

TECHNICAL MANUAL
CALIBRATION PROCEDURE
FOR
SPECTRUM ANALYZER
2390A

(IFR)

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T.O. 33K3-4-3353-1

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SPECTRUM ANALYZER**2390A****(IFR)****1 CALIBRATION DESCRIPTION:***Table 1.*

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency Accuracy		
Reference Oscillator	Range: 100 MHz Accuracy: Accuracy: $\pm 2 \times 10^{-6}$ in the first year; * ¹ $\pm 1 \times 10^{-6}$ every year thereafter; * ¹ Aging/year: $\pm 2 \times 10^{-6}$ in the first year; $\pm 1 \times 10^{-6}$ every year thereafter; Temperature: $< 2 \times 10^{-7}$ * ²	Verified during Ref Out Calibration
Ref Out	Range: Frequency: 100 MHz Accuracy: Same as Reference Oscillator Range: Amplitude: -30 dBm Accuracy: ± 0.5 dB	Compared to a Frequency Standard Measured with Power Meter and Power Sensor
Frequency Readout Accuracy	Range: 0 Hz to 22 GHz Accuracy: $\pm(3\%$ of Span Width + Reference Oscillator Accuracy + 50% of RBW)	Compared to a known frequency
Frequency Span Width	Range: 0 Hz; 100 Hz to 22 GHz; 10 Hz/div to 2.2 GHz/div in FULL SPAN; 0 Hz to 22 GHz in Start/Stop Accuracy: $\pm 5\%$ of indicated Span	

 See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency Counter	Range: 0 Hz to 22 GHz; Resolution from 1 Hz to 1 kHz in decade steps Accuracy: \pm (Reference Oscillator + Counter Resolution); Sensitivity: (at 120 MHz with 0 dB attenuation) \leq -85 dBm with 3 kHz RBW; \leq -65 dBm with 5 MHz RBW	Frequency compared to a known frequency. Sensitivity compared to a known signal level
Average Noise Level	Range: 9 kHz to 22 GHz; 3 Hz RBW with VBW N/A; 300 Hz RBW and 10 Hz VBW Accuracy: 300 Hz RBW and 10 Hz VBW: \leq -95 dBm, 9 to 100 kHz; \leq -115 dBm, 100 kHz to 2.9 GHz; \leq -110 dBm, 2.9 to 12 GHz; \leq -105 dBm, 12 to 22 GHz 3 Hz RBW with VBW N/A: \leq -115 dBm, 9 to 100 kHz; \leq -135 dBm, 100 kHz to 2.9 GHz; \leq -130 dBm, 2.9 to 12 GHz; \leq -125 dBm, 12 to 22 GHz	Measured on TI
Display Linearity	Range: 1, 2, 5, 10 dB/div and Linear Accuracy: 5 or 10 dB/div: \pm 0.15 dB/dB * ³ , \leq \pm 1.5 dB over 8 div; 1 or 2 dB/div: \pm 0.5 dB over 8 div; Linear: \pm 2% of Reference Level over 8 div, RBW \leq 5 MHz; \pm 10% of Reference Level over 8 div with RBW 10 and 30 MHz and Attenuation coupled to Reference Level	Compared to a known signal level
IF Gain	Range: <10 MHz RBW and 0 dB Attenuation: -95 to +30 dBm Accuracy: \pm 0.25 dB, -40 to -20 dBm; \pm 0.5 dB, -85 to -40 dBm	

