

TECHNICAL MANUAL  
CALIBRATION PROCEDURE  
FOR  
RADIO TEST SET  
2975  
(AEROFLEX)

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**RADIO TEST SET****2975****(AEROFLEX)****1 CALIBRATION DESCRIPTION:***Table 1.*

<b>Test Instrument (TI) Characteristics</b>	<b>Performance Specifications</b>	<b>Test Method</b>
Frequency		
Time Base	Range: 10 MHz  Accuracy: Accuracy: $\pm 1 \times 10^{-7}$ ; * <sup>1</sup> Aging/year: $\pm 1 \times 10^{-7}$ ; Temperature: $\pm 1 \times 10^{-8}$ * <sup>2</sup>	Compared to a Frequency Standard
RF Signal Generator		
Output Level	Range: T/R: -137 to -30 dBm; GEN: -110 to +10 dBm  Accuracy: T/R: $\pm 1$ dB (1 MHz to <1.3 GHz, >-120 dBm); $\pm 1.5$ dB ( $\geq 1.3$ to 2.7 GHz, >-110 dBm); GEN: $\pm 1.5$ dB (<1.3 GHz); $\pm 2.5$ dB ( $\geq 1.3$ GHz)	Measured with a Power Meter, Power Sensor and Microwave Measurement Receiver (MMR)
Spectral Purity		
Harmonics	Range: 1 MHz to 2.7 GHz  Accuracy: $\leq -20$ dBc, <50 MHz; $\leq -25$ dBc, >50 MHz	Measured with a Spectrum Analyzer

See footnotes at end of Table.

*Table 1. (Cont.)*

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
RF Signal Generator ( <i>Cont.</i> )		
Spectral Purity ( <i>Cont.</i> )		
Non-Harmonics	Range: 1 MHz to 2.7 GHz  Accuracy: ≤-40 dBc, <1.5 GHz; ≤-30 dBc, >1.5 GHz	Measured with a Spectrum Analyzer
Residual FM	Range: 1 MHz to 2.7 GHz  Accuracy: <15 Hz rms (Post Detection BW = 300 Hz to 3 kHz)	Measured with an MMR
Phase Noise	Range: 1 MHz to 2.7 GHz  Accuracy: (20 kHz offset) ≤-92 dBc/Hz (<1 GHz); ≤-90 dBc/Hz (>1 GHz)	Measured with an MMR Spectrum Analyzer
Residual AM	Range: 1 MHz to 2.7 GHz  Accuracy: ≤0.1% AM (Post Detection BW = 300 Hz to 3 kHz)	Measured with a Microwave Measurement System
Frequency Modulation		
Distortion	Range: 1 MHz to 2.7 GHz  Accuracy: ≤1% THD (1 kHz rate, 6 kHz deviation, 50 Hz to 15 kHz BW)	Measured with an MMR
Deviation	Range: Off, 10 Hz to 40 kHz; Rate: 1 Hz to 20 kHz; Resolution: 10 Hz  Accuracy: ±(3% of setting + residual FM + LSD) 1 to 20 kHz dev, 1 to 10 kHz rate; ±(5% of setting + residual FM + LSD) >20 to 40 kHz dev, 1 to 20 kHz rate;	Measured with an MMR

*Table 1. (Cont.)*

<b>Test Instrument (TI) Characteristics</b>	<b>Performance Specifications</b>	<b>Test Method</b>
RF Signal Generator ( <i>Cont.</i> )		
Amplitude Modulation		
Depth	Range: 30 to 90 %; Resolution: 1%  Accuracy: 1 kHz rate, RF Level <-40 dBm T/R, <0 dBm GEN, $\pm(5\% \text{ FS} + \text{residual AM} + \text{resolution})$	Measured with an MMR
Receiver		
Power Meter	Range: 1 MHz to 2.7 GHz, 100 mW to 200 W (1-2-5 sequences); Resolution: 3 digits  Accuracy: 100 mW to 125 W, $\pm(10\% \text{ of FS} + \text{resolution})$	Measured on TI with known signal applied
VSWR	Range: 1 MHz to 2.7 GHz  Accuracy: 1 MHz to 1 GHz, <1.2:1	Not Calibrated
Frequency Counter	Range: 1 MHz to 2.7 GHz; Resolution: 1 Hz  Accuracy: $\pm(\text{Time Base} + \text{LSD})$	Calibrated during Audio Frequency Counter calibration
Frequency Error Meter	Range: Auto, $\pm 100$ , $\pm 200$ , $\pm 500$ Hz, $\pm 1$ , $\pm 5$ , $\pm 10$ , $\pm 20$ , $\pm 50$ , $\pm 100$ kHz; Resolution: 1 Hz  Accuracy: $\pm(\text{Time Base} + \text{LSD})$	

*Table 1. (Cont.)*

<b>Test Instrument (TI) Characteristics</b>	<b>Performance Specifications</b>	<b>Test Method</b>
<i>Receiver (Cont.)</i>		
Frequency Modulation Deviation Meter	Range: AUTO, 5, 10, 20, 50, 100 kHz; Resolution: 10 Hz; Rate: 50 Hz to 20 kHz  Accuracy: ±(5% of FS + 2 LSD + residual FM), (12.5 kHz IF, 1 kHz rate, >1 to ≤5 kHz deviation), (25 kHz IF, 1 kHz rate, >1 to ≤10 kHz deviation), (60 kHz IF, 1 kHz rate, >1 to ≤25 kHz deviation); ±(7% of FS + 2 LSD + residual FM), (200 kHz IF, 50 Hz to 20 kHz rate, >5 to ≤40 kHz deviation)	Measured on TI with known signal applied
Amplitude Modulation Meter	Range: AUTO, 10, 50, 100%; Resolution: 1%  Accuracy: ±(5% of FS + residual AM), (6 kHz IF, 1 kHz rate, 10 to 90% depth)	
Audio Frequency Counter	Range: 200, 500 Hz, 1, 2, 5, 10 and 20 kHz; Resolution: 0.1 or 1.0 Hz  Accuracy: ±(Time Base + LSD)	
Receive Signal Strength Indication Meter	Range: 1 MHz to 2.7 GHz; T/R: -40 to +30 dBm, 0 dB atten; ANT: -80 to -10 dBm, 0 dB atten  Accuracy: ±1.5 dB T/R: -30 to +20 dBm, 0 dB atten; ANT: -70 to -20 dBm, 0 dB atten	
SINAD Meter	Range: 1 MHz to 2.7 GHz, 20 and 40 dB FS; Resolution: 0.1 dB  Accuracy: ±(1.0 dB + 1 LSD), (1 kHz rate at 12 dB SINAD)	

*Table 1. (Cont.)*

<b>Test Instrument (TI) Characteristics</b>	<b>Performance Specifications</b>	<b>Test Method</b>
Receiver ( <i>Cont.</i> )		
Distortion Meter	Range: 1 MHz to 2.7 GHz, 5, 10, 20, 50, 100% FS; Resolution: 0.1%  Accuracy: $\pm(1.5\% \text{ distortion} + 1 \text{ LSD})$ , (1 kHz rate at 5% distortion)	Measured on TI with known signal applied
Spectrum Analyzer		
Frequency Span	Range: Zero Span, 1 kHz to 2 GHz (1-2-5 sequence), 3 GHz;  Accuracy: $\pm 1\%$ span width	Compared to a known frequency
Frequency Display	Range: 1 MHz to 2.7 GHz  Accuracy: $\pm(\text{Span Accuracy} +$ $\text{Time Base} + 50\% \text{ of RBW})$	
Sweep Rate	Range: 20, 50, 100, 200 500 ms, 1, 2, 5, 10 s  Accuracy: $\pm 1\%$ of setting	
Harmonic Spurious	Range: 1 MHz to 2.7 GHz  Accuracy: $\leq -55 \text{ dBc}$ at -40 dBm, (Antenna Port, no attenuation)	
Non-Harmonic Spurious	Range: 10 MHz to 2.7 GHz  Accuracy: $\leq -60 \text{ dBc}$ at -40 dBm, (Antenna Port, no attenuation)	Signal applied through filters. Non-Harmonic Distortion is then measured
Residual Spurious	Range: 1 MHz to 2.7 GHz  Accuracy: $\leq -80 \text{ dBm}$ , (input terminated, Antenna Port, no attenuation)	Measured on TI

*Table 1. (Cont.)*

<b>Test Instrument (TI) Characteristics</b>	<b>Performance Specifications</b>	<b>Test Method</b>
<i>Spectrum Analyzer (Cont.)</i>		
Level	Range: ANT: -100 to -20 dBm, no attenuation; ≤-10 dBm, 10 dB attenuation; T/R: -30 to +30 dBm, no attenuation  Accuracy: ±2 dB, (-30 dBm input, Antenna Port, 0 dB attenuation, -20 dBm ref level, normalized)	Measured on TI with known signal applied
Log Linearity	Range: ANT: -100 to -20 dBm, no attenuation; ≤-10 dBm, 10 dB attenuation; T/R: -30 to + 30 dBm, no attenuation  Accuracy: ±2 dB	
Attenuator	Range: 100 MHz; T/R: 0, 10, 20, 30, 40 dB; ANT: 0, 10 dB  Accuracy: ±0.5 dB/step, ±1 dB cumulative	
Residual Phase Noise	Range: 1 MHz to 2.7 GHz  Accuracy: ≤-92 dBc/Hz, (20 kHz offset)	
Tracking Generator Output Flatness * <sup>3</sup>	Range: GEN: 10 MHz to 2.7 GHz, -110 to +10 dBm  Accuracy: ±2 dB, (≤500 MHz Span, ≤1.25 GHz Center Frequency)	Measured with a Power Meter and Power Sensor

See footnotes at end of Table.



*Table 1. (Cont.)*

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Oscilloscope * <sup>3</sup>		
Vertical	Range: 20 mV to 50 V/div (1-2-5 sequence)  Accuracy: ±10% FS, (DC to 50 kHz)	Measured on TI with known signal applied
Horizontal Sweep	Range: 10 μs to 1 s/div  Accuracy: ±1% FS sweep	
Audio Frequency Generator		
Amplitude (into 10 kΩ)	Range: Combination of FGEN1 and FGEN2 cannot exceed: Unbalanced: 0 to 20 V p-p, (Audio Out 1 [FGEN] and Audio Out 2 [DEM0D]); Balanced - High Range: 0 to 6 V rms, (Audio Out 1 [FGEN] only); Balanced - Low Range: 0 to 600 mV rms, (Audio Out 1 [FGEN] only)  Accuracy: (Sine Wave) Unbalanced (Audio Out 1 or 2, >0.5 V p-p): ±3% of setting (20 Hz to 3 kHz); ±5% of setting (3 to 5 kHz); ±15% of setting (5 to 10 kHz); Balanced - High Range: ±10% of setting, (1 kHz, >0.5 V p-p) Balanced - Low Range: ±10% of setting, (1 kHz, >0.05 V p-p)	Measured on a Digital Multimeter

See footnotes at end of Table.

*Table 1. (Cont.)*

<b>Test Instrument (TI) Characteristics</b>	<b>Performance Specifications</b>	<b>Test Method</b>
Audio Frequency Generator ( <i>Cont.</i> )		
Distortion	Range: 20 Hz to 20 kHz  Accuracy: (Sine Wave) <0.5% THD, (1 kHz, 3 V p-p); <2.0% THD, (20 Hz to 20 kHz, 1 to 15 V p-p)	Measured on an Audio Analyzer
Frequency	Range: Unbalanced: DC to 20 kHz, (Audio Out 1 [FGEN] and Audio Out 2 [DEMOD]); Balanced: 50 Hz to 20 kHz, (Audio Out 1 [FGEN] only)  Accuracy: $\pm 1$ Hz	Measured on an Universal Counter
Digital Voltmeter		
AC	Range: 400 mV to 100 V (1-2-4 sequence); Resolution: 10 mV (0.4 V range); 1 mV (1, 2 and 4 V ranges); 10 mV (10, 20 and 40 V ranges); 100 mV (100 V range)  Accuracy: 50 Hz to 20 kHz, $\pm(6\% \text{ FS} + 1 \text{ LSD})$	Measured on TI with known signal applied
DC	Range: 400 mV to 100 V (1-2-4 sequence); Resolution: 10 mV (0.4 V range); 1 mV (1, 2 and 4 V ranges); 10 mV (10, 20 and 40 V ranges); 100 mV (100 V range)  Accuracy: $\pm(2\% \text{ FS} + 1 \text{ LSD})$	

\*<sup>1</sup> The accuracy is the manufacturers calculated specification after one year. The accuracy specification is found by multiplying the longest term aging rate by the appropriate time interval to obtain one year.

\*<sup>2</sup> Typical or operational specification. Not calibrated.

\*<sup>3</sup> See step 3.9.

