

# TB 9-6625-2372-24

CHANGE 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

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## CALIBRATION PROCEDURE FOR NAV/COMM TEST SET, AEROFLEX, MODEL IFR 4000

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Headquarters, Department of the Army, Washington, DC  
19 December 2012

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*Distribution Statement A: Approved for public release; distribution is unlimited.*

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TB 9-6625-2372-24, 13 November 2012, 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**  
17 and 18

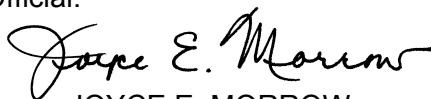
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2. File this change sheet in front of the publication for reference purposes.

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# \*TB 9-6625-2372-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

## CALIBRATION PROCEDURE FOR NAV/COMM TEST SET AEROFLEX, MODEL IFR 4000

Headquarters, Department of the Army, Washington, DC  
13 November 2012

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### 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-MSS-LP, 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](mailto: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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\*This bulletin supersedes TB 9-6625-2372-40, dated 4 April 2012, including all changes.

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## SECTION I IDENTIFICATION AND DESCRIPTION

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of Nav/ Comm Test Set, Aeroflex Model IFR 4000. 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.** None.

**b. Time and Technique.** The time required for this calibration is approximately 9 hours, using the microwave technique.

### 2. Forms, Records, and Reports

**a.** Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

**b.** Report any adjustments made to bring TI within tolerance.

**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
<b>RF SIGNAL GENERATOR</b>	
Output Frequency Range: VOR LOC Marker Beacon Comm AM G/S Comm FM Accuracy	107 to 118 MHz 107 to 113 MHz 72 to 78 MHz 117 to 401 MHz 327 to 337 MHz 155 to 175 MHz time base ±1 ppm after autocal
Output Level ANT Connector Single Carrier Range Accuracy Flatness	-67 to +13 dBm ±3 dB ≤ 1 dB

Table 1. Calibration Description – Continued.

Test instrument parameters	Performance specifications
<b>RF SIGNAL GENERATOR - CONTINUED</b>	
RF I/O Connector Single Carrier Range Accuracy  Flatness	-130 to -12 dBm ±3 dB from -120 to -95 dBm ±2 dB from -94.5 to -40 dBm ±2.5 dB from -39.5 to -12 dBm  ≤ 1 dB
Spectral Purity Harmonics Range Accuracy Non-Harmonics Range Accuracy	 72 to 401 MHz <-20 dBc  75 to 400 MHz <-35 dBc
<b>VOR MODE</b>	
Tone Frequency Range Accuracy  AM Modulation Range Accuracy Modulation Distortion  FM Modulation Range Accuracy  Bearing Range Accuracy	30 Hz Ref, 30 Hz Var, 1020 and 9960 Hz ±0.02 %  30% for 30, 1020 and 9960 Hz In CAL position ±2% AM < 2.5% THD  30 Hz Ref @ ± 480 Hz pk deviation on 9960 Hz sub-carrier ±25 Hz pk deviation  0.0 to 359.9 degrees ±0.1 degrees
<b>LOC MODE</b>	
Tone Frequency Range Accuracy Modulation Range  Accuracy Modulation Distortion	90, 150 and 1020 Hz ±0.02% of setting  20% AM for 90 and 150 Hz 30% AM for 1020 audio tone In CAL position ±2% AM <2.5% THD

Table 1. Calibration Description – Continued.

Test instrument parameter	Performance specifications
<b>LOC MODE</b>	
DDM	
Fixed	
Range	±0.093, 0.155 or 0.200 DDM and Tone Delete
Accuracy	±(0.0015 DDM+3% of setting) for output levels ≤+10 dBm
Variable	
Range	±0.4 DDM
Accuracy	±(0.0025 DDM+3% of setting) for output levels ≤+10 dBm
<b>G/S MODE</b>	
Tone Frequency	
Range	90 and 150 Hz
Accuracy	±0.02%
Modulation	
Range	40% AM for 90 and 150 Hz
Accuracy	In CAL position
Modulation	±2% AM
Distortion	<2.5 THD
DDM	
Fixed	
Range	±0, 0.091, 0.175 or 0.400 DDM and Tone Delete
Accuracy	±(0.0048 DDM+3% of setting) for output levels ≤+10 dBm
Variable	
Range	±0.8 DDM
Accuracy	±(0.0048 DDM+3% of setting) for output levels ≤+10 dBm
<b>MARKER MODE</b>	
Tone Frequency	
Range	400, 1300 and 3000 Hz
Accuracy	In CAL position
Modulation	±5% AM
Distortion	<2.5% THD, single carrier
<b>COMM MODE</b>	
Tone Frequency	
Range	1020 Hz
Accuracy	±0.02% of setting
Modulation	
Range	30% AM, 1020 Hz
Accuracy	In CAL position
Modulation	±2% AM
Distortion	<2.5% THD
<b>FREQUENCY COUNTER</b>	
ANT & RF I/O Input Connectors	
Range	10 to 400 MHz
Resolution	100 Hz
Accuracy	(±1ppm ±1 count)
AUX I/O Connector	
Range	1 to 10 MHz
Resolution	1 Hz
Accuracy	(±1ppm ±1 count)

Table 1. Calibration Description – Continued.

Test instrument parameter	Performance specifications
AM METER	
Range	50 to 3000 Hz
Accuracy	10 to 99% mod ±10% of reading
FM METER	
Range	50 to 3000 Hz
Accuracy	1 to 15 kHz dev ±(0.4 kHz + 8% of reading)
SWR Meter	
Range	10 to 400 MHz
Accuracy	±0.2 ±20% of reading
POWER METER	
Range	118.0 TO 400 MHz
Resolution	0.1 to 300 W 0.01 from 0.1 to <1 W 0.1 from 1 to <100 W
Accuracy	±(8% of reading + 1 digit) for CW only

## SECTION II EQUIPMENT REQUIREMENTS

**4. Equipment Required.** Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-286; AN/GSM-287; or AN/GSM-440 and Secondary Reference Calibration Standards Set, NSN 4931-00-621-7878. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

**5. Accessories Required.** The accessories required for this calibration are common usage accessories, issued as indicated in paragraph 4 above, and are not listed in this calibration procedure.

Table 2. Minimum Specifications of Equipment Required.

Common name	Minimum use specifications	Manufacturer and model (part number)
FREQUENCY COUNTER	Frequency range: 10 Hz to 400 MHz Accuracy: ±0.25 ppm	Fluke, Model PM 6681/656 (PM 6681/656)
FUNCTION GENERATOR	Frequency: 1 kHz to 40 kHz Accuracy: ±0.5 ppm	Agilent, Model 33250A (33250A)

Table 2. Minimum Specifications of Equipment Required – Continued.

Common name	Minimum use specifications	Manufacturer and model (part number)
<p>MEASURING RECEIVER</p> <p>Power Measurement:</p> <p>FM:</p> <p>AM:</p> <p>CW Frequency:</p> <p>Audio Frequency:</p> <p>Bearing:</p> <p>AM:</p> <p>FM:</p> <p>Deviation</p> <p>DDM:</p>	<p>Range: 75 MHz to 1.5 GHz -127 to +13 dB Accuracy: <math>\pm 0.5</math> dB</p> <p>Range: 165 MHz 1 to 13 kHz Accuracy: (<math>\pm 1\% \pm 1</math> digit)</p> <p>Range: 400 MHz 30 to 90% @ 1 kHz rate Accuracy: (<math>\pm 1\% \pm 1</math> digit)</p> <p>Range: 75 to 335 MHz Range: 29 to 9962 Hz Range: 0.00 to 359.99° Accuracy: <math>\leq 0.025</math></p> <p>Range: 400 MHz 30 to 90 % Accuracy: (1% of reading <math>\pm 1</math> count)</p> <p>Range: <math>\pm 505</math> Peak Deviation Accuracy: (1% of reading <math>\pm 1</math> count)</p> <p>Range: <math>\pm 0.415</math> Accuracy: <math>\pm 0.001</math></p>	<p>Measuring receiver system N5530S consisting of: Spectrum Analyzer, Agilent Model E4440A (E4440A), Power meter, Agilent Model E4419B (E4419B), Sensor module, Agilent Model N5532A opt. 504 (504) and U3030-H06 Avionics Measuring Receiver (AMR) Software for VOR / ILS Measurements</p>
MISMATCH STANDARDS	<p>Frequency range: 100 to 400 MHz VSWR: 1.05 +0.00, -0.05 1.2 <math>\pm 0.10</math> (1.50 <math>\pm 0.17</math>) (2.00 <math>\pm 0.22</math>)</p>	<p>Premier Microwave 2334-001-1 2334-001-2 2334-001-3 2334-001-4</p>
POWER METER	<p>Frequency: 75 to 400 MHz Power Range: -40 to -20 dBm Accuracy: <math>\pm 0.5</math> dB</p>	<p>Agilent, Model E4419B (E4419B) or Agilent, Model N1911A (N1911A) with Power Sensor E9304AH18</p>
RF POWER AMPLIFIER	<p>Frequency: 100 MHz to 300 MHz Output: 0.3 to 25 W Accuracy: N/A</p>	<p>Ophir, RF, Model XRF733 (XRF733)</p>
RF POWER METER	<p>Frequency: 100 MHz to 300 MHz Output: 0.3 to 25 W Accuracy: <math>\pm 0.5</math> dB</p>	<p>Bird, Model 4421 (4421) w/ Directional power sensor, Model 4022 (4022)</p>
RF REFERENCE SOURCE	<p>Frequency: 100 MHz to 300 MHz Output: 0.1 W Accuracy: <math>\pm 0.5</math> dB</p>	<p>Fluke, Model 9640A-LPN</p>

See footnote at end of table.

