

TECHNICAL MANUAL
CALIBRATION PROCEDURE
FOR
NAV/COMM TEST SET
IFR4000

(AEROFLEX)

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NAV/COMM TEST SET

IFR4000

(AEROFLEX)

1 CALIBRATION DESCRIPTION:*Table 1.*

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
RF Signal Generator		
Output Frequency	Range: VOR: 107 to 118 MHz; LOC: 107 to 113 MHz; Marker Beacon: 72 to 78 MHz; Comm VHF AM: 117 to 157 MHz (10 to 400 MHz for MOD 2); G/S: 327 to 337 MHz; Comm VHF FM: 155 to 175 MHz (10 to 400 MHz for MOD 2); Comm UHF: 224 to 401 MHz; SELCAL: 117 to 157 MHz Accuracy: time base ±1 ppm when Autocal is performed; Aging/year: ±1 ppm	Compared to a Frequency Standard
Output Level		
ANT Connector		
Single Carrier	Range: -67 to +13 dBm (10 to 75 MHz, -67 to -17 dBm for MOD 2) (75 to 400 MHz, -67 to +13 dBm for MOD 2) Accuracy: ±3 dB	Measured with a Power Meter, Power Sensor and Microwave Measurement Receiver

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
RF Signal Generator (<i>Cont.</i>)		
Output Level (<i>Cont.</i>)		
RF I/O Connector		Measured with a Power Meter, Power Sensor and Microwave Measurement Receiver
Single Carrier	Range: -130 to -12 dBm (10 to 75 MHz, -130 to -40 dBm for MOD 2) (75 to 400 MHz, -130 to -12 dBm for MOD 2)	
	Accuracy: -120 to -95 dBm, ± 3 dB; -94.5 to -40 dBm, ± 2 dB; -39.5 to -12 dBm, ± 2.5 dB (only 75 to 400 MHz MOD 2)	
Spectral Purity		
Harmonics	Range: 72 to 401 MHz (10 to 400 MHz for MOD 2)	Measured with a Spectrum Analyzer
	Accuracy: < -20 dBc	
Non-Harmonics	Range: 75 to 400 MHz (10 to 400 MHz for MOD 2)	
	Accuracy: < -35 dBc (< -32 dBc for MOD 2)	
VOR Mode		
Tone Frequency	Range: 30 Hz Ref, 30 Hz Var, 1020 and 9960 Hz	Measured with ILS/VOR Signal Calibrator, Universal Counter and Audio Analyzer
	Accuracy: $\pm 0.02\%$ of setting	
AM Modulation	Range: 30%, 30, 1020 and 9960 Hz; 10%, 1020 Hz Morse Code	
	Accuracy: In CAL position: Modulation: $\pm 2\%$ AM; Distortion: $< 2.5\%$ THD ($< 2.0\%$ THD for MOD 2) * ¹	
FM Modulation	Range: 30 Hz Ref @ ± 480 Hz Peak Deviation on 9960 Hz sub-carrier	
	Accuracy: ± 25 Hz peak deviation	

See footnote at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
VOR Mode (<i>Cont.</i>)		Measured with ILS/VOR Signal Calibrator, Universal Counter and Audio Analyzer
Bearing	Range: 0.0° to 359.9° Accuracy: ±0.1°	
LOC Mode		
Tone Frequency	Range: 90, 150 and 1020 Hz Accuracy: ±0.02% of setting	
Modulation	Range: 20% AM, 90 and 150 Hz; 30% AM, 1020 audio tone; 10% AM, 1020 Morse Code Accuracy: In CAL position: Modulation: ±2% AM; Distortion: <2.5% THD	
DDM		
Fixed	Range: ±0, 0.093, 0.155 or 0.200 DDM and Tone Delete Accuracy: ≤+10 dBm output level, ±(0.0015 DDM +3% of setting)	
Variable	Range: ±0.4 DDM Accuracy: ≤+10 dBm output level, ±(0.0025 DDM +3% of setting)	
G/S Mode		
Tone Frequency	Range: 90 and 150 Hz Accuracy: ±0.02% of setting	
Modulation	Range: 40% AM; 90 and 150 Hz Accuracy: In CAL position: Modulation: ±2% AM; Distortion: <2.5% THD	

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
G/S Mode <i>(Cont.)</i>		Measured with ILS/VOR Signal Calibrator, Universal Counter and Audio Analyzer
DDM		
Fixed	Range: $\pm 0, 0.091, 0.175$ or 0.400 DDM and Tone Delete Accuracy: $\leq +10$ dBm output level, $\pm(0.003$ DDM + 3% of setting)	
Variable	Range: ± 0.8 DDM Accuracy: $\leq +10$ dBm output level, $\pm(0.0048$ DDM + 3% of setting)	
COMM Mode		Measured with ILS/VOR Signal Calibrator, Universal Counter and Audio Analyzer
Tone Frequency	Range: 1020 Hz Accuracy: $\pm 0.02\%$ of setting	
Modulation	Range: 30% AM, 1020 Hz Accuracy: In CAL position: Modulation: $\pm 2\%$ AM; Distortion: $< 2.5\%$ THD	
Marker Mode		Measured with ILS/VOR Signal Calibrator, Universal Counter and Microwave Measurement Receiver
Tone Frequency	Range: 400, 1300 and 3000 Hz Accuracy: $\pm 0.02\%$ of setting	
Modulation	Range: 95% AM; 400, 1300 and 3000 Hz Accuracy: In CAL position: Modulation: $\pm 5\%$ AM; Distortion: $< 2.5\%$ THD, single carrier	
Frequency Counter		Verified during RF Signal Generator Frequency Output calibration
ANT and RF I/O input Connectors	Range: 10 to 400 MHz; Resolution: 100 Hz Accuracy: Same as time base, ± 1 dig	

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency Counter (<i>Cont.</i>)		Verified during RF Signal Generator Frequency Output calibration
AUX I/O Connector	Range: 1 to 10 MHz; Resolution: 1 Hz Accuracy: Same as time base, ± 1 dig	
Power Meter	Range: * ² 118.0 to 400.0 MHz (10 to 400 MHz for MOD 2), 0.1 to 300 W; Resolution: 0.1 to <1 W, 0.01 W; 1 to <100 W, 0.1 W; 100 to 300 W, 1 W Accuracy: * ³ CW only (w/o attenuator), $\pm(8\%$ of rdg + 1 dig); <100 MHz CW only (w/o attenuator), $\pm(12\%$ of rdg + 1 dig), for MOD 2	Measured on TI with known signal applied
AM Meter	Range: 50 to 3000 Hz, 10 to 99% mod Accuracy: $\pm 10\%$ of rdg	
FM Meter	Range: 50 to 3000 Hz, 1 to 15 kHz dev Accuracy: $\pm(0.4$ kHz + 8% of rdg)	
SWR Meter	Range: 75 to 400 MHz (10 to 410 MHz for MOD 2) Accuracy: SWR <3:1, $\pm(0.2$ + 20% of rdg); SWR $\geq 3:1$, $\pm(0.3$ + 20% of rdg)	Verified using known Mismatch at TI input

*¹ VOR Mode 1020 Hz Morse Code Distortion inherently calibrated.

*² On/Off Duty Cycle: ≤ 10 W Continuous; > 10 to ≤ 20 W On, max of 3 min, Off, min of 2 min;
 > 20 to ≤ 30 W On, max of 1 min, Off, min of 2 min.

*³ External Attenuator required for input power > 30 W.

2 EQUIPMENT REQUIREMENTS:

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1	FREQUENCY STANDARD	Range: 10 MHz Accuracy: $<2.5 \times 10^{-7}$	Arbiter 1083B	
2.2	UNIVERSAL COUNTER	Range: 29 Hz to 335 MHz Accuracy: $\pm 0.005\%$ of rdg	Hewlett-Packard 53132A OPT 124	
2.3	POWER METER	Range: -43.0 to 16.0 dBm Accuracy: * ¹	Agilent E4418B	
2.4	POWER SENSOR	Range: 50 to 335 MHz, -42 to +16 dBm Accuracy: (all of Charted Cal Factor) $\pm 2.4\%$ of charted Cal Factor	Agilent E4412A	
2.5	MEASURING RECEIVER	Range: (AM) 400 MHz, 30 to 90% AM, 1 kHz rate Accuracy: $\pm 2.5\%$ of indication Range: (FM) 165 MHz, 1 to 13 kHz deviation, 1 kHz rate Accuracy: $\pm 2.8\%$ of indication	Hewlett-Packard 8902MS	
2.6	SPECTRUM ANALYZER	Range: 75 MHz to 1.5 GHz, 0 to 50 dB Accuracy: (Scale Fidelity) ± 1.6 dB	Hewlett-Packard 8563E	

¹ See footnote at end of Table.