**2 EQUIPMENT REQUIREMENTS:**

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1 FREQUENCY STANDARD	Range: 10 MHz Accuracy: $<2.5 \times 10^{-8}$	Arbiter 1083B	
2.2 UNIVERSAL COUNTER	Range: 9 Hz to 10 MHz Accuracy: $\pm 1$ count of LSD (10 MHz); $\pm 12.5$ ppm (10 Hz to 20 kHz)	Agilent 53132A	
2.3 MICROWAVE MEASUREMENT RECEIVER (MMR)	<p>Range: (Relative Tuned RF Level) 10.1 MHz to 2.7 GHz, -121 to 0 dB</p> <p>Accuracy: *<sup>1</sup> Residual Noise to Max power, <math>\pm(0.015 \text{ dB} + 0.005 \text{ dB}/10 \text{ dB})</math>; Minimum Power to Residual Noise Threshold, <math>\pm(\text{Cumulative Error} + 0.0012 \times (\text{Input Power} - \text{Residual Noise Threshold Power})^2)</math>); Range 2, <math>\pm 0.031 \text{ dB}</math>; *<sup>2</sup> Range 3, <math>\pm 0.031 \text{ dB}</math> *<sup>3</sup></p> <p>Range: (Residual FM) 500 MHz to 2.7 GHz</p> <p>Accuracy: <math>&lt;3.75 \text{ Hz rms}</math></p> <p>Range: (FM) 10.1 MHz to 2.7 GHz, 4.5 to 43 kHz Deviation, 50 Hz to 10 kHz rates</p> <p>Accuracy: Deviation: <math>\pm 1\%</math> of indication; *<sup>4</sup> Distortion: <math>\pm 1 \text{ dB}</math></p> <p>Range: (AM) 10.1 to 2.7 GHz, 9 to 96% AM, 1 kHz rate</p> <p>Accuracy: Depth: 10% AM: <math>\pm 2.5\%</math> of indication; 20 to 96% AM: <math>\pm 0.5\%</math> of indication</p>	Agilent N5530SE26	

See footnotes at end of Equipment Requirements.

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.3.1 MMR SPECTRUM ANALYZER	Range: -92 to +10 dBm, 500 MHz to 2.7 GHz  Accuracy: (Scale Fidelity) ±1.6 dB	Agilent E4440A OPT 233	
2.4 SYNTHESIZED SIGNAL GENERATOR	Range: 12.5 to 100 MHz, 0 dBm, 4.5 to 35 kHz FM Deviation, 10 to 90 AM Depth, 1 kHz rate  Accuracy: N/A	Agilent E8257D OPT 550, UNT (P/O E5530SE50)	
2.5 POWER METER	Range: -40 to +11.5 dBm  Accuracy: * <sup>1</sup> ±1.2% of indication	Agilent E4418B	
2.6 POWER SENSOR	Range: 10.1 MHz to 2.7 GHz  Accuracy: (all of Charted Cal Factor) : * <sup>1</sup> ±2.0%, 10.1 to ≤30 MHz; ±2.4%, >30 MHz to 2.7 GHz	Agilent E4412A	
2.7 SPECTRUM ANALYZER	Range: 1 MHz to 11 GHz  Accuracy: (Scale Fidelity) ±1.6 dB	Hewlett-Packard 8563E	
2.8 MICROWAVE MEASUREMENT SYSTEM	Range: (Residual AM) 300 Hz to 3 kHz BW  Accuracy: <0.025% rms	Hewlett-Packard 8902MS	
2.9 AUDIO ANALYZER	Range: Input: Distortion, 0 to 100%, 20 Hz to 20 kHz; Output: 50 mV to 5 V rms, 1 kHz  Accuracy: Input: Distortion, ±1 dB; Output: N/A	Hewlett-Packard 8903B OPT 51 or OPT 011	
2.10 POWER AMPLIFIER	Range: 10 to 50 W, 400 MHz  Accuracy: N/A	Microwave Products SSPA0240-22/6140	
2.11 COUPLER SET	Range: 400 MHz  Accuracy: ±3% of charted value	Premier Microwave 1852A	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.12 POWER METER	Range: 1 to 10 mW Accuracy: $\pm 1\%$ of rdg	Hewlett-Packard 432B-H05	
2.13 SIGNAL GENERATOR	Range: (CW) 1 MHz to 2.7 GHz, -65 to +10 dBm Accuracy: Frequency: $\pm 4$ ppm of setting  Accuracy: Harmonics: <-30 dBc Non-harmonics: <-65 dBc  Accuracy: SSB Phase Noise: $\leq -94$ dBc/Hz at 20 kHz offset	Hewlett-Packard 8664A Opt H15 (P/O E5504B)	
2.14 MICROPHONE/ AUDIO ADAPTER	Range: BNC to Telephone Accuracy: NA	Aeroflex AC25007 (P/O TI)	
2.15 RF REFERENCE SOURCE	Range: 50 mV to 260 mV rms, 2 kHz; -60 to +10 dBm, 300 Hz to 100 MHz; Attenuator: -60 to 0 dB, 50 MHz  Accuracy: Attenuator: $\pm 0.4$ dB; Frequency: $\pm 1.3 \times 10^{-6}$	Fluke 9610 A/AF	
2.16 POWER SPLITTER	Range: 100 MHz to 2.7 GHz Accuracy: $\leq 0.15$ dB	Hewlett-Packard 11667A	
2.17 DIGITAL MULTIMETER	Range: AC: 50 mV to 7.3 V rms, 1 to 7.5 kHz  Accuracy: $\pm 0.75\%$ of indication	Hewlett-Packard 3458A	
2.18 SYNTHESIZED FUNCTION GENERATOR	Range: 1 Hz to 1 kHz, 0 to +5 dBm, 0 to 1 V rms  Accuracy: $\pm 0.31\%$ of setting	Hewlett-Packard 3325B	
2.19 POWER DIVIDER	Range: 1 to 2 kHz Accuracy: N/A	Weinschel 1506A	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.20 LOW PASS FILTER	Range: Cutoff >40 MHz; Rejection >50 dB at 80 MHz  Accuracy: Verify before use	Hewlett-Packard 0955-0306	
2.21 TERMINATION	Range: 50 $\Omega$ , 1 MHz to 2.7 GHz  Accuracy: N/A	Hewlett-Packard 908A	
2.22 ATTENUATOR	Range: 20 dB  Accuracy: N/A	Hewlett-Packard 8491A OPT020	
2.23 OSCILLOSCOPE CALIBRATOR	Range: (Squarewave) 120 mV to 190 V p-p  Accuracy: $\pm 3.33\%$ of setting  Range: (Time Marker) 10 $\mu$ s to 1 s  Accuracy: $\pm 0.31\%$ of setting	Fluke 9500B/3200AF	
2.24 RESISTOR	Range: 10 k $\Omega$  Accuracy: $\pm 0.1\%$ of nominal	As Available	
2.25 METER CALIBRATOR	Range: 0.36 to 90 VAC, 1 to 20 kHz; 0.36 to 90 VDC  Accuracy: VAC: $\pm 1.67\%$ of setting VDC: $\pm 0.56\%$ of setting	Fluke 5700A	

\*<sup>1</sup> The TAR is the Root Sum Square (RSS) result of the Power Meter (2.5), Power Sensor and MMR accuracies. The worst case TAR for TI RF Signal Generator Output Level Calibration is 3.3:1.

\*<sup>2</sup> This specification applies 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.

\*<sup>3</sup> This specification, in addition to the Range 2 error, applies 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.

\*<sup>4</sup> The worst case TAR for TI RF Signal Generator Frequency Modulation Calibration is 3.1:1.

### **3 PRELIMINARY OPERATIONS:**

3.1 Review and become familiar with entire procedure before beginning 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 the appropriate power source. Set all POWER switches to ON and allow warm-up as required by the manufacturer.

3.3 Connect the TI Power Cord to the appropriate power source.

3.4 Press the TI front panel POWER on key. Allow a 5 min warm-up period.

3.5 Throughout the Calibration Procedure, when directed to a submenu or menu value, use the ↑, ↓, ← and →, as necessary, to select the submenu or menu value then press ENTER. When required to enter a value, utilize the DATA ENTRY numerical keys, as necessary, to enter the value.

3.6 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*.

3.7 Press the TI MODE and select **System** then **Configuration**. Press FACTORY DEFAULT.

3.8 Verify the Low Pass Filter in accordance with Appendix A.

3.9 See the remarks field of T.O. 33K-1-100-2 for the TI software version this Calibration Procedure is valid for. If the TI has another software version, contact the TCM at AFMETCAL. If the TI has software version 1.8.1, annotate and attach a Limited Certification Label stating: Oscilloscope and Spectrum Analyzer Tracking Generator not calibrated.

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

3.11 Set the MMR for the Factory Preset. Preset the MMR. Perform Align All Now. Set RF coupling to DC.

#### NOTE

Whenever a measurement is made in Spectrum Analysis mode 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.

#### NOTE

The 50 Ω Leveling Head (p/o RF Reference Source) is an integral part of the RF Reference Source. All connections are to be made through the 50 Ω Leveling Head.

3.12 Make copies of Tables, as required, for use as worksheets.

#### **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 TIME BASE FREQUENCY CALIBRATION:**

##### **NOTE**

Adjustment of the Time Base Oscillator is normal due to the Aging Rate of the crystals. 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 to the nominal value each time it is calibrated.

4.1.1 Connect Frequency Standard 10 MHz REF OUT to the Universal Counter Ref In (rear panel).

4.1.2 Connect TI EXT REF IO to the Universal Counter CHANNEL 1 Input. Set the Universal Counter 50Ω/1MΩ switch to 50Ω.

4.1.3 Adjust Universal Counter controls as required for a stable display indication, then push RESET.

##### **NOTE**

The values in the following steps are derived from multiplication of the Aging Rate to determine the offset at one year. Use these calculated one year values regardless of the length of the calibration interval for this TI in T.O. 33K-1-100-1/2. The longest aging rate specification not to exceed 1 year has been used to calculate the limits.

4.1.4 Verify the Universal Counter indication is within 9 999 999 to 10 000 001 Hz.

4.1.5 Disconnect test setup.

4.1.6 To ensure reliability of the TI, the following action will be taken: If TI passed the above steps, perform the applicable adjustment steps in Commercial Data and enter the applicable code into the Maintenance Data Collection System. If TI failed, perform the applicable steps listed in Commercial Data and enter the applicable code into the Maintenance Data Collection System.

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

4.2.1 Repeat step 3.7 to restore the TI factory defaults.

4.2.2 Standardize Power Meter (2.5) and Power Sensor. Set the Power Meter (2.5) controls for a dBm measurement. Connect the Power Sensor to the TI T/R connector.

4.2.3 Press the TI Generator key, set **OUTPUT** to *T/R* and set **LEVEL** to *-30 dBm*.

4.2.4 Set the TI **FREQ** to the first value listed in the Applied column of Table 2 and set **RF** to *ON*.

4.2.5 Set the Power Meter (2.5) CAL FACTOR switch to the appropriate value for the frequency being verified.

4.2.6 Verify the Power Meter (2.5) indication is within the values listed in the Limits column of Table 2. Record the Power Meter (2.5) indication. Set the TI **RF** to *OFF*.



4.2.7 Repeat step 4.2.4 through 4.2.6 for remaining corresponding values listed in Table 2.

**Table 2.**

<b>Applied (MHz)</b>	<b>Limits (dBm)</b>
10.1	-31.0 to -29.0
100	-31.0 to -29.0
500	-31.0 to -29.0
1000	-31.0 to -29.0
2000	-31.5 to -28.5
2700	-31.5 to -28.5

4.2.8 Disconnect the Power Sensor from the TI T/R connector.

4.2.9 Connect the MMR 10 MHz OUT (SWITCHED) connector to the TI EXT RF I/O connector (rear panel).

4.2.10 Set the MMR controls, as required, to provide a 10 MHz timebase output.

4.2.11 Press the TI MODE and select **System** then **Configuration**. Set **10 MHz REFERENCE** to *External*.

4.2.12 Connect the TI T/R connector to the MMR RF INPUT 50  $\Omega$  connector.

4.2.13 Set the TI **FREQ** to *10.1 MHz* then set **LEVEL** to the first value listed in the Level column of Table 3 and set **RF** to *ON*.

4.2.14 If required, set the MMR to Measuring Receiver mode and set the MMR frequency to the TI frequency.

**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.

4.2.15 Set the MMR to make a Tuned RF Level measurement in High Accuracy mode.

4.2.16 Set the MMR to Set Ref.

4.2.17 Allow the MMR Tuned RF Level indication to settle.

4.2.18 Set the MMR Ext RF Atten to the value recorded, in dB, in step 4.2.6 for the frequency being verified.

4.2.19 Set the TI **LEVEL** to the next value listed in the Level column of Table 3.

4.2.20 Allow the MMR Tuned RF Level indication to settle. Verify the MMR Tuned RF Level indication is within the corresponding values listed in the appropriate Limits column of Table 3.

4.2.21 Repeat steps 4.2.19 and 4.2.20 for the remaining applicable corresponding values listed in Table 3.

*Table 3.*

Level (dBm)	Limits (dB)	
	<1.3 GHz	≥1.3 GHz
-30	Reference	Reference
-40	-41 to -39	-41.5 to -38.5
-50	-51 to -49	-51.5 to -48.5
-60	-61 to -59	-61.5 to -58.5
-70	-71 to -69	-71.5 to -68.5
-80	-81 to -79	-81.5 to -78.5
-90	-91 to -89	-91.5 to -88.5
-100	-101 to -99	-101.5 to -98.5
-109	-110 to -108	-110.5 to -107.5
-119	-120 to -118	N/A

4.2.22 Set the MMR Ext RF Atten to 0.0 dB.

4.2.23 Set the TI **RF** to *OFF*.

4.2.24 Repeat steps 4.2.13 through 4.2.23 for test frequencies of 100, 500 MHz, 1, 2 and 2.7 GHz.

4.2.25 Disconnect the TI T/R connector from the MMR RF INPUT 50 Ω connector.

4.2.26 Leave the MMR 10 MHz OUT (SWITCHED) connector connected to the TI EXT RF I/O connector (rear panel).

4.2.27 Connect the Power Sensor to the TI GEN connector. Set the TI **OUTPUT** to *GEN*.

4.2.28 Set the TI **LEVEL** to the first value listed in the Level column of Table 4.

4.2.29 Set the TI **FREQ** to the first value listed in the Frequency column of Table 4 and set **RF** to *ON*.

4.2.30 Set the Power Meter (2.5) CAL FACTOR switch to the appropriate value for the frequency being verified.

4.2.31 Verify the Power Meter (2.5) indication is within the values listed in the Limits column of Table 4. Record the Power Meter (2.5) indication for the 0 dBm level, only. Set the TI **RF** to *OFF*.