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
IF Gain <i>(Cont.)</i>	Range: 10 and 30 MHz RBW: -50 to +30 dBm Accuracy: ± 2 dB	Compared to a known signal level
Attenuator	Range: 0 to 60 dB Accuracy: ± 0.5 dB or $\pm 2\%$ of dB setting, whichever is greater, 9 kHz to 2.9 GHz; ± 1 dB or $\pm 4\%$ of dB setting, whichever is greater, 2.9 to 18 GHz; ± 1.5 dB or $\pm 7\%$ of setting, whichever is greater, 18 to 22 GHz	
Frequency Response	Range: 9 kHz to 22 GHz (10 dB Attenuation, peaking after >2.9 GHz, referenced to REF OUT connector and peak of RBW filter response) Accuracy: ± 1.5 dB, 9 kHz to 2.9 GHz; ± 2.0 dB, 2.9 to 12 GHz; ± 3.0 dB, 12 to 18 GHz; ± 4.0 dB, 18 to 22 GHz	
Resolution Bandwidth	Range: 3, 10, 30, 100 and 300 Hz, 3, 30 and 300 kHz, 5 MHz; 10 and 30 MHz (Linear display and FM modes) Accuracy: (All specifications are at 3 dB) 300 Hz to 30 kHz, $\pm 20\%$ of RBW setting; 300 kHz to 30 MHz, $\pm 30\%$ of RBW setting	-3 dB points are measured on TI
Selectivity	Range: 60 dB to 3 dB ratio with the exception of 50 dB to 3 dB ratio for 300 Hz RBW Accuracy: <5:1, 3 kHz to 5 MHz RBW; <10:1, 300 Hz RBW	-60 dB (-50 dB for 300 Hz RBW) Bandwidth is measured, then divided by the -3 dB Bandwidth
Resolution Bandwidth Switching Error	Range: 3, 10, 30, 100 and 300 Hz, 3, 30 and 300 kHz, 5 MHz; 10 and 30 MHz (Linear display and FM modes) Accuracy: (referenced to 30 kHz RBW) ± 0.5 dB, 3 kHz to 5 MHz RBW; ± 1.0 dB, ≤ 300 Hz RBW; * ⁴ ± 2.0 dB, 10 and 30 MHz RBW	Measured on TI

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Sweep Time	Range: Span = 0: resolution reduced <2 μ s/div, 200 ns to 10 s/div in a 1-2-5 sequence Accuracy: $\pm 1\%$ of FS, ≥ 2 μ s/div	Compared to a known signal
Residual Responses	Range: 9 kHz to 22 GHz (Input terminated with 50 Ω , 0 dB Attenuation) Accuracy: ≤ -90 dBm, 9 to 100 kHz; ≤ -100 dBm, 100 kHz to 22 GHz * ⁵	Measured on TI
Residual FM	Range: 10 Hz to 22 GHz (p-p in 20 ms, Spans <1 MHz/div, 100 Hz VBW) Accuracy: <10 Hz to <6 GHz; <20 Hz, 6 to 12 GHz; <40 Hz, 12 to 22 GHz	Signal is applied to TI and Residual FM is measured
Noise Sidebands	Range: 0.1 to 22 GHz (Spans ≤ 100 kHz/div, at 10 and 30 kHz offset) Accuracy: 10 kHz Offset: 0.1 to 1 GHz, ≤ -97 dBc/Hz; 1 to 2.8 GHz, ≤ -92 dBc/Hz; 2.8 to 6 GHz, ≤ -93 dBc/Hz; 6 to 12 GHz, ≤ -88 dBc/Hz; 12 to 22 GHz, ≤ -81 dBc/Hz; 30 kHz Offset: 0.1 to 1 GHz, ≤ -101 dBc/Hz; 1 to 2.8 GHz, ≤ -95 dBc/Hz; 2.8 to 6 GHz, ≤ -100 dBc/Hz; 6 to 12 GHz, ≤ -95 dBc/Hz; 12 to 22 GHz, ≤ -88 dBc/Hz	Signal is applied to TI and Noise Sidebands are measured
Harmonic Distortion	Range: Band 0 (9 kHz to 2.9 GHz) with -30 dBm input and 10 dB Attenuation; Bands 1 and 2 (2.6 to 22 GHz) with -10 dBm input and 10 dB Attenuation Accuracy: Band 0, ≤ -70 dBc; Bands 1 and 2, ≤ -100 dBc	Signal applied through filters. Harmonic Distortion is then measured

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Third Order Intermodulation Distortion	Range: 9 kHz to 22 GHz (-30 dBm input and 10 dB Attenuation) Accuracy: <9 GHz and >12 GHz, ≤ -80 dBc; 9 to 12 GHz, ≤ -75 dBc	Two signals at specific offsets are applied to TI. Third Order Intermodulation Distortion is then measured
Scope Mode Amplitude	Range: 5 mV to 5 V/div in 1-2-5 sequence Accuracy: $\pm 3\%$ FS at 1 kHz	Compared to a known signal level
Bandwidth	Range: DC to ≥ 5 MHz Accuracy: Down not more than 3 dB at sweep time ≤ 2 μ s/div	Apply a constant amplitude signal while changing frequency. Vertical deflection compared to deflection at reference frequency

*¹ 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.