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.7 ILS/VOR SIGNAL CALIBRATOR	Range: CW Frequency: 50 to 335 MHz; Audio Frequency: 29 to 9962 Hz Bearing: 0.00 to 359.99°; AM: 8 to 100% AM; * ² FM: ±505 Peak Deviation; DDM: ±0.415 DDM; Accuracy: AM: ±0.5% AM (±2% AM at 90 to 99% depth); * ² Bearing: ≤0.025°; FM: 6.25 Hz Peak Deviation; DDM: ±0.001 DDM	Rhode-Schwartz CIVS	
2.8 POWER AMPLIFIER * ³	Range: 800 mW to 28 W, 10 to 500 MHz Accuracy: N/A	Comtech BHED1758-200/4006	Comtech BHED1758- 1000/4006
2.9 RF POWER MEASUREMENT SET	Range: 50 to 500 MHz Accuracy: ±3% of rdg * ⁴	Bird 4421A300	
2.10 ATTENUATOR	Range: 50 to 500 MHz Accuracy: N/A	Weinschel 82-10-34	
2.11 SIGNAL GENERATOR	Range: (CW) 50 to 400 MHz, -5 to 0 dBm; (AM) 30 to 90% modulation, 1 kHz rate; (FM) 1 to 13 kHz deviation, 1 kHz rate Accuracy: N/A	Hewlett-Packard 8664A Opt H15 (P/O E5504B)	
2.12 AUDIO ANALYZER	Range: 0 to 100% Accuracy: ±1 dB	Hewlett-Packard 8903B	

See footnote at end of Table.

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.13 MICROWAVE MEASUREMENT RECEIVER (MMR)	Range: -123 to +16 dBm, 50 to 335 MHz Accuracy: * ⁵ Relative Tuned RF Level: Residual Noise to Max Power, $\pm(0.015 \text{ dB} + 0.005 \text{ dB}/10 \text{ dB})$ Minimum Power to Residual Noise Threshold, $\pm(\text{Cumulative Error} + 0.0012 \text{ X (Input Power - Residual Noise Threshold Power)}^2)$; Range 2, $\pm 0.031 \text{ dB}$; * ⁶ Range 3, $\pm 0.031 \text{ dB}$ * ⁷ Range: (Amplitude Modulation) 75 MHz, 90 to 100% AM, 400, 1300 and 3000 Hz rates Accuracy: AM Depth: $\pm 1.25\%$ AM; Distortion: $< 0.5\%$ THD	Agilent N5530SE50	
2.13.1 SPECTRUM ANALYZER	Range: -123 to +16 dBm, 75 MHz Accuracy: Scale Fidelity: $\pm 1.6 \text{ dB}$	Agilent E4448A	
2.14 MISMATCH	Range: 10 to 410 MHz Accuracy: VSWR: $1.50 \pm 6.6\%$ of nominal value	JFW Industries 50T-473-1.5	As Available
2.15 MISMATCH	Range: 10 to 410 MHz Accuracy: VSWR: $4.00 \pm 5.6\%$ of nominal value	JFW Industries 50T-473-4.0	As Available
2.16 POWER SPLITTER	Range: 400 MHz Accuracy: Tracking: $\leq 0.15 \text{ dB}$	Weinschel 1870A	

*¹ Power Meter Accuracy is included in the Power Sensor Accuracy.

*² TAR of 2.5:1 for Marker Mode Alternate Method Calibration.

*³ When using Power Amplifier p/n BHED1758-1000/4006, use Attenuator to protect TI. See Caution at beginning of para 4.9.

- *⁴ TAR of 2.8:1 for Power Meter Measurement.
- *⁵ Accuracy applies when MMR is set to *Tuned RF Lvl* and *Accuracy Normal/High* is set to *High*.
- *⁶ Add this specification when the MMR enters Range 2. Range 2 is entered when the Range 1 Signal to Noise Ratio (SNR) falls between 50 and 28 dB. The SNR value is tuning dependent. Range 2 will be displayed on the MMR when the range is entered.
- *⁷ Add this specification, in addition to the Range 2 error, when the MMR enters Range 3. Range 3 is entered when the Range 2 SNR falls between 50 and 28 dB. The SNR value is tuning dependent. Range 3 will be displayed on the MMR when the range is entered.

3 PRELIMINARY OPERATIONS:


3.1 Review and become familiar with the entire procedure before beginning the Calibration Process.



Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) or turned off, where applicable. Ensure that all equipment switches are set to the proper position before making connections or applying power. If not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

3.2 Connect the test equipment to appropriate power source. Set all POWER switches to ON and allow warm-up as required by the manufacturer.

3.3 Throughout the Calibration Procedure, all hard keys will be in all CAPS, soft keys will be underlined, submenus will be in **Bold**, and menu values will be in *Italics*.

3.4 Connect the TI Power Cord to appropriate power source. Press TI POWER  key to on. Allow a 15 min warm-up period.

NOTE

Whenever a measurement is made with MMR at a carrier frequency of <20 MHz, the RF coupling must be set to DC. The 50 GHz MMR RF coupling is always DC. The 26.5 GHz MMR RF coupling must be set to DC.

3.5 Throughout the Calibration Process, the components of the Microwave Measurement Receiver (MMR) system will be identified by their nomenclature. For example, when instructed to use the MMR Spectrum Analyzer that is p/o the MMR, the procedure will refer to the Spectrum Analyzer as the MMR Spectrum Analyzer.

3.5.1 Throughout this procedure, all MMR hardkeys will be in **BOLD** and all softkeys will be in *ITALICS*.

3.5.2 When entering keystrokes and changing functions with the MMR, allow sufficient time for the unit to register the entries.

3.5.3 Press the MMR Spectrum Analyzer **SYSTEM**, *Power On/Presets*, *Presets* type to *Factory*, then **PRESET**. Then press **SYSTEM**, *Alignments*, then *Align All Now*. Configure the MMR Spectrum Analyzer for a measuring receiver measurement.

3.6 Press the TI SETUP key, as necessary to display the SETUP menu, and press H/W TOOLS, DIAGS, SELF TEST and RUN to initiate Self Test. When complete, ensure all Self-Tests pass. Press RETURN 3 times.

3.7 Press the TI SETUP key, as necessary to display the SETUP menu, and press STORE/RECALL. Press PREV or NEXT, as necessary, to select *PRESET SETTINGS* and then press RECALL. Press RETURN.

3.8 Throughout the Calibration Procedure, when required to enter a value, utilize the ↑, ↓, ← and → keys to enter the value.

NOTE

The firmware can be checked by pressing the TI SETUP key and then INFO and/or H/W TOOLS softkeys where applicable.

3.9 Consult the T.O. 33K-1-100-2 or Calibration Measurement Summary (CMS) using the AFCAV Viewer to verify that the TI has the appropriate version of firmware.

3.9.1 If the TI has another boot sw, main sw, fpga, cpld or micro version, contact the TCM at AFMETCAL.

3.10 If main sw version is 2.0 or above, throughout the Calibration Procedure, menu settings using the newer mentioned firmware will reference this step to include MOD 2 versions. When preset frequency values cannot be achieved as directed by the procedure, (i.e. TI with MOD 2 set to 50 MHz), the frequency control should be changed to variable. To change the preset frequency control to variable, use the following: Press the TI SETUP key as necessary to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **FREQ** field. Use the UP ARROW until VAR is displayed. Select MODE to return to previous screen. To return frequency controls to preset values, follow the above except use the UP ARROW until PRESET is displayed.

