

TB 9-6625-2372-40

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

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

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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

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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. 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
RF SIGNAL GENERATOR	
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	-67 to +13 dBm ± 3 dB

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
RF SIGNAL GENERATOR - CONTINUED	
RF I/O Connector Single Carrier Range Accuracy	-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
Spectral Purity Harmonics Range Accuracy Non-Harmonics Range Accuracy	72 to 401 MHz <-20 dBc 75 to 400 MHz <-35 dBc
VOR MODE	
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° ± 0.1°
LOC MODE	
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
LOC MODE	
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
G/S MODE	
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
MARKER MODE	
Tone Frequency	
Range	400, 1300 and 3000 Hz
Accuracy	In CAL position
Modulation	±5% AM
Distortion	<2.5% THD, single carrier
COMM MODE	
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
FREQUENCY COUNTER	
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
POWER METER	
Range	118.0 TO 400 MHz
Resolution	0.1 to 300W 0.01 from 0.1 to <1W 0.1 from 1 to <100W
Accuracy	±(8% of reading + 1 digit) for CW only
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)

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 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)
LOW PASS FILTERS LOW PASS FILTER NO. 1 LOW PASS FILTER NO. 2	Cutoff frequency (MHz): 125 450	TLC125-6EF1 TLC450-6EF or similar LP filters from Rodale Electronics, Model 13589299 (13589299)
MEASURING RECEIVER	Power measurement: Range: 75 to 335 MHz -127 to +13 dB Accuracy: ± 0.5 dB FM: Range: 165 MHz 1 to 13 kHz Accuracy: ($\pm 1\% \pm 1$ digit) AM: Range: 400 MHz 30 to 90% @ 1 kHz rate Accuracy: ($\pm 1\% \pm 1$ digit)	Agilent, Model 8902A (8902A) w/sensor, Agilent, Model 11722A (11722A)
MISMATCH STANDARDS	Frequency range: 100 to 400 MHz VSWR ¹ : 1.05 +.00, -.05 1.2 \pm .10 1.50 \pm .17 2.00 \pm .22	Premier Microwave 2334-001-1 2334-001-2 2334-001-3 2334-001-4
MODULATION ANALYZER	CW Frequency Range: 75 to 335 MHz Audio Frequency Range: 29 to 9962 Hz Bearing Range: 0.00 to 359.99° Accuracy: ≤ 0.025 AM Range: 400 MHz 30 to 90 % Accuracy: : (1% of reading ± 1 count) FM Range: ± 505 Peak Deviation Accuracy: (1% of reading ± 1 count) Deviation DDM Range: ± 0.415 Accuracy: ± 0.001	Rhode & Shwarz, Model FMAV
POWER METER	Frequency: 75 to 400 MHz Power Range: -40 to -20 dBm Accuracy: ± 0.5 dB	Agilent, Model 437B (13440045) w/power sensor Agilent, Model 8481D.
RF POWER AMPLIFIER	Frequency: 100 MHz to 300 MHz Output: 0.3 to 25 W Accuracy: N/A	Antenna Research Asso Inc., Model 757LC (757LC) (MIS-45845)

See footnote at end of table.

Table 2. Minimum Specifications of Equipment Required - Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
RF POWER METER	Frequency: 100 MHz to 300 MHz Output: 0.3 to 25 W Accuracy: ± 0.5 dB	Bird, Model 4421 (4421) w/ Directional power sensor, Model 4022 (4022)
RF REFERENCE SOURCE	Frequency: 100 MHz to 300 MHz Output: 0.1 W Accuracy: ± 0.5 dB	Fluke, Model 9640A
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)
SPECTRUM ANALYZER	Frequency Range: 75 MHz to 1.5 GHz 0 to 50 dB Accuracy: ± 1.6 dB	(AN/USM-677)
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)

¹As charted on calibration report provided by APSL.

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. Additional maintenance information is contained in TM 11-6625-3244-40 and TM 11-6625-3245-40 for these TIs.

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 necessary, install version **2.06** from the folder **IFR4000_V2_06** located in the TB 9-6670-2372-40 procedure folder on the USATA website.

- 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 Ω.
- (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 and 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 **108.001 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.

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

(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) **TONE** to set **MOD TONE** to **OFF**.