Table 2. Minimum Specifications of Equipment Required – Continued.

Common name	Minimum use specifications	Manufacturer and model (part number)
SIGNAL GENERATOR	Range: -5 to 0 dBm Frequency: 118 to 400 MHz Accuracy: (<1 ppm) AM range: 30 to 90%AM @ 1kHz rate FM range: 1 to 13 kHz deviation @ 1 kHz rate Accuracy: N/A	Aeroflex, Model 2023B (2023B)
TIME/FREQUENCY WORKSTATION	Frequency: 10 MHz Accuracy: <2.5 parts in 10-11	Datum, Model ET6000-75 (13589305)
VSWR BRIDGE	Frequency range: 75 to 400 MHz Directivity: 40 dB	Wiltron, Model 60NF50 (7916686)

### 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 the procedure.

d. Unless otherwise specified, all controls and control setting refer to the TI.

e. Throughout this procedure hard keys will be denoted in **bold** font, soft keys will be in **[brackets]**, submenus will be underlined, and menu values will be in *italics*.

f. Use the main , , ,  keys whenever required to change a field setting (submenu) or enter a value.

g. All TI adjustments are performed by following the prompts within the **CALIBRATION** menu. Press the following TI keys in (1) through (4) below to access the **CALIBRATION** menu screen:

- (1) **SETUP** ..... Setup Menu screen
- (2) **[H/W TOOLS]**..... Hardware Tools screen
- (3) **[CAL]**..... Calibration password prompt screen
- (4) Enter password (**3524**) using the soft keys.




## 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 setup within the performance check where applicable.

### NOTE

This procedure was written for TI firmware **2.06**. Before starting the procedure verify TI firmware by pressing TI **SETUP** and **[INFO]** keys. If TI firmware version is **2.05** or earlier, install version **2.06** from the folder **IFR4000\_V2\_06** located in the TB 9-6625-2372-24 procedure folder on the USATA website. Otherwise proceed with procedures in TB if TI firmware version is **2.06** and above.

- a. Connect TI to a 115 V ac source using the supplied external dc power supply.
- b. Press **POWER**  key to on and allow 15 minutes for equipment warm-up.
- c. Disconnect all cables from TI before running self test.
- d. Press the self test key sequence listed in (1) through (5) below:
  - (1) **SETUP** ..... Displays Setup Menu screen
  - (2) **[H/W TOOLS]** ..... Displays Hardware Tools screen
  - (3) **[DIAGS]** ..... Displays Diagnostics screen
  - (4) **[SELFTEST]** ..... Displays Self Test screen
  - (5) **[RUN]** ..... Initiates Self Test
- e. If any of the self tests fail, refer to manufacturer's manual for maintenance.
- f. Press **[RETURN]** three times to return to **SETUP** Menu.
- g. From the **SETUP** menu, press instrument preset key sequence as follows:
  - (1) **[STORE/RECALL]** ..... Displays Store/Recall Menu
  - (2) **PRESET SETTINGS** ..... Displays Preset Conditions
  - (3) **[RECALL]** ..... Recalls Preset Settings
  - (4) **[RETURN]** ..... Returns to previous menu

## 8. RF Generator Frequency

### a. Performance Check







- (1) Connect TI **ANT** connector to frequency counter **CHANNEL A** input.
- (2) Set the frequency counter input to 50  $\Omega$ .
- (3) Press **SETUP**, as needed, to display **SETUP** menu.
- (4) Press [**NEXT PARAM**], as needed, to select **PORT** field.
- (5) Press ,  keys, as needed, to set **PORT** to **ANT**.
- (6) Press the following TI keys, as needed, in (a) through (c) below.
  - (a) **MODE** to display **VOR** mode screen.
  - (b) **FREQ** to set **FREQ** to **108.000 MHz**.
  - (c) **M MOD** to set **M MOD** to **0%**.
- (7) Press **RF LVL** and use , , ,  keys to set **RF LVL** to **0.0 dbm**.
- (8) Adjust frequency counter for a stable indication. If frequency counter does not indicate within the limits for the first mode setting in table 3, perform **b** below.
- (9) Repeat step (6) above to obtain the remaining mode settings in table 3.

Table 3. RF Generator Frequency.

MODE	FREQ	M MOD	LIMITS (Hz)
VOR	108.000 MHz	0%	107999892.0 to 108000108.0
LOCALIZER	108.100 MHz	0%	108099891.9 to 108100108.1
MARKER BEACON	75.000 MHz	N/A	74999925.0 to 75000075.0






- (10) Press **MODE** until **SELCAL** mode screen is displayed.
- (11) Press **RF LVL** and set **RF LVL** to **0.0 dbm**.
- (12) Press the following keys, as needed, in (a) through (d) below to change the **FREQ** field setting from **PRESET** to **VAR**.
  - (a) **SETUP** to display **SETUP** menu.
  - (b) [**NEXT PARAM**] until **FREQ** field is selected.
  - (c)  key to set **FREQ** field to **VAR**.
  - (d) Press **MODE** or **SETUP** to exit setup screen.
- (13) Press **FREQ** to select **FREQ** field.
- (14) Use , , ,  keys to set **FREQ** to **118.001 MHz**. If frequency counter does not indicate within the limits in the first row of table 4 perform **b** below.
- (15) Repeat step (14) above for the remaining settings in table 4.
- (16) Perform step (12) above to change **FREQ** field from **VAR** back to **PRESET**.
- (17) Press the following TI keys, as needed, in (a) through (d) below.
  - (a) **MODE** until **COMM AM** mode screen is displayed.
  - (b) **STONE** to set **MOD TONE** to **OFF**.
  - (c) [**SWITCH GEN/RX**] to set **COMM AM** mode to **GENERATING**.

Table 4. SELCAL Frequency Accuracy.

FREQ	LIMITS (Hz)
118.001 MHz	118000882.0 to 118001118.0
118.002 MHz	118001882.0 to 118002118.0
118.003 MHz	118002882.0 to 118003118.0
118.004 MHz	118003882.0 to 118004118.0

(18) Press **FREQ**, as needed, to set **FREQ** to **118.000 MHz**. If frequency counter does not indicate within the limits for the first setting in table 5 perform b below.

(19) Repeat step (18) above for the remaining settings in table 5.

Table 5. COMM AM Frequency Accuracy.

FREQ	LIMITS (Hz)
118.0000 MHz	117999882.0 to 118000118.0
137.0000 MHz	136999863.0 to 137000137.0
156.0000 MHz	155999844.0 to 156000156.0
225.0000 MHz	224999775.0 to 225000225.0
312.0000 MHz <sup>1</sup>	311999688.0 to 312000312.0
400.0000 MHz	399999600.0 to 400000400.0

<sup>1</sup>Switch frequency counter connection to Channel C.

(20) Press **MODE** until **GLIDE SLOPE** mode screen is displayed.

(21) Press **M MOD**, as needed, to set **M MOD** to **0%**.

(22) Press **FREQ** and set **FREQ** to **334.700 MHz**. If frequency counter does not indicate between 334699665.3 and 334700334.7 Hz perform **b** below.

(23) Reduce **RF LVL** to **-67.0 dBm** and disconnect equipment setup.

**b. Adjustments**

- (1) Perform paragraph **6 g** above to access **CALIBRATION** menu screen.
- (2) Press [**MISC CALS**] to display **MISC CALS** screen.
- (3) Press [**TCXO**] to display **TCXO CAL** screen.
- (4) Connect time/frequency workstation 10 MHz output to **TI AUX I/O** connector.
- (5) Press [**START**] to begin the **TCXO CAL** sequence.
- (6) When **TCXO CAL** sequence is complete, press [**SAVE & RETURN**].
- (7) Press [**RETURN**] 3 times to return to setup menu.
- (8) Disconnect 10 MHz reference signal.

**9. RF Generator Output Level Accuracy and Flatness (ANT Connector)**

**a. Performance Check**

- (1) Repeat paragraph **7 g** to preset **TI**.

- (2) Zero and calibrate measuring receiver and ensure that sensor module calibration factors are loaded.
- (3) Connect measuring receiver to TI ANT connector.
- (4) Press the following TI keys, as needed, in (a) through (e) below.
  - (a) **MODE** until **GLIDE SLOPE** mode screen is displayed.
  - (b) **FREQ** and use main ▲, ▼ keys to set **FREQ** to **334.700 MHz**.
  - (c) **M MOD** to set **M MOD** to **0%**.
  - (d) **RF LVL** to select **RF LVL** field.
  - (e) Use main ▲, ▼, ◀, ▶ keys to set **RF LVL** to **0.0 dBm**.
- (5) Setup measuring receiver for tuned RF absolute power measurement (do not set reference).
- (6) Use TI main ▲, ▼, ◀, ▶ keys to step **RF LVL** down to **-30.0 dBm**. If measuring receiver does not indicate between -33.0 and -27.0 dBm, perform **b** below.
- (7) Setup measuring receiver for RF power measurement.
- (8) Press the following TI keys, as needed, in (a) through (d) below.
  - (a) **MODE** until **VOR** mode screen is displayed.
  - (b) **FREQ** to set **FREQ** to **108.000 MHz**.
  - (c) **TONE** to set **MOD TONE** to **OFF**.
  - (d) **M MOD** to set **M MOD** to **0%**.
- (9) Press **RF LVL** and use main ▲, ▼, ◀, ▶ keys to set **RF LVL** to **13.0 dBm**. If measuring receiver does not indicate within the limits in table 6, perform **b** below.
- (10) Set **RF LVL** to the remaining RF levels in table 6. If measuring receiver does not indicate within the limits in table 6, perform **b** below.
- (11) Setup measuring receiver for RF power measurement.