3.11 For reference purposes only, when interpolation is used, use the following formula:

$$CF_x = \left[\frac{(f_x - f_1)(CF_2 - CF_1)}{(f_2 - f_1)} \right] + CF_1$$

Where:

CF_x = Unknown CF

f_x = Freq of interest

CF₁ = Cal Factor from Report of Measurement

CF₂ = Cal Factor from Report of Measurement

f₁ = Freq from Report of Measurement

f₂ = Freq from Report of Measurement

3.12 The RF Power Measurement Set consists of the RF Power Meter and Directional Power Sensor.

4 CALIBRATION PROCESS:

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

4.1 RF SIGNAL GENERATOR OUTPUT FREQUENCY CALIBRATION:

4.1.1 Connect Frequency Standard 10 MHz REF OUT to the Universal Counter Ref In (rear panel). For TIs with firmware referenced in step 3.10, proceed to step 4.1.3.

4.1.2 Press the TI SETUP key, as necessary to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *ANT*. Press the TI SWITCH GEN/RX, if necessary to set to *GENERATING*.

4.1.3 Connect the TI ANT connector to the Universal Counter CHANNEL 1 input. Set the Universal Counter 50Ω/1MΩ switch to 50Ω.

4.1.4 Press the TI MODE key, as necessary, to display the VOR mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *REF&VAR*. Press **FREQ** and set **FREQ** to *108.000 MHz*.

4.1.5 Press the TI RF LVL key and set **RF LVL** to *0.0 dBm (-17.0 dBm for 50 MHz)*.

4.1.6 Adjust Universal Counter controls as required for a stable display indication. Verify the Universal Counter indication is within the appropriate values listed in the Before Autocal Limits column of Table 2.

Table 2.

MODE	Limits (Hz)	
	Before Autocal	After Autocal
VOR	107999784.0 to 108000216.0	107999892.0 to 108000108.0
LOCALIZER	108099783.8 to 108100216.2	108099891.9 to 108100108.1
MARKER BEACON	74999850.0 to 75000150.0	74999925.0 to 75000075.0
COMM VHF AM (COMM AM for TIs with firmware referenced in step 3.10)	117999764.0 to 118000236.0	117999882.0 to 118000118.0

4.1.7 Press the TI MODE key, as necessary, to display the LOCALIZER mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *90 & 150*. Press **FREQ** and set **FREQ** to *108.100 MHz*.

4.1.8 Repeat steps 4.1.5 and 4.1.6.

4.1.9 Press the TI MODE key, as necessary, to display the MARKER BEACON mode screen. Press **FREQ** and set **FREQ** to *75.00 MHz*.

4.1.10 Repeat steps 4.1.5 and 4.1.6.

4.1.11 Press the TI MODE key, as necessary, to display the COMM VHF AM (COMM AM for TIs with firmware referenced in step 3.10) mode screen. Press SWITCH GEN/RX, as necessary, to set to *GENERATING*. Press **FREQ** and set **FREQ** to *118.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*.

4.1.12 Repeat steps 4.1.5 and 4.1.6.

4.1.13 For TIs with MOD 2, continue with step 4.1.14; otherwise proceed to step 4.1.15.

4.1.14 Repeat steps 4.1.11 and 4.1.12 for 50 MHz and verify the Universal Counter indication is within 49999900.0 to 50000100.0 Hz (49999950.0 to 50000050.0 Hz after Autocal).

4.1.15 Disconnect the TI ANT connector from the Universal Counter CHANNEL 1 input and connect the TI ANT connector to the Universal Counter CHANNEL 3 input.

4.1.16 Press the TI MODE key, as necessary, to display the GLIDE SLOPE mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *90 & 150*. Press **FREQ** and set **FREQ** to *334.700 MHz*.

4.1.17 Repeat steps 4.1.5 and 4.1.6 using Table 3.

4.1.18 Press the TI MODE key, as necessary, to display the COMM UHF (COMM AM for TIs with firmware referenced in step 3.10) mode screen. Press SWITCH GEN/RX, as necessary, to set to *GENERATING*. Press **FREQ** and set **FREQ** to *225.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*.

4.1.19 Repeat steps 4.1.5 and 4.1.6 using Table 3.

Table 3.

MODE	Limits (Hz)	
	Before Autocal	After Autocal
GLIDE SLOPE	334699330.6 to 334700669.4	334699665.3 to 334700334.7
COMM UHF (COMM AM for TIs with firmware referenced in step 3.10)	224999550.0 to 225000450.0	224999775.0 to 225000225.0

4.1.20 Press the TI RF LVL key and set **RF LVL** to *-67.0 dBm*. Disconnect the test setup.

4.1.21 Repeat step 3.7 to restore the TI factory presets.

NOTE

Adjustment of the Time Base Oscillator is normal due to the Aging Rate of the crystal. This is common to all Quartz Oscillators. The adjustment actions taken during this calibration will ensure the greatest reliability of the TI by adjusting the time base reference frequency to the nominal value each time it is calibrated.

4.1.22 Perform TI Time Base Autocal as follows:

4.1.23 Press TI SETUP key, as necessary to display the SETUP menu, then press H/W TOOLS then CAL.

4.1.24 On the TI enter password (3, 5, 2 and 4). Press MISC CAL, then TXCO. Follow the instructions on the TI screen (TI will instruct connecting the Frequency Standard 10 MHz REF OUT to the TI AUX connector, then pressing the START key).

4.1.25 The TI will indicate when the test is complete. Press SAVE/RETURN, then RETURN.

4.1.26 Repeat steps 4.1.1 through 4.1.19, except in step 4.1.6, verify the Universal Counter indication is within the appropriate values listed in the After Autocal Limits column of Table 2 and Table 3.

4.1.27 Press the TI RF LVL key and set **RF LVL** to *-67.0 dBm*. Disconnect the test setup.

4.2 RF SIGNAL GENERATOR OUTPUT LEVEL CALIBRATION:**NOTE**

As required, ensure the Power Sensor(s) Calibration Factors have been programmed into the Power Meter memory. Select the appropriate Power Sensor file throughout the Calibration Process.

4.2.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, proceed to step 4.2.3.

4.2.2 Press the TI SETUP key, as necessary to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *ANT*.

4.2.3 Press the TI MODE key, as necessary, to display the VOR mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *REF&VAR*. Press **FREQ** and set **FREQ** to *108.000 MHz*. Press the TI M MOD key and set **M MOD** to 0%. Press the TI 9960 MOD and set **9960 Hz MOD** to 0%. Press 30 MOD and set **30 Hz MOD** to 0%.

4.2.4 Standardize Power Meter and Power Sensor. Set the Power Meter controls for a dBm measurement.

4.2.5 Connect the Power Sensor to the TI ANT connector.

4.2.6 Press the TI RF LVL key and set **RF LVL** to the first applicable value listed in the Level column of Table 4.

4.2.7 Set the Power Meter FREQUENCY / CAL FACTOR switch as required to the appropriate value for the frequency being verified.

NOTE

The Calibration Factors for the E-Series Power Sensors are automatically downloaded from the Power Sensor EEPROM when the Power Sensor is connected to the Power Meter and the Power Meter is turned on.

4.2.8 Verify the Power Meter indication is within the values listed in the Limits column of Table 4. Record the Frequency and Power Meter Power indication.

Table 4.

Level (dBm)	Limits (dBm)
+13 *	10.0 to 16.0
0 *	-3.0 to +3.0
-10 *	-13.0 to -7.0
-20	-23.0 to -17.0
-30	-33.0 to -27.0
-40	-43.0 to -37.0

See footnote at end of Table.

Table 4. (Cont.)

Level (dBm)	Limits (dBm)
-50	-53.0 to -47.0
-60	-63.0 to -57.0
-67	-70.0 to -64.0

* N/A for frequencies <75 MHz.

4.2.9 Press the TI RF LVL key and set **RF LVL** to minimum. Disconnect the Power Sensor from the TI ANT connector and connect to the TI RF I/O connector.

4.2.10 Press the TI SETUP key and press NEXT PARAM, as necessary, to select the **PORT** field and set to *RF I/O*. Press the MODE key.

4.2.11 Press the TI RF LVL key and set **RF LVL** to the first applicable value listed in the Level column of Table 5.

4.2.12 Verify the Power Meter indication is within the corresponding values listed in the Limits column of Table 5. Record the Power Meter Power indication.

Table 5.

