and wait for completion of sweep. TI **Δ MKR** amplitude indication will be less than -76 dBc.

b. Adjustments. No adjustments can be made.

15. Frequency Readout and Frequency Count Marker Accuracy

a. Performance Check

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

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

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

(4) Press TI keys and enter values using **DATA** keys as listed in (a) through (f) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **1.5 GHz**.

(c) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(d) **INSTRUMENT STATE RECALL**.

(e) **[MORE]**.

(f) **[FACTORY PRSEL PK]**.

(5) Press TI **MARKER PEAK SEARCH** key. TI **MKR** frequency indication will be between 1.499948 and 1.500051 GHz.

(6) Repeat technique of (4) (c) and (5) above for remaining TI **SPAN [SPAN WIDTH]** settings listed in table 10. TI **MKR** frequency indications will be within the limits specified in table 10.

Table 10. Frequency Readout Accuracy – 1.5 GHz

Signal generator frequency setting (GHz)	Test instrument			
	FREQUENCY (CENTER FREQ] setting (GHz)	**SPAN [SPAN WIDTH]** settings	**MKR** frequency indications (GHz)	
			Min	Max
1.5	1.5	10 MHz	1.49948	1.50051
1.5	1.5	20 MHz	1.49895	1.50104
1.5	1.5	50 MHz	1.49745	1.50254
1.5	1.5	100 MHz	1.4948	1.5052
1.5	1.5	1 GHz	1.450	1.550

(7) Set signal generator frequency to 4 GHz.

(8) Press TI keys and enter values using **DATA** keys as listed in (a) through (e) below:

(a) **FREQUENCY** then **[CENTER FREQ]** to **4 GHz**.

(b) **MARKER PEAK SEARCH**.

(c) **INSTRUMENT STATE MIXER INT**.

(d) **[PRESEL AUTO PK]** wait for **PEAKING** message to disappear.

(e) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(9) Press TI **MARKER PEAK SEARCH** key. TI **MKR** frequency indication will be between 3.999948 and 4.000051 GHz.

(10) Press TI **SPAN** key then **[SPAN WIDTH]** to **10 MHz**.

(11) Press TI **MARKER PEAK SEARCH** key. TI **MKR** frequency indication will be between 3.99948 and 4.00051 GHz.

(12) Repeat technique of (10) and (11) above for remaining **SPAN [SPAN WIDTH]** settings listed in table 11. TI **MKR** frequency indications will be within limits specified in table 11.

Table 11. Frequency Readout Accuracy – 4 GHz

Signal generator frequency setting (GHz)	Test instrument			
	FREQUENCY (CENTER FREQ] setting (GHz)	**SPAN [SPAN WIDTH]** settings	**MKR** frequency indications (GHz)	
			Min	Max
4	4	20 MHz	3.99895	4.00104
4	4	50 MHz	3.99745	4.00254
4	4	100 MHz	3.9948	4.0051
4	4	1 GHz	3.950	4.050

(13) Set signal generator frequency to 9 GHz.

(14) Press TI keys and enter values using **DATA** keys as listed in (a) through (e) below:

(a) **FREQUENCY** then **[CENTER FREQ]** to **9 GHz**.

(b) **MARKER PEAK SEARCH**.

(c) **INSTRUMENT STATE MIXER INT**.

(d) **[PRESEL AUTO PK]** wait for **PEAKING** message to disappear.

(e) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(15) Press TI **MARKER PEAK SEARCH** key. TI **MKR** frequency indication will be between 8.999948 and 9.000051 GHz.

(16) Press TI **SPAN** key then **[SPAN WIDTH]** to **10 MHz.**

(17) Press TI **MARKER PEAK SEARCH** key. TI **MKR** frequency indication will be between 8.99948 and 9.00051 GHz.

(18) Repeat technique of (16) and (17) above for remaining **SPAN [SPAN WIDTH]** settings listed in table 12. TI **MKR** frequency indications will be within limits specified in table 12.

Table 12. Frequency Readout Accuracy – 9 GHz

Signal generator frequency setting (GHz)	Test instrument			
	FREQUENCY (CENTER FREQ] setting (GHz)	**SPAN [SPAN WIDTH]** settings	**MKR** frequency indications (GHz)	
			Min	Max
9	9	20 MHz	8.99895	9.00104
9	9	50 MHz	8.99745	9.00254
9	9	100 MHz	8.9948	9.0051
9	9	1 GHz	8.950	9.050

(19) Set signal generator frequency to 16 GHz.

(20) Press TI keys and enter values using **DATA** keys as listed in (a) through (e) below:

(a) **FREQUENCY** then **[CENTER FREQ]** to **16 GHz**.

(b) **MARKER PEAK SEARCH**.

(c) **INSTRUMENT STATE MIXER INT**.

(d) **[PRESEL AUTO PK]** wait for **PEAKING** message to disappear.

(e) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(21) Press TI **MARKER PEAK SEARCH** key. TI **MKR** frequency indication will be between 15.999948 and 16.000051 GHz.

(22) Press TI **SPAN** key then **[SPAN WIDTH]** to **10 MHz.**

(23) Press TI **MARKER PEAK SEARCH** key. TI **MKR** frequency indication will be between 15.99948 and 16.00051 GHz.