**NOTE**

The measuring receiver indications for the 10 dBm and -10 dBm settings in table 6 must be recorded in appendix A, in order to verify flatness in steps (29) and (30) below.

Table 6. Output Accuracy.

RF LVL (dBm)	Measuring receiver indications	
	Min (dBm)	Max (dBm)
13.0	10.0	16.0
10.0 <sup>1</sup>	7.0	13.0
0.0 <sup>2</sup>	-3.0	3.0
-10.0 <sup>3</sup>	-13.0	-7.0
-30.0	-33.0	-27.0

<sup>1</sup> Record measuring receiver indication in 10 dBm column of appendix A.

<sup>2</sup> Setup measuring receiver for tuned RF absolute power measurement.

<sup>3</sup> Record measuring receiver indication in -10 dBm column of appendix A.



(12) Press the following TI keys, as needed, in (a) through (d) below.

- (a) **MODE** to display **MARKER BEACON** mode screen.
- (b) **FREQ** to set **FREQ** to **75.000 MHz**.
- (c) **TONE** to set **MOD TONE** to **OFF**.
- (d) **M MOD** to set **M MOD** to **0%**.

(13) Repeat steps (9) through (11) above.

(14) Press the following TI keys, as needed, in (a) through (d) below.

- (a) **MODE** to display **COMM AM** mode screen.
- (b) **TONE** to set **MOD TONE** to **OFF**.
- (c) **M MOD** to set **M MOD** to **0%**.
- (d) **[SWITCH GEN/RX]** to set **COMM AM** mode to **GENERATING**.

(15) Press **FREQ** and ,  keys, as needed, to set **FREQ** to **400.000 MHz**.

(16) Repeat steps (9) through (11) above.

(17) Set **FREQ** to **312.000 MHz**.

(18) Repeat steps (9) through (11) above.

(19) Set **FREQ** to **225.000 MHz**.

(20) Repeat steps (9) through (11) above.

(21) Set **FREQ** to **156.000 MHz**.





(22) Repeat steps (9) through (11) above.





(23) Set **FREQ** to **137.000 MHz**.

(24) Repeat steps (9) through (11) above.

(25) Set **FREQ** to **118.000 MHz**.

(26) Press **RF LVL** to select **RF LVL** field.

(27) Use , , ,  keys to set **RF LVL** to **13.0 dBm**. If measuring receiver does not indicate within the limits in table 7, perform **b** below.

(28) Use , , ,  keys to set **RF LVL** to remaining settings in table 7. If TI does not indicate within the limits specified for each setting, perform **b** below.

**NOTE**

The measuring receiver indications for the 10 dBm and -10 dBm settings in table 7 must be recorded in appendix A for use in steps (29) and (30) below to verify flatness.

(29) Subtract lowest recorded 10 dBm indication from the highest recorded 10 dBm indication in appendix A. The difference (flatness) should not exceed 1 dB.

(30) Subtract lowest recorded -10 dBm indication from the highest recorded -10 dBm indication in appendix A. The difference (flatness) should not exceed 1 dB.

Example:

If lowest -10 dBm indication = -10.9 dBm  
 and highest -10 dBm indication = -10.1 dBm,  
 then, -10.1dB-(-10.9 dB) = 0.8 dB flatness

Table 7. Comm AM Output Accuracy

TI RF LVL (dBm)	Measuring receiver indications	
	Min (dBm)	Max (dBm)
13.0	10.0	16.0
10.0 <sup>1</sup>	7.0	13.0
3.0	0.0	6.0
0.0 <sup>2</sup>	-3.0	3.0
-7.0	-10.0	-4.0
-10.0 <sup>3</sup>	-13.0	-7.0
-17	-20.0	-14.0
-27.0	-30.0	-24.0
-37.0	-40.0	-34.0
-47.0	-50.0	-44.0
-57.0	-60.0	-54.0
-67.0	-70.0	- 64.0

<sup>1</sup> Record measuring receiver indication in appendix A 10 dBm column.

<sup>2</sup> Setup measuring receiving for tuned RF measurement.

<sup>3</sup> Record measuring receiver indication in appendix A -10 dBm column.

(31) Disconnect measuring receiver from TI ANT connector.

**b. Adjustments**

(1) Connect measuring receiver to signal generator and calibrate measuring receiver in tuned RF mode at the frequencies listed in table 8, storing the calibrations in the locations indicated.

Table 8. Stored Calibration Levels.

Storage Location	Frequency (MHz)
1	113.000
2	75.000
3	225.000
4	332.000
5	400.000
6	175.000
7	250.000
8	108.000

(2) Connect the measuring receiver **MODULATION OUTPUT/AUDIO INPUT** to the audio analyzer **HIGH INPUT**.

(3) Set audio analyzer to measure distortion.

- (4) Perform paragraph 6 g to access **CALIBRATION** menu screen.
- (5) Press [**AMP LVL CALS**] to display **AMPL LEVEL CAL** menu screen.

**NOTE**

If only **MARKER BEACON** level is out of tolerance, then proceed to step (16) below.

- (6) Press [**MAIN**] to display **MAIN AMPL LEVEL** sequence screen.
- (7) Connect measuring receiver to **TI ANT** connector.
- (8) Switch between tuned RF level and AM mode on the measuring receiver as necessary. For AM measurements use Peak  $\pm$  /2 detector and 3 kHz LP filter. For distortion measurements use 80 kHz LP filter on audio analyzer.

(9) Follow the on-screen prompts and recall stored calibration levels from table 8 when necessary. For **MAIN AMPL LEVEL** sequence, the AM modulation setting error must be <0.5 % and the amplitude setting error must be <0.1 dB.

(10)Reference the following during the **MAIN AMPL LEVEL** sequence.

(a) In **Step 1** of **MAIN AMPL LEVEL** sequence, turn TI **Modulation: OFF** to set and check RF level. Toggling the TI **Modulation** field between **OFF** and **ON** and the measuring receiver between AM and tuned RF level several times may be necessary to meet the requirements of this step.

(b) In **Step 2**, once the **VALUE:** field has been set for minimum distortion, press [**PREV**] to return to **Step 1**.

**NOTE**

Steps 1 and 2 are interactive; toggling between the two is required to meet the requirements of the steps.

(c) In **Steps 3 to 6**, follow the on-screen prompts and recall the necessary calibrations on the measuring receiver.

(d) In **Steps 7 to 26**, connect measuring receiver to the **RF I/O** connector.

(e) In **Step 27**, entering 140 MHz on the measuring receiver displays **UNCAL** and **RECAL**. Press the measuring receiver Calibrate button and allow the cal routine to complete before setting the TI **VALUE:** field.

(f) In **Steps 28 to 29**, follow the on-screen prompts and recall the necessary calibrations on the measuring receiver.

(11)When the calibration sequence is complete, press [**SAVE & RETURN**] to return to **AMPL LEVEL CAL** screen.

(12)Press [**LOC**] to display the **LOC AMPL LEVEL** sequence screen.

(13)Follow the on-screen prompts and recall stored calibration levels on the measuring receiver. The AM modulation setting error must be <0.5% and the amplitude setting error must be <0.1 dB.

(14)Reference the following during the **LOC AMPL LEVEL** calibration sequence.

(a) In **Step 1** of **LOC AMPL LEVEL** sequence, turn TI modulation **OFF** to set and check RF level. Toggling the TI modulation field between **OFF** and **ON** and the measuring receiver between AM and tuned RF level several times may be necessary to meet the requirements of this step.

(b) In **Step 2**, once the **VALUE:** field has been set for minimum distortion, press [**PREV**] to return to **Step 1**.

#### NOTE

Steps 1 and 2 are interactive; toggling between the two is required to meet the requirements of the steps.

(15) When the **LOC AMPL LEVEL** calibration sequence is complete, press [**SAVE & RETURN**] to return to **AMPL LEVEL CAL** screen.

(16) Press [**MKR**] to display **MKR AMPL LEVEL** calibration sequence screen.

(17) Connect 10 dB attenuator between measuring receiver and TI **ANT** connector.

(18) Follow the on-screen prompts and recall stored calibration levels on the measuring receiver. The AM modulation setting error must be <1.0% and the amplitude setting error must be <0.1 dB (taking into account the 10 dB attenuator).

(19) Reference the following during the **MKR AMPL LEVEL** calibration sequence:

(a) In **Step 1 to 2**, turn TI modulation **OFF** to set and check RF level. Toggling the TI modulation field between **OFF** and **ON** and the measuring receiver between AM and tuned RF level several times may be necessary to meet the requirements of these steps.

(b) In **Step 3**, select 15 kHz LP filter on the measuring receiver.

(20) When the calibration sequence is complete, press [**SAVE & RETURN**] to return to **AMPL LEVEL CAL** screen.

(21) Press [**RETURN**] to return to the **CALIBRATION** screen.

## 10. RF Generator Output Level Accuracy and Flatness (RF I/O Connector)

### a. Performance Check

(1) Connect power sensor to power meter and ensure that sensor calibration factors are loaded in power meter.

(2) Zero and calibrate power meter.

(3) Connect power meter to TI **RF I/O** connector.

(4) Press **SETUP**, as needed, to display **SETUP** menu.

(5) Press [**NEXT PARAM**], as needed, to select **PORT** field and set to **RF I/O**.

(6) Press the following TI keys, as needed, in (a) through (c) below.









(a) **MODE** until **GLIDE SLOPE** mode screen is displayed.

(b) **M MOD** to set **M MOD** to **0%**.

(c) **FREQ** and use main ,  keys to set **FREQ** to **334.700 MHz**.





(7) Enter TI frequency (334.700 MHz) into power meter to enable sensor calibration factor.