4.2.32 Repeat step 4.2.28 through 4.2.31 for the remaining applicable corresponding values listed in Table 4.

**Table 4.**

<b>Level (dBm)</b>	<b>Frequency (MHz)</b>	<b>Limits (dBm)</b>
0	10.1	-1.5 to +1.5
	100	-1.5 to +1.5
	500	-1.5 to +1.5
	1000	-1.5 to +1.5
	2000	-2.5 to +2.5
	2700	-2.5 to +2.5
+10	10.1	8.5 to 11.5
	100	8.5 to 11.5
	500	8.5 to 11.5
	1000	8.5 to 11.5
	2000	7.5 to 12.5
	2700	7.5 to 12.5

4.2.33 Disconnect the Power Sensor from the TI GEN connector.

4.2.34 Connect the TI GEN to the MMR RF INPUT 50  $\Omega$ .

4.2.35 Set the TI **FREQ** to *10.1 MHz*, set **LEVEL** to *0 dBm* and set **RF** to *ON*.

4.2.36 Set the MMR frequency to the TI frequency.

4.2.37 Set the MMR to make a Tuned RF Level measurement.

4.2.38 Set the MMR to Set Ref.

4.2.39 Allow the MMR Tuned RF Level indication to settle.

4.2.40 Set the MMR Ext RF Atten to the value recorded, in dB, in step 4.2.31 for the frequency being verified.

4.2.41 Set the TI **LEVEL** to the first value listed in the Level column of Table 5.

4.2.42 Allow the MMR Tuned RF Level indication to settle. Verify the MMR Tuned RF Level indication is within the corresponding values listed in the appropriate Limits column of Table 5.

4.2.43 Repeat steps 4.2.41 and 4.2.42 for the remaining corresponding values listed in Table 5.

*Table 5.*

Level (dBm)	Limits (dB)	
	<1.3 GHz	≥1.3 GHz
0	Reference	Reference
-10	-11.5 to -8.5	-12.5 to -7.5
-20	-21.5 to -18.5	-22.5 to -17.5
-30	-31.5 to -28.5	-32.5 to -27.5
-40	-41.5 to -38.5	-42.5 to -37.5
-50	-51.5 to -48.5	-52.5 to -47.5
-60	-61.5 to -58.5	-62.5 to -57.5
-70	-71.5 to -68.5	-72.5 to -67.5
-80	-81.5 to -78.5	-82.5 to -77.5
-90	-91.5 to -88.5	-92.5 to -87.5
-100	-101.5 to -98.5	-102.5 to -97.5
-110	-111.5 to -108.5	-112.5 to -107.5

4.2.44 Set the MMR Ext RF Atten to 0.0 dB.

4.2.45 Set the TI **RF** to *OFF*.

4.2.46 Repeat steps 4.2.35 through 4.2.45 for test frequencies of 100, 500 MHz, 1, 2 and 2.7 GHz.

4.2.47 Set the MMR controls, as required, to turn off the 10 MHz timebase output.

4.2.48 Press the TI MODE and select **System** then **Configuration**. Set **10 MHz REFERENCE** to *Internal*.

4.2.49 Disconnect the test setup.

### **4.3 RF SIGNAL GENERATOR SPECTRAL PURITY CALIBRATION:**

4.3.1 Repeat step 3.7 to restore the TI factory defaults.

4.3.2 Connect the TI GEN connector to the Spectrum Analyzer INPUT 50 Ω.

4.3.3 Press the TI Generator key, set **OUTPUT** to *GEN* and **FREQ** to the first value listed in the Freq column of Table 6. Set **LEVEL** to *-10 dBm* and set **RF** to *ON*.

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

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

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

4.3.7 Set the Spectrum Analyzer controls as required to measure Non-Harmonic signal levels.

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

4.3.9 Set the TI **FREQ** to the next value listed in the Freq column of Table 6. Repeat steps 4.3.4 through 4.3.8.

4.3.10 Repeat step 4.3.9 for the remaining corresponding values listed in Table 6.

**Table 6.**

Freq (MHz)	Limits (dBc)	
	Harmonics	Non-Harmonics
1	≤-20	≤-40
10	≤-20	≤-40
100	≤-25	≤-40
500	≤-25	≤-40
1000	≤-25	≤-40
1250	≤-25	≤-40
1750	≤-25	≤-30
2000	≤-25	≤-30
2500	≤-25	≤-30
2700	≤-25	≤-30

4.3.11 Set the TI **RF** to *OFF* and disconnect test setup.

#### **4.4 RF SIGNAL GENERATOR RESIDUAL FM AND PHASE NOISE CALIBRATION:**

4.4.1 Repeat step 3.7 to restore the TI factory defaults.

4.4.2 Connect the TI GEN connector to the MMR RF INPUT 50 Ω.

4.4.3 Press the TI Generator key, set **OUTPUT** to *GEN* and **FREQ** to *500 MHz*. Set **LEVEL** to *+10 dBm*. Set **RF** to *ON*.

4.4.4 If required, set the MMR to Measuring Receiver mode.

4.4.5 Set the MMR Frequency to the TI frequency. Set the MMR controls, as required, to measure FM Deviation. Set the High Pass Filter to 300 Hz, Low Pass Filter to 3 kHz and Detector to RMS.

4.4.6 Verify the MMR FM Deviation indication is within the corresponding value listed in the Limits column of Table 7 for the frequency being verified.

4.4.7 Press the TI Generator key, set **OUTPUT** to *GEN* and **FREQ** to the next value listed in the Applied column of Table 7.

4.4.8 Set the MMR Frequency to the TI frequency. Restart the MMR.

4.4.9 Verify the MMR FM Deviation indication is within the corresponding value listed in the Limits column of Table 7 for the frequency being verified.

**Table 7.**

<b>Applied (Hz)</b>	<b>Limits (Hz rms)</b>
500 M	<15
2.6 G	<15

4.4.10 Repeat step 3.7 to restore the TI factory defaults.

4.4.11 Press the TI Generator key, set **OUTPUT** to *GEN* and **FREQ** to *500 MHz*. Set **LEVEL** to *+10 dBm*. Set **RF** to *ON*.

4.4.12 Set the MMR to Spectrum Analysis Mode. Set the MMR Frequency to the TI frequency, Span to 50 kHz and RBW to 300 Hz. Set the reference level as required to set the peak at a convenient level.

4.4.13 Set the MMR Spectrum Analyzer to do a peak search, set the Marker Delta to 20 kHz and set the Marker Noise to On.

4.4.14 Verify the MMR Spectrum Analyzer  $\Delta$ Mkr Noise Level is within the corresponding value listed in the Limits column in Table 8 for the frequency being verified.

**NOTE**

The MMR Spectrum Analyzer will display the indication in dB/Hz vs dBc/Hz.

4.4.15 Set the MMR Spectrum Analyzer Markers to Off.

4.4.16 Press the TI Generator key, set **OUTPUT** to *GEN* and **FREQ** to the next value listed in the Applied column of Table 8.

4.4.17 Set the MMR Spectrum Analyzer Frequency to the TI frequency. Set the reference level as required to set the peak at a convenient level.

4.4.18 Set the MMR Spectrum Analyzer to do a peak search, set the Marker Delta to 20 kHz and set the Marker Noise to On.

4.4.19 Verify the MMR Spectrum Analyzer  $\Delta$ Mkr Noise Level is within the corresponding value listed in the Limits column in Table 8 for the frequency being verified.

Table 8.

Applied (Hz)	Limits (dBc/Hz)
500 M	$\leq -92$
2.6 G	$\leq -90$

4.4.20 Set the TI **RF** to *OFF* and disconnect test setup.

#### 4.5 **RF SIGNAL GENERATOR RESIDUAL AM CALIBRATION:**

4.5.1 Repeat step 3.7 to restore the TI factory defaults.

4.5.2 Connect equipment as shown in Figure 1.

4.5.3 Press the TI Generator key, set **OUTPUT** to *GEN* and **FREQ** to *10.1 MHz*. Set **LEVEL** to *0 dBm* and set **RF** to *ON*.

4.5.4 Press the Measuring Receiver INSTR PRESET. Press the AM, Blue Shift and RMS keys. Select the 300 Hz HP FILTER and the 3 kHz LP FILTER.

4.5.5 Verify the Measuring Receiver indication is within the value listed in the Limits column of Table 9.

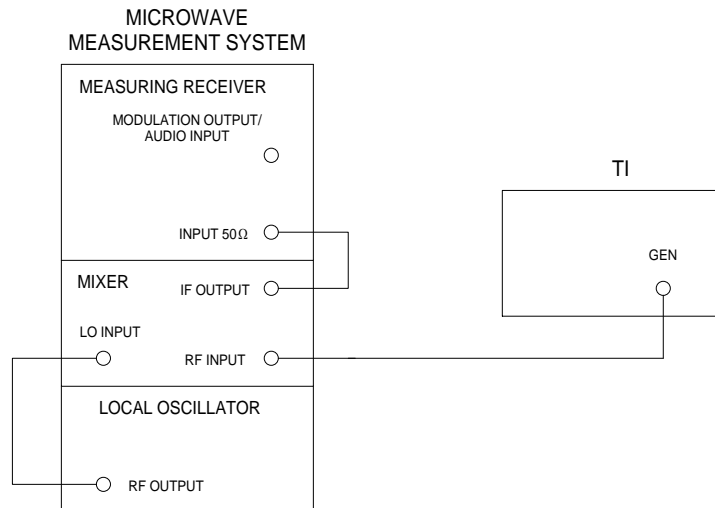


Figure 1.

4.5.6 Set the TI **FREQ** for the next value listed in the Applied column of Table 9. Repeat steps 4.5.4 and 4.5.5.

4.5.7 Repeat step 4.5.6 for the remaining corresponding values listed in Table 9.

**Table 9.**

<b>Applied (MHz)</b>	<b>Limits (% rms)</b>
10.1	<0.1
500	<0.1
1000	<0.1
2000 *	<0.1
2700 *	<0.1

\* Set the Microwave Measurement System in frequency offset mode for the applicable value.

4.5.8 Set the TI **RF** to *OFF*.

#### **4.6 RF SIGNAL GENERATOR FREQUENCY MODULATION CALIBRATION:**

4.6.1 Repeat step 3.7 to restore the TI factory defaults.

4.6.2 Connect the TI GEN connector to the MMR RF INPUT 50  $\Omega$ .

4.6.3 Press the TI Generator key, set **OUTPUT** to *GEN* and **FREQ** to *10.1 MHz*. Set **LEVEL** to *-10 dBm* and set **RF** to *ON*. Set **MOD TYPE** to *FM*, **M1** to *TONE* at *6 kHz* and **AF** to *1000 Hz Sine*.

4.6.4 Set the MMR Frequency to the TI frequency. Set the MMR controls, as required, to measure FM Deviation. Set the High Pass Filter to 50 Hz, Low Pass Filter to 15 kHz and Detector to Peak +.

4.6.5 Verify the MMR FM Mod Distortion indication is <1%.

4.6.6 Set the TI **FREQ** to the first value listed in the Applied Frequency column of Table 10.

4.6.7 Set the TI **M1** to the first value listed in the Applied Deviation column of Table 10.

4.6.8 Set the TI **AF** to the first value listed in the Applied Rate column of Table 10.

4.6.9 Set the MMR Frequency to the TI frequency. Set the MMR controls, as required, to measure FM Deviation (in kHz). Set the High Pass and Low Pass Filters, as necessary, to envelope the frequency listed in the Applied Rate column of Table 10.

4.6.10 Verify the MMR FM Deviation indication is within the corresponding value listed in the Limits column of Table 10 for the frequency being verified.

4.6.11 Repeat steps 4.6.6 through 4.6.10 as necessary, for the remaining corresponding values listed in Table 10 at the frequency being verified.



*Table 10.*

Frequency (MHz)	Applied Deviation (kHz)	Rate (Hz)	Limits (kHz)	
10.1	10	50	9.684 to 10.316	
		1000	9.684 to 10.316	
		3000	9.684 to 10.316	
		10000	9.684 to 10.316	
	20	1000	19.384 to 20.616	
		40	1000	37.984 to 42.016
			20000	37.984 to 42.016
		1000	10	50
1000	9.684 to 10.316			
3000	9.684 to 10.316			
10000	9.684 to 10.316			
20	10000		19.384 to 20.616	
	40		1000	37.984 to 42.016
			20000	37.984 to 42.016
	2700		10	50
1000		9.684 to 10.316		
3000		9.684 to 10.316		
10000		9.684 to 10.316		
20		1000	19.384 to 20.616	
		40	1000	37.984 to 42.016
			20000	37.984 to 42.016

4.6.12 Set the TI **RF** to *OFF*.

#### **4.7 RF SIGNAL GENERATOR AMPLITUDE MODULATION CALIBRATION:**

4.7.1 Repeat step 3.7 to restore the TI factory defaults.

4.7.2 Press the TI Generator key, set **OUTPUT** to *GEN*. Set **LEVEL** to *-10 dBm* and set **RF** to *ON*. Set **MOD TYPE** to *AM*, **M1** to *TONE* at 30% and **AF** to *1000 Hz Sine*.