*² Typical or operational specification. Not calibrated.

*³ Manufacturer specification is ± 0.15 dB/dB. However, the TI will be certified to ± 0.2 dB/dB due to the TI resolution.

*⁴ See step 3.13.

*⁵ See step 3.14.

2 EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1 FREQUENCY STANDARD	Range: 10 MHz Accuracy: $\leq 2.5 \times 10^{-7}$	Arbiter 1083B	Austron 2100F
2.2 MEASURING RECEIVER w/ SENSOR MODULE	Range: 100 MHz Accuracy: ± 1 count of LSD	Agilent N5531S w/N5532A OPT 504	
2.3 SYNTHESIZED SWEEPER	Range: 50 MHz to 22 GHz, -85 to -10 dBm Accuracy: ± 1 count of LSD	Hewlett-Packard 8340B	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.3 SYNTHESIZED SWEEPER <i>(Cont.)</i>	Range: 60 MHz to 18 GHz Accuracy: Frequency: $\pm 1.56\%$ Range: Signal Sideband Phase Noise at 2.4999 GHz and 50 kHz offset Accuracy: ≤ -86 dBc/Hz	Hewlett-Packard 8340B	
2.4 POWER SENSOR	Range: 100 MHz, -31 to -29 dBm Accuracy: $\pm 3.5\%$ of charted value *	Hewlett-Packard 8484A	
2.5 POWER SENSOR	Range: 50 MHz to 22 GHz, -30 to -10 dBm Accuracy: (all % are of charted value) $\pm 3.5\%$, 50 to 100 MHz; $\pm 3.3\%$, 100 MHz to 2 GHz; $\pm 3.4\%$, 2 to 8 GHz; $\pm 3.8\%$, 8 to 12 GHz; $\pm 4.1\%$, 12 to 18 GHz; $\pm 4.4\%$, 18 to 22 GHz	Hewlett-Packard 8485A	
2.6 POWER SPLITTER	Range: 9 kHz to 22 GHz Accuracy: Tracking: ≤ 0.25 dB, 9 kHz to 18 GHz; ≤ 0.40 dB, 18 to 22 GHz	Hewlett-Packard 11667B	
2.7 FREQUENCY SYNTHESIZER	Range: 600 Hz to 14 MHz sinewave at -30 dBm Accuracy: Frequency: $\pm 1.56\%$ Range: 0.01 Hz to 50 kHz triangle wave from 0 to 1.14 V p-p Accuracy: Frequency: $\pm 0.25\%$ Range: 1 kHz to 5 MHz sinewave at 4 V p-p Accuracy: Flatness: ± 0.42 dB	Hewlett-Packard 3325B	

See footnote at end of Equipment Requirements.

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.8 SYNTHESIZED LEVELED GENERATOR	Range: -75 to +13 dBm, 50 MHz Accuracy: ±0.025 dB, +4.01 to +13.01 dBm; ±0.031 dB, -5.99 to +3.01 dBm; ±0.041 dB, -25.99 to -6.99 dBm; ±0.061 dB, -45.99 to -26.99 dBm; ±0.081 dB, -55.99 to -46.99 dBm; ±0.091 dB, -65.99 to -56.99 dBm; ±1.01 dB, -75.00 to -66.99 dBm Range: 9 kHz to 50 MHz (Flatness) Accuracy: ±0.375 dB	Hewlett-Packard 3335A	
2.9 POWER METER	Range: -30 to -10 dBm, 50 MHz to 22 GHz Accuracy: ±2% of indication *	Hewlett-Packard 436A	
2.10 TERMINATION	Range: 50 Ω, 9 kHz to 22 GHz Accuracy: N/A	Hewlett-Packard 908A	
2.11 SIGNAL GENERATOR	Range: 40 MHz to 2.95 GHz, -30 to 0 dBm Accuracy: SSB Phase Noise: 500 MHz at 10 kHz offset, ≤-135 dBc/Hz; 2 GHz at 10 kHz offset, ≤-123 dBc/Hz; 2.9 GHz at 10 kHz offset, ≤-119 dBc/Hz; Harmonics: ≤-30 dBc at 0 dBm	Hewlett-Packard 8664A OPT H15	
2.12 LOW PASS FILTER	Range: Cutoff >40 MHz; Rejection >50 dB at 80 MHz Accuracy: Verify before use	Hewlett-Packard 0955-0306	
2.13 LOW PASS FILTERS (2 EA)	Range: Cutoff >2.95 GHz; Rejection >50 dB at 5.9 GHz Accuracy: Verify before use	Hewlett-Packard 360D	RCL Electronics L1411