(24) Repeat technique of (22) and (23) above for remaining **SPAN [SPAN WIDTH]** settings listed in table 13. TI **MKR** frequency indications will be within limits specified in table 13.

Table 13. Frequency Readout Accuracy – 16 GHz

Signal generator frequency setting (GHz)	Test instrument			
	FREQUENCY (CENTER FREQ] setting (GHz)	**SPAN [SPAN WIDTH]** settings	**MKR** frequency indications (GHz)	
			Min	Max
16	16	20 MHz	15.99895	16.00104
16	16	50 MHz	15.99745	16.00254
16	16	100 MHz	15.9948	16.0051
16	16	1 GHz	15.950	16.050

(25) Set signal generator frequency to 1.5 GHz.

(26) Press TI keys and enter values using **DATA** keys as listed in (a) through (c) below:

(a) **FREQUENCY** then **[CENTER FREQ]** to **1.5 GHz**.

(b) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(c) **INSTRUMENT STATE FREQ COUNT** then **[COUNTER RES]** to **10 Hz**.

(27) Press **MARKER PEAK SEARCH** key. TI **MKR** frequency indication will be between 1.49999994 and 1.50000006 GHz.

(28) Repeat technique of (25) through (27) above for signal generator and TI **[CENTER FREQ]** settings listed in table 14. TI **MKR** frequency indication will be within limits specified in table 14.

Table 14. Frequency Count Marker Accuracy

Signal generator frequency settings (GHz)	Test instrument **[CENTER FREQ]** settings (GHz)	Test instrument **MKR** frequency indications (GHz)	
		Min	Max
4	4	3.99999994	4.00000006
9	9	8.99999989	9.00000011
16	16	15.99999984	16.00000016

b. Adjustments. Refer to paragraph **1 a**.

16. Frequency Span Accuracy

a. Performance Check

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

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

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

(a) **INSTRUMENT STATE PRESET**.

(b) **INSTRUMENT STATE RECALL**.

(c) **[MORE]**.

(d) **[FACTORY PRSEL PK]**.

(4) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **1.5 GHz**.

(5) Press TI **SPAN** key then **[SPAN WIDTH]** to **10 kHz**.

(6) Set signal generator frequency to 1.499996 GHz and level output to -10 dBm.

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

(a) **MARKER OFF**.

(b) **CONTROL TRIG**.

(c) **[SINGLE]** wait for completion of sweep.

(d) **MARKER PEAK SEARCH**.

(e) **[MARKER DELTA]**.

(8) Set signal generator frequency to 1.500004 GHz.

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

(a) **CONTROL TRIG**.

(b) **[SINGLE]** wait for completion of sweep.

(c) **MARKER PEAK SEARCH**.

(10) TI **Δ MKR** indication will be between 7.6 and 8.4 kHz.

(11) Repeat technique of (5) through (9) above for TI **SPAN [SPAN WIDTH]** and signal generator frequency settings listed in table 15. TI **Δ MKR** indications will be within limits specified in table 15.

Table 15. Frequency Span Accuracy – 1.5 GHz Center Frequency

Test instrument		Signal generator		Test instrument	
FREQUENCY [CENTER FREQ] settings	**SPAN [SPAN WIDTH]** settings	Frequency (GHz) settings in (6) above	Frequency (GHz) settings in (8) above	**Δ MKR** indications	
				Min	Max
1.5	20 kHz	1.499992	1.500008	15.2 kHz	16.8 kHz
1.5	50 kHz	1.49998	1.50002	38.0 kHz	42.0 kHz
1.5	100 kHz	1.49996	1.50004	76.0 kHz	84.0 kHz
1.5	101 kHz	1.49996	1.50004	76.0 kHz	84.0 kHz
1.5	200 kHz	1.49992	1.50008	152 kHz	168.0 kHz
1.5	500 kHz	1.4998	1.5002	380 kHz	420 kHz
1.5	1 MHz	1.4996	1.5004	760 kHz	840 kHz
1.5	1.01 MHz	1.4996	1.5004	760 kHz	840 kHz
1.5	2 MHz	1.4992	1.5008	1.52 MHz	1.68 MHz
1.5	5 MHz	1.498	1.502	3.80 MHz	4.20 MHz
1.5	10 MHz	1.496	1.504	7.60 MHz	8.40 MHz
1.5	20 MHz	1.492	1.508	15.2 MHz	16.8 MHz
1.5	50 MHz	1.48	1.52	38.0 MHz	42.0 MHz
1.5	100 MHz	1.46	1.54	76.0 MHz	84.0 MHz
1.5	200 MHz	1.42	1.58	152 kHz	168.0 MHz
1.5	500 MHz	1.3	1.7	380.0 MHz	420.0 MHz
1.5	1 GHz	1.1	1.9	760.0 MHz	840.0 MHz
1.5	2 GHz	0.7	2.3	1.52 GHz	1.68 GHz

(12) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **9 GHz**.

(13) Set signal generator frequency to 9 GHz.

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

(a) **MARKER OFF**.