4.7.3 Set the TI **FREQ** to the first value listed in the Applied Frequency column of Table 11.

4.7.4 Set the TI **MI** to the first value listed in the Applied Depth column of Table 11.

4.7.5 Set the MMR frequency to the TI carrier frequency.

4.7.6 Set the MMR controls, as required, to measure AM Depth (in %). Set High Pass Filter to 300 Hz, Low Pass Filter to 3 kHz and the Detector to Peak + - / 2.

4.7.7 Allow the MMR AM Depth indication to settle. Verify the MMR AM Depth indication is within the corresponding values listed in the Limits column of Table 11.

4.7.8 Repeat steps 4.7.3 through 4.7.7, as necessary, for the remaining corresponding values listed in Table 11 at the frequency being verified.

**Table 11.**

<b>Applied Frequency (MHz)</b>	<b>Depth (%)</b>	<b>Limits (%)</b>
10.1	30	24.4 to 35.6
	50	44.4 to 55.6
	90	84.4 to 95.6
1000	30	24.4 to 35.6
	50	44.4 to 55.6
	90	84.4 to 95.6
2700	30	24.4 to 35.6
	50	44.4 to 55.6
	90	84.4 to 95.6

4.7.9 Set the TI **RF** to *OFF* and disconnect test setup.

**4.8 RECEIVER RF POWER METER CALIBRATION:**

4.8.1 Repeat step 3.7 to restore the TI factory defaults.

**CAUTION**

Damage to the TI may occur if >50 W continuous is applied. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

4.8.2 Connect equipment as shown in Figure 2.

4.8.3 Press the TI Receiver key, set **INPUT** to *T/R* and set **FREQ** to *400 MHz*. Set **Options** to *Power*.

4.8.4 On the Power Meter (2.12) set switch to 40 dB Coupler and CAL FACTOR/Vernier controls to the appropriate value.

4.8.5 On the Power Amplifier set the Filter Switching Unit BAND SELECT-MHz to 250-400 and POWER ADJUST controls fully CCW.

4.8.6 Set the Signal Generator as required for 0.0 dBm output at 400 MHz.

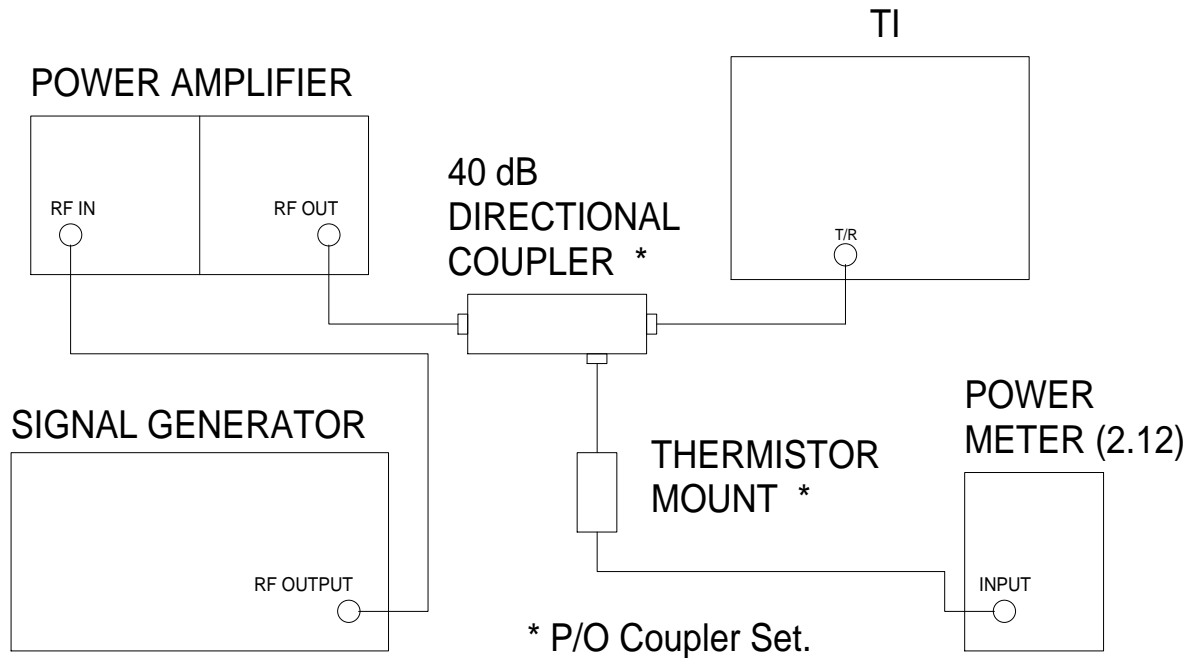


Figure 2.

4.8.7 Set the TI **POWER Range** to the first value listed in the Range column of Table 12.

4.8.8 On the Power Amplifier set the Filter Switching Unit 250-400 MHz POWER ADJUST controls to the first value listed in the Applied column of Table 12 as indicated on the Power Meter (2.12).

4.8.9 Verify the TI indicates within the values listed in the Limits column of Table 12.

4.8.10 On the Power Amplifier set the Filter Switching Unit 250-400 MHz POWER ADJUST controls for minimum.

4.8.11 Repeat steps 4.8.7 through 4.8.10 for the remaining values listed in Table 12.

*Table 12.*

Applied (W)	Range (W)	Limits (W)
10	20	7.9 to 12.1
30	50	24.9 to 35.1
50	100	39.9 to 60.1

4.8.12 Set outputs to minimum and disconnect test setup.

**4.9 RECEIVER FREQUENCY MODULATION DEVIATION METER CALIBRATION:**

4.9.1 Connect the Synthesized Signal Generator RF OUTPUT 50 Ω to a BNC Tee. Connect one leg of the BNC Tee to the MMR RF INPUT 50 Ω and the other leg to the TI ANT.

4.9.2 Set the Synthesized Signal Generator to produce a 12.5 MHz, 0 dBm, FM signal with a 4.5 kHz deviation at a 1 kHz modulation rate.

4.9.3 Ensure the MMR is set to Measuring Receiver mode. Set to measure FM Deviation on a 12.5 MHz carrier. Set the High Pass filter to 300 Hz, the Low Pass filter to 3 kHz and the Detector to Peak +.

4.9.4 Press the TI Receiver key, set **INPUT** to *ANT* and set **FREQ** to *12.5 MHz*. Set **DEMODO** to *FM* and **ATTEN** to *0 dB*. Set **FILTER** (default states NO FILTER) to 300 Hz to 4 kHz BP.

4.9.5 Set the TI **DEV Range** to *5 kHz*.

4.9.6 Set the TI **IF BW** to *12.5 kHz*.

4.9.7 Set the Synthesized Signal Generator, as required, for an MMR FM Deviation indication of 4.5 kHz.

4.9.8 Verify the TI **DEV** indication is within 4.21 to 4.79 kHz.

4.9.9 Set the Synthesized Signal Generator for a 100 MHz carrier.

4.9.10 Repeat step 4.9.3 for a 100 MHz carrier.

4.9.11 Set the TI **FREQ** to *100.0 MHz*.

4.9.12 Set the TI **DEV Range** to the first value listed in the Range column of Table 13.

4.9.13 Set the TI **IF BW** to the first value listed in the IF BW column of Table 13.

4.9.14 Set the Synthesized Signal Generator, as required, for an MMR FM Deviation indication of the first value listed in the Applied column of Table 13.

4.9.15 Verify the TI **DEV** indication is within the values listed in the appropriate Limits column of Table 13.

4.9.16 Repeat steps 4.9.12 through 4.9.15 for the remaining corresponding values listed in Table 13.

*Table 13.*

<b>Range (kHz)</b>	<b>IF BW</b>	<b>Applied (kHz)</b>	<b>Limits (kHz)</b>
10	25	9.0	8.46 to 9.54
20	60	18.0	16.96 to 19.04
50	200	35	31.46 to 38.54

4.9.17 Set outputs to minimum and leave the test setup connected.

**4.10 RECEIVER AMPLITUDE MODULATION METER CALIBRATION:**

- 4.10.1 Repeat step 3.7 to restore the TI factory defaults.
- 4.10.2 Set the Synthesized Signal Generator to produce a 12.5 MHz, -20 dBm, AM signal with a 10% AM Depth at a 1 kHz modulation rate.
- 4.10.3 Ensure the MMR is set to Measuring Receiver mode. Set to measure AM Depth on a 12.5 MHz carrier. Set the Detector to Peak + - / 2.
- 4.10.4 Press the TI Receiver key, set **INPUT** to *ANT* and set **FREQ** to *12.5 MHz*. Set **DEMODO** to *AM* and **ATTEN** to *0 dB*. Set **FILTER** (default states NO FILTER) to 300 Hz to 4 kHz BP. Set **IF BW** to *6 kHz*.
- 4.10.5 Set the TI **MOD Range** to the first value listed in the Range column of Table 14.
- 4.10.6 Set the Synthesized Signal Generator, as required, for an MMR AM Depth indication of the first value listed in the Applied column of Table 14.
- 4.10.7 Verify the TI AM modulation indication is within the values listed in the appropriate Limits column of Table 14.
- 4.10.8 Repeat steps 4.10.5 and 4.10.7 for the remaining corresponding values listed in Table 14.

*Table 14.*

<b>Range (%)</b>	<b>Applied (%)</b>	<b>Limits (%)</b>
10	10	9 to 11
50	20	17 to 23
50	30	27 to 33
50	45	42 to 48
100	25	20 to 30
100	50	45 to 55
100	75	70 to 80
100	90	85 to 95

- 4.10.9 Set outputs to minimum and disconnect test setup.

**4.11 RECEIVER AUDIO FREQUENCY COUNTER CALIBRATION:**

- 4.11.1 Repeat step 3.7 to restore the TI factory defaults.
- 4.11.2 Connect the Microphone/Audio Adapter to the TI MIC and AUDIO I/O connectors.
- 4.11.3 Connect the RF Reference Source through the Leveling Head to the Microphone/Audio Adapter AUDIO IN connector.
- 4.11.4 Press the TI Receiver key and set **COUNT Resolution** to *0.1 Hz*.

4.11.5 Set the RF Reference Source for the first value listed in the Applied column of Table 15 at a Level of 0.0 dBm.

4.11.6 Verify the TI indication is within the values listed in the Limits column of Table 15.

4.11.7 Repeat steps 4.11.5 and 4.11.6 for the remaining corresponding values listed in Table 15.

**Table 15.**

<b>Applied (Hz)</b>	<b>Limits (Hz)</b>
300	299.9 to 300.1
10000	9 999.9 to 10 000.1
19000	18 999.9 to 19 000.1

4.11.8 Set RF Reference Source to minimum and disconnect test setup.

**4.12 RECEIVER RECEIVE SIGNAL STRENGTH INDICATION METER CALIBRATION:**

4.12.1 Repeat step 3.7 to restore the TI factory defaults.

4.12.2 Press the TI Receiver key, set **INPUT** to *T/R* and set **FREQ** to *100 MHz*.

4.12.3 Standardize Power Meter (2.5) and Power Sensor. Set the Power Meter (2.5) controls for a dBm measurement.

4.12.4 Connect the equipment as shown in Figure 3.

4.12.5 Set the Power Meter (2.5) CAL FACTOR switch to the appropriate value for the frequency being verified.

4.12.6 Set the Signal Generator frequency to 100 MHz and output level for a +10 dBm indication on the Power Meter (2.5).

4.12.7 Set the MMR controls, as required, to provide a 10 MHz timebase output.

4.12.8 If required set the MMR to Measuring Receiver mode and set the MMR frequency to the TI frequency.

4.12.9 Set the MMR to make a Tuned RF Level measurement in High Accuracy mode.

4.12.10 Set the MMR to Set Ref.

4.12.11 Set the Signal Generator RF OUTPUT ON/OFF to OFF. Disconnect the Power Sensor from the Power Splitter.

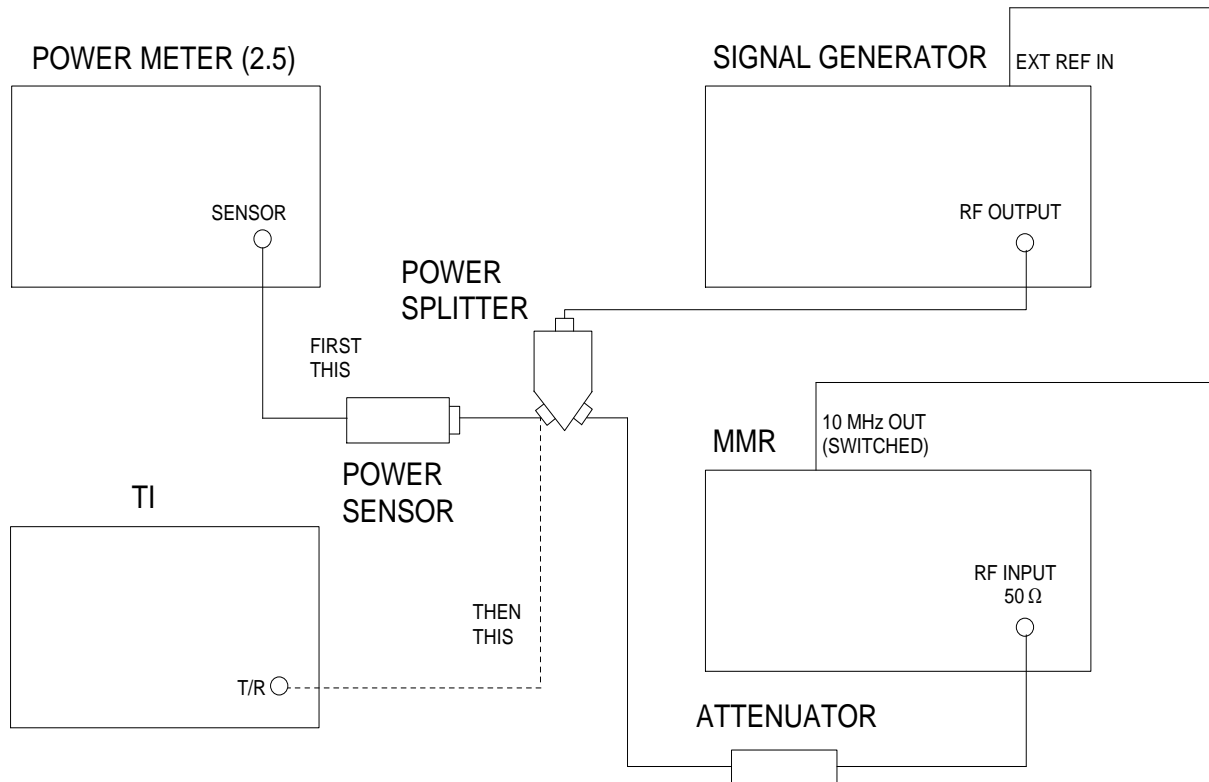


Figure 3.