Level (dBm)	Limits (dBm)
-12 *	-14.5 to -9.5
-20 *	-22.5 to -17.5
-30 *	-32.5 to -27.5
-40	-42.0 to -38.0
-50	-52.0 to -48.0
-60	-62.0 to -58.0
-70	-72.0 to -68.0
-80	-82.0 to -78.0
-90	-92.0 to -88.0
-100	-103.0 to -97.0
-110	-113.0 to -107.0
-120	-123.0 to -117.0

* N/A for frequencies <75 MHz.

- 4.2.13 Press the TI RF LVL key and set **RF LVL** to minimum. Disconnect the Power Sensor from the TI RF I/O connector.
- 4.2.14 Press the TI MODE key, as necessary, to display the LOCALIZER mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *90 & 150*. Press **FREQ** and set **FREQ** to *108.100 MHz*.
- 4.2.15 Repeat steps 4.2.5 through 4.2.13 as required. Record the TI LOCALIZER ANT and RF I/O Output Power Meter Power indications.
- 4.2.16 Press the TI MODE key, as necessary, to display the GLIDE SLOPE mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *90 & 150*. Press **FREQ** and set **FREQ** to *334.250 MHz*.
- 4.2.17 Repeat steps 4.2.5 through 4.2.13 as required. Record the TI GLIDE SLOPE ANT and RF I/O Output Power Meter Power indications.
- 4.2.18 Press the TI MODE key, as necessary, to display the MARKER BEACON mode screen. Press **FREQ** and set **FREQ** to *75.00 MHz*.
- 4.2.19 Repeat steps 4.2.5 through 4.2.13 as required. Record the TI MARKER BEACON ANT and RF I/O Output Power Meter Power indications.
- 4.2.20 Press the TI MODE key, as necessary, to display the COMM VHF AM (COMM AM for TIs with firmware referenced in step 3.10) mode screen. Press SWITCH GEN/RX, as necessary, to set to *GENERATING*. Press **FREQ** and set **FREQ** to *118.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*.
- 4.2.21 Repeat steps 4.2.5 through 4.2.13 as required. Record the TI COMM VHF AM (COMM AM) ANT and RF I/O Output Power Meter Power indications.
- 4.2.22 For TIs with MOD 2, continue with step 4.2.23. Otherwise proceed to step 4.2.25.
- 4.2.23 Press the TI SETUP menu, and press NEXT PARAM, as necessary, to select the **FREQ** field. Use the UP ARROW until VAR is displayed. Select MODE to return to previous screen. Press TI **FREQ** and set **FREQ** to *50.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*.
- 4.2.24 Repeat steps 4.2.5 through 4.2.13 as required. Record the TI COMM VHF AM (COMM AM) ANT and RF I/O Output Power Meter Power indications.
- 4.2.25 Press **FREQ** and set **FREQ** to *225.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*. For TIs with firmware version less than 2.0, press the TI MODE key, as necessary, to display the COMM UHF mode screen. Press SWITCH GEN/RX, as necessary, to set to *GENERATING*.
- 4.2.26 Repeat steps 4.2.5 through 4.2.13 as required. Record the TI COMM VHF AM (COMM AM) ANT and RF I/O Output Power Meter Power indications.
- 4.2.27 Press the TI MODE key, as necessary, to display the VOR mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *REF&VAR*. Press **FREQ** and set **FREQ** to *108.000 MHz*. Press the TI M MOD key and set **MOD** to *0%*. Press the TI 9960 MOD and set **9960 Hz MOD** to *0%*. Press 30 MOD and set **30 Hz MOD** to *0%*.
- 4.2.28 Connect the TI ANT connector to the MMR Spectrum Analyzer RF INPUT 50 Ω .
- 4.2.29 Set the MMR Spectrum Analyzer for a Tuned RF Level measurement. Select Track Ranges and Bandwidths as required for a stable indication and a noise floor low enough to achieve readings at the lowest power levels.

NOTE

For Tuned RF Level measurements do not change the signal level during the Range 2 Switch Level Cal Factor and Range 3 Switch Level Cal Factor calibration. Wait for the red calibrating message to disappear before continuing. Use this method throughout the Calibration Process when making Tuned RF Level measurements.

- 4.2.30 Set the MMR to the TI Frequency.
- 4.2.31 Press the TI RF LVL key and set **RF LVL** to the first applicable value listed in the Level column of Table 4.
- 4.2.32 Set the MMR to Set Ref. Allow the MMR Tuned RF Level indication to settle.
- 4.2.33 Set the MMR Ext RF Atten to the value recorded, in dB, in step 4.2.8 for the frequency being verified.
- 4.2.34 Press the TI RF LVL key and set **RF LVL** to the next applicable value listed in the Level column of Table 4.
- 4.2.35 Allow the MMR Spectrum Analyzer indication to settle. Verify the MMR Spectrum Analyzer Tuned RF Power indication is within the corresponding values listed in the Limits column of Table 4.
- 4.2.36 Repeat steps 4.2.34 and 4.2.35 for the remaining values listed in Table 4.
- 4.2.37 Set the MMR Spectrum Analyzer *Ext RF Atten* to 0.0 dB.
- 4.2.38 Disconnect the MMR Spectrum Analyzer from the TI ANT connector and connect to the TI RF I/O connector.
- 4.2.39 Press the TI SETUP key and press NEXT PARAM, as necessary, to select the **PORT** field and set to *RF I/O*. Press the MODE key.
- 4.2.40 Ensure the MMR Spectrum Analyzer is set to make a Tuned RF Level measurement.
- 4.2.41 Press the TI RF LVL key and set **RF LVL** to the first applicable value listed in the Level column of Table 5.
- 4.2.42 Set the MMR to Set Ref.
- 4.2.43 Allow the MMR Tuned RF Level indication to settle.
- 4.2.44 Set the MMR Ext RF Atten to the value recorded, in dB, in step 4.2.12 for the frequency being verified.
- 4.2.45 Press the TI RF LVL key and set **RF LVL** to the next applicable value listed in the Level column of Table 5.
- 4.2.46 Allow the MMR Spectrum Analyzer indication to settle. Verify the MMR Spectrum Analyzer Tuned RF Power indication is within the corresponding values listed in the Limits column of Table 5.
- 4.2.47 Repeat steps 4.2.45 and 4.2.46 for the remaining values listed in Table 5.
- 4.2.48 Set the MMR Spectrum Analyzer *Ext RF Atten* to 0.0 dB.
- 4.2.49 Disconnect the MMR Spectrum Analyzer from the TI RF I/O connector.

4.2.50 Press the TI SETUP key, as necessary to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *ANT*.

4.2.51 Press the TI MODE key, as necessary, to display the LOCALIZER mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *90 & 150*. Press **FREQ** and set **FREQ** to *108.100 MHz*.

4.2.52 Repeat steps 4.2.28 through 4.2.50, as required.

4.2.53 Press the TI MODE key, as necessary, to display the GLIDE SLOPE mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *90 & 150*. Press **FREQ** and set **FREQ** to *334.250 MHz*.

4.2.54 Repeat steps 4.2.28 through 4.2.50, as required.

4.2.55 Press the TI MODE key, as necessary, to display the MARKER BEACON mode screen. Press **FREQ** and set **FREQ** to *75.00 MHz*.

4.2.56 Repeat steps 4.2.28 through 4.2.50, as required.

4.2.57 Press the TI MODE key, as necessary, to display the COMM VHF AM (COMM AM for TIs with firmware referenced in step 3.10) mode screen. Press SWITCH GEN/RX, as necessary, to set to *GENERATING*. Press **FREQ** and set **FREQ** to *118.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*.

4.2.58 Repeat steps 4.2.28 through 4.2.50, as required.

4.2.59 For TIs with MOD 2, continue with step 4.2.60. Otherwise proceed to step 4.2.62.

4.2.60 Press TI **FREQ** and set **FREQ** to *50.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*.

4.2.61 Repeat steps 4.2.28 through 4.2.50, as required.

4.2.62 Press **FREQ** and set **FREQ** to *225.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*. For TIs with firmware version less than 2.0, press the TI MODE key, as necessary, to display the COMM UHF mode screen. Press SWITCH GEN/RX, as necessary, to set to *GENERATING*.

4.2.63 Repeat steps 4.2.28 through 4.2.50, as required.

4.2.64 Disconnect the test setup.

4.3 RF SIGNAL GENERATOR SPECTRAL PURITY HARMONICS AND SPECTRAL PURITY NON-HARMONICS CALIBRATION:

4.3.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *RF I/O*.