See footnote at end of Equipment Requirements.

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.14 ATTENUATOR	Range: 20 dB at 50 MHz Accuracy: N/A	Hewlett-Packard 8491B OPT 020	
2.15 ATTENUATOR (2 EA)	Range: 10 dB, 50 MHz to 2.5 GHz Accuracy: N/A	Hewlett-Packard 8491B OPT 010	
2.16 CALIBRATION GENERATOR	Range: 20 m to 20 V p-p Accuracy: 1.5% of applied	Tektronix PG506A	
2.17 SPECTRUM ANALYZER	Range: 40 MHz to 5.9 GHz, -70 to 0 dBm Accuracy: ±1.6 dB	Hewlett-Packard 8563E	
2.18 FEEDTHROUGH TERMINATION	Range: 50 Ω, 1 kHz to 5 MHz Accuracy: ±2% of nominal	Tektronix 011-0049-01	
2.19 STEP ATTENUATOR	Range: 0 to 11 dB, 50 MHz Accuracy: N/A	Hewlett-Packard 8494B	
2.20 STEP ATTENUATOR	Range: 0 to 10 dB, 50 MHz Accuracy: N/A	Hewlett-Packard 8496B	

* A TAR of 2.7:1 is achieved by the RSS (Root Sum Square) value of the Power Meter and Power Sensor (2.4) for the TI REF OUT Calibration.

3 PRELIMINARY OPERATIONS:

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



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 TI to appropriate power source. Set TI Main Power switch (rear panel) to \uparrow . Set TI SUPPLY switch (front panel) to illuminate the SUPPLY \uparrow indicator.

3.3 TI will initiate a Power-up Self Test. A normal functioning TI will beep and display the IFR logo briefly before entering the Center Frequency Operation Screen. If an error message is displayed, this indicates an abnormal condition. If this occurs, set TI SUPPLY switch (front panel) to illuminate the SUPPLY \downarrow indicator. Wait about 30 seconds, then set TI SUPPLY switch (front panel) to illuminate the SUPPLY \uparrow indicator. If the error re-occurs, refer to appropriate Commercial Data for corrective action.

3.4 Allow the TI a 1 hour warm-up period.

3.5 Connect all test equipment to appropriate power source. Set all POWER switches to ON or STBY and allow a warm-up period as required by the manufacturer.

3.6 Multiple firmware versions may exist for TIs covered by this Calibration Procedure. This may require variations of softkeys, menus, keystrokes, pathways, steps or etc. to achieve setting of the TI to the required state/configuration. These variations are permitted provided the required state/configuration is maintained. Technicians may need to consult the Commercial Data and become familiar with the softkeys, menus, keystrokes, pathways, steps or etc. to activate the exact TI state/configuration required by each respective step in the Calibration Procedure prior to performing the Calibration Process. These variations do not constitute changes required to the Calibration Procedure.

3.7 This procedure identifies the Hardkeys in bold and the Softkeys (Menu keys) in Italics. Values shall be entered by use of the DATA key pad. For example: Press TI **AMPLITUDE BW**, *VBW* and set to 30 **k**. The **AMPLITUDE BW** key is a Hardkey, the *VBW* is a Softkey (Menu key), the 3 and 0 are entries using the DATA key pad, then push the **k** key which is also a part of the DATA keys. The TI **x1** key is for singular entries (for example, Hz, s or dB) and will reflect the value appropriately.