(b) **CONTROL TRIG**.

(c) **[CONT]**.

(d) **MARKER PEAK SEARCH**.

(e) **INSTRUMENT STATE MIXER INT**.

(f) **[PRESEL AUTO PK]** wait for **PEAKING** message to disappear.

(g) **SPAN** then **[SPAN WIDTH]** to **10 kHz**.

(15) Set signal generator frequency to 8.999996 GHz.

(16) Press TI keys as listed in (a) through (e) below:
   (a) **MARKER OFF**.
   (b) **CONTROL TRIG**.
   (c) **[SINGLE]** wait for completion of sweep.
   (d) **MARKER PEAK SEARCH**.
   (e) **[MARKER DELTA]**.

(17) Set signal generator frequency to 9.000004 GHz.

(18) Press TI keys as listed in (a) through (c) below:
   (a) **CONTROL TRIG**.
   (b) **[SINGLE]** wait for completion of sweep.
   (c) **MARKER PEAK SEARCH**.

(19) TI **Δ MKR** indication will be between 7.6 and 8.4 kHz.

(20) Press TI **SPAN** key then **[SPAN WIDTH]** to **20 MHz**.

(21) Set signal generator frequency to 8.992 GHz.

(22) Press TI keys as listed in (a) through (e) below:
   (a) **MARKER OFF**.
   (b) **CONTROL TRIG**.
   (c) **[SINGLE]**.
   (d) **MARKER PEAK SEARCH**.
   (e) **[MARKER DELTA]**.

(23) Set signal generator frequency to 9.008 GHz.

(24) Press TI keys as listed in (a) through (c) below:
   (a) **CONTROL TRIG**.
   (b) **[SINGLE]**.
   (c) **MARKER PEAK SEARCH**.

(25) TI **Δ MKR** indication will be between 15.2 and 16.8 MHz.

(26) Press TI **SPAN** key then **[SPAN WIDTH]** to **50 MHz**.

(27) Set signal generator frequency to 8.98 GHz.

(28) Press TI keys as listed in (a) through (e) below:
   (a) **MARKER OFF**.
   (b) **CONTROL TRIG**.
   (c) **[SINGLE]**.
   (d) **MARKER PEAK SEARCH**.
   (e) **[MARKER DELTA]**.

(29) Set signal generator frequency to 9.02 GHz.

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

(a) **CONTROL TRIG**.

(b) **[SINGLE]**.

(c) **MARKER PEAK SEARCH**.

(31) TI **Δ MKR** indication will be between 38 and 42 MHz.

(32) Press TI **SPAN** key then **[SPAN WIDTH]** to **5 GHz**.

(33) Set signal generator frequency to 7 GHz.

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

(a) **MARKER OFF**.

(b) **CONTROL TRIG**.

(c) **[SINGLE]**.

(d) **MARKER PEAK SEARCH**.

(e) **[MARKER DELTA]**.

(35) Set signal generator frequency to 11 GHz.

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

(a) **CONTROL TRIG**.

(b) **[SINGLE]**.

(c) **MARKER PEAK SEARCH**.

(37) TI **Δ MKR** indication will be between 3.8 and 4.2 GHz.

(38) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **16 GHz**.

(39) Set signal generator frequency to 16 GHz.

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

(a) **MARKER OFF**.

(b) **CONTROL TRIG**.

(c) **[CONT]**.

(d) **MARKER PEAK SEARCH**.

(e) **INSTRUMENT STATE MIXER INT**.

(f) **[PRESEL AUTO PK]** wait for **PEAKING** message to disappear.

(g) **SPAN** then **[SPAN WIDTH]** to **10 kHz**.

(41) Set signal generator frequency to 15.999996 GHz.

(42) Press TI keys as listed in (a) through (e) below:
- (a) **MARKER OFF**.
- (b) **CONTROL TRIG**.
- (c) **[SINGLE]** wait for completion of sweep.
- (d) **MARKER PEAK SEARCH**.
- (e) **[MARKER DELTA]**.

(43) Set signal generator frequency to 16.000004 GHz.

(44) Press TI keys as listed in (a) through (c) below:
- (a) **CONTROL TRIG**.
- (b) **[SINGLE]** wait for completion of sweep.
- (c) **MARKER PEAK SEARCH**.

(45) TI **Δ MKR** indication will be between 7.6 and 8.4 kHz.

(46) Press TI **SPAN** key then **[SPAN WIDTH]** to **50 MHz**.

(47) Set signal generator frequency to 15.98 GHz.

(48) Press TI keys as listed in (a) through (e) below:
- (a) **MARKER OFF**.
- (b) **CONTROL TRIG**.
- (c) **[SINGLE]**.
- (d) **MARKER PEAK SEARCH**.
- (e) **[MARKER DELTA]**.

(49) Set signal generator frequency to 16.02 GHz.

(50) Press TI keys as listed in (a) through (c) below:
- (a) **CONTROL TRIG**.
- (b) **[SINGLE]**.
- (c) **MARKER PEAK SEARCH**.

(51) TI **Δ MKR** indication will be between 38 and 42 MHz.

(52) Press TI **SPAN** key then **[SPAN WIDTH]** to **5 GHz**.