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

(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
137.000 MHz	136999863.0 to 137000137.0
156.000 MHz	155999844.0 to 156000156.0
225.0000 MHz	224999775.0 to 225000225.0
312.000 MHz ¹	3119996888.0 to 312000312.0
400.000 MHz	399999600.0 to 400000400.0

¹Switch 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** 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) Zero and calibrate measuring receiver and ensure that sensor module calibration factors are loaded.
- (2) Connect measuring receiver to TI **ANT** connector.
- (3) Repeat **7 g** to preset TI.
- (4) Press the following TI keys, as needed, in (a) through (e) below.
 - (a) **MODE** until **GLIDESLOPE** 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 ¹	7.0	13.0
0.0 ²	-3.0	3.0
-10.0 ³	-13.0	-7.0
-30.0	-33.0	-27.0

¹Record measuring receiver indication in 10 dBm column of Appendix A.

²Setup measuring receiver for tuned RF absolute power measurement.

³Record 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.

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 ¹	7.0	13.0
3.0	0.0	6.0
0.0 ²	-3.0	3.0
-7.0	-10.0	-4.0
-10.0 ³	-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

¹Record measuring receiver indication in Appendix A 10 dBm column.

²Setup measuring receiving for tuned RF measurement.

³Record measuring receiver indication in Appendix A -10 dBm column.

(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

(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 **GLIDESLOPE** 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.
- MODE** until **MARKER BEACON** mode screen is displayed.
 - TONE** to set **MOD TONE** to **OFF**.
 - M MOD** to set **M MOD** to **0%**.
 - 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.
- MODE** until **COMM AM** mode screen is displayed.
 - TONE** to set **MOD TONE** to **OFF**.
 - M MOD** to set **M MOD** to **0%**.
 - [**SWITCH GEN/RX**] to set **COMM AM** mode to **GENERATING**.
- (17) Press **FREQ** to set **FREQ** to **400.000 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 **312.000 MHz**.
- (23) Repeat steps (18) through (21) above.
- (24) Set **FREQ** to **225.000 MHz**.
- (25) Repeat steps (18) through (21) above.
- (26) Set **FREQ** to **156.000 MHz**.
- (27) Repeat steps (18) through (21) above.
- (28) Set **FREQ** to **137.000 MHz**.
- (29) Repeat steps (18) through (21) above.
- (30) Set **FREQ** to **118.000 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 with a 3.8 special function.

(38) Verify that power meter indication is within the limits specified in table 9.

(39) Set TI **RF LVL** to remaining settings in table 9 and verify that power meter indication is within the limits specified.

Table 9. Comm AM Output Accuracy

TI RF LVL (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. 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 spectrum analyzer to the TI **ANT** connector.
- (2) Press **SETUP** and repeat 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 spectrum analyzer 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 **GLIDESLOPE** 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 **137.000 MHz**.
- (23) Repeat steps (5) through (10) above.
- (24) Press **FREQ** to set **FREQ** to **400.000 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 fig 1.
- (2) Set signal generator output level to 0.0 dBm.
- (3) Set signal generator to first frequency in table 10.
- (4) Setup spectrum analyzer to measure first frequency in table 10.
- (5) On spectrum analyzer, 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) Spectrum analyzer 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