**NOTE**

A CAL is required on the TI when the CAL background turns yellow. Follow the instructions on the TI display to perform CAL when prompted.

- 4.12.12 Connect the TI T/R connector to the open port of the Power Splitter.
- 4.12.13 Set the Signal Generator RF OUTPUT ON/OFF to ON.
- 4.12.14 Verify the TI indicates within the values listed in the Limits column of Table 16.

**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.

- 4.12.15 Set the Signal Generator output level for an MMR indication of the next value listed in the MMR Indication column of Table 16  $\pm 0.05$  dB.
- 4.12.16 Verify the TI indication is within the values listed in the Limits column of Table 16.
- 4.12.17 Repeat steps 4.12.15 and 4.12.16 for the remaining corresponding values in Table 16.

**Table 16.**

<b>Applied (dBm)</b>	<b>MMR Indication (dB)</b>	<b>Limits (dBm)</b>
+10	Reference	8.5 to 11.5
0	-10.00	-1.5 to +1.5
-10	-20.00	-11.5 to -8.5
-20	-30.00	-21.5 to -18.5
-25	-35.00	-26.5 to -23.5

4.12.18 Set all outputs to minimum. Set the equipment as shown in the original configuration as shown in Figure 3.

4.12.19 Set the TI **FREQ** to *1000 MHz*.

4.12.20 Repeat steps 4.12.5 through 4.12.18 at 1 GHz.

4.12.21 Set the TI **FREQ** to *2700 MHz*

4.12.22 Repeat steps 4.12.5 through 4.12.18 at 2.7 GHz.

4.12.23 Set all outputs to minimum. Set the equipment as shown in the original configuration as shown in Figure 3, except using the TI ANT connector and remove the Attenuator from the test setup.

4.12.24 Set the TI **INPUT** to *ANT* and set the **FREQ** to *100 MHz*.

4.12.25 Repeat steps 4.12.5 through 4.12.22 using Table 17 and using TI ANT connector where TI T/R connector is listed.

**Table 17.**

<b>Applied (dBm)</b>	<b>MMR Indication (dB)</b>	<b>Limits (dBm)</b>
-25	Reference	-26.5 to -23.5
-30	-5.00	-31.5 to -28.5
-40	-15.00	-41.5 to -38.5
-50	-25.00	-51.5 to -48.5
-60	-35.00	-61.5 to -58.5
-65	-40.00	-66.5 to -63.5

4.12.26 Set the MMR controls, as required, to turn off the 10 MHz timebase output.

4.12.27 Set all outputs to minimum and disconnect test setup.



**4.13 RECEIVER SINAD METER AND DISTORTION METER CALIBRATION:**

4.13.1 Repeat step 3.7 to restore the TI factory defaults.

4.13.2 Connect equipment as shown in Figure 4 with the Power Divider input connected to the Digital Multimeter input.

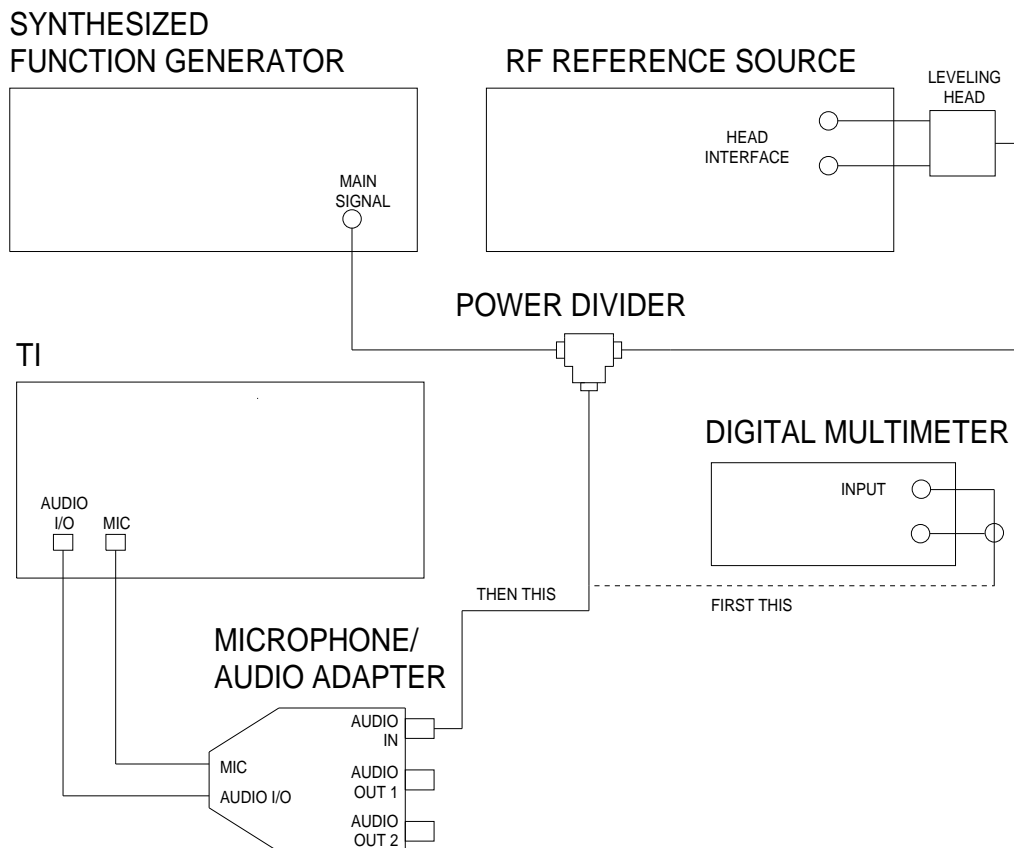


Figure 4.

4.13.3 Set the Digital Multimeter for ACV measurement.

4.13.4 Set the Synthesized Function Generator frequency to 1 kHz and output level for 1.000 V rms, as monitored on the Digital Multimeter.

4.13.5 Record the Synthesized Function Generator indication. Set the Synthesized Function Generator to minimum.

4.13.6 Set the RF Reference Source Frequency to 2 kHz and Level for 260.0 mV rms as monitored on the Digital Multimeter.

4.13.7 Set the Synthesized Function Generator to the value recorded in step 4.13.5.

4.13.8 Disconnect the Power Divider Input from the Digital Multimeter.

4.13.9 Connect the Power Divider Input to the Microphone/Audio Adapter AUDIO IN.

4.13.10 Press the TI Receiver key.

4.13.11 Verify the TI SINAD meter indicates within 10.9 to 13.1 dB.

4.13.12 Set all outputs to minimum. Connect equipment as shown in Figure 4 with the Power Divider input connected to the Digital Multimeter input.

4.13.13 Set the RF Reference Source Frequency to 2 kHz and Level for 50.0 mV rms as monitored on the Digital Multimeter.

4.13.14 Set the Synthesized Function Generator to the value recorded in step 4.13.5.

4.13.15 Disconnect the Power Divider Input from the Digital Multimeter.

4.13.16 Connect the Power Divider Input to the Microphone/Audio Adapter AUDIO IN.

4.13.17 Set the TI **Options** to *Distortion*.

4.13.18 Verify the TI DIST meter indicates within 3.4 to 6.6%.

4.13.19 Set all outputs to minimum and disconnect test setup.

**4.14 SPECTRUM ANALYZER FREQUENCY SPAN CALIBRATION:**

4.14.1 Repeat step 3.7 to restore the TI factory defaults.

4.14.2 Connect the Signal Generator to the TI T/R connector.

4.14.3 Press the TI Spectrum Analyzer key and set **FREQ** to *1500 MHz*.

4.14.4 Set the TI **SPAN** to the first value listed in the Span Freq column of Table 18.

4.14.5 Set the Signal Generator frequency to the first value listed in the First Freq column of Table 18 and output level to 0 dBm.

4.14.6 Adjust the Signal Generator frequency to place the center of the signal on the first graticule line from the left on the TI CRT. Record the Signal Generator frequency.

4.14.7 Adjust the Signal Generator frequency to place the center of the signal on the ninth graticule line from the left on the TI CRT. Record the Signal Generator frequency.

4.14.8 Subtract the value recorded in step 4.14.6 from the value recorded in step 4.14.7.

4.14.9 Verify the result of step 4.14.8 is within the first values listed in the Limits column of Table 18.

4.14.10 Repeat steps 4.14.4 through 4.14.9 for the remaining corresponding values listed in Table 18.

*Table 18.*

<b>Span Freq (Hz)</b>	<b>First Freq (MHz)</b>	<b>Limits (Hz)</b>
1 k	1499.9996	790 to 810
2 k	1499.9992	1.58 to 1.62 k
5 k	1499.9980	3.95 to 4.05 k

Table 18. (Cont.)

Span Freq (Hz)	First Freq (MHz)	Limits (Hz)
10 k	1499.9960	7.90 to 8.10 k
20 k	1499.9920	15.80 to 16.20 k
50 k	1499.9800	39.50 to 40.50 k
100 k	1499.9600	79.00 to 81.00 k
200 k	1499.9200	158.00 to 162.00 k
500 k	1499.8000	395.00 to 405.00 k
1 M	1499.6000	790.00 to 810.00 k
2 M	1499.2000	1.58 to 1.62 M
5 M	1498.0000	3.95 to 4.05 M
10 M	1496.0000	7.90 to 8.10 M
20 M	1492.0000	15.80 to 16.20 M
50 M	1480.0000	39.50 to 40.50 M
100 M	1460.0000	79.00 to 81.00 M
200 M	1420.0000	158.00 to 162.00 M
500 M	1300.0000	395.00 to 405.00 M
1 G	1100.0000	790.00 to 810.00 M
2 G	700.0000	1.58 to 1.62 G
3 G	300.0000	2.37 to 2.43 G

4.14.11 Set all outputs to minimum and disconnect test setup.

#### **4.15 SPECTRUM ANALYZER FREQUENCY DISPLAY CALIBRATION:**

4.15.1 Repeat step 3.7 to restore the TI factory defaults.

4.15.2 Connect the Signal Generator to the TI T/R connector.

4.15.3 Press the TI Spectrum Analyzer key.

4.15.4 Set the TI **SPAN** to *1 kHz* and **RBW** to *300 Hz*.

4.15.5 Set the TI **FREQ** to the first value listed in the Center Freq column of Table 19.

4.15.6 Set the Signal Generator to the first value listed in the Center Freq column of Table 19 at an output level of 0 dBm.

4.15.7 Adjust the Signal Generator frequency to place the center of the signal on the center graticule line on the TI CRT.

4.15.8 Verify the Signal Generator frequency indication is within the values listed in the Limits column of Table 19.

4.15.9 Repeat steps 4.15.5 through 4.15.8 for the remaining corresponding values listed in Table 19.

**Table 19.**

<b>Center Freq (MHz)</b>	<b>Limits (Hz)</b>
1	999 840 to 1 000 160
5	4 999 840 to 5 000 161
10	9 999 839 to 10 000 161
50	49 999 835 to 50 000 165
100	99 999 830 to 100 000 170
500	499 999 790 to 500 000 210
1000	999 999 740 to 1 000 000 260
1500	1 499 999 690 to 1 500 000 310
2000	1 999 999 640 to 2 000 000 360
2500	2 499 999 590 to 2 500 000 410

4.15.10 Set the Signal Generator output to minimum.

**4.16 SPECTRUM ANALYZER SWEEP RATE CALIBRATION:**

4.16.1 Repeat step 3.7 to restore the TI factory defaults.

4.16.2 Connect the equipment as shown in Figure 5.

4.16.3 Press the TI Spectrum Analyzer key and set the TI **FREQ** to *500 MHz* and **SPAN** to *0 SPAN*. Press **SHIFT**, **MODE** and select **Configure Markers**. Set **Marker 1** and **Marker 2** to *ON VERT* then select **CLOSE**.