- (8) Press **RF LVL** and use , , ,  main keys to set TI **RF LVL** to **-40.0 dBm**. If power meter does not indicate between -42.0 and -38 dBm perform b below.
- (9) Press the following TI keys, as needed, in (a) through (d) below.
- (a) **MODE** until **VOR** mode screen is displayed.
  - (b) **TONE** to set **MOD TONE** to **OFF**.
  - (c) **M MOD** to set **M MOD** to **0%**.
  - (d) **FREQ** to set **FREQ** to **108.000 MHz**.
- (10) Enter TI frequency into power meter to enable sensor calibration factor.
- (11) Press **RF LVL** and use , , ,  main keys to set **RF LVL** to **-40.0 dBm**. If power meter does not indicate between -42.0 and -38 dBm perform **b** below.
- (12) Record the power meter indication from step (11) above in the -40 dbm column of appendix A.
- (13) Set TI **RF LVL** to **-20.0 dBm** and record power meter indication in the -20 dBm column of appendix A.

**NOTE**

The -40 dBm and -20 dBm values recorded in appendix A will be used in steps (32) and (33) below to verify flatness.

- (14) Press the following TI keys, as needed, in (a) through (d) below.
- (a) **MODE** until **MARKER BEACON** mode screen is displayed.
  - (b) **TONE** to set **MOD TONE** to **OFF**.
  - (c) **M MOD** to set **M MOD** to **0%**.
  - (d) **FREQ** to set **FREQ** to **75.000 MHz**.
- (15) Repeat steps (10) through (13) above.
- (16) Press the following TI keys, as needed, in (a) through (d) below.
- (a) **MODE** until **COMM AM** mode screen is displayed.
  - (b) **TONE** to set **MOD TONE** to **OFF**.
  - (c) **M MOD** to set **M MOD** to **0%**.
  - (d) **[SWITCH GEN/RX]** to set **COMM AM** mode to **GENERATING**.
- (17) Press **FREQ** to set **FREQ** to **400.0000 MHz**.
- (18) Enter TI frequency into power meter to enable sensor calibration factor.
- (19) Press **RF LVL** and use , , ,  main keys to set **RFLVL** to **-40.0 dBm**. If power meter does not indicate between -42.0 and -38 dBm perform **b** below.
- (20) Record the power meter indication from step (19) above in the -40 dbm column of appendix A.
- (21) Set TI **RF LVL** to **-20.0 dBm** and record power meter indication in the -20 dBm column of appendix A.
- (22) Press **FREQ** to set **FREQ** to **312.0000 MHz**.
- (23) Repeat steps (18) through (21) above.

- (24) Set **FREQ** to **225.0000 MHz**.
- (25) Repeat steps (18) through (21) above.
- (26) Set **FREQ** to **156.0000 MHz**.
- (27) Repeat steps (18) through (21) above.
- (28) Set **FREQ** to **137.0000 MHz**.
- (29) Repeat steps (18) through (21) above.
- (30) Set **FREQ** to **118.0000 MHz**.
- (31) Repeat steps (18) through (21) above.
- (32) Subtract lowest recorded -40 dBm indication from the highest recorded -40 dBm indication in appendix A. The difference (flatness) should not exceed 1 dB.
- (33) Subtract lowest recorded -20 dBm indication from the highest recorded -20 dBm indication in appendix A. The difference (flatness) should not exceed 1 dB.
- (34) Disconnect power meter from TI **RF I/O** connector.
- (35) Connect measuring receiver to TI **RF I/O** connector.
- (36) Press **RF LVL** and set **RF LVL** to **-12.0 dBm**.
- (37) Setup measuring receiver for 118.000 MHz tuned RF measurement.
- (38) Verify that measuring receiver indication is within the limits specified in table 9.
- (39) Set TI **RF LVL** to remaining settings in table 9 and verify that measuring receiver indication is within the limits specified.

Table 9. Comm AM Output Accuracy.

TI <b>RF LVL</b> (dBm)	Measuring receiver indications	
	Min (dBm)	Max (dBm)
-12.0	-14.5	-9.5
-22.0	-24.5	-19.5
-32.0	-34.5	-29.5
-42.0	-44.0	-40.0
-52.0	-54.0	-50.0
-62.0	-64.0	-60.0
-72.0	-74.0	-70.0
-82.0	-84.0	-80.0
-92.0	-94.0	-90.0
-102	-105	-99.0
-112.0	-115.0	-109.0
-120.0	-123.0	-117.0

- (40) Disconnect measuring receiver from TI.

**b. Adjustments.** Same as paragraph 9 b above. If adjustments in paragraph 9 b were already performed, then no further adjustments can be made.

## 11. Spectral Purity Harmonics and Spurious

### a. Performance Check

- (1) Connect measuring receiver to the TI ANT connector.
- (2) Press **SETUP** and repeat paragraph 7 g to preset TI.
- (3) Press **MODE** until **VOR** mode screen is displayed.
- (4) Press **FREQ** and set **FREQ** to **108.000 MHz**.
- (5) Press **TONE**, as needed, to set **MOD TONE** to **OFF**.
- (6) Press **M MOD**, as needed, to set **M MOD** to **0%**.
- (7) Press **RF LVL** and set **RF LVL** to **0.0 dBm**.
- (8) Setup measuring receiver in spectrum analyzer mode to view the peak of the TI carrier frequency and at least four harmonics.
- (9) Verify that harmonics are <-20 dBc.
- (10) Verify that all spurious signals are <-35 dBc.
- (11) Press **MODE** until **LOCALIZER** mode screen is displayed.
- (12) Press **FREQ** to set **FREQ** to **108.100 MHz**.
- (13) Repeat steps (6) through (10) above.
- (14) Press **MODE** until **GLIDE SLOPE** mode screen is displayed.
- (15) Press **FREQ** and set **FREQ** to **334.700 MHz**.
- (16) Repeat steps (6) through (10) above.
- (17) Press **MODE** until **MARKER BEACON** mode screen is displayed.
- (18) Press **FREQ** to set **FREQ** to **75.000 MHz**.
- (19) Repeat steps (6) through (10) above.
- (20) Press **MODE** until **COMM AM** mode screen is displayed.
- (21) Press **[SWITCH GEN/RX]** to set **COMM AM** mode to **GENERATING**.
- (22) Press **FREQ** to set **FREQ** to **137.0000 MHz**.
- (23) Repeat steps (5) through (10) above.
- (24) Press **FREQ** to set **FREQ** to **400.0000 MHz**.
- (25) Repeat steps (6) through (10) above.
- (26) Reduce output to minimum and disconnect test equipment.

**b. Adjustments.** No adjustments can be made.

**12. VSWR (RF I/O Connector)**

**a. Performance Check**

- (1) Connect equipment as shown in figure 1.
- (2) Set signal generator output level to 0.0 dBm.
- (3) Set signal generator to first frequency in table 10.
- (4) Setup measuring receiver in spectrum analyzer mode to measure first frequency in table 10.
- (5) On measuring receiver, press PEAK SEARCH, MARKER and [DELTA] to set up delta marker reference measurement.
- (6) Connect VSWR bridge Device Under Test (DUT) port to TI **RF I/O** connector.
- (7) Measuring receiver delta marker will indicate within the limits in table 10.
- (8) Repeat steps (3) through (7) above for the remaining settings in table 10.

Table 10. VSWR.

Freq (MHz)	Limits (dB)	Equivalent VSWR limits
75	<-17.7	<1.30
225	<-17.7	<1.30
400	<-16.5	<1.35

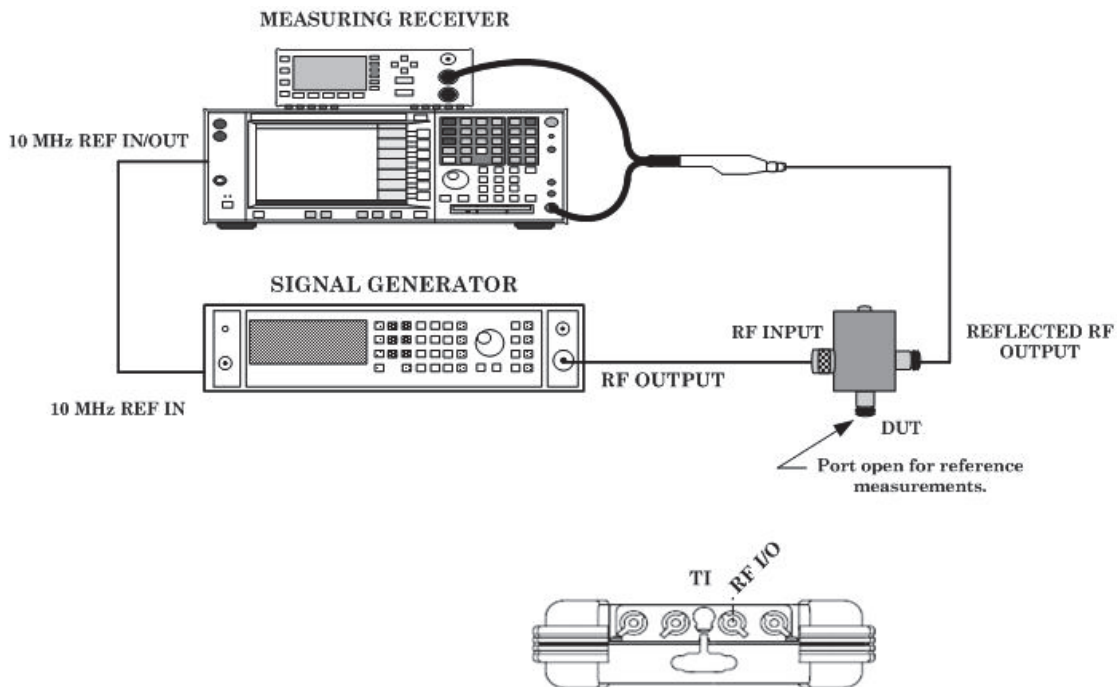


Figure 1. VSWR Setup.