4.3.2 Connect the TI RF I/O connector to the Spectrum Analyzer INPUT 50 Ω .

4.3.3 Press the TI MODE key, as necessary, to display the VOR mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *REF&VAR*. Press **FREQ** and set **FREQ** to *108.000 MHz*. Press the TI 9960 MOD and set **9960 Hz MOD** to *0%*.

4.3.4 Press the TI RF LVL key and set **RF LVL** to *-12.0 dBm*.

4.3.5 Set the Spectrum Analyzer controls to view the carrier. Set the Spectrum Analyzer controls to place the peak of the carrier at a convenient reference level.

4.3.6 Set the Spectrum Analyzer controls as required to measure at least four harmonic signal levels.

4.3.7 Verify the amplitude of the Harmonic signals are within the first value listed in the Harmonics column of Table 6.

4.3.8 Verify the amplitude of the Non-Harmonic signals are within the first value listed in the Non-Harmonics column of Table 6.

Table 6.

MODE	Limits (dBc)		
	Harmonics	Non-Harmonics	(MOD 2 Only) Non-Harmonics
VOR	<-20	<-35	<-32
LOCALIZER	<-20	<-35	<-32
GLIDE SLOPE	<-20	<-35	<-32
MARKER BEACON	<-20	<-35	<-32
COMM VHF AM (COMM AM for TIs with firmware referenced in step 3.10)	<-20	<-35	<-32
COMM UHF (COMM AM for TIs with firmware referenced in step 3.10)	<-20	<-35	<-32

4.3.9 Press the TI MODE key, as necessary, to display the LOCALIZER mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *90 & 150*. Press **FREQ** and set **FREQ** to *108.100 MHz*.

4.3.10 Repeat steps 4.3.4 through 4.3.8.

4.3.11 Press the TI MODE key, as necessary, to display the GLIDE SLOPE mode screen. Press TONE DEL, as necessary, to set **TONE DEL** to *90 & 150*. Press **FREQ** and set **FREQ** to *334.250 MHz*.

4.3.12 Repeat steps 4.3.4 through 4.3.8.

4.3.13 Press the TI MODE key, as necessary, to display the MARKER BEACON mode screen. Press **FREQ** and set **FREQ** to *75.00 MHz*.

4.3.14 Repeat steps 4.3.4 through 4.3.8.

4.3.15 Press the TI MODE key, as necessary, to display the COMM VHF AM (COMM AM for TIs with firmware referenced in step 3.10) mode screen. Press SWITCH GEN/RX, as necessary, to set to *GENERATING*. Press **FREQ** and set **FREQ** to *118.0000 MHz*. Press **TONE**, as necessary, and set **MOD TONE** to *OFF*.

4.3.16 Repeat steps 4.3.4 through 4.3.8.

4.3.17 Press the TI MODE key, as necessary, to display the COMM UHF (COMM AM for TIs with firmware referenced in step 3.10) mode screen. Press SWITCH GEN/RX, as necessary, to set to *GENERATING*. Press FREQ and set **FREQ** to *225.0000 MHz*. Press TONE, as necessary, and set **MOD TONE** to *OFF*.

4.3.18 Repeat steps 4.3.4 through 4.3.8.

4.3.19 Press the RF LVL key and set **RF LVL** to *-130.0 dBm*. Disconnect the test setup.

4.4 VOR MODE CALIBRATION:

4.4.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *RF I/O*.

4.4.2 Connect the TI RF I/O to the ILS/VOR Signal Calibrator 50 Ω Input connector.

4.4.3 Press the TI MODE, as necessary, for the VOR mode screen. Press the TI RF LVL and set **RF LVL** to *-20.0 dBm*.

4.4.4 Press the TI TONE DEL, as necessary, to set **TONE DEL** to *REF*. Press 9960 MOD and set **9960 Hz MOD** to *30%*, set **30 Hz MOD** to *0%*.

4.4.5 Set the ILS/VOR Signal Calibrator as a receiver for % AM modulation measurement.

4.4.6 Connect ILS/VOR Signal Calibrator AF output to the Universal Counter CHANNEL 1 input.

4.4.7 Verify the Universal Counter indication is within the values listed in the Frequency column of Table 7 for 9960 Hz Tone.

4.4.8 Verify the ILS/VOR Signal Calibrator indication is within the values listed in the AM Modulation column of Table 7 for the 9960 Hz Tone.

4.4.9 Disconnect Universal Counter from the ILS/VOR Signal Calibrator AF output.

4.4.10 Connect the ILS/VOR Signal Calibrator AF output to the Audio Analyzer HI input for distortion measurement.

4.4.11 Verify the Audio Analyzer indication is within the values listed in the Distortion column of Table 7 for the 9960 Hz Tone.

4.4.12 Disconnect Audio Analyzer from the ILS/VOR Signal Calibrator AF output.

4.4.13 Press the TI 9960 MOD and set **9960 Hz MOD** to *0%*. Press 30 MOD and set **30 Hz MOD** to *30%*. Repeat steps 4.4.6 through 4.4.12, as applicable, for the 30 Hz Tone.

NOTE

The TI M MOD and 30 Hz MOD are interactive.

4.4.14 Press the TI 30 MOD and set **30 Hz MOD** to *0%*. Press TONE, as necessary, to set **MOD TONE** to *1020 Hz*. Repeat steps 4.4.6 through 4.4.12, as applicable for the 1020 Hz Tone.

4.4.15 Press the TI TONE, as necessary, to set **MOD TONE** to *MORSE*. Press the SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM, as necessary, to select **MORSE CODE**. Using the Arrow key, set **MORSE CODE** to *OOOO*. Press TI *MODE* key. Repeat steps 4.4.5 through 4.4.12, as applicable, for the 1020 Hz Morse Code Tone.

Table 7.

Tone (Hz)	Frequency (Hz)	Limits		
		AM Modulation (%)	Distortion (%)	(MOD 2 Only) Distortion (%)
9960	9958.008 to 9961.992	28 to 32	<2.5	<2.0
30	29.994 to 30.006	28 to 32	<2.5	<2.0
1020	1019.796 to 1020.204	28 to 32	<2.5	<2.0
1020 Morse Code *	N/A	8 to 12	N/A	N/A

* The ILS/VOR Signal Calibrator display will jump from about 10% to zero because it is a Morse Code signal (on/off).

4.4.16 Press the TI TONE, as necessary, to set **MOD TONE** to *OFF*. Press 30 MOD and set **30 Hz MOD** to 30%, then press 9960 MOD and set **9960 Hz MOD** to 30%. Press the TONE DEL, as necessary, to set **TONE DEL** to —.

4.4.17 On the ILS/VOR Signal Calibrator press DEMOD, AM Avion, VOR and DEV 9.96k.

4.4.18 Verify the ILS/VOR Signal Calibrator indicates within 455 to 505 Hz p.

4.4.19 Set up the ILS/VOR Signal Calibrator as a receiver for VOR Phase measurement.

4.4.20 Press the TI BRG and set **BRG** to the first value listed in the Applied column of Table 8.

4.4.21 Verify the ILS/VOR Signal Calibrator indicates within the appropriate values listed in the Limits column of Table 8.

4.4.22 Repeat steps 4.4.20 and 4.4.21 for the remaining corresponding values listed in Table 8.

Table 8.

Applied (°)	Limits (°)
0.0	179.9 to 180.1
30	209.9 to 210.1
60	239.9 to 240.1
90	269.9 to 270.1

Table 8. (Cont.)

Applied (°)	Limits (°)
120	299.9 to 300.1
150	329.9 to 330.1
180	359.9 to 0.1
210	29.9 to 30.1
240	59.9 to 60.1
270	89.9 to 90.1
300	119.9 to 120.1
330	149.9 to 150.1

4.4.23 Leave test setup connected.

4.5 LOC MODE CALIBRATION:

4.5.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *RF I/O*.

4.5.2 Press the TI MODE, as necessary, for the LOCALIZER mode screen. Press the TI RF LVL and set **RF LVL** to *-20.0 dBm*.