(53) Set signal generator frequency to 14 GHz.

(54) Press TI keys as listed in (a) through (e) below:
- (a) **MARKER OFF**.
- (b) **CONTROL TRIG**.
- (c) **[SINGLE]**.
- (d) **MARKER PEAK SEARCH**.
- (e) **[MARKER DELTA]**.

(55) Set signal generator frequency to 18 GHz.

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

(a) **CONTROL TRIG**.

(b) **[SINGLE]**.

(c) **MARKER PEAK SEARCH**.

(57) TI **Δ MKR** indication will be between 3.8 and 4.2 GHz.

b. Adjustments. Refer to paragraph **1 a**.

17. Frequency Response

a. Performance Check

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

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

(3) Press TI keys and enter values using **DATA** keys as listed in (a) through (g) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **INSTRUMENT STATE RECALL**.

(c) **[MORE]**.

(d) **[FACTORY PRSEL PK]**.

(e) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.

(f) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(g) **AMPLITUDE** then **[LOG dB/DIV]** to **2 dB/DIV**.

(4) Set signal generator frequency to 300 MHz and level output to -5 dBm.

(5) Press **MARKER PEAK SEARCH** key.

(6) Adjust signal generator level output for TI **MKR** amplitude indication between -9.95 and -10.05 dBm. Record **MKR** indication.

(7) Set signal generator frequency to 18 GHz.

(8) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **18 GHz**.

(9) Press **MARKER PEAK SEARCH** key.

(10) TI **MKR** indication will be within ±6.1 dB of indication recorded in (6) above.

(11) Repeat (7) through (10) above for the remaining signal generator frequency and TI **[CENTER FREQ]** settings listed in table 16.

Table 16. Frequency Response

Signal generator frequency and test instrument **[CENTER FREQ]** settings	
17.5	GHz
17.0	GHz
16.5	GHz
16.0	GHz
15.5	GHz
15.0	GHz
14.5	GHz
14.0	GHz
13.5	GHz
13.0	GHz
12.5	GHz
12.0	GHz
11.5	GHz
11.0	GHz
10.5	GHz
10.0	GHz
9.5	GHz
9.0	GHz
8.5	GHz
8.0	GHz
7.5	GHz
7.0	GHz
6.5	GHz
6.0	GHz
5.5	GHz
5.0	GHz
4.5	GHz
4.0	GHz
3.5	GHz
3.0	GHz
2.5	GHz
2.0	GHz
1.5	GHz
1.0	GHz
500	MHz
100	MHz
50	MHz
20	MHz

(12) Set signal generator frequency to 10 MHz.

(13) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **10 MHz**.

(14) Press TI **SPAN** key then **[SPAN WIDTH]** to **10 kHz**.

(15) Press **MARKER PEAK SEARCH** key.

(16) TI **MKR** indication will be within ±6.1 dB of indication recorded in (6) above. Record TI **MKR** indication.

(17) Disconnect signal generator from TI.

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

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

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

(a) **FREQUENCY** to **10 MHz**.

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

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

(21) Press TI **MARKER PEAK SEARCH** key.

(22) Slowly adjust synthesizer/level generator amplitude until TI **MKR** indication is as close as possible to the indication recorded in (16) above.

(23) Set synthesizer/level generator frequency to 1 MHz.

(24) Press **FREQUENCY** key then **[CENTER FREQ]** to **1 MHz**.

(25) Press **MARKER PEAK SEARCH** key.

(26) TI **MKR** indication will be within ±6.1 dB of indication recorded in (6) above.

(27) Repeat (23) through (26) above for synthesizer/level generator frequency and TI **[CENTER FREQ]** 100 kHz and 10 kHz settings.

b. Adjustments. Perform paragraph **18**.

18. Frequency Response (Alternate Technique)

NOTE

Do not perform if indications in paragraph **17** are within tolerance.

a. Performance Check

NOTE

Perform measuring receiver and sensor module (11792A) ZERO and CALIBRATE.

(1) Connect equipment as shown in figure 5.

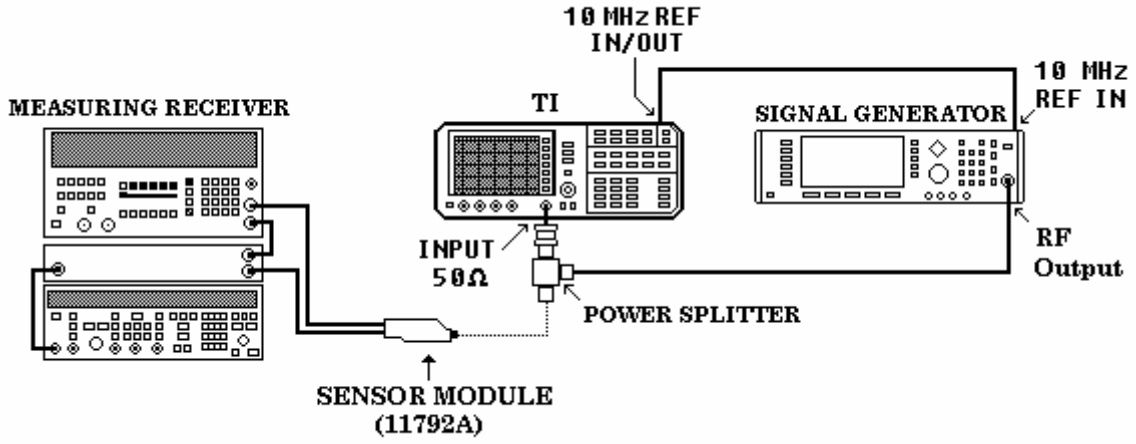

Figure 5. Frequency response - equipment setup.