(9) Disconnect equipment setup.

**b. Adjustments.** No adjustments can be made.

**13. VOR**

**a. Performance Check**

- (1) Connect measuring receiver to RF input TI ANT connector.
- (2) Repeat paragraph 7 g to preset TI.
- (3) Press the following TI keys, as needed, in (a) through (g) below.
  - (a) **MODE** to display **VOR** mode screen.
  - (b) **FREQ** to set **FREQ** to **108.000 MHz**.
  - (c) **RF LVL** and set **RF LVL** to **10.0 dBm**.
  - (d) **TONE** to set **MOD TONE** to **1020 Hz**.
  - (e) **M MOD** to set **M MOD** to **CAL (90%)**.
  - (f) [**30 MOD**] and set **30 Hz MOD** to **0%**.
  - (g) [**9960 MOD**] and set **9960 Hz MOD** to **0%**.

(4) Configure measuring receiver for AM measurement.

(5) Verify that measuring receiver indicates within the frequency, AM depth and distortion limits in table 11 for the 1020 Hz Tone. If AM depth is not within limits, perform **b** below.

Table 11. VOR.

TONE (Hz)	Limits				
	Frequency (Hz)		AM %		Distortion (%)
	Min	Max	Min	Max	
1020	1019.796	1020.204	28	32	<2.5
30	29.994	30.006	28	32	<2.5
9960	9958.008	9961.992	28	32	<2.5

- (6) Press **TONE**, to set **MOD TONE** to **OFF**.
- (7) Press [**30 MOD**] and set **30 Hz MOD** to **30%**.
- (8) Repeat step (5) above for 30 Hz Tone.
- (9) Set **30 Hz MOD** to **0%**.
- (10) Press [**9960 MOD**] and set **9960 Hz MOD** to **30%**.
- (11) Repeat step (5) above for 9960 Hz Tone.

(12) Press [**30 MOD**] and set **30 Hz MOD** to **30%**. If measuring receiver does not indicate between 56% and 64% AM, perform **b** below.

(13) Configure measuring receiver for VOR measurement. If measuring receiver does not indicate between 455 and 505 Hz, perform **b** below.

(14) Press the following TI keys, as needed, in (a) through (d) below.

- (a) **SETUP** to display **SETUP** mode screen.
- (b) [**NEXT PARAM**] until **VOR BRG** is selected and set to **FIXED**.
- (c) **MODE** to display **VOR** mode screen.
- (d) [**TO/FROM**] to set **TO/FROM** to **TO**.

(15) Press [**BRG**] and set **BRG** to the first value in table 12. Measuring receiver should indicate within the limits in table 12. No adjustments can be made.

(16) Repeat step (15) above for the remaining values listed in table 12.

Table 12. Bearing (TO).

<b>BRG</b> (degrees)	Limits (degrees)	
	Min	Max
0.0	179.9	180.1
30	209.9	210.1
60	239.9	240.1
90	269.9	270.1
120	299.9	300.1
150	329.9	330.1
180	359.9	0.1
210	29.9	30.1
240	59.9	60.1
270	89.9	90.1
300	119.9	120.1
330	149.9	150.1

(17) Press [**TO/FROM**] and set **TO/FROM** to **FROM**.

(18) Press [**BRG**] and set **BRG** to the first value in table 13. Measuring receiver should indicate within the limits in table 13. No adjustments can be made.

Table 13. Bearing (FROM).





<b>BRG</b> (degrees)	Limits (degrees)	
	Min	Max
0.0	359.9	0.1
30	29.9	30.1
90	89.9	90.1
150	149.9	150.1
210	209.9	210.1
270	269.9	270.1
330	329.9	330.1

(19) Press **SETUP** to display **SETUP** mode screen.

(20) Press [**NEXT PARAM**] until **VOR BRG** is selected and set to **VAR**.

(21) Press **MODE** to display **VOR** mode screen.

(22) Press [**BRG**] to select **BRG** field.

(23) Use , , ,  to set **BRG** to the first value in table 14. Measuring receiver should indicate within the limits in table 14. No adjustments can be made.

(24) Repeat step (23) above for the remaining values in table 14.

Table 14. Bearing (VAR).

BRG (degrees)	Limits	
	Min	Max
1.0	0.9	1.1
2.0	1.9	2.1
10.1	10.0	10.2
10.2	10.1	10.3

(25) Leave measuring receiver connected to TI ANT connector.

**b. Adjustments**

- (1) Perform paragraph 6 g above to access **CALIBRATION** menu screen.
- (2) Press [**MOD CALS**] to display **MODULATION CAL** menu screen.
- (3) Press [**VOR**] to display **VOR CAL** sequence screen.
- (4) Follow the on-screen prompts and recall stored calibration levels from table 8 when necessary. For **VOR CAL** sequence, the AM modulation setting error must be <0.5% and the amplitude setting error must be <0.1 dB.
- (5) Reference the following during the **VOR CAL** sequence:
  - (a) In **STEP 2**, select 15 kHz LP filter on measuring receiver.
  - (b) In **STEP 3**, select 3 kHz LP filter on measuring receiver.
- (6) When the calibration sequence is complete, press [**SAVE & RETURN**].
- (7) Press [**RETURN**], as needed, to return to the **SETUP** menu screen.
- (8) Press [**MODE**], to return to the **VOR** mode screen.

**14. Localizer**



**a. Performance Check**

- (1) Repeat paragraph 7 g to preset TI.
- (2) Configure measuring receiver for AM measurement.
- (3) Press the following TI keys, as needed, in (a) through (f) below.
  - (a) **MODE** to display **LOCALIZER** mode screen.
  - (b) **FREQ** to set **FREQ** to *108.1000 MHz*.
  - (c) **RF LVL** and set **RF LVL** to *-20.0 dBm*.
  - (d) **TONE** to set **MOD TONE** to *1020 Hz*.
  - (e) **M MOD** to set **M MOD** to *CAL (70%)*.
  - (f) [**TONE DEL**] to set **TONE DEL** to *90 & 150*. This will change M MOD to CAL (30%).
- (4) Verify that measuring receiver indications are within the frequency, AM depth and distortion limits in table 15 for the 1020 Hz Tone. If AM depth is not within the limits in table 15, then perform **b** below.

Table 15. Localizer.

TONE (Hz)	Limits				
	Frequency (Hz)		AM %		Distortion (%)
	Min	Max	Min	Max	
1020	1019.8	1020.2	28	32	<2.5
90	89.982	90.018	18	22	<2.5
150	149.97	150.03	18	22	<2.5

- (5) Press **TONE**, to set **MOD TONE** to **OFF**.
- (6) Press [**TONE DEL**] to set **TONE DEL** to **150**.
- (7) Repeat step (4) above for 90 Hz Tone.
- (8) Press [**TONE DEL**] to set **TONE DEL** to **90**.
- (9) Repeat step (4) above for 150 Hz Tone.
- (10) Press [**TONE DEL**] to set **TONE DEL** to **---**.
- (11) Configure measuring receiver for ILS-Localizer measurement.

(12) Press **DDM/μA LOC** ,  keys, as needed, to obtain the first setting in table 16. Measuring receiver should indicate within the limits in table 16.

(13) Repeat step (12) above for the remaining settings in table 16.

Table 16. LOC DDM.

LOC DDM	Limits	
	Min	Max
0.000 CENTER	-0.0015	+ 0.0015
0.093 LEFT	-0.0973	-0.0887
0.155 LEFT	-0.1612	-0.1489
0.200 LEFT	-0.2075	-0.1925
0.200 RIGHT	0.1925	0.2075
0.155 RIGHT	0.1488	0.1612
0.093 RIGHT	0.0887	0.0973







- (14) Press [**DEV STEP**] and set **DEV STEP** to **VAR**.
- (15) Press **DDM/μA LOC**  key to select **LOC DDM**.
- (16) Use main , , ,  to set **LOC DDM** to first value in table 17. Modulation analyzer should indicate within the limits listed.
- (17) Repeat step (16) above for remaining settings in table 17.





Table 17. LOC DDM (Variable).

LOC DDM	Limits	
	Min	Max
0.094	0.0887	0.0993
0.095	0.0897	0.1004
0.096	0.0906	0.1014
0.097	0.0916	0.1024

(18) Press [DEV STEP] and set **DEV STEP** to *FIXED*.

(19) Press **DDM/μA LOC**  to set **LOC DDM** to *0.000 CENTER*.

(20) Press [90/150 Hz] to select **90/150 Hz** field.

(21) Press , , as needed, to set **90/150 Hz** field to first setting in table 18. measuring receiver AMR should indicate within the limits in table 18.

(22) Repeat step (21) above for remaining settings in table 18.

Table 18. LOC Phase.

90/150 Hz (degrees)	Limits	
	Min	Max
120	-0.5	0.5
80	39.5	40.5
40	-40.5	-39.5
20	-20.5	-19.5
10	-10.5	-9.5
5	-5.5	-4.5
0	-0.5	0.5

**b. Adjustments**

- (1) Perform paragraph **6 g** to access **CALIBRATION** menu screen.
- (2) Press [MOD CALS] to display **MODULATION CAL** menu screen.
- (3) Press [MAIN LOC] to display **MAIN PATH LOC** calibration sequence screen.
- (4) Connect multimeter to the **AUX I/O** connector and set multimeter for AC measurement.
- (5) Follow the on-screen prompts.
- (6) When the calibration sequence is complete, press [SAVE & RETURN] to return to **MODULATION CAL** screen.
- (7) Press [LOC LOC], to display to the **LOC PATH LOC** calibration screen.
- (8) Setup measuring receiver to measure AM with a 110.05 MHz carrier signal, using 3 kHz LP filter.