4.5.3 Press the TI TONE DEL, as necessary, to set **TONE DEL** to *150*.

4.5.4 Set the ILS/VOR Signal Calibrator as a receiver for % AM modulation measurement.

4.5.5 Connect ILS/VOR Signal Calibrator AF output to the Universal Counter CHANNEL 1 input.

4.5.6 Verify the Universal Counter indication is within the values listed in the Frequency column of Table 9 for 90 Hz Tone.

4.5.7 Verify the ILS/VOR Signal Calibrator indication is within the values listed in the AM Modulation column of Table 9 for the 90 Hz Tone.

4.5.8 Disconnect Universal Counter from the ILS/VOR Signal Calibrator AF output.

4.5.9 Connect the ILS/VOR Signal Calibrator AF output to the Audio Analyzer HI input for distortion measurement.

4.5.10 Verify the Audio Analyzer indication is within the values listed in the Distortion column of Table 9 for the 90 Hz Tone.

4.5.11 Disconnect Audio Analyzer from the ILS/VOR Signal Calibrator AF output.

4.5.12 Press the TI TONE DEL, as necessary, to set **TONE DEL** to 90. Repeat steps 4.5.5 through 4.5.11 for the 150 Hz Tone.

4.5.13 Press the TI TONE DEL, as necessary, to set **TONE DEL** to 90&150, then press TONE, as necessary, to set **MOD TONE** to 1020 Hz. Repeat steps 4.5.5 through 4.5.11 for the 1020 Hz Tone.

Table 9.

Tone (Hz)	Frequency (Hz)	Limits	
		AM Modulation (%)	Distortion (%)
90	89.982 to 90.018	18 to 22	<2.5
150	149.970 to 150.030	18 to 22	<2.5
1020	1019.796 to 1020.204	28 to 32	<2.5

4.5.14 Press the TI TONE DEL, as necessary, to set **TONE DEL** to —, then press TONE, as necessary, to set **MOD TONE** to OFF.

4.5.15 Set the ILS/VOR Signal Calibrator for a DDM measurement.

4.5.16 Press the TI DDM/μA LOC ← and →, as necessary, to select the first value listed in the Applied column in Table 10.

4.5.17 Verify the ILS/VOR Signal Calibrator indication is within the values listed in the Limits column of Table 10.

4.5.18 Repeat steps 4.5.16 and 4.5.17 for the remaining corresponding values listed in Table 10.

Table 10.

Applied (DDM)	Limits (DDM)
0.200 LEFT	-0.2075 to -0.1925
0.155 LEFT	-0.1612 to -0.1488
0.093 LEFT	-0.0973 to -0.0887
0.000 CENTER	-0.0015 to +0.0015
0.093 RIGHT	0.0887 to 0.0973
0.155 RIGHT	0.1488 to 0.1612
0.200 RIGHT	0.1925 to 0.2075

4.5.19 Leave test setup connected.

4.6 G/S MODE CALIBRATION:

4.6.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *RF I/O*.

4.6.2 Press the TI MODE, as necessary, for a the GLIDE SLOPE mode screen. Press the TI RF LVL and set **RF LVL** to *-20 dBm*.

4.6.3 Press the TI TONE DEL, as necessary, to set **TONE DEL** to *150*.

4.6.4 Set the ILS/VOR Signal Calibrator as a receiver for % AM modulation measurement.

4.6.5 Connect ILS/VOR Signal Calibrator AF output to the Universal Counter CHANNEL 1 input.

4.6.6 Verify the Universal Counter indication is within the values listed in the Frequency column of Table 11 for 90 Hz Tone.

4.6.7 Verify the ILS/VOR Signal Calibrator indication is within the values listed in the AM Modulation column of Table 11 for the 90 Hz Tone.

4.6.8 Disconnect Universal Counter from the ILS/VOR Signal Calibrator AF output.

4.6.9 Connect the ILS/VOR Signal Calibrator AF output to the Audio Analyzer HI input for distortion measurement.

4.6.10 Verify the Audio Analyzer indication is within the values listed in the Distortion column of Table 11 for the 90 Hz Tone.

4.6.11 Disconnect Audio Analyzer from the ILS/VOR Signal Calibrator AF output.

4.6.12 Press the TI TONE DEL, as necessary, to set **TONE DEL** to *90*. Repeat steps 4.6.5 through 4.6.11 for the 150 Hz Tone.

Table 11.

Tone (Hz)	Frequency (Hz)	Limits	
		AM Modulation (%)	Distortion (%)
90	89.982 to 90.018	38 to 42	<2.5
150	149.970 to 150.030	38 to 42	<2.5

4.6.13 Press the TI TONE DEL, as necessary, to set **TONE DEL** to —.

4.6.14 Set the ILS/VOR Signal Calibrator for a DDM measurement.

4.6.15 Press the TI DDM/ μ A G/S \uparrow and \downarrow , as necessary, to select the first value listed in the Applied column in Table 12.

4.6.16 Verify the ILS/VOR Signal Calibrator indication is within the values listed in the Limits column of Table 12.

4.6.17 Repeat steps 4.6.15 and 4.6.16 for the remaining corresponding values listed in Table 12.

Table 12.

Applied (DDM)	Limits (DDM)
0.400 DOWN	+0.3850 to +0.4150
0.175 DOWN	+0.1667 to +0.1833
0.091 DOWN	+0.0853 to +0.0967
0.000 CENTER	-0.0030 to +0.0030
0.091 UP	-0.0967 to -0.0853
0.175 UP	-0.1833 to -0.1667
0.400 UP	-0.4150 to -0.3850

4.6.18 Leave test setup connected.

4.7 COMM MODE CALIBRATION:

4.7.1 Connect the TI RF I/O to the ILS/VOR Signal Calibrator 50 Ω Input connector.

4.7.2 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *RF I/O*.

4.7.3 Press the TI MODE, as necessary, for a the COMM VHF AM (COMM AM for TIs with firmware referenced in step 3.10) mode screen. Press the TI RF LVL and set **RF LVL** to *-20.0 dBm*, then press SWITCH GEN/RX, as necessary, to select *GENERATING*.

4.7.4 Set the ILS/VOR Signal Calibrator as a receiver for % AM modulation measurement.

4.7.5 Connect ILS/VOR Signal Calibrator AF output to the Universal Counter CHANNEL 1 input.

4.7.6 Verify the Universal Counter indication is within the appropriate values listed in the Limits column of Table 13 for the Function being verified.

4.7.7 Verify the ILS/VOR Signal Calibrator modulation indication is within the appropriate values listed in the Limits column of Table 13 for the Function being verified.

4.7.8 Disconnect Universal Counter from the ILS/VOR Signal Calibrator AF output.

4.7.9 Connect the ILS/VOR Signal Calibrator AF output to the Audio Analyzer HI input for distortion measurement.

4.7.10 Verify the Audio Analyzer indication is within the appropriate values listed in the Limits column of Table 13 for the Function being verified.

Table 13.

Tone (Hz)	Function	Limits
1020	Frequency	1019.80 to 1020.20 Hz
	AM Modulation	28 to 32%
	Distortion	<2.5%

4.7.11 Set outputs to minimum and leave test setup connected.

4.8 MARKER MODE CALIBRATION:

4.8.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM. as necessary, to select the **PORT** field and set to *RF I/O*.

4.8.2 Press the TI MODE, as necessary, for a MARKER BEACON mode screen. Press the TI RF LVL and set **RF LVL** to *-20.0 dBm*.

4.8.3 Press the TI TONE, as necessary, to set **MOD TONE** to *400 Hz*.

4.8.4 Set the ILS/VOR Signal Calibrator as a receiver for % AM modulation measurement.

4.8.5 Connect ILS/VOR Signal Calibrator AF output to the Universal Counter CHANNEL 1 input.

4.8.6 Verify the Universal Counter indication is within the values listed in the Frequency column of Table 14 for 400 Hz Tone.

Table 14.