(2) Press TI keys and enter values using **DATA** keys as listed in (a) through (g) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **INSTRUMENT STATE RECALL**.

(c) **[MORE]**.

(d) **[FACTORY PRSEL PK]**.

(e) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.

(f) **SPAN** then **[SPAN WIDTH]** to **1 MHz**.

(g) **AMPLITUDE** then **[LOG dB/DIV]** to **2 dB/DIV**.

(3) Set signal generator frequency to 300 MHz and level output to -5 dBm.

(4) Press **MARKER PEAK SEARCH** key.

(5) Set measuring receiver to measure RF power in dBm at 300 MHz.

(6) Adjust signal generator level output for a TI **MKR** amplitude indication between -9.95 and -10.05 dBm.

(7) Record measuring receiver indication.

(8) Set signal generator frequency to 18 GHz.

(9) Set measuring receiver to measure RF power in dBm at signal generator frequency.

(10) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **18 GHz**.

(11) Press **MARKER PEAK SEARCH** key.

(12) Repeat (6) above. Measuring receiver indication will be within ±6.1 dB of indication recorded in (7) above.

(13) Repeat technique of (8) through (12) above for the remaining signal generator frequency and TI **[CENTER FREQ]** settings listed in table 17.

Table 17. Frequency Response

Signal generator frequency and test instrument **[CENTER FREQ]** settings
17.5 GHz
17.0 GHz
16.5 GHz
16.0 GHz
15.5 GHz
15.0 GHz
14.5 GHz
14.0 GHz
13.5 GHz
13.0 GHz
12.5 GHz
12.0 GHz
11.5 GHz
11.0 GHz
10.5 GHz
10.0 GHz
9.5 GHz
9.0 GHz
8.5 GHz
8.0 GHz
7.5 GHz
7.0 GHz
6.5 GHz
6.0 GHz
5.5 GHz
5.0 GHz
4.5 GHz
4.0 GHz
3.5 GHz
3.0 GHz
2.5 GHz
2.0 GHz
1.5 GHz
1.0 GHz
500 MHz
100 MHz
50 MHz
20 MHz

(14) Set signal generator frequency to 10 MHz.

(15) Repeat (9) above.

(16) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **10 MHz**.

(17) Press TI **SPAN** key then **[SPAN WIDTH]** to **10 kHz**.

(18) Press **MARKER PEAK SEARCH** key.

(19) Repeat (12) above.

(20) Record measuring receiver indication.

(21) Connect equipment as shown in figure 6.

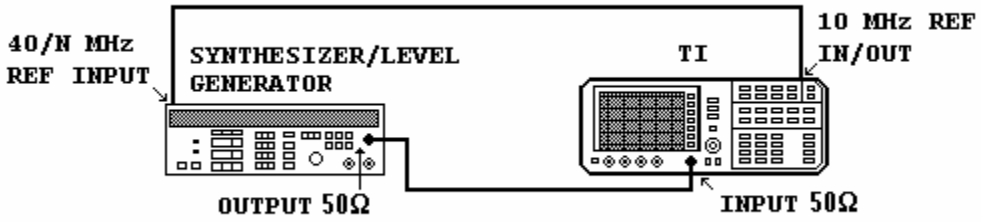

Figure 6. Frequency response - equipment setup.

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

(a) **FREQUENCY** to **10 MHz**.

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

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

(23) Press TI **MARKER PEAK SEARCH** key.

(24) Slowly adjust synthesizer/level generator amplitude until TI **MKR** indication is as close as possible to measuring receiver indication recorded in (20) above.

(25) Set synthesizer/level generator frequency to 1 MHz.

(26) Press **FREQUENCY** key then **[CENTER FREQ]** to **1 MHz**.

(27) Press **MARKER PEAK SEARCH** key.

(28) TI **MKR** indication will be within ±6.1 dB of measuring receiver indication recorded in (7) above.

(29) Repeat (25) through (28) above for synthesizer/level generator frequency and TI **[CENTER FREQ]** 100 kHz and 10 kHz settings.

b. Adjustments. Refer to paragraph **1 a**.

19. Residual Responses

a. Performance Check

(1) Connect TI **CAL OUTPUT** to **INPUT 50Ω**.

(2) Press TI keys and enter values using **DATA** keys as listed in (a) through (j) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.

(c) **SPAN** then **[SPAN WIDTH]** to **10 kHz**.

(d) **CONTROL BW** then **[RES BW]** to **300 Hz**.

(e) **AMPLITUDE** then **[REF LVL]** to **-10 dBm**.

(f) **[ATTEN]** to **0 dB**.