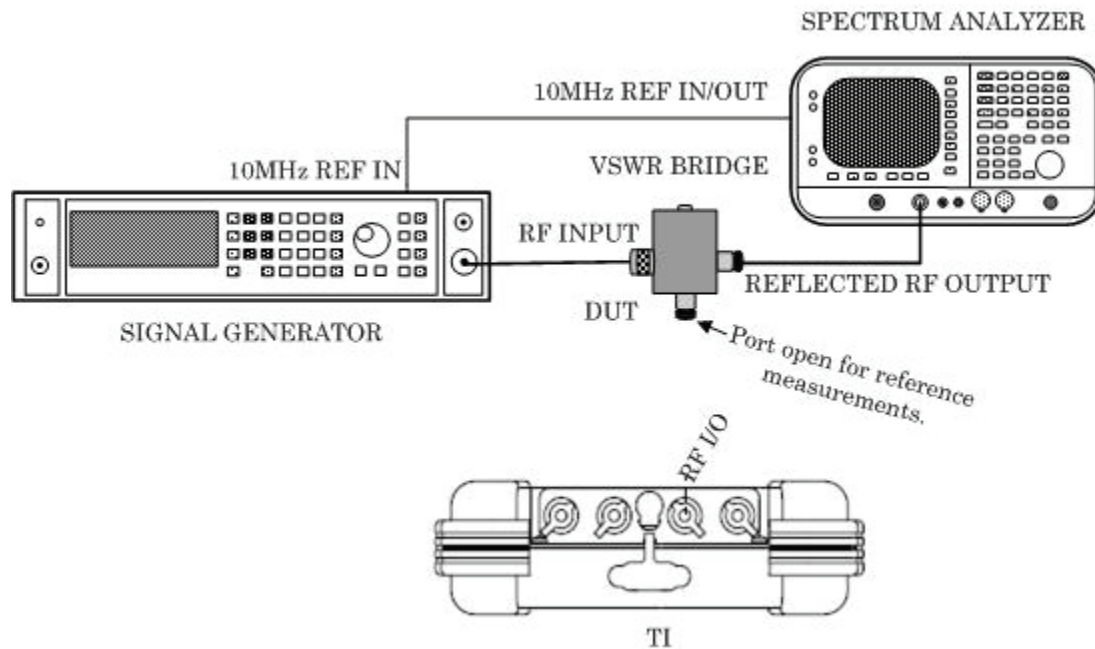


Figure 1. VSWR setup.

(9) Disconnect equipment setup.

b. Adjustments. No adjustments can be made.

13. VOR

a. Performance Check

- (1) Connect modulation analyzer RF Input to 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) On modulation analyzer, press **DEMOD** and **[AM]** for AM measurement.
- (5) Verify modulation analyzer 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.

NOTE

To toggle modulation analyzer audio display between audio frequency and distortion, press **AUDIO** to display audio menu and press [**Dist Sinad**] or [**Audio Freq**] as needed.

Table 11. Marker Beacon

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%**. Modulation analyzer AM indication should be between 56% and 64%.
- (13) On modulation analyzer, press **DEMODO**, [**AM Avion**](twice), [**VOR**], and [**DEV 9.96K**]. Modulation analyzer should indicate between 455 and 505 Hz.
- (14) On modulation analyzer, press [**VOR Phase**] to setup phase measurement.
- (15) 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**.
- (16) Press [**BRG**] and set **BRG** to the first value in table 12. Modulation analyzer should indicate within the limits in table 12. No adjustments can be made.
- (17) Repeat step (16) above for the remaining values listed in table 12.

Table 12. Bearing (TO)

BRG (degrees)	Limits	
	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

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

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

Table 13. Bearing (FROM).





BRG (degrees)	Limits	
	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

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

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

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

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

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

(25) Repeat step (24) 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

(26) Leave modulation analyzer connected to **TI ANT** connector.

b. Adjustments

- (1) Perform paragraph **6 g** 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 5 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 **7 g** to preset TI.
- (2) On modulation analyzer, press **DEMOD** and [**AM**] 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**.
- (4) Verify that modulation analyzer 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) On modulation analyzer, press **DEMODO**, [**AM Avion**], [**ILS**], and [**DDM**].
- (12) Press **DDM/μA LOC** ,  keys, as needed, to obtain the first setting in table 16. Modulation analyzer 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) On modulation analyzer, press [**ILS Phase**].



(22) Press , , as needed, set **90/150 Hz** field to first setting in table 18. Modulation analyzer should indicate within the limits in table 18.

Table 18. LOC Phase

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

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

(24) Set **90/150 Hz** field to *0 deg*.

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 modulation analyzer 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) On modulation analyzer, press **DEMODO** and [AM] keys 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 modulation analyzer 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 modulation analyzer, press **DEMODO**, [**AM Avion**](twice), [**ILS**](twice), and [**DDM**].
- (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 modulation analyzer is not within the limits listed, perform **b.** below.
- (9) Repeat step (8) above for the remaining settings in table 20.

Table 20. G/S DDM

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






- (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. Modulation analyzer will indicate within the limits listed in table 21.
- (13) Repeat step (8) above for the remaining settings in table 21.

Table 21. G/S DDM (Variable)

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

- (14) Set **G/S DDM** to **0.000 CENTER**.
- (15) Press [**DEV STEP**] and set **DEV STEP** to **FIXED**.
- (16) On modulation analyzer, press [**ILS Phase**].
- (17) Press **90/150 Hz** and set **90/150 Hz** to first setting in table 22. Modulation analyzer will indicate within the limits listed.
- (18) Repeat step (17) 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	-4.5	-5.5
10	-9.5	-10.5
20	-19.5	-20.5
40	-39.5	-40.5
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 modulation analyzer input frequency to 332.000MHz and activate 3kHz 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 modulation analyzer **RF INPUT** to **TI ANT** connector.
- (2) Set modulation analyzer to 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 modulation analyzer 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 modulation analyzer to **TI ANT** connector using a 10 db attenuator.
- (3) Setup modulation analyzer 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 modulation analyzer indicates between 74.99993 and 75.00008 MHz.