4.16.4 Set the Signal Generator output for 500 MHz at -10 dBm. Set the AM and FM controls to off.

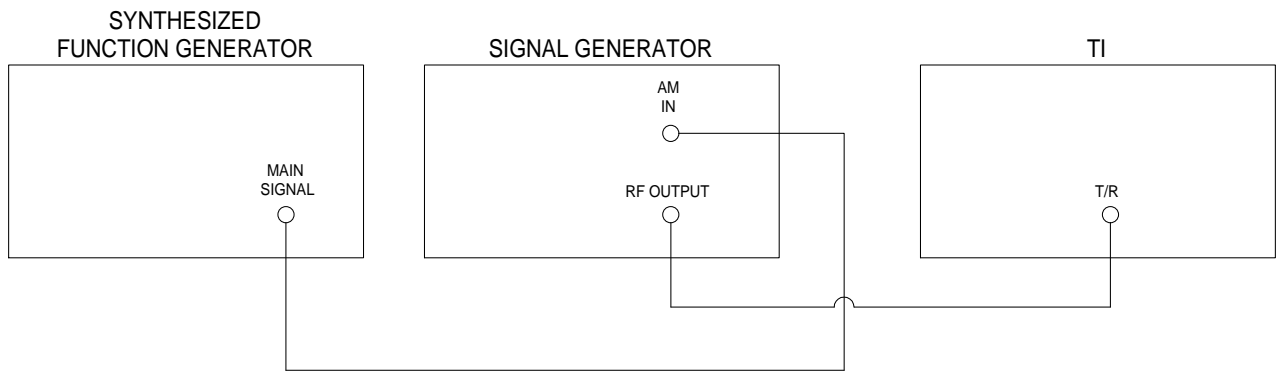


Figure 5.

4.16.5 Set Synthesized Function Generator for a 500 Hz at +3.0 dBm triangle wave output.

4.16.6 Set the TI **SWEEP** to the first value listed in the Sweep Time column of Table 20.

4.16.7 Press the Signal Generator MODULATION AM, ON and EXT DC buttons. Ensure the EXT HI or EXT LO indication lights are not lit. If either light is lit, adjust the Function Generator output level accordingly to extinguish light. Set the Signal Generator AM Modulation to 90%.

4.16.8 Press the TI Trace STOP key.

4.16.9 Select the TI Marker 2 and set to align with the peak of the left most signal. Select Marker 1 and set to align with the 9th peak from the left.

4.16.10 Algebraically subtract the Marker 2 reading from the Marker 1 reading and verify the results are within the corresponding values listed in Limits column of Table 20.

**Table 20.**

<b>Sweep Time (s)</b>	<b>Applied (Hz)</b>	<b>Limits (s)</b>
20 m	500	15.8 to 16.2 m
50 m	200	39.5 to 40.5 m
100 m	100	79.0 to 81.0 m
200 m	50	158 to 162 m
500 m	20	395 to 405 m
1	10	790 to 810 m
2	5	1.58 to 1.62
5	2	3.95 to 4.05
10	1	7.90 to 8.10

4.16.11 Press the TI Trace RUN key and set the TI **SWEEP** to the next value listed in the Sweep Time column of Table 20.

4.16.12 Set the Synthesized Function Generator Frequency to the next value listed in Applied column of Table 20.

4.16.13 Repeat steps 4.16.8 through 4.16.12 for remaining values listed in Table 20.

4.16.14 Set the Signal Generator and the Synthesized Function Generator outputs for minimum and disconnect test setup.

**4.17 SPECTRUM ANALYZER HARMONIC SPURIOUS AND NON-HARMONIC SPURIOUS CALIBRATION:**

4.17.1 Repeat step 3.7 to restore the TI factory defaults.

4.17.2 Standardize Power Meter (2.5) and Power Sensor. Set the Power Meter (2.5) controls for a dBm measurement. Connect equipment as shown in Figure 6.

4.17.3 Press the TI Spectrum Analyzer key. Press MODE and select **System Configuration** and set **10 MHz REFERENCE** to *External*. Press MODE and select **Spectrum Analyzer**.

4.17.4 Set the TI **FREQ** to *40 MHz*, **SPAN** to *1 kHz* and **dBm** to *-40 dBm*. Set Input to *ANT*.

4.17.5 Set the Power Meter (2.5) CAL FACTOR switch to the appropriate value for the frequency being verified.

4.17.6 Set the Signal Generator for 40 MHz and as close as possible to an output level of -40 dBm as indicated on the Power Meter (2.5).

4.17.7 Set the Signal Generator RF ON/OFF to OFF.

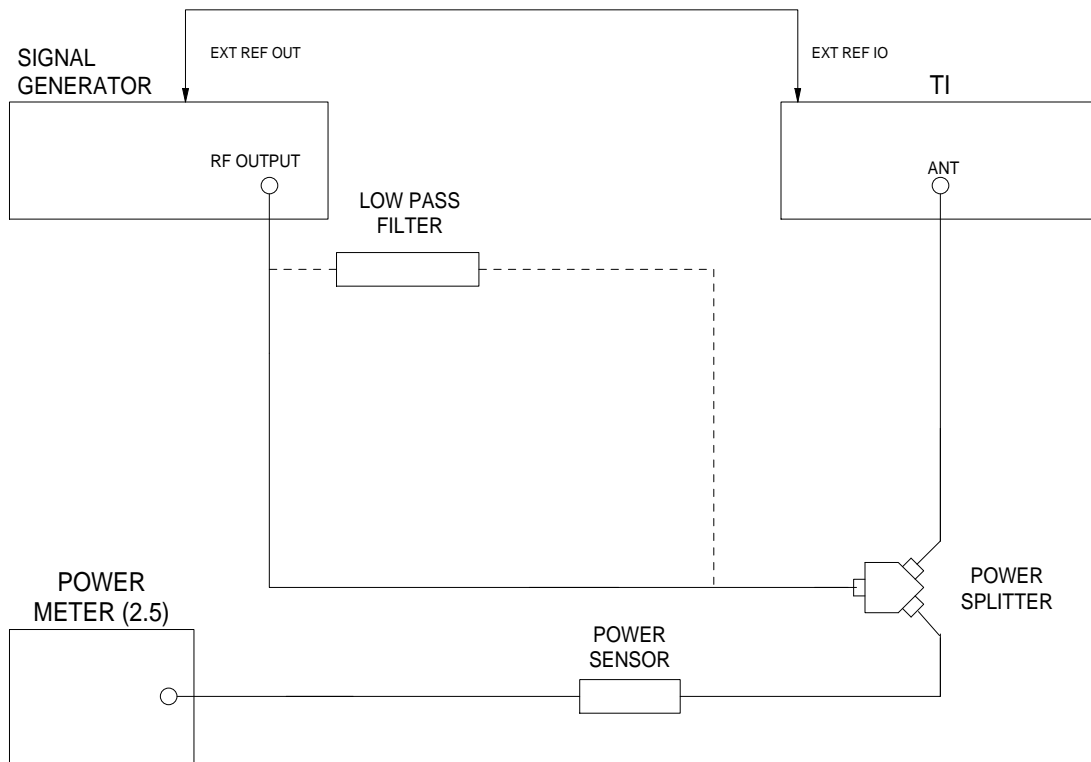


Figure 6.

4.17.8 Insert the Low Pass Filter between the Power Splitter and the Signal Generator.

4.17.9 Set the Signal Generator RF ON/OFF to ON.

4.17.10 Set the TI **FREQ** to *80 MHz*.

4.17.11 Verify the signal at 80 MHz is  $\leq -55$  dBc.

4.17.12 Verify any non-harmonic spurious is  $\leq -60$  dBc.

4.17.13 Set the Signal Generator RF ON/OFF button to OFF and disconnect test setup.

#### **4.18 SPECTRUM ANALYZER RESIDUAL SPURIOUS CALIBRATION:**

4.18.1 Repeat step 3.7 to restore the TI factory defaults.

4.18.2 Connect the Termination to the TI ANT connector.

4.18.3 Press the TI Spectrum Analyzer key and set the **SPAN** to *100 kHz* and **dBm** to *-40 dBm*. Set Input to *ANT*.

4.18.4 Set the TI FREQ to the first value listed in the Center Freq column of Table 21.

4.18.5 Verify the Residual Spurious is within the value listed in the Limits column of Table 21.

4.18.6 Repeat steps 4.18.4 and 4.18.5 for the remaining corresponding values listed in the Center Freq (MHz) column of Table 21.

*Table 21.*

Center Freq (MHz)	Limits (dBm)
1	$\leq -80$
10	$\leq -80$
30	$\leq -80$
100	$\leq -80$
300	$\leq -80$
1000	$\leq -80$
1500	$\leq -80$
2000	$\leq -80$
2700	$\leq -80$

4.18.7 Disconnect the Termination from the TI ANT connector.

**4.19 SPECTRUM ANALYZER LEVEL CALIBRATION:**

4.19.1 Repeat step 3.7 to restore the TI factory defaults.

4.19.2 Standardize Power Meter (2.5) and Power Sensor. Set the Power Meter (2.5) controls for a dBm measurement. Connect equipment as shown in Figure 7.

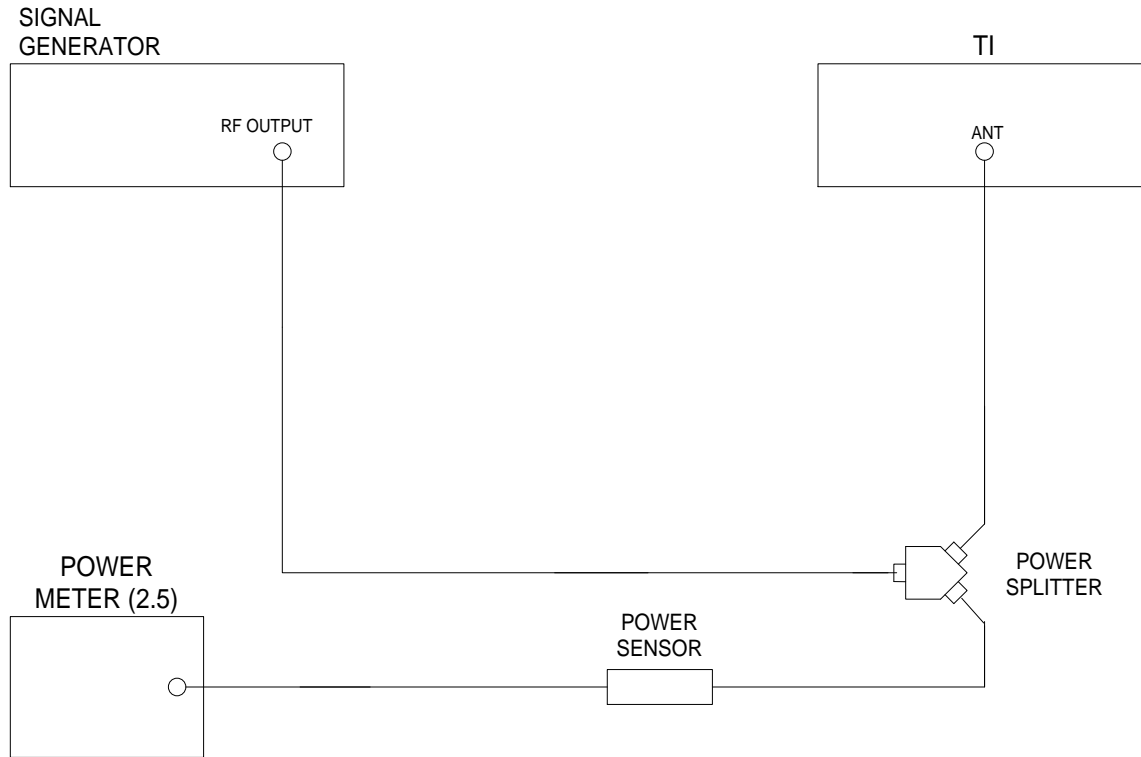


Figure 7.

4.19.3 Set the Power Meter (2.5) CAL FACTOR switch to the appropriate value for the frequency being verified.

4.19.4 Press the TI Spectrum Analyzer key then press the TI NORMAL key.

4.19.5 Set the TI **FREQ** to 1500 MHz and the **SPAN** to 100 kHz and **dBm** to -20 dBm. Set Input to ANT.

4.19.6 Set the Signal Generator for 1.5 GHz and adjust the output level for the peak of the signal to align with the -30.0 dBm graticule on the TI CRT.

4.19.7 Verify the Power Meter (2.5) indication is within -32 to -28 dBm.

4.19.8 Set the Signal Generator RF ON/OFF button to OFF and disconnect test setup.

**4.20 SPECTRUM ANALYZER LOG LINEARITY CALIBRATION:**

4.20.1 Repeat step 3.7 to restore the TI factory defaults.

■ 4.20.2 Connect the RF Reference Source through the Leveling Head and the Attenuator to the TI ANT.

■ 4.20.3 Set the RF Reference Source Frequency to 50 MHz and Level to 0.0 dBm.



4.20.4 Press the TI Spectrum Analyzer key. Set the TI **FREQ** to *50 MHz*, **SPAN** to *1 kHz* and **dBm** to *-20 dBm*. Set **Input** to *ANT*.

4.20.5 Adjust the RF Reference Source output level to place the peak of the signal at the top graticule line. Record the RF Reference Source Level indication.

4.20.6 Set the TI **dBm** to the next value listed in the Level column of Table 22.

4.20.7 Adjust the RF Reference Source Level to place the peak of the signal at the top graticule line. Record the RF Reference Source Level indication.

4.20.8 Algebraically subtract the value recorded in step 4.20.5 from the value recorded in step 4.20.7.

4.20.9 Verify the result of step 4.20.8 is within the values listed in the Limits column of Table 22.

*Table 22.*

<b>Level (dBm)</b>	<b>Limits (dB)</b>
-20	Reference
-30	-12 to -8
-40	-22 to -18
-50	-32 to -28
-60	-42 to -38
-70	-52 to -48
-80	-62 to -58

4.20.10 Repeat steps 4.20.6 through 4.20.9 for the remaining corresponding values listed in Table 22.

4.20.11 Set the RF Reference Source output to minimum and disconnect test setup.

#### **4.21 SPECTRUM ANALYZER ATTENUATOR CALIBRATION:**

4.21.1 Repeat step 3.7 to restore the TI factory defaults.

4.21.2 Connect the RF Reference Source through the Leveling Head to the TI T/R connector.

4.21.3 Press the TI Spectrum Analyzer key. Set the TI **FREQ** to *100 MHz*, **SPAN** to *1 kHz* and **dBm** to *+20 dBm*.