Tone (Hz)	Frequency (Hz)	Limits	
		AM Modulation (%)	Distortion (%)
400	399.92 to 400.08	90 to 100	<2.5
1300	1299.74 to 1300.26	90 to 100	<2.5
3000	2999.40 to 3000.60	90 to 100	<2.5

4.8.7 Press the TI TONE, as necessary, to set **MOD TONE** to *1300 Hz*. Repeat step 4.8.6 for the 1300 Hz Tone.

4.8.8 Press the TI TONE, as necessary, to set **MOD TONE** to *3000 Hz*. Repeat step 4.8.6 for the 3000 Hz Tone.

4.8.9 Disconnect Universal Counter from the ILS/VOR Signal Calibrator AF output.

4.8.10 Connect the TI ILS/VOR Signal Calibrator AF output to the MMR Spectrum Analyzer AUDIO INPUT 100k Ω .

4.8.11 Press the TI TONE, as necessary, to set **MOD TONE** to *400 Hz*.

4.8.12 Set the MMR Spectrum Analyzer controls as follows:

Sweep	
<i>Auto Sweep Time Norm Accy</i>	<i>Accy</i>
MODE	<i>Measuring Receiver</i>
MEASURE	<i>More 1 of 3</i>
	<i>Audio Distortion</i>
DET/DEMODO	
<i>High Pass Filter</i>	<i>50 Hz</i>
<i>Low Pass Filter</i>	<i>None</i>
Input/Output	<i>(More 1 of 2)</i>
<i>Audio Ranging</i>	<i>Range 0</i>

4.8.13 Press MMR Spectrum Analyzer **MEASURE**, then *Audio Distortion*.

4.8.14 Verify the MMR Spectrum Analyzer indication is within the values listed in the Distortion column of Table 14 for the 400 Hz Tone.

4.8.15 Press the TI TONE, as necessary, to set **MOD TONE** to *1300 Hz*. Repeat steps 4.8.13 and 4.8.14 for the 1300 Hz Tone.

4.8.16 Press the TI TONE, as necessary, to set **MOD TONE** to *3000 Hz*. Repeat steps 4.8.13 and 4.8.14 for the 3000 Hz Tone.

4.8.17 Disconnect test setup.

4.8.18 Connect the Adapter to the MMR Spectrum Analyzer RF INPUT 50 Ω. Connect the TI *RF I/O* through Adapter to the MMR Spectrum Analyzer RF INPUT 50 Ω.

4.8.19 Press the TI TONE, as necessary, to set **MOD TONE** to *400 Hz*.

4.8.20 Press the MMR Spectrum Analyzer **PRESET** key, then set controls as follows:

MODE	<i>Measuring Receiver</i>
MEASURE	<i>More 1 of 3</i>
	<i>Modulation Distortion</i>
DET/DEMODO	<i>Detector</i>
	<i>Peak + - / 2</i>
<i>High Pass Filter</i>	<i>50 Hz</i>
<i>Low Pass Filter</i>	<i>None</i>

AMPLITUDE Y SCALE*Display Unit*

%

FREQUENCY/CHANNEL

75 MHz

4.8.21 Press MMR Spectrum Analyzer **MEASURE**, then *AM Depth*.

4.8.22 Verify the MMR Spectrum Analyzer indication is within the values listed in the AM Modulation column of Table 14 for the 400 Hz Tone.

4.8.23 Press the TI TONE, as necessary, to set **MOD TONE** to *1300 Hz*. Repeat steps 4.8.21 and 4.8.22 for the 1300 Hz Tone.

4.8.24 Press the TI TONE, as necessary, to set **MOD TONE** to *3000 Hz*. Repeat steps 4.8.21 and 4.8.22 for the 3000 Hz Tone.

4.8.25 Disconnect test setup.

4.8A MARKER MODE CALIBRATION: (Alternate Method)

4.8A.1 Connect the TI RF I/O to the ILS/VOR Signal Calibrator 50 Ω Input connector.

4.8A.2 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *RF I/O*.

4.8A.3 Press the TI MODE, as necessary, for a MARKER BEACON mode screen. Press the TI RF LVL and set **RF LVL** to *-20.0 dBm*.

4.8A.4 Press the TI TONE, as necessary, to set **MOD TONE** to *400 Hz*.

4.8A.5 Set the ILS/VOR Signal Calibrator as a receiver for % AM modulation measurement.

4.8A.6 Connect ILS/VOR Signal Calibrator AF output to the Universal Counter CHANNEL 1 input.

4.8A.7 Verify the Universal Counter indication is within the values listed in the Frequency column of Table 2A for 400 Hz Tone.

4.8A.8 Verify the ILS/VOR Signal Calibrator indication is within the values listed in the AM Modulation column of Table 2A for the 400 Hz Tone.

4.8A.9 Disconnect Universal Counter from the ILS/VOR Signal Calibrator AF output.

4.8A.10 Connect the ILS/VOR Signal Calibrator AF output to the Audio Analyzer HI input for distortion measurement.

4.8A.11 Verify the Audio Analyzer indication is within the values listed in the Distortion column of Table 2A for the 400 Hz Tone.

4.8A.12 Disconnect Audio Analyzer from the ILS/VOR Signal Calibrator AF output.

4.8A.13 Press the TI TONE, as necessary, to set **MOD TONE** to 1300 Hz. Repeat steps 4.8A.6 through 4.8A.12 for the 1300 Hz Tone.

4.8A.14 Press the TI TONE, as necessary, to set **MOD TONE** to 3000 Hz. Repeat steps 4.8A.6 through 4.8A.12 for the 3000 Hz Tone.

Table 2A.

Tone (Hz)	Frequency (Hz)	Limits	
		AM Modulation (%)	Distortion (%)
400	399.92 to 400.08	90 to 100	<2.5
1300	1299.74 to 1300.26	90 to 100	<2.5
3000	2999.40 to 3000.60	90 to 100	<2.5

4.8A.15 Disconnect test setup.

4.9 POWER METER CALIBRATION:

CAUTION

The Attenuator must be used when using the Power Amplifier BHED1758-1000/4006 to avoid damage to the TI. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

4.9.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary, to display the SETUP menu, and press NEXT PARAM. as necessary, to select the **PORT** field and set to *RF I/O*.

4.9.2 Press the TI MODE, as necessary, for the COMM VHF AM (COMM AM for TIs with firmware referenced in step 3.10) mode screen. Press the TI POWER METER, as necessary, to select *AVG*.

4.9.3 Press the TI ZERO, ensure to remove all cables from RF I/O connector then press NEXT.

4.9.4 Connect test equipment as shown in Figure 1.

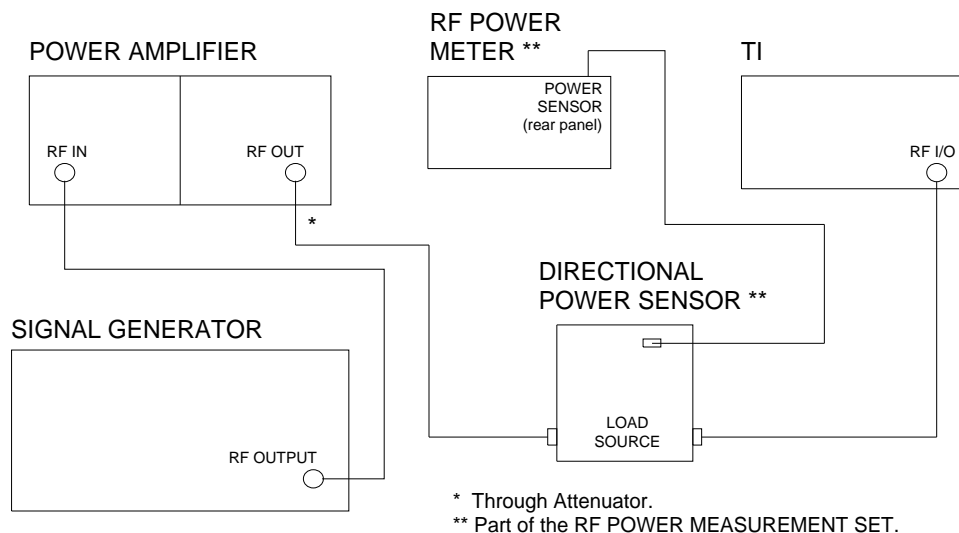


Figure 1.

NOTE

Use the applicable Directional Power Sensor, as required, for the frequency being tested.

4.9.5 Set the RF Power Meter, as required, to measure Watts.

4.9.6 Adjust Power Amplifier RF OUTPUT LEVEL CONTROL fully CCW.

4.9.7 Set the Signal Generator frequency to 118 MHz at 0 dBm.

CAUTION

When applying power to TI, technician must follow the On/Off Duty Cycle: ≤ 10 W, Continuous; >10 to ≤ 20 W, On: Max of 3 min, Off: Min of 2 min; >20 to ≤ 30 W, On: Max of 1 min, Off: Min of 2 min. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

NOTE

Ensure the RF Power Meter FWD lamp is illuminated. If not, press the RF PWR key.