(6) Verify that modulation analyzer 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 modulation analyzer 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 modulation analyzer indicates between 108.09989 and 108.10011 MHz.
- (14) On modulation analyzer, press **RF** and **[Level]**. Modulation analyzer will indicate between -12.5 and -7.5 dBm.
- (15) Verify that modulation analyzer 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 modulation analyzer indicates within the 90 Hz limits in table 24.
- (19) Press **[TONE DEL]** to set **TONE DEL** to **90**.
- (20) Verify that modulation analyzer indicates within the 150 Hz limits in table 24.
- (21) Set **TONE DEL** to **---**.
- (22) On modulation analyzer, press **DEMOD**, **[AM Avion]**(twice), **[ILS]**(twice), and **[DDM]**.
- (23) Press **DDM/μA LOC** ,  keys, as needed, to obtain the first setting in table 25. If modulation analyzer 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. Modulation analyzer 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) On modulation analyzer, press [ILS Phase].
- (32) Press [90/150 Hz] to select **90/150 Hz** field.
- (33) Press , , as needed, set **90/150 Hz** field to first setting in table 27.
- (34) Repeat step (33) above for remaining settings in table 27.

Table 27. ILS

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

- (35) Set **90/150 Hz** field to **---**.
- (36) Disconnect 10 dB attenuator and modulation analyzer from TI **ANT** connection.
- (38) Connect measuring receiver to TI **ANT** connector.
- (36) Press TI **RF LVL** and set **G/S LVL** to **0.0 dBm**.
- (37) Calibrate measuring receiver for 334.700 MHz in tuned RF mode.
- (38) Press **RF LVL** and set **G/S LVL** to **-30.0 dBm**. Measuring receiver should indicate between -33 and -27 dBm.
- (39) Set **G/S LVL** to **-10.0 dBm**. Measuring receiver should indicate between -13 and -7 dBm.
- (40) Disconnect measuring receiver from TI **ANT** connector.

b. Adjustments. No further adjustments can be made.

18. COMM AM

a. Performance Check

- (1) Connect modulation analyzer to TI **ANT** connector.
- (2) On modulation analyzer, press **DEMOD** and [**AM**] keys 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 modulation analyzer 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 modulation analyzer 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	100.1009	100.1011
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 -10 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 Ω 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	9.999998	1.000002
1.00001	1.000008	1.000012
5.10001	5.100004	5.100016
9.99999	9.999979	1.000011

(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) Setup 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) Setup measuring receiver for AM measurement with 300 Hz HP and 3 kHz LP filters on.
- (7) Press TI **FREQ** and set **FREQ** to **400.000 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

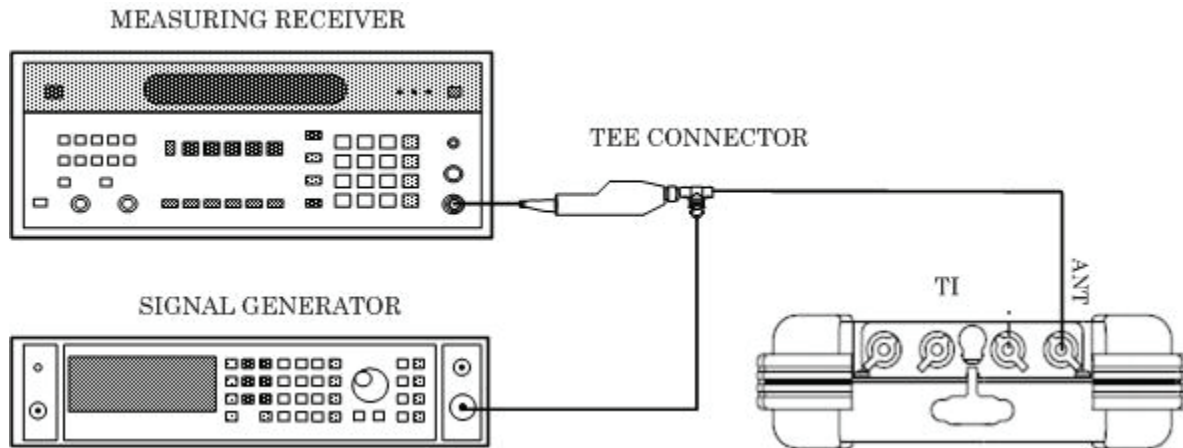


Figure 2. AM/FM meter setup.

- (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 AM modulation level until measuring receiver indicates last 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) Setup measuring receiver for a 165 MHz measurement.
- (5) Set signal generator FM on and modulation frequency to 400 Hz.
- (6) Setup 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 -10.0 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.
- (4) Connect 1.05 VSWR mismatch standard to TI **SWR** connector using adapter.
- (5) 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.
- (6) Repeat step (5) above for the remaining settings in table 32.