- (9) Follow the on-screen prompts.
- (10) When the calibration sequence is complete, press [**SAVE & RETURN**] to return to **MODULATION CAL** screen.
- (11) Press [**RETURN**], as needed, to return to the **SETUP** menu screen.
- (12) Press [**MODE**], to return to the **LOCALIZER** mode screen.

**15. Glide Slope**

**a. Performance Check**

- (1) Configure measuring receiver for AM measurement.
- (2) Press the following TI keys, as needed, in (a) through (d) below.
  - (a) **MODE** to display **GLIDE SLOPE** mode screen.
  - (b) **FREQ** to set **FREQ** to *334.7000 MHz*.
  - (c) **RF LVL** and set **RF LVL** to *10.0 dBm*.
  - (d) [**TONE DEL**] to set **TONE DEL** to *90*.
- (3) Verify that measuring receiver indications are within the frequency, AM depth and distortion limits in table 19 for the 150 Hz Tone.

Table 19. Glide Slope.

TONE (Hz)	Limits				Distortion (%)
	Frequency (Hz)		AM %		
	Min	Max	Min	Max	
150	149.97	150.03	38	42	<2.5
90	89.982	90.018	38	42	<2.5








- (4) Press [**TONE DEL**] to set **TONE DEL** to *150*.
- (5) Repeat step (3) above for 90 Hz Tone.
- (6) On measuring receiver for ILS-Glideslope measurement.
- (7) Press [**TONE DEL**] to set **TONE DEL** to *—*.
- (8) Press **DDM/μA G/S** , , as needed, to set **G/S DDM** to first setting in table 20. If measuring receiver is not within the limits listed, perform **b.** below.
- (9) Repeat step (8) above for the remaining settings in table 20.
- (10) Press [**DEV STEP**] and set **DEV STEP** to *VAR*.
- (11) Press **DDM/μA G/S**  key to select **G/S DDM** field.
- (12) Use , , ,  to set **G/S DMM** to first setting in table 21. Measuring receiver will indicate within the limits listed in table 21.
- (13) Repeat step (8) above for the remaining settings in table 21.

Table 20. G/S DDM.

G/S DDM	Limits	
	Min	Max
0.000 CENTER	-0.0030	0.0030
0.091 UP	-0.0967	-0.0853
0.175 UP	-0.1833	-0.1667
0.400 UP	-0.4150	-0.3850
0.400 DOWN	0.3850	0.4150
0.175 DOWN	0.1667	0.1833
0.091 DOWN	0.0853	0.0967

Table 21. G/S DDM (Variable).

G/S DDM	Limits	
	Min	Max
0.176 DOWN	0.1659	0.1861
0.177 DOWN	0.1669	0.1871
0.178 DOWN	0.1679	0.1881
0.179 DOWN	0.1688	0.1892

(14) Set **G/S DDM** to **0.000 CENTER**.

(15) Press [DEV STEP] and set **DEV STEP** to **FIXED**.

(16) Press **90/150 Hz** and set **90/150 Hz** to first setting in table 22. Modulation analyzer will indicate within the limits listed.

(17) Repeat step (16) above for remaining settings in table 22.

Table 22. G/S Phase.

90/150 Hz (degrees)	Limits	
	Min	Max
0	-0.5	0.5
5	-5.5	-4.5
10	-10.5	-9.5
20	-20.5	-19.5
40	-40.5	-39.5
80	39.5	40.5
120	-0.5	0.5

**b. Adjustments**

- (1) Perform paragraph **6 g** to access **CALIBRATION** menu screen.
- (2) Press [**MOD CALS**] to display **MODULATION CAL** menu screen.
- (3) Press [**MAIN G/S**] to display **MAIN PATH G/S** calibration sequence screen.
- (4) Set measuring receiver input frequency to 332.000MHz and activate 3 kHz LP filter.
- (5) Follow on-screen prompts.
- (6) When the calibration sequence is complete, press [**SAVE & RETURN**] to return to **MAIN PATH G/S** calibration sequence screen.
- (7) Press [**RETURN**], as needed, to return to the **SETUP** menu screen.
- (8) Press [**MODE**], to return to the **GLIDE SLOPE** mode screen.

**16. Marker Beacon**

**a. Performance Check**

- (1) Connect measuring receiver to **TI ANT** connector.
- (2) Configure measuring receiver for AM measurement.
- (3) Repeat paragraph **7 g** to preset **TI**.
- (4) Press the following **TI** keys, as needed, in (a) through (e) below.
  - (a) **MODE** to display **MARKER BEACON** mode screen.
  - (b) **FREQ** to set **FREQ** to *75.000 MHz*.
  - (c) **RF LVL** and set **RF LVL** to *10.0 dBm*.
  - (d) **TONE** to set **MOD TONE** to *400 Hz*.
  - (e) **M MOD** to set **M MOD** to *CAL (95%)*.
- (5) Verify that measuring receiver indications are within the limits in table 23 for the set **MOD TONE**.

Table 23. Marker Beacon Mod Tone.

MOD TONE (Hz)	Limits				
	Frequency (Hz)		AM %		Distortion (%)
	Min	Max	Min	Max	
400	399.02	400.08	90	100	<2.5
1300	1299.74	1300.26	90	100	<2.5
3000	2999.40	3000.60	90	100	<2.5

- (6) Press **TONE** to set **MOD TONE** to *1300 Hz*.
- (7) Repeat step (5) above.
- (8) Set **MOD TONE** to *3000 Hz* and repeat step (5) above.
- (9) Disconnect test equipment.

**b. Adjustments.** No adjustments can be made.

17. ILS

a. Performance Check

- (1) Repeat paragraph 7 g to preset TI.
- (2) Connect measuring receiver to TI ANT connector using a 10 db attenuator.
- (3) Configure Measuring receiver for AM measurement.
- (4) Press the following TI keys, as needed, in (a) through (d) below.
  - (a) **MODE** until **ILS** mode screen is displayed.
  - (b) **FREQ** and set **FREQ** to **108.100 MHz**.
  - (c) **RF LVL** and set **G/S LVL** to **-30.0 dBm**.
  - (d) **TONE** to set **MOD TONE** to **400 Hz Marker On**.
- (5) Verify that measuring receiver indicates between 74.99993 and 75.00008 MHz.
- (6) Verify that measuring receiver indicates within the limits in table 24 for 400 Hz Mod Tone.

Table 24. ILS MOD TONE.

MOD TONE (Hz)	Limits				
	Frequency (Hz)		AM Depth (%)		Distortion %
	Min	Max	Min	Max	
400	399.02	400.08	90	100	<5.0
1300	1299.7	1300.3	91.25	98.75	<3.75
3000	2999.4	3000.6	91.25	98.75	<3.75
1020	1019.8	1020.2	28.00	32.00	<2.5
90	89.980	90.020	18.00	22.00	<2.5
150	149.97	150.03	18.00	22.00	<2.5

- (7) Set **MOD TONE** to **1300 Hz Marker On**.
- (8) Verify that measuring receiver indicates within the limits in table 24 for 1300 Hz Mod Tone.
- (9) Set **MOD TONE** to **3000 Hz Marker On**.
- (10) Repeat step (8) above for 3000 Hz Mod Tone.
- (11) Set **MOD TONE** to **1020 Hz**.
- (12) Press [**TONE DEL**] to set **TONE DEL** to **90 & 150**.
- (13) Verify that measuring receiver indicates between 108.09989 and 108.10011 MHz.
- (14) Configure measuring receiver for power measurement. Measuring receiver will indicate between -12.5 and -7.5 dBm.
- (15) Configure measuring receiver for AM measurement and verify that measuring receiver indicates within the 1020 Hz limits in table 24.
- (16) Press [**TONE DEL**] to set **TONE DEL** to **150**.
- (17) Press **TONE** to set **MOD TONE** to **OFF**.



- (18) Verify that measuring receiver indicates within the 90 Hz limits in table 24.
- (19) Press [TONE DEL] to set **TONE DEL** to **90**.
- (20) Verify that measuring receiver indicates within the 150 Hz limits in table 24.
- (21) Set **TONE DEL** to **--**.
- (22) Configure measuring receiver for ILS-Localizer measurement.
- (23) Press **DDM/μA LOC** ,  keys, as needed, to obtain the first setting in table 25. If measuring receiver does not indicate within the limits listed, perform **b** below.
- (24) Repeat step (23) above for the remaining settings in table 25.

Table 25. ILS DDM.

LOC DDM	Limits	
	Min	Max
0.000 CENTER	-0.0015	+ 0.0015
0.093 LEFT	-0.0973	-0.0887
0.155 LEFT	-0.1612	-0.1489
0.200 LEFT	-0.2075	-0.1925
0.200 RIGHT	0.1925	0.2075
0.155 RIGHT	0.1488	0.1612
0.093 RIGHT	0.0887	0.0973


- (25) Press [DEV STEP] and set **DEV STEP** to **VAR**.
- (26) Press **DDM/μA LOC**  key to select **LOC DMM**.
- (27) Use , , ,  to set **LOC DMM** to first value in table 26. Measuring receiver should indicate within the limits listed.
- (28) Repeat step (27) above for remaining settings in table 26.

Table 26. ILS DDM (Variable).

LOC DDM	Limits	
	Min	Max
0.094	0.0887	0.0993
0.095	0.0897	0.1004
0.096	0.0906	0.1014
0.097	0.0916	0.1024



- (29) Set **LOC DMM** to **0.000 CENTER**.
- (30) Press [DEV STEP] and set **DEV STEP** to **FIXED**.
- (31) Press [90/150 Hz] to select **90/150 Hz** field.
- (32) Press , , as needed, set **90/150 Hz** field to first setting in table 27.
- (33) Repeat step (32) above for remaining settings in table 27.