(g) **MARKER PEAK SEARCH**.

(h) **AMPLITUDE**.

(i) **[MORE]**.

(j) **[REF LVL CAL]**.

(3) Slowly adjust TI knob until **MKR** amplitude indication is between -9.83 and -10.17 dBm.

(4) Press **[STORE REF LVL]** key.

(5) Disconnect TI **CAL OUTPUT** from **INPUT 50Ω** and connect a 50Ω termination to **INPUT 50 Ω.**

(6) Press TI keys and enter values using **DATA** keys as listed in (a) through (i) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **15.2 MHz**.

(c) **SPAN** then **[SPAN WIDTH]** to **30 MHz**.

(d) **FREQUENCY** then **[CF STEP]** to **28.5 MHz**.

(e) **AMPLITUDE** then **[REF LVL]** to **-50 dBm**.

(f) **[ATTEN]** to **0dB**.

(g) **CONTROL BW** then **[RES BW]** to **10 kHz**.

(h) **CONTROL TRIG** then **[SINGLE]**.

(i) **CONTROL DISPLAY** then **[DISPLAY LINE]** to **-90 dBm**.

(7) Press TI **CONTROL TRIG** key, then **[SINGLE]** key, and wait for completion of sweep. The noise level will be at least 6 dB below the display line; if not, reduce **SPAN [SPAN WIDTH]** and **CONTROL BW [RES BW]** values to reduce noise level.

NOTE

If **SPAN** is reduced, **[CF STEP]** reduction must be no more than 95 percent of the **SPAN**.

(8) If a residual is not present proceed to (13) below. If residual is suspected, press **CONTROL TRIG** key then **[SINGLE]** key**.** Record the amplitude and frequency of any response above the display line.

NOTE

Noise peak will not persist when **[SINGLE]** key is pressed. However a residual response will persist.

(9) If response is marginal, press TI keys as listed in (a) through (d) below:

(a) **INSTRUMENT STATE SAVE**.

(b) **[SAVE STATE]**.

(c) **[STATE 0]**.

(d) **MARKER ON**.

(10) Position marker on peak of response in question and press TI keys as listed in (a) through (e) below:

(a) **MARKER MKR→** then **[MARKER→ CF]**.

(b) **SPAN** then **[SPAN WIDTH]**.

(c) **STEP ⇓** four times**.**

(d) **CONTROL TRIG** then **[CONT]**.

(e) **CONTROL BW** then **[RES BW AUTO]**.

(11) Reduce **SPAN [SPAN WIDTH]** and **CONTROL BW [RES BW]** until **[RES BW]** is **300 Hz**. Record the frequency and amplitude of any residual response above the display line. Residual responses will be <-90 dBm.

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

(a) **INSTRUMENT STATE RECALL**.

(b) **[RECALL STATE]**.

(c) **[STATE 0]**.

(13) Press TI **FREQUENCY** key then **[CENTER FREQ]** key.

(14) Press **STEP ⇑** key.

(15) Repeat (7) through (14) above to check for residuals up to 2.9 GHz.

(16) Press TI **FREQUENCY** key then **[CENTER FREQ]** to **2.915 GHz** and repeat (7) through (14) above to check residuals up to 6.46 GHz.

b. Adjustments. No adjustments can be made.

20. Frequency Drift

a. Performance Check

(1) Connect equipment as shown in figure 7.

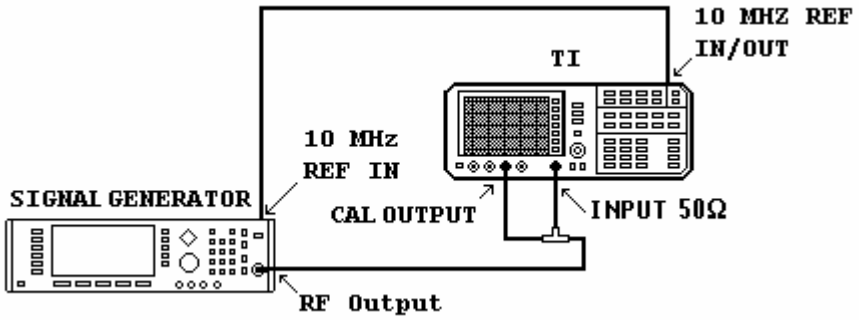

Figure 7. Frequency drift - equipment setup.

(2) Set signal generator frequency to 300.0015 MHz and level to -15 dBm. Press signal generator **OUTPUT On Off** pushbutton to **Off**.

(3) Press TI keys and enter values using **DATA** keys as listed in (a) through (f) below:

(a) **INSTRUMENT STATE PRESET**.
(b) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.
(c) **SPAN** then **[SPAN WIDTH]** to **2.5 kHz**.
(d) **CONTROL BW** then **[RES BW]** to **100 Hz**.
(e) **AMPLITUDE** then **[REF LVL]** to **–8 dBm**.
(f) **LOG dB/DIV** to **2 dB**.

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

(a) **MARKER PEAK SEARCH**.
(b) **[MARKER → CF]** wait for completion of sweep.
(c) **FREQUENCY**.
(d) **STEP** ⇑ three times.