Table 32 SWR Meter Accuracy

FREQ (MHz)	Limits
75	<1.6
137	<1.6
225	<1.6
312	<1.6
400	<1.6

(7) Disconnect 1.05 VSWR mismatch standard and connect 1.20 VSWR mismatch standard to TI **SWR** connector.

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

(9) Repeat step (8) above for the remaining settings in table 33.

Table 33 SWR Meter Accuracy

FREQ (MHz)	Limits
400	Max
312	<1.8
225	<1.8
137	<1.8
75	<1.8

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

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

(12) Repeat step (11) for the remaining settings in table 34.

Table 34. SWR Meter Accuracy

FREQ (MHz)	Limits	
	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

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

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

(15) Repeat step (14) above for the remaining settings in table 35.

Table 35. SWR Meter Accuracy

FREQ (MHz)	Limits	
	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

(16) Disconnect 2.00 VSWR mismatch standard from TI **SWR** connector.

b. Adjustments

NOTE

TNC Short P/N:3069F, TNC Open P/N:09922, and TNC cable supplied with the TI are required for SWR meter calibration.

- (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.

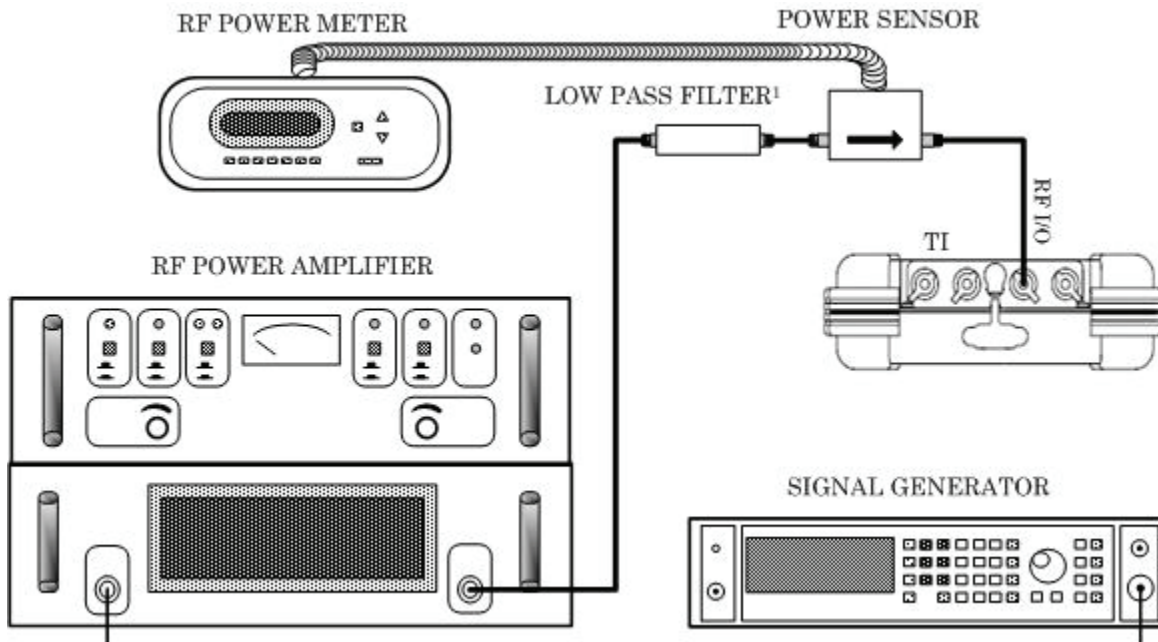
- (8) Connect equipment as shown in figure 3.
- (9) Set signal generator to first frequency listed in table 36.

(10) Adjust both signal generator and RF power amplifier outputs, as necessary, to obtain first 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 cal screen does not exceed 35 degrees.

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



¹Select LP filter from table 2 based on measurement frequency.

Figure 3. Power meter setup.

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

Table 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	400.000				
COMM AM	312.000				
COMM AM	225.000				
COMM AM	156.000				
COMM AM	137.000				
COMM AM	118.000				
	Max reading				
	Min Reading				
	Flatness (Max-Min) ≤ 1 dB				

By Order of the Secretary of the Army:

Official:



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

0804601

GEORGE W. CASEY, JR.
*General, United States Army
Chief of Staff*

Distribution:

To be distributed in accordance with STD IDS No. RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-6625-2372-40.

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.