3.8 Perform TI Self Test as follows:

3.8.1 Press TI **UTILITY**, then *DIAG*.

3.8.2 Using the TI \uparrow , \downarrow , \leftarrow and \rightarrow keys and the TI Control Knob, select the first test listed on the TI screen.

3.8.3 Press TI *TEST*.

3.8.4 Once the TI is finished, verify the test status indicates PASSED on the TI screen.

3.8.5 Repeat steps 3.8.2 through 3.8.4 for each remaining test listed on the TI screen.

3.8.6 Press TI *RETURN* as necessary to return to the TI Utility menu.

3.9 Set the TI controls as follows:

UTILITY

3

ENTER

5

ENTER

↑ or ↓

To toggle the TIME
CALIBRATION to ENABLED

ENTER

3.10 Make copies of Tables 7, 8, 19 and 20 for use as Calibration Worksheets.

3.11 Due to the lack of suitable standards, the TI Residual FM and Noise Sidebands will be verified to 6 GHz. Attach a Limited Certification Label to the TI stating Residual FM and Noise Sidebands are certified to 6 GHz only.

3.12 Due to the resolution of the TI, the Display Linearity for the 5 and 10 dB/div will be verified to ± 0.2 dB/dB. Attach a Limited Certification Label to the TI stating Display Linearity for 5 dB/div and 10 dB/div are certified to ± 0.2 dB/dB.

3.13 Annotate and attach a Limited Certification Label stating: Resolution Bandwidth Switching Error is not certified below 300 Hz RBW.

3.14 Annotate and attach a Limited Certification Label stating: Residual Response is certified to 5.8 GHz only.

3.15 Verify the Low Pass Filters in accordance with Appendix B.

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 REF OUT CALIBRATION:

4.1.1 Connect the Frequency Standard 10 MHz REF OUT to the Measuring Receiver EXT REF IN. Set the Measuring Receiver controls as required for use of an external frequency reference.

4.1.2 Connect the TI REF OUT connector through the Sensor Module to the Measuring Receiver.

4.1.3 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.1.4 Set the Measuring Receiver to Frequency Counter mode and enter a frequency of 100 MHz.

NOTE

The values in the following step 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.

4.1.5 Verify the Measuring Receiver RF Freq Error indication is ± 200 Hz ± 1 count of LSD if the TI is within the first year of service and ± 100 Hz ± 1 count of LSD thereafter.

4.1.6 Set the Measuring Receiver for internal reference and disconnect the test setup.

4.1.7 To ensure reliability of the TI, the following action will be taken: If the TI passed the above steps, perform the applicable adjustment steps in Appendix A, and enter NO ADJUSTMENT ACTION into the Maintenance Data Collection System. If the TI failed, perform the applicable steps listed in Appendix A and enter appropriate ADJUSTMENT ACTION into the Maintenance Data Collection System.

4.1.8 Connect the TI REF OUT to the TI ANALYZER INPUT connector.

4.1.9 Set the TI controls as follows:

FREQUENCY CENTER	100 M
AMPLITUDE SCALE	1 x1
FREQUENCY SPAN	200 k
AMPLITUDE REF	

4.1.10 Adjust the TI Control Knob to place the peak of the displayed signal at a convenient reference line.

4.1.11 Remove the cable from the TI REF OUT connector and connect to the Synthesized Sweeper RF OUT connector.

4.1.12 Set the Synthesized Sweeper to 100 MHz and adjust the output controls to place the peak of the signal at the same reference set in step 4.1.10. Do not change the Synthesized Sweeper output controls for the remainder of this para.