4.21.4 Select TI NORMAL key and wait for routine to finish.

4.21.5 Set the RF Reference Source Frequency to 100 MHz and Level to +10 dBm.

4.21.6 Adjust the RF Reference Source Level for the peak of the signal to align with the +10.0 dBm graticule on the TI CRT. Record the RF Reference Source output level indication.

4.21.7 Change the TI **dBm** to *+30 dBm* (this automatically increments the **ATTEN** setting by 10 dB).

4.21.8 Adjust the RF Reference Source Level for the peak of the signal to align with the +10.0 dBm graticule on the TI CRT. Record the RF Reference Source Level indication.

4.21.9 Repeat steps 4.21.7 and 4.21.8 for the remaining corresponding values listed in the TI Setting column of Table 23.

4.21.10 Algebraically subtract the previous recorded value from the current recorded value listed in the Reading column of Table 23.

4.21.11 Verify the results of step 4.21.10 are within -0.5 to +0.5 dB.

**Table 23.**

<b>TI Attenuator (dB)</b>	<b>TI Setting (dBm)</b>	<b>Limits (dB)</b>	<b>Reading</b>
0	20	Reference	_____
10	30	-0.5 to +0.5	_____
20	40	-0.5 to +0.5	_____
30	50	-0.5 to +0.5	_____
40	60	-0.5 to +0.5	_____

4.21.12 The cumulative error of any combination of the recorded values in Table 23 must not exceed  $\pm 1.0$  dB.

4.21.13 Set the RF Reference Source for minimum output and disconnect test setup.

**4.22 SPECTRUM ANALYZER RESIDUAL PHASE NOISE CALIBRATION:**

4.22.1 Repeat step 3.7 to restore the TI factory defaults.

4.22.2 Connect the Signal Generator RF OUT connector to the TI ANT connector.

4.22.3 Set the Signal Generator to -20 dBm at 1 GHz.

4.22.4 Press the TI Spectrum Analyzer key. Set the TI **FREQ** to *1000 MHz* and **SPAN** to *1 kHz*. Set Input to *ANT*.

4.22.5 Press the TI MODE and select **Receiver (TX Test)** and set **ATTEN** to *0 dB*. Press MODE and select **Spectrum Analyzer**.

4.22.6 Adjust the Signal Generator output level for the peak of the signal to align with the top graticule line on the TI CRT.

4.22.7 Set the TI **FREQ** to *1000.02 MHz* and **dBm** to *-40 dBm*.

4.22.8 Verify the signal level at center graticule line on the TI CRT is  $\leq -87.23$  dBm. Reduce TI **VBW** to *10 Hz* and increase the **SWEEP** to *10 s* to average the displayed noise.

**NOTE**

With an applied signal of -20 dBm, -92 dBc equates to an absolute level of -112 dBm. However, this is a noise measurement normalized to a 1 Hz bandwidth since the TI specification is  $\leq -92$  dBc/Hz. The test is performed with a TI Spectrum Analyzer RBW setting of 300 Hz, so the absolute level of -112 dBm must be corrected by  $10 \log(\text{RBW})$ , or 24.77 dB, to give the threshold of -87.23 dBm (equivalent to -92 dBc/Hz).

4.22.9 Set the Signal Generator for minimum output and disconnect test setup.

**4.23 SPECTRUM ANALYZER TRACKING GENERATOR OUTPUT FLATNESS CALIBRATION:**

4.23.1 Repeat step 3.7 to restore the TI factory defaults.

4.23.2 Press the TI Spectrum Analyzer key. Set the TI **SPAN** to *0 SPAN*. Press SHIFT MODE, select *Tracking Gen* and set the **TG LVL** to *+10 dBm*.

**NOTE**

If a partial box appears below and to the left of SLOPE, highlight the partial box and press *I*, *0* and ENTER. This will set **TG LVL** to +10 dBm.

4.23.3 Standardize Power Meter (2.5) and Power Sensor. Set the Power Meter (2.5) controls for a dBm measurement. Connect the Power Sensor to the TI GEN connector.

4.23.4 Set the TI **FREQ** to the first value listed in the Freq column of Table 24.

4.23.5 Set the Power Meter (2.5) CAL FACTOR switch to the appropriate value for the frequency being verified.

4.23.6 Record the Power Meter (2.5) indication.

4.23.7 Repeat steps 4.23.4 through 4.23.6 for the remaining corresponding values listed in Table 24.

4.23.8 Verify the algebraic difference between the highest and lowest point recorded in step 4.23.6 is  $\leq 2$  dBm.

**Table 24.**

<b>Freq (MHz)</b>	<b>Reading (dBm)</b>
10	_____
100	_____
200	_____
300	_____
400	_____
500	_____
600	_____
700	_____

**Table 24. (Cont.)**

Freq (MHz)	Reading (dBm)
800	_____
900	_____
1000	_____
1100	_____
1250	_____

4.23.9 Set the TI **TG LVL** to *-100 dB* and disconnect the test setup.

**4.24 OSCILLOSCOPE VERTICAL CALIBRATION:**

4.24.1 Repeat step 3.7 to restore the TI factory defaults.

4.24.2 Press the TI SCOPE.

4.24.3 Connect the Oscilloscope Calibrator through the active head to the TI SCOPE CH1. Set the OUTPUT to ON, channel load to 1 MΩ and set for a 1 kHz frequency output.

4.24.4 Set the TI **SWEEP** to *500 μs*. Set the TI **COUPLING** to *AC*.

4.24.5 Set the TI **V/div** to the first value listed in the Range column of Table 25.

4.24.6 Set the Oscilloscope Calibrator amplitude to the first value listed in the Applied column of Table 25.

4.24.7 Adjust the Oscilloscope Calibrator output control for the amount of vertical display listed first in the Deflection column of Table 25.

4.24.8 Verify the Oscilloscope Calibrator indicates within the values listed in the Limits column of Table 25.

4.24.9 Repeat steps 4.24.5 through 4.24.8 for the remaining corresponding values listed in Table 25.

4.24.10 Set the Oscilloscope Calibrator OUTPUT to OFF.

4.24.11 Disconnect the Active Head from the TI SCOPE CH1 and connect to the TI SCOPE CH2. Set the TI Trigger **SOURCE** to *CH2*. Set the Oscilloscope Calibrator amplitude to minimum and set the OUTPUT to ON.

**Table 25.**

Range (Volts/Div)	Applied (V p-p)	Deflection (Div)	Limits (V p-p)
0.02	120 m	6	104 to 136 m
0.05	300 m	6	260 to 340 m
0.1	600 m	6	520 to 680 m

*Table 25. (Cont.)*

<b>Range (Volts/Div)</b>	<b>Applied (V p-p)</b>	<b>Deflection (Div)</b>	<b>Limits (V p-p)</b>
0.2	1.2	6	1.04 to 1.36
0.5	3	6	2.60 to 3.40
1	6	6	5.20 to 6.80
2	12	6	10.4 to 13.6
5	30	6	26.0 to 34.0
10	60	6	52.0 to 68.0
20	120	6	104 to 136
50	150	3	110 to 190

4.24.12 Repeat steps 4.24.4 through 4.24.9 for the TI SCOPE CH2.

4.24.13 Set the Oscilloscope Calibrator OUTPUT to OFF and leave test setup connected.

#### **4.25 OSCILLOSCOPE HORIZONTAL SWEEP CALIBRATION:**

4.25.1 Set the TI **V/div** to *200 mV* and set the Oscilloscope Calibrator amplitude to 1 V p-p. Ensure the Oscilloscope Calibrator channel load is set to 1 M $\Omega$ . Set the Oscilloscope Calibrator OUTPUT to ON.

4.25.2 Set the TI **SWEEP** to the first value listed in the Range column of Table 26.

4.25.3 Set the Oscilloscope Calibrator marker output to the first value listed in the Range column of Table 26.

4.25.4 Adjust the Oscilloscope Calibrator deviation output control for one marker per division across the center 8 div on the TI CRT.

4.25.5 Verify the Oscilloscope Calibrator indicates within the values listed in the Limits column of Table 26.

4.25.6 Repeat steps 4.25.2 through 4.25.5 for the remaining corresponding values listed in Table 26.

*Table 26.*

<b>Range (Sec/Div)</b>	<b>Limits (%)</b>
10 $\mu$	-1.25 to +1.25
20 $\mu$	-1.25 to +1.25
50 $\mu$	-1.25 to +1.25
100 $\mu$	-1.25 to +1.25

Table 26. (Cont.)

Range (Sec/Div)	Limits (%)
200 $\mu$	-1.25 to +1.25
500 $\mu$	-1.25 to +1.25
1 m	-1.25 to +1.25
2 m	-1.25 to +1.25
5 m	-1.25 to +1.25
10 m	-1.25 to +1.25
20 m	-1.25 to +1.25
50 m	-1.25 to +1.25
100 m	-1.25 to +1.25
200 m	-1.25 to +1.25
500 m	-1.25 to +1.25
1	-1.25 to +1.25

4.25.7 Set the Oscilloscope Calibrator OUTPUT to OFF.

4.25.8 Set all outputs to minimum and disconnect test setup.

**4.26 AUDIO FREQUENCY GENERATOR AMPLITUDE CALIBRATION:**

4.26.1 Repeat step 3.7 to restore the TI factory defaults.

4.26.2 Connect equipment as shown in Figure 8.

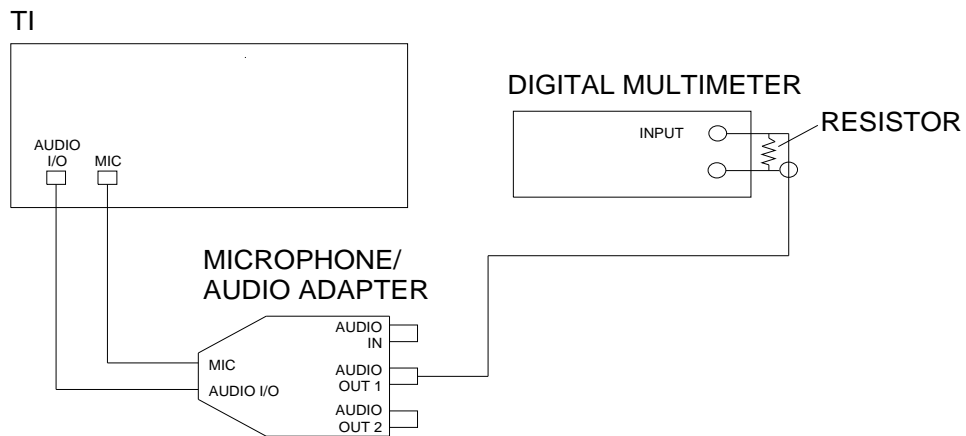


Figure 8.

4.26.3 Press the TI Function Generator key.

4.26.4 Set the TI **FGEN1** to *TONE*. Set the **AUDIO ROUTE** for **Audio Out #1 FGEN1** to *ON* and **FGEN2** to *OFF* then select **CLOSE**.

4.26.5 Set the TI **FREQ** to the first value listed in the Freq column of Table 27.

4.26.6 Set the TI **LVL** to the first value listed in the Applied column of Table 27.

4.26.7 Verify the Digital Multimeter indication is within the values listed in the Limits column of Table 27.

4.26.8 Repeat steps 4.26.4 through 4.26.7, as necessary, for the remaining corresponding values listed in Table 27.

*Table 27.*

<b>Freq (kHz)</b>	<b>Applied (V p-p)</b>	<b>Limits (V rms)</b>
1	20	6.85894 to 7.28320
	18	6.17304 to 6.55488
	16	5.48715 to 5.82656
	14	4.80126 to 5.09824
	12	4.11536 to 4.36992
	10	3.42947 to 3.64160
	7	2.40063 to 2.54912
	4.4	1.50897 to 1.60230
	2	0.68589 to 0.72832
4	550 m	0.18473 to 0.20418
	20	6.71751 to 7.42462
	18	6.04576 to 6.68216
	16	5.37401 to 5.93970
	14	4.70226 to 5.19723
	12	4.03051 to 4.45477
	10	3.35876 to 3.71231
	7	2.35113 to 2.59862
	4.4	1.47785 to 1.63342

*Table 27. (Cont.)*

<b>Freq (kHz)</b>	<b>Applied (V p-p)</b>	<b>Limits (V rms)</b>
4	2	0.67175 to 0.74246
	550 m	0.18473 to 0.20418
7.5	20	6.01041 to 8.13173
	18	5.40937 to 7.31856
	16	4.80833 to 6.50538
	14	4.20729 to 5.69221
	12	3.60624 to 4.87904
	10	3.00520 to 4.06586
	7	2.10364 to 2.84610
	4.4	1.32229 to 1.78898
	2	0.60104 to 0.81317
	550 m	0.16529 to 0.22362

4.26.9 Set the TI **FGEN1** to *OFF* and **FGEN2** to *TONE*. Set the **AUDIO ROUTE** for **Audio Out #1** **FGEN1** to *OFF* and **FGEN2** to *ON* then select **CLOSE**.