Table 27. ILS

90/150 Hz (degrees)	Limits	
	Min	Max
0	-0.5	0.5
5	-5.5	-4.5
10	-10.5	-9.5
20	-20.5	-19.5
40	-40.5	-39.5
80	39.5	40.5
120	-0.5	0.5

(34) Set **90/150 Hz** field to —.

(35) Disconnect 10 dB attenuator and modulation analyzer from TI **ANT** connection.

(36) Connect measuring receiver to TI **ANT** connector.

(37) Press TI **RF LVL** and set **G/S LVL** to **0.0 dBm**.

(38) Calibrate measuring receiver for 334.700 MHz in tuned RF mode.

(39) Press **RF LVL** and set **G/S LVL** to **-10.0 dBm**. Measuring receiver should indicate between -13 and -7 dBm.

(40) Set **G/S LVL** to **-30.0 dBm**. Measuring receiver should indicate between -33 and -27 dBm

(41) Disconnect measuring receiver from TI **ANT** connector.

**b. Adjustments.** No further adjustments can be made.

## 18. COMM AM

### a. Performance Check

(1) Connect measuring receiver to TI **ANT** connector.

(2) Configure measuring receiver for AM measurement.

(3) Press the following TI keys, as needed, in (a) through (f) below.

(a) **MODE** to display **COMM AM** mode screen.

(b) **FREQ** to set **FREQ** to **137.0000 MHz**.

(c) **RF LVL** and set **RF LVL** to **10.0 dBm**.

(d) **TONE** to set **MOD TONE** to **1020 Hz**.

(e) **M MOD** to set **M MOD** to **CAL (30%)**.

(f) [**SWITCH GEN/RX**] to set **COMM AM** mode to **GENERATING**.

(4) Verify measuring receiver indicates between 1019.80 and 1020.20 Hz with <10% distortion and 28 to 32 % AM.

(5) Press **FREQ** to set **FREQ** to **312.0000 MHz**.

(6) Repeat step (4) above.

(7) Disconnect measuring receiver from TI.

**b. Adjustments.** No adjustments can be made.


**19. Frequency Counter**

**a. Performance Check**

- (1) Press [SWITCH GEN/RX] to set **COMM AM** mode to **RECEIVING**.
- (2) Connect signal generator to **TI ANT** connector.
- (3) Set signal generator output level to -35 dBm.
- (4) Set signal generator frequency to the first setting in table 28. If TI indication is not within the limits listed, perform **b** below.
- (5) Repeat step (4) above for remaining settings in table 28.

Table 28. Frequency Counter Accuracy.

FREQ (MHz)	Limits (MHz)	
	Min	Max
10.000	9.9999	10.0001
10.001	10.0009	10.0011
100.101	100.1008	100.1012
399.999	399.9985	399.9995

- (6) Press **SETUP** to display **SETUP** mode screen.
- (7) Press  key to set **PORT** to **RF I/O**.
- (8) Press **MODE** to return to **COMM AM** mode screen.
- (9) Move signal generator connection from **TI ANT** to **RF I/O** connector.
- (10) Set signal generator output level to 0 dBm.
- (11) Repeat steps (4) and (5) above.
- (12) Press **MODE** until **FREQUENCY COUNTER** mode screen is displayed.

**NOTE**

Do not disconnect signal generator from **TI RF I/O** connector.

- (13) Connect function generator to **TI AUX I/O** connector.
- (14) Set function generator output to 50  $\Omega$  and 1 Vp-p.
- (15) Set function generator to the first frequency listed in table 29. TI will indicate within the limits listed.
- (16) Repeat step (15) above for the remaining settings in table 29.

Table 29. Frequency Counter.

FREQ (MHz)	Limits (MHz)	
	Min	Max
1.000	0.999998	1.000002
1.00001	1.000008	1.000012
5.10001	5.100004	5.100016
9.99999	9.999979	10.000011



(17) Disconnect both signal generator and function generator from TI.

**b. Adjustments.** No adjustments can be made.

**20. AM Meter**

**a. Performance Check**

- (1) Repeat paragraph 7 g to preset TI.
- (2) Press **MODE** until **COMM AM** mode screen is displayed.
- (3) Connect equipment as shown in figure 2.
- (4) Configure measuring receiver for a 400 MHz measurement.
- (5) Set signal generator output to 0 dBm adjust for a 400 MHz indication on measuring receiver.
- (6) Configure measuring receiver for AM measurement with 300 Hz HP and 3 kHz LP filters and **PEAK ± /2** detectors on.
- (7) Press **TI FREQ** and set **FREQ** to **400.0000 MHz**.
- (8) Set signal generator to AM with a 1 kHz modulation frequency.
- (9) Adjust signal generator AM modulation level until a measuring receiver indicates first value in table 28. **TI TX MOD** should indicate within the limits in table 30.
- (10) Repeat step (9) above for the remaining settings in table 30.

Table 30. AM Meter.

AM (%)	Limits (%)	
	Min	Max
30.0	27	33
50.0	45	55
90.0	81	99

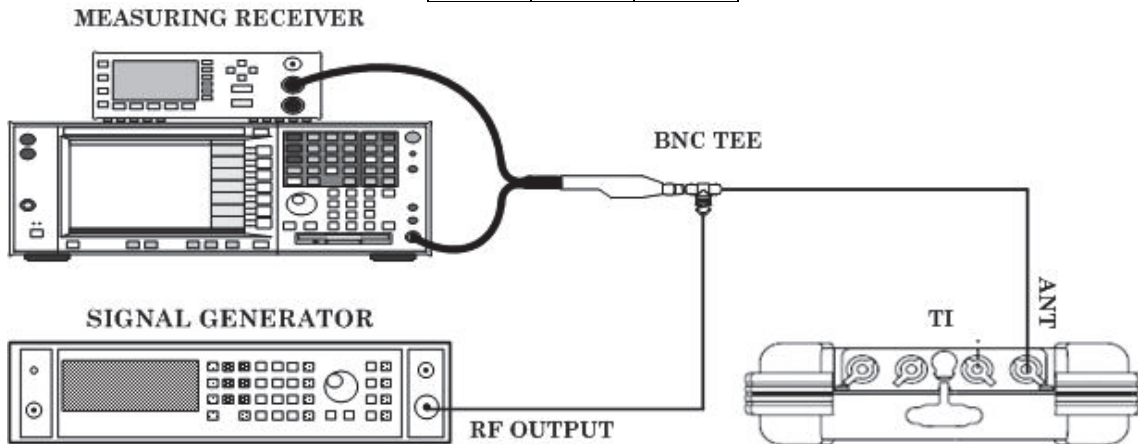


Figure 2. AM/FM meter setup.

- (11) Press **SETUP** to display **SETUP** mode screen.
- (12) Set **PORT** to **RF I/O**.
- (13) Press **MODE** to return to **COMM AM** mode screen.
- (14) Move connection from **TI ANT** to **RF I/O** connector.
- (15) Adjust signal generator output level to +21 dBm for 30% and 50% modulation levels and +19.5 dBm for 90% modulation level. Adjust signal generator AM modulation level until measuring receiver indicates setting in table 30. **TI TX MOD** should indicate within the limits in table 30.
- (16) Repeat step (15) above for remaining settings in table 30.

**b. Adjustments.** No adjustments can be made.

**21. FM Meter**

**a. Performance Check**


- (1) Press the following TI keys, as needed, in (a) through (e) below.
  - (a) **MODE** until **COMM FM** mode screen is displayed.
  - (b) **FREQ** and set **FREQ** to *165.000 MHz*.
  - (c) **SETUP** to display **SETUP** mode screen.
  - (d)  key to set **PORT** to **ANT**.
  - (e) **MODE** to return to **COMM FM** mode screen.
- (2) Connect equipment as shown in figure 2.
- (3) Set signal generator to -20.0 dBm at 165 MHz.
- (4) Configure measuring receiver for a 165 MHz measurement.
- (5) Set signal generator FM on and modulation frequency to 400 Hz.
- (6) Configure measuring receiver for FM measurement with 50 Hz HP and 3 kHz LP filters on.
- (7) Vary signal generator FM deviation frequency until measuring receiver indicates the first setting in table 31. If **TX DEV** does not indicate within the limits in table 31, perform b below.
- (8) Repeat step (7) above for the remaining FM settings in table 31.

Table 31. FM Meter

FM (kHz)	Limits (kHz)	
	Min	Max
1	0.6	1.5
10	8.8	11.2
15	13.4	16.6

- (9) Set signal generator modulation frequency to 1 kHz.
- (10) Repeat steps (7) and (8) above.
- (11) Press **SETUP** to display **SETUP** mode screen.
- (12) Set **PORT** to **RF I/O**.

- (13) Press **MODE** to return to **COMM FM** mode screen.
- (14) Move connection from **TI ANT** to **RF I/O** connector.
- (15) Set signal generator output to +6 dBm.
- (16) Repeat steps (7) and (8) above.
- (17) Disconnect test equipment.

**b. Adjustments**

- (1) Perform paragraph **6 g** to access **CALIBRATION** menu screen.
- (2) Press the following TI keys in (a) through (c) below.
  - (a) [**MISC CALS**] to display **MISC CALS** screen.
  - (b) [**FM CAL**] to display **FM CAL** screen.
  - (c) [**FM DEV**] to display **FM DEV CAL** screen.
- (3) Follow the on-screen prompts.

**NOTE**

After changing deviation levels, wait several seconds to allow the TI to average the modulation before pressing [NEXT].

- (4) When FM deviation calibration is complete, press [**SAVE & RETURN**].
- (5) Press [**RETURN**], as needed, to return to **SETUP** menu.