(5) Verify signal is about 2 divisions from leftmost graticule line.

(6) Press signal generator **OUTPUT On Off** pushbutton to **On**.

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

(a) **CONTROL TRIG**.
(b) **[SINGLE]** wait for completion of sweep.
(c) **MARKER PEAK SEARCH**.
(d) **[MARKER DELTA]**.
(e) **[NEXT PEAK]**.

(8) Record TI **Δ MKR** frequency indication.

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

(a) **MARKER OFF**.

(b) **CONTROL SWEEP** then **[SWEEP TIME]** to **100 sec**.

(c) **CONTROL TRIG**.

(d) **[SINGLE]** wait for completion of sweep (100 seconds).

(e) **MARKER PEAK SEARCH**.

(f) **[MARKER DELTA]**.

(g) **[NEXT PEAK]**.

(10) Record TI **Δ MKR** frequency indication.

(11) Subtract **Δ MKR** indication recorded in (10) above from **Δ MKR** indication recorded in (8) above. The difference will be < 50 Hz.

(12) Set signal generator frequency to 300.0606 MHz and press **Output On Off** pushbutton to **Off**.

(13) Press TI keys and enter values using **DATA** as listed in (a) through (f) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.

(c) **SPAN** then **[SPAN WIDTH]** to **101 kHz**.

(d) **CONTROL BW** then **[RES BW]** to **1 kHz**.

(e) **AMPLITUDE** then **[REF LVL]** to **–8 dBm**.

(f) **LOG dB/DIV** to **2 dB**.

(14) Repeat (4) through (10) above.

(15) Subtract **Δ MKR** indication recorded in (10) above from **Δ MKR** indication recorded in (8) above. The difference will be < 2 kHz.

b. Adjustments. No adjustments can be made.

21. Marker Amplitude Accuracy

a. Performance Check

(1) Connect TI **CAL OUTPUT** to **INPUT 50Ω**.

(2) Press TI keys and enter values using **DATA** keys as listed in (a) through (i) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.

(c) **SPAN** then **[ZERO SPAN]**.

(d) **AMPLITUDE** then **[REF LEVEL]** to **-10 dBm**.

(e) **CONTROL BW** then **[RES BW]** to **300 kHz**.

(f) **MARKER PEAK SEARCH**.

(g) **AMPLITUDE**.

(h) **[MORE]**.

(i) **[REF LVL CAL]**.

(3) Slowly adjust TI knob until **MKR** amplitude indication is between -9.83 and -10.17 dBm.

(4) Press **[STORE REF LVL]** key.

NOTE

If necessary, perform measuring receiver and sensor module (11722A) ZERO and CALIBRATE.

(5) Connect equipment as shown in figure 8.

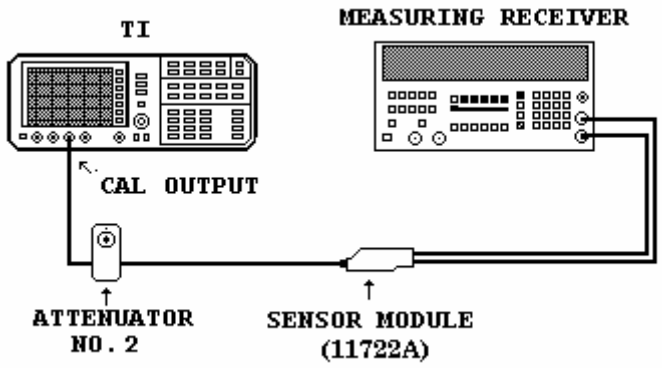

Figure 8. Marker amplitude accuracy test - equipment setup.

(6) Set attenuator No. 2 to 0 dB.

(7) Setup measuring receiver to measure power in dBm at 300 MHz. Record measuring receiver indication as ideal **MKR** indication for TI **[REF LVL]** 0 dBm setting in table 18.

Table 18. Marker Amplitude Accuracy

Attenuator No. 2 settings (dB)	Test instrument		
	[REF LVL] settings (dBm)	**MKR** indications	
		Ideal	Actual
0	0		
60	-10		
60	-40		
60	-50		

(8) Disconnect sensor module from attenuator No. 2 and connect open end of attenuator No. 2 to TI **INPUT 50Ω**.

(9) Press TI keys to values using **DATA** keys as listed in (a) through (f) below:

(a) **INSTRUMENT STATE PRESET**.

(b) **FREQUENCY** then **[CENTER FREQ]** to **300 MHz**.

(c) **SPAN** then **[ZERO SPAN]**.

(d) **CONTROL BW** then **[RES BW]** to **300 kHz**.

(e) **[VIDEO BW]** to **1 Hz**.

(f) **MARKER ON**.

(10) Record TI **MKR** amplitude indication as actual **MKR** indication for **[REF LVL]** 0 dBm setting in table 18.

(11) Set attenuator No. 2 to 60 dB.

(12) Press **AMPLITUDE** key then **[REF LVL]** to **–10 dBm**. Record TI **MKR** amplitude indication as actual **MKR** indication for **[REF LVL]** –10 dBm setting in table 18.