4.9.8 On the Power Amplifier press the appropriate BAND, as required, for 118 MHz. Adjust the Power Amplifier RF OUTPUT LEVEL CONTROL until the TI TX PWR = indicates the first value listed in the Applied column of Table 15.

4.9.9 Verify the RF Power Meter indicates the first value listed in the Limits column of Table 15 for the frequency being verified.

4.9.10 On the Power Amplifier adjust RF OUTPUT LEVEL CONTROL fully CCW.

4.9.11 Repeat steps 4.9.8 through 4.9.10 for the remaining values listed in the Applied column of Table 15. Use the applicable Directional Power Sensor, as required, for the frequency being tested.

Table 15.

Applied (W)	Limits (W)	
	All Other Frequencies	<100 MHz (MOD 2 Only)
1	0.820 to 1.180	0.780 to 1.220
10	9.100 to 10.900	8.700 to 11.300
20	18.300 to 21.700	17.500 to 22.500
25	22.900 to 27.100	21.900 to 28.100

4.9.12 Press the TI MODE, as necessary, for the COMM UHF (COMM AM for TIs with firmware referenced in step 3.10) mode screen.

4.9.13 Repeat steps 4.9.7 through 4.9.11 for 250 MHz. Use the applicable Directional Power Sensor, as required, for the frequency being tested.

4.9.14 Repeat steps 4.9.7 through 4.9.11 for 400 MHz. Use the applicable Directional Power Sensor, as required, for the frequency being tested.

4.9.15 If TI is MOD 2, continue with step 4.9.16. Otherwise, proceed to step 4.9.17.

4.9.16 Repeat steps 4.9.7 through 4.9.11 for 50 MHz. Use the applicable Directional Power Sensor, as required, for the frequency being tested.

4.9.17 Set the Signal Generator to minimum and disconnect test setup.

4.10 AM METER CALIBRATION:

4.10.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI MODE, as necessary, for the COMM AM mode screen, then proceed to step 4.10.3.

4.10.2 Press the TI SETUP key, as necessary to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *ANT*. Press MODE, as necessary, for the COMM UHF mode screen.

4.10.3 Connect the Signal Generator output to the Power Splitter. Connect one leg of the Power Splitter to the TI ANT and the other leg to the MMR Spectrum Analyzer RF INPUT 50 Ω. As required, set the Signal Generator to -10 dBm at 400 MHz.

4.10.4 Press the MMR Spectrum Analyzer **PRESET** key, then set controls as follows:

MODE	<i>Measuring Receiver</i>
MEASURE	<i>AM Depth</i>
DET/DEMODO	<i>Detector</i>
	<i>Peak + - /2</i>
<i>High Pass Filter</i>	<i>300 Hz</i>
<i>Low Pass Filter</i>	<i>3 kHz</i>
AMPLITUDE Y SCALE	<i>Display Unit</i>
	<i>%</i>
FREQUENCY/CHANNEL	<i>400 MHz</i>

4.10.5 Press the TI FREQ and set **FREQ** to *400.000 MHz*.

4.10.6 Set the Signal Generator MODULATION AM to ON and the audio frequency to 1 kHz.

4.10.7 Set the Signal Generator AM modulation level, as required, for a MMR Spectrum Analyzer indication of the first value listed in the Applied column of Table 16.

4.10.8 Verify the TI TX MOD = modulation indication is within the values listed in the appropriate Limits column of Table 16.

4.10.9 Repeat steps 4.10.7 and 4.10.8 for the remaining corresponding values listed in Table 16.

Table 16.

Applied (%)	Limits (%)
30.0	27 to 33
50.0	45 to 55
90.0	81 to 99

4.10.10 Set outputs to minimum and disconnect test setup.

4.11 FM METER CALIBRATION:

4.11.1 Repeat step 3.7 to restore the TI factory presets. For TIs with firmware referenced in step 3.10, press the TI MODE, as necessary, for a COMM FM mode screen, then proceed to step 4.11.3.

4.11.2 Press the TI SETUP key, as necessary to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **PORT** field and set to *ANT*. Press the TI MODE, as necessary, for the COMM VHF FM mode screen.

4.11.3 Connect the Signal Generator output to the Power Splitter. Connect one leg of the Power Splitter to the TI ANT and the other leg to the Measuring Receiver RF INPUT 50 Ω.

4.11.4 Set the Signal Generator to 0 dBm at 165 MHz. Set the Signal Generator MODULATION FM to ON and the audio frequency to 1 kHz.

4.11.5 Press the Measuring Receiver INSTR PRESET. Adjust the Signal Generator frequency for a 165 MHz indication on the Measuring Receiver. Press the Measuring Receiver FM key and set HP Filter to 300 Hz and LP Filter to 3 kHz and the Detector to Peak +/-2.

4.11.6 Press the TI FREQ and set **FREQ** to *165.000 MHz*.

4.11.7 Set the Signal Generator FM deviation level, as required, for a Measuring Receiver indication of the first value listed in the Applied column of Table 17.

NOTE

The Measuring Receiver Filters may be adjusted as required for a stable reading.

4.11.8 Verify the TI TX DEV = indication is within the values listed in the appropriate Limits column of Table 17.

4.11.9 Repeat steps 4.11.7 and 4.11.8 for the remaining corresponding values listed in Table 17.

Table 17.

Applied (kHz)	Limits (kHz)
4.5	3.74 to 5.26
10 *	8.80 to 11.20
13 *	11.56 to 14.44

* Press MMR Spectrum Analyzer *FM Deviation*, **Meas Setup**, *IF BW*, **3, 0**, then *kHz* as required.

4.11.10 Set outputs to minimum. Disconnect test setup.

4.12 SWR METER CALIBRATION:

4.12.1 Repeat step 3.7 to restore the TI factory presets.

4.12.2 For TIs with firmware referenced in step 3.10, press the TI SETUP key, as necessary to display the SETUP menu and set the **GEN FREQ** field to *VAR*. Press the MODE key, as necessary, for the SWR mode screen, then proceed to step 4.12.4.

4.12.3 Press the TI SETUP key, as necessary to display the SETUP menu, and press NEXT PARAM, as necessary, to select the **GEN FREQ** field and set to *VAR*. Press the MODE key, as necessary, for the SWR mode screen.

4.12.4 Connect the Mismatch (2.14) to the TI SWR connector.

4.12.5 Set the TI FREQ field to the first value listed in the Freq column of Table 18.

4.12.6 Verify the TI SWR indication is within the values listed in the appropriate Limits column of Table 18.

4.12.7 Repeat steps 4.12.5 and 4.12.6 for the remaining corresponding values in Table 18.

Table 18.

Freq (MHz)	(2.14) Limits	(2.15) Limits
10 *	1.000 to 2.000	2.900 to 5.100
25 *	1.000 to 2.000	2.900 to 5.100
50 *	1.000 to 2.000	2.900 to 5.100
75	1.000 to 2.000	2.900 to 5.100
100	1.000 to 2.000	2.900 to 5.100
125	1.000 to 2.000	2.900 to 5.100
150	1.000 to 2.000	2.900 to 5.100
175	1.000 to 2.000	2.900 to 5.100
200	1.000 to 2.000	2.900 to 5.100
225	1.000 to 2.000	2.900 to 5.100
250	1.000 to 2.000	2.900 to 5.100
275	1.000 to 2.000	2.900 to 5.100
300	1.000 to 2.000	2.900 to 5.100
325	1.000 to 2.000	2.900 to 5.100
350	1.000 to 2.000	2.900 to 5.100
375	1.000 to 2.000	2.900 to 5.100
400	1.000 to 2.000	2.900 to 5.100
410 *	1.000 to 2.000	2.900 to 5.100

* For MOD 2.

4.12.8 Disconnect test setup. Connect the Mismatch (2.15) to the TI SWR connector.

4.12.9 Repeat steps 4.12.5 through 4.12.7.

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4.12.10 Set all POWER switches to OFF or STBY. Disconnect and secure all equipment.

CALIBRATION PERFORMANCE TABLE

Not Required