4.26.10 Repeat steps 4.26.5 through 4.26.8 for **FGEN2**.

4.26.11 Set the TI **AUDIO ROUTE** for **Output Level** to *BALAN* then select **CLOSE**.

4.26.12 Set the TI **FREQ** to *1 kHz*.

4.26.13 Set the TI **LVL** to the first value listed in the Applied column of Table 28.

4.26.14 Verify the Digital Multimeter indication is within the first values listed in the Limits of Table 28.

4.26.15 Repeat steps 4.26.13 and 4.26.14 for the remaining corresponding values listed in Table 28.

*Table 28.*

<b>Applied (V p-p)</b>	<b>Limits (V rms)</b>
20	6.36396 to 7.77817
18	5.72756 to 7.00036
16	5.09117 to 6.22254
14	4.45477 to 5.44472



**Table 28. (Cont.)**

<b>Applied (V p-p)</b>	<b>Limits (V rms)</b>
12	3.81838 to 4.66690
10	3.18198 to 3.88909
7	2.22739 to 2.72236
4.4	1.40007 to 1.71120
2	0.63640 to 0.77782
550 m	0.17501 to 0.21390

4.26.16 Set the TI **AUDIO ROUTE** for **Output Level** to *x0.1* then select **CLOSE**.

4.26.17 Repeat steps 4.26.13 through 4.26.15 using Table 29.

**Table 29.**

<b>Applied (V p-p)</b>	<b>Limits (V rms)</b>
550 m	0.01750 to 0.02139
500 m	0.01591 to 0.01945
400 m	0.01273 to 0.01556
300 m	9.546 to 11.667 m
200 m	6.364 to 7.778 m
100 m	3.182 to 3.889 m
55 m	1.750 to 2.139 m

4.26.18 Set the TI **AUDIO ROUTE** for **Output Level** to *x1* then select **CLOSE**.

4.26.19 Set the TI **FGEN1** to *TONE* and **FGEN2** to *OFF*. Set the **AUDIO ROUTE** for **Audio Out #1 FGEN1** to *ON* and **FGEN2** to *OFF* then select **CLOSE**.

4.26.20 Repeat steps 4.26.12 through 4.26.17 for **FGEN1**.

4.26.21 Set **FGEN1** to *OFF* and disconnect test setup.

#### **4.27 AUDIO FREQUENCY GENERATOR DISTORTION CALIBRATION:**

4.27.1 Repeat step 3.7 to restore the TI factory defaults.

4.27.2 Connect equipment as shown in Figure 9.

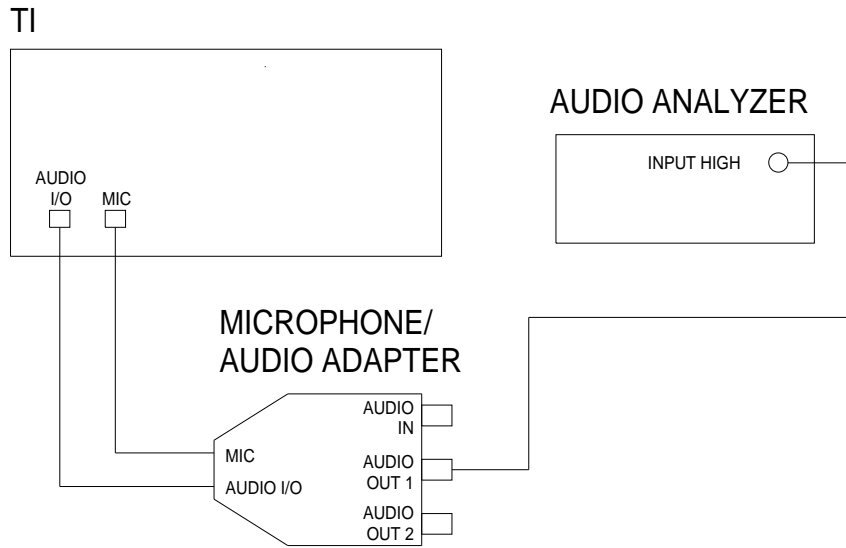


Figure 9.

4.27.3 Press the TI Function Generator key.

4.27.4 Set the TI **FGEN1** to *TONE*. Set the **AUDIO ROUTE** for **Audio Out #1 FGEN1** to *ON* and **FGEN2** to *OFF* then select **CLOSE**. Set the **LVL** to *3 Vpp*.

4.27.5 Set the Audio Analyzer MEASUREMENT to *DISTN*.

4.27.6 Set the TI **FREQ** to the first value listed in the Freq column of Table 30.

4.27.7 Verify the Audio Analyzer indication is within the first value listed in the Limits column of Table 30.

4.27.8 Repeat steps 4.27.6 through 4.27.7 for the remaining corresponding values listed in Table 30.

**Table 30.**

<b>Freq (Hz)</b>	<b>Limits (THD)</b>
20	<2.0%
100	<2.0%
1 k	<0.5%
10 k	<2.0%
20 k	<2.0%

4.27.9 Set the TI **FGEN1** to *OFF* and **FGEN2** to *TONE*. Set the **AUDIO ROUTE** for **Audio Out #1 FGEN1** to *OFF* and **FGEN2** to *ON* then select **CLOSE**. Set the **LVL** to *3 Vpp*.

4.27.10 Repeat steps 4.27.6 through 4.27.8 for **FGEN2**.

4.27.11 Set the TI **FGEN2** to *OFF* and disconnect test setup.

**4.28 AUDIO FREQUENCY GENERATOR FREQUENCY CALIBRATION:**

4.28.1 Repeat step 3.7 to restore the TI factory defaults.

4.28.2 Connect equipment as shown in Figure 10.

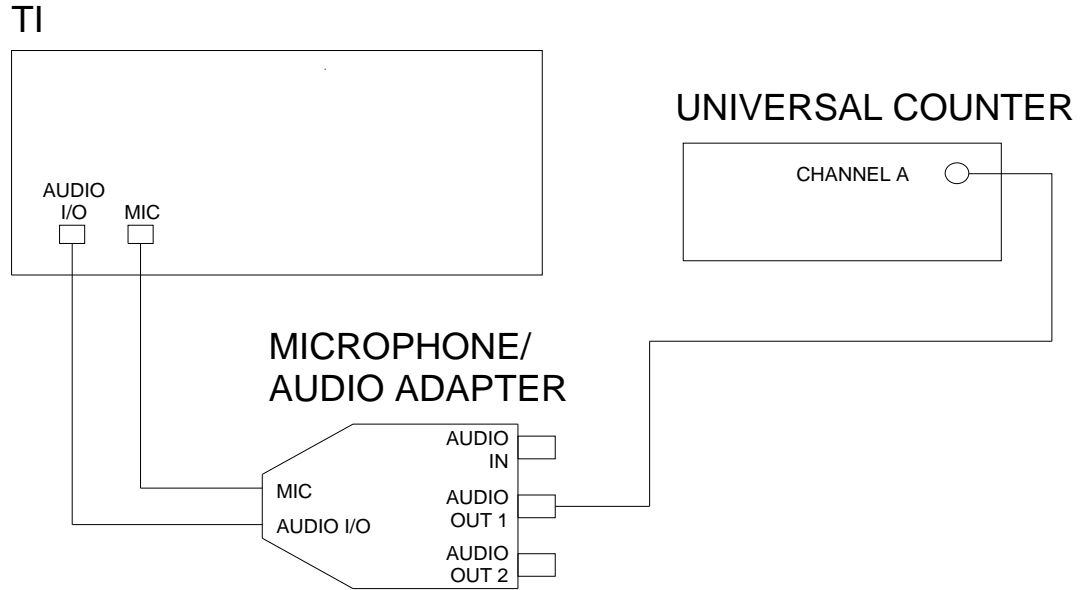


Figure 10.

4.28.3 Press the TI Function Generator key.

4.28.4 Set the TI **FGEN1** to *TONE*. Set the **AUDIO ROUTE** for **Audio Out #1 FGEN1** to *ON* and **FGEN2** to *OFF* then select **CLOSE**. Set the **LVL** to *1 Vpp*.

4.28.5 Set the TI **FREQ** to the first value listed in the Freq column of Table 31.

4.28.6 Verify the Universal Counter indication is within the first value listed in the Limits column of Table 31.

4.28.7 Repeat steps 4.28.5 through 4.28.6 for the remaining corresponding values listed in Table 31.

**Table 31.**

<b>Freq (Hz)</b>	<b>Limits (Hz)</b>
10	9 to 11
100	99 to 101
1 k	999 to 1 001
10 k	9 999 to 10 001
20 k	19 999 to 20 001

4.28.8 Set the TI **FGEN1** to *OFF* and **FGEN2** to *TONE*. Set the **AUDIO ROUTE** for **Audio Out #1** **FGEN1** to *OFF* and **FGEN2** to *ON* then select **CLOSE**.

4.28.9 Repeat steps 4.28.5 through 4.28.7 for **FGEN2**.

4.28.10 Set the TI **FGEN2** to *OFF* and disconnect test setup.

**4.29 DIGITAL VOLTMETER CALIBRATION:**

4.29.1 Repeat step 3.7 to restore the TI factory defaults.

4.29.2 Connect the Meter Calibrator output to the TI DVM connector.

4.29.3 Press the TI Receiver key. Set the TI **Options** to *DVM*.

4.29.4 Set the TI **DVM Range** to the first value listed in the Range column of Table 32.

4.29.5 Set the Meter Calibrator to the first values listed in the Frequency and Applied columns of Table 32. Set the Meter Calibrator OPR/STBY key to OPR.

4.29.6 Verify the TI indication is within the values listed in the Limits column of Table 32. Set the Meter Calibrator OPR/STBY key to STBY.

4.29.7 Repeat steps 4.29.4 through 4.29.6 for the remaining corresponding values listed in Table 32.

*Table 32.*

<b>Range (V)</b>	<b>Frequency (kHz)</b>	<b>Applied (VAC)</b>	<b>Limits (V rms)</b>
0.4	20	0.36	0.33 to 0.39
1	1	0.9	0.84 to 0.96
1	1	0.7	0.64 to 0.76
1	1	0.3	0.24 to 0.36
1	10	0.9	0.84 to 0.96
1	10	0.7	0.64 to 0.76
1	10	0.3	0.24 to 0.36
1	20	0.9	0.84 to 0.96
1	20	0.7	0.64 to 0.76
1	20	0.3	0.24 to 0.36
2	20	1.8	1.68 to 1.92
4	20	3.6	3.36 to 3.84

**Table 32. (Cont.)**

<b>Range (V)</b>	<b>Frequency (kHz)</b>	<b>Applied (VAC)</b>	<b>Limits (V rms)</b>
10	20	9	8.39 to 9.61
20	20	18	16.79 to 19.21
40	20	36	33.59 to 38.41
100	20	90	83.9 to 96.1

4.29.8 Set the TI **DVM** to *DC*.

4.29.9 Set the TI **DVM Range** to the first value listed in the Range column of Table 33.

4.29.10 Set the Meter Calibrator to the first value listed in the Applied column of Table 33. Set the Meter Calibrator OPR/STBY key to OPR.

4.29.11 Verify the TI indication is within the first values listed in the Limits column of Table 33. Set the Meter Calibrator OPR/STBY key to STBY.

4.29.12 Repeat steps 4.29.9 through 4.29.11 for the remaining corresponding values listed in Table 33.

**Table 33.**

<b>Range (V)</b>	<b>Applied (VDC)</b>	<b>Limits (VDC)</b>
0.4	0.36	0.34 to 0.38
1	0.9	0.88 to 0.92
1	0.7	0.68 to 0.72
1	0.3	0.28 to 0.32
2	1.8	1.76 to 1.84
4	3.6	3.52 to 3.68
10	9	8.79 to 9.21
20	18	17.59 to 18.41
40	36	35.19 to 36.81
100	90	87.9 to 92.1

4.29.13 Disconnect test setup.

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

4.29.15 Annotate and attach a Limited Certification Label per step 3.9, if applicable.

CALIBRATION PERFORMANCE TABLE

Not Required

**APPENDIX A****A-1 LOW PASS FILTER VERIFICATION:****NOTE**

In step A-1.1, select the Signal Generator (Signal Source) listed in the Equipment Requirements.

- A-1.1 Connect the Signal Source through the Low Pass Filter being verified to the Spectrum Analyzer RF INPUT 50  $\Omega$  connector.
- A-1.2 Set the Signal Source frequency to the CF for the Low Pass Filter listed in the Equipment Requirements. Set the amplitude to 0 dBm.
- A-1.3 On the Spectrum Analyzer, set the FREQUENCY to the CF for the Low Pass Filter listed in the Equipment Requirements.
- A-1.4 Set the Spectrum Analyzer SPAN as necessary to view the signal with a baseline  $\geq 60$  dB from the top graticule line.
- A-1.5 Press the Spectrum Analyzer PEAK SEARCH, MKR $\rightarrow$  and MARKER $\rightarrow$ CF buttons.
- A-1.6 Press the Spectrum Analyzer PEAK SEARCH, MKR $\rightarrow$ , MARKER $\rightarrow$ REF LVL and MARKER  $\Delta$  buttons.
- A-1.7 Ensure the signal displayed on the Spectrum Analyzer CRT is at the top graticule line with a baseline  $\geq 60$  dB from the top graticule line. If the baseline is not  $\geq 60$  dB down from the top graticule line, set the Spectrum Analyzer SPAN and RES BW controls as necessary and repeat steps B-1.5 and B-1.6.
- A-1.8 Set the Signal Source frequency and Spectrum Analyzer FREQUENCY to 2 X CF listed in the Equipment Requirements.
- A-1.9 Press the Spectrum Analyzer PEAK SEARCH. Verify the Spectrum Analyzer MKR  $\Delta$  indicates  $\geq$  the rejection listed in the Equipment Requirements for the Low Pass Filter being verified.