**22. SWR Meter**

**a. Performance Check**

- (1) Press **SETUP** to display **SETUP** mode screen.
- (2) Repeat paragraph **8 a** (12) to change **FREQ** field to **VAR**.
- (3) Press **MODE** until **SWR** mode screen is displayed.

**NOTE**

Make all connections to the TI SWR connector using an adapter (TNC male to N-type female).

- (4) Press [**CAL**] and follow TI on-screen instructions using 1.0 VSWR mismatch standard when prompted for 50  $\Omega$  load.
- (5) When cal sequence is complete, press [**SAVE & RETURN**] to return to **SWR MODE** screen.
- (6) Leave 1.0 VSWR mismatch standard connected to TI SWR connector.
- (7) Press **FREQ** and set **FREQ** to first setting in table 32. If TI does not indicate within the limits in table 32, perform **b** below.
- (8) Repeat step (7) above for the remaining frequency settings in table 32.

Table 32. SWR Meter Accuracy

<b>FREQ</b> (MHz)	Limits (VSWR)
75	≤1.5
137	≤1.5
225	≤1.5
312	≤1.5
400	≤1.5

(9) Disconnect 1.0 VSWR mismatch standard and connect 1.20 VSWR mismatch standard to TI **SWR** connector.

(10) Set TI **FREQ** to first setting in table 33. If TI does not indicate within the limits in table 33, perform b below.

(11) Repeat step (10) above for the remaining frequency settings in table 33.

Table 33. SWR Meter Accuracy

<b>FREQ</b> (MHz)	Limits (VSWR)
400	≤1.7
312	≤1.7
225	≤1.7
137	≤1.7
75	≤1.7

(12) Disconnect 1.20 VSWR mismatch standard and connect 1.50 VSWR mismatch standard to TI **SWR** connector.

(13) Set TI **FREQ** to first setting in table 34. If TI does not indicate within the limits in table 34, perform b below.

(14) Repeat step (13) above for the remaining frequency settings in table 34.

Table 34. SWR Meter Accuracy

<b>FREQ</b> (MHz)	Limits (VSWR)	
	Min	Max
75	1.1	2.1
137	1.1	2.1
225	1.1	2.1
312	1.1	2.1
400	1.1	2.1

(15) Disconnect 1.50 VSWR mismatch standard and connect 2.00 VSWR mismatch standard to TI **SWR** connector.

(16) Set TI **FREQ** to first setting in table 35. If TI does not indicate within the limits in table 35, perform b below.

(17) Repeat step (16) above for the remaining frequency settings in table 35.

Table 35. SWR Meter Accuracy

FREQ (MHz)	Limits (VSWR)	
	Min	Max
400	1.5	2.8
312	1.5	2.8
225	1.5	2.8
137	1.5	2.8
75	1.5	2.8

(18) Disconnect 2.00 VSWR mismatch standard and adapter from TI **SWR** connector.

**b. Adjustments**

- (1) Perform paragraph **6 g** to access **CALIBRATION** menu screen.
- (2) Press [**MISC CALS**] to display **MISC CALS** screen.
- (3) Press [**SWR**] to display **SWR CAL** sequence screen.
- (4) Follow on-screen prompts.
- (5) When cal sequence is complete, press [**SAVE & RETURN**] to return to **MISC CALS** screen.
- (6) Press [**RETURN**], as needed, to return to **SETUP** menu.

**23. Power Meter**

**a. Performance Check**

- (1) Press **SETUP** to display **SETUP** mode screen.
- (2) Set **PORT** to **RF I/O**.
- (3) Press **MODE** until **COMM AM** mode screen is displayed.
- (4) Connect RF reference source to TI **RF I/O** connector.
- (5) Set RF reference source for a 100 MHz, 100 mW output. If TI **TX PWR** does not indicate between 0.08 and 0.12 W, perform **b** below.
- (6) Change RF reference source frequency to 300 MHz. If TI **TX PWR** does not indicate between 0.08 and 0.12 W, perform **b** below.
- (7) Disconnect RF reference source from TI **RF I/O** connector.
- (8) Connect equipment as shown in figure 3.
- (9) Set signal generator to first frequency listed in table 36.
- (10) Adjust both signal generator and RF power amplifier outputs, as necessary, to obtain first rf power meter indication in table 36. If TI **TX PWR** does not indicate within the limits listed in table 36, perform **b** below.

**CAUTION**

The TI is not rated for continuous power >10 W. Complete these steps as quickly as possible and reduce input power settings to allow power termination to cool. Ensure that the temperature indicated on the TI does not exceed 35 degrees.

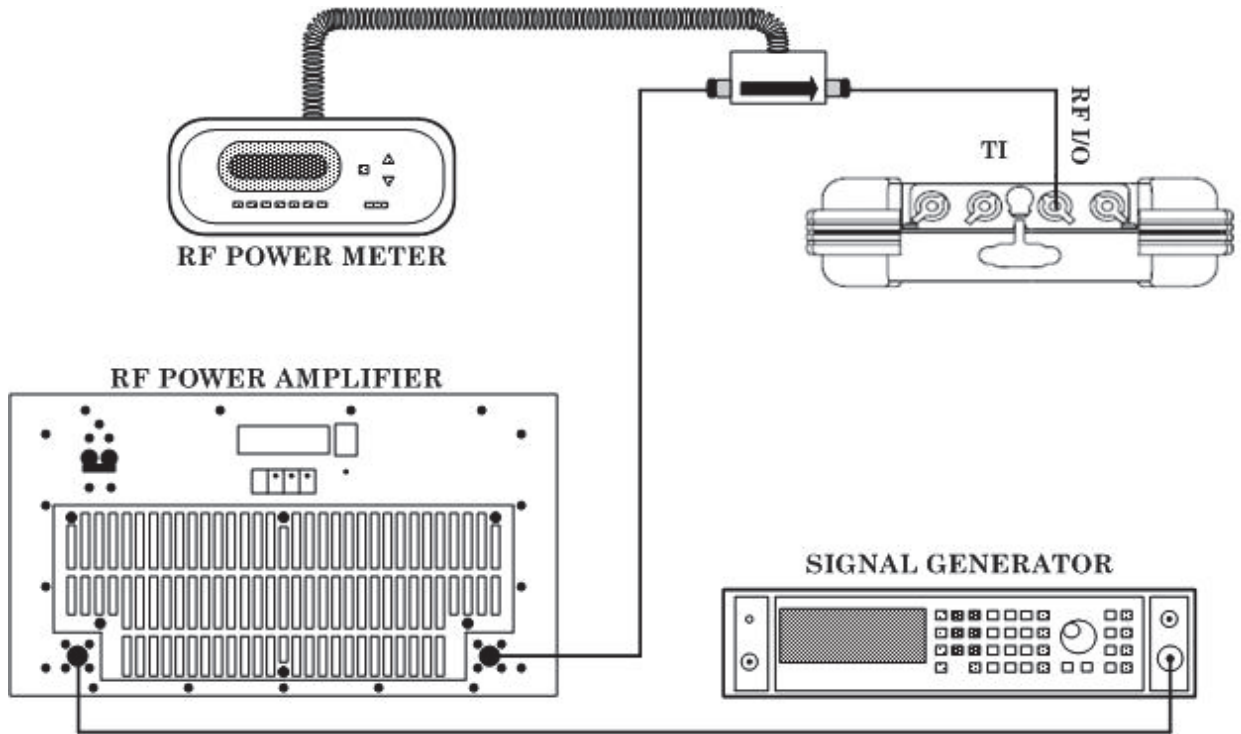


Figure 3. Power Meter Setup.

(11) Repeat steps (9) and (10) above for the remaining settings in table 36.

Table 36. Power Meter

FREQ (MHz)	Power (W)	Limits (W)	
		Min	Max
100	1.0	0.8	1.2
100	5.0	4.5	5.5
100	10.0	9.1	10.9
100	20.0	18.3	21.7
100	25.0	22.9	27.1
300	1.0	0.8	1.2
300	5.0	4.5	5.5
300	10.0	9.1	10.9
300	20.0	18.3	21.7
300	25.0	22.9	27.1

(12) Deenergize and disconnect all test equipment.

**b. Adjustments**

- (1) Perform paragraph **6 g** to access **CALIBRATION** menu screen.
- (2) Press [**MISC CALS**] to display **MISC CALS** screen.
- (3) Press [**POWER METER**] to display **POWER METER CAL** sequence screen.
- (4) Disconnect test equipment from TI **RF I/O** connector.
- (5) Follow on screen prompts.
- (6) In **STEP 2**, when prompted to connect equipment to **RF I/O** port, reconnect equipment as shown in figure 3.
- (7) When calibration sequence is completed, press [**SAVE & RETURN**] to return to the **MISC CAL** screen.
- (8) Press [**RETURN**], as needed, to return to **SETUP** menu.

**24. Final Procedure**

- a. Deenergize and disconnect all equipment.
- b. Annotate and affix DA label/form in accordance with TB 750-25.

**APPENDIX A  
FLATNESS VERIFICATION TABLE**

Table A-1. Flatness Indications.


MODE	FREQ (MHz)	RF LVL (ANT)		RF LVL (RF I/O)	
		10 dBm	-10 dBm	-40 dBm	-20 dBm
VOR	108.000				
MARKER BEACON	75.000				
COMM AM	400.0000				
COMM AM	312.0000				
COMM AM	225.0000				
COMM AM	156.0000				
COMM AM	137.0000				
COMM AM	118.0000				
	Max reading				
	Min Reading				
	Flatness (Max-Min) $\leq 1$ dB				



By Order of the Secretary of the Army:

Official:

RAYMOND T. ODIERNO  
*General, United States Army*  
*Chief of Staff*

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

1229903

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 345190, requirements for calibration procedure TB 9-6625-2372-24.

### 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](mailto: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.