(13) Repeat technique of (12) above for remaining **[REF LVL]** settings listed in table 18.

(14) Subtract actual attenuation of attenuator No. 2 at 60 dB (correction chart) from ideal **MKR** indication for TI **[REF LVL]** 0 dBm setting recorded in (7) above and record difference in table 18 as ideal **MKR** indication for **[REF LVL]** -10, -40, and -50 dBm settings in table 18.

(15) Subtract actual **MKR** indication from ideal **MKR** indication in each **[REF LVL]** row listed in table 18. The difference will be between -3.3 and +3.3 dB.

b. Adjustments. Refer to paragraph **1 a**.

22. Power Supply

NOTE

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

a. Performance Check

(1) Press TI **LINE** switch to **OFF.**

WARNING

Allow 30 seconds for the high-voltage capacitors to discharge before removing the protective cover from the A6 power supply (located at TI top).

(2) Remove A6 power supply cover.

(3) Set multimeter to measure 1000V dc.

(4) Connect multimeter **INPUT HI** to A6TP405 (fig. 9) and **INPUT LO** to A6TP401 (fig. 9).

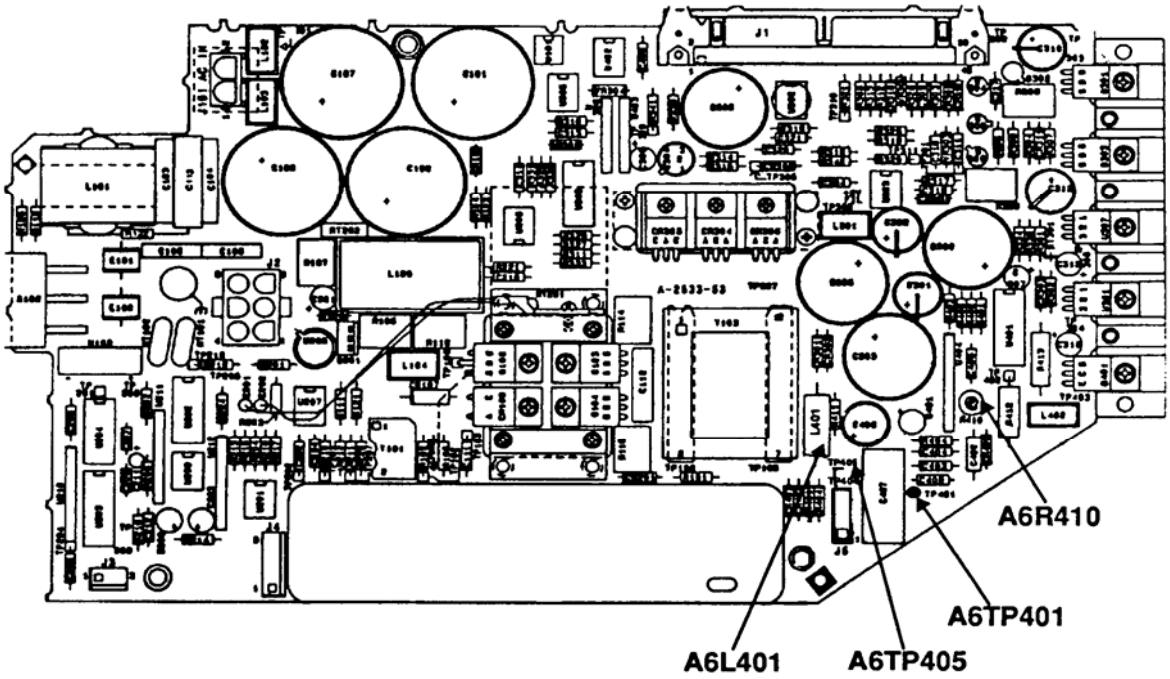

Figure 9. Power supply location sheet.

(5) Record dc voltage marked on A6A1 HV module (located at TI top).

(6) Note the value of inductor A6L401 (fig. 9). If A6L401 (fig. 9) is 10 mH, perform (7) and (8) below. If A6L401 (fig. 9) is 20 mH, perform (7) and (9) below.

(7) Press TI **LINE** switch to **ON.**

NOTE

Perform (8) below ONLY if A6L401 (fig. 9) is 10 mH.

(8) If multimeter does not indicate a dc voltage equal to 2 V above the dc voltage recorded in (5) above, perform **b** (1) below.

NOTE

Perform (9) below ONLY if A6L401 (fig. 9) is 20 mH.

(9) If multimeter does not indicate a dc voltage equal to the dc voltage recorded in (5) above, perform **b** (2) below.

(10) Press TI **LINE** switch to **OFF**.

b. Adjustments

(1) Adjust A6R410 (fig. 9) for a dc voltage equal to 2 V above the dc voltage recorded in (5) above (R).

(2) Adjust A6R410 (fig. 9) for a dc voltage equal to the dc voltage recorded in (5) above (R).

23. Final Procedure

a. Deenergize and disconnect all equipment.

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

By Order of the Secretary of the Army:

Official:

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

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

0323904

Distribution:
To be distributed in accordance with IDN 343553, requirements for calibration procedure TB 9-6625-2250-35.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.