4.1.13 Disconnect the cable from the Synthesized Sweeper.

4.1.14 Standardize the Power Meter and Power Sensor (2.4).

4.1.15 Connect the Power Sensor (2.4) to the Synthesized Sweeper RF OUT connector.

4.1.16 Verify the Power Meter indicates within -30.5 to -29.5 dBm.

4.1.17 Set the Synthesized Sweeper for minimum output and disconnect test setup.

4.2 FREQUENCY READOUT ACCURACY CALIBRATION:

4.2.1 Connect equipment as shown in Figure 1.

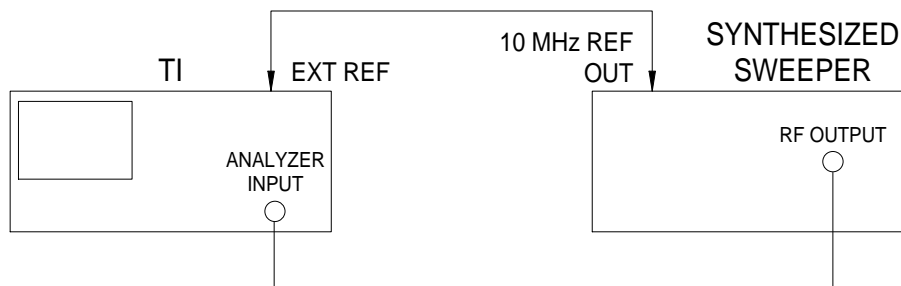


Figure 1.

4.2.2 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.2.3 Set the TI controls as follows:

UTILITY

3

ENTER

6

ENTER

↑ or ↓

To toggle the reference to EXT

4.2.4 Set the TI controls as follows:

FREQUENCY CENTER

First value listed in the
Frequency column of Table 2

FREQUENCY SPAN

First value listed in the
Span/Div column of Table 2

AMPLITUDE BW

CPL RBW

To Off

BW

First value listed in the
Bandwidth column of Table 2

AMPLITUDE REF

-10 x1

4.2.5 Press the Synthesized Sweeper INSTR PRESET and set the controls as follows:

CW

First value listed in the
Frequency column of Table 2

POWER LEVEL

-10 dBm

4.2.6 Press the TI **FREQUENCY CENTER** and using the TI Control Knob, align the displayed signal on the TI center vertical graticule line.

4.2.7 Verify the TI frequency indication is within the values listed in the Limits column of Table 2.

4.2.8 Repeat steps 4.2.4 through 4.2.7 for the remaining values listed in Table 2.

Table 2.

Frequency (GHz)	Span/Div (Hz)	Bandwidth (Hz)	Limits (GHz)
1.5	1 M	300 k	1.499 550 to 1.500 450
1.5	100 k	30 k	1.499 9550 to 1.500 0450
1.5	10 k	3 k	1.499 995 50 to 1.500 004 50
1.5	1 k	300	1.499 999 550 to 1.500 000 450

4.2.9 Set the Synthesized Sweeper for minimum output and leave equipment connected.

4.3 FREQUENCY SPAN WIDTH CALIBRATION:

4.3.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.3.2 Set the TI controls as follows:

UTILITY

3

ENTER

6

ENTER

↑ or ↓

To toggle the reference to EXT

4.3.3 Set the TI controls as follows:

FREQUENCY CENTER

First value listed in the Center Freq column of Table 3

FREQUENCY SPAN

First value listed in the Span/Div column of Table 3

NOTE

During the following steps, if the *MKR*→*PK* function locks onto one of the noise spikes, adjust the TI Peak Level as follows:

MODE MARKER

MKR→*PK*

PK FUNC

PK LVL

Adjust control knob until peak is set above noise spikes

4.3.4 Set the Synthesized Sweeper frequency to the first value listed the Frequency 1 column of Table 3 at -30 dBm.

4.3.5 Press TI **FREQUENCY CENTER**, then adjust TI Control Knob so the displayed signal is on the TI 2nd vertical graticule line (1 graticule from left-most).

4.3.6 Set the TI controls as follows:

MODE MARKER

MARKER→*PK*

DELTA

4.3.7 Set the Synthesized Sweeper frequency to the first value listed the Frequency 2 column of Table 3.

4.3.8 Press TI Δ*MARKER*. Use the Control Knob to superimpose the active marker over the displayed signal.

4.3.9 Verify the TI Δ*M* frequency indication is within the values listed in the Limits column of Table 3.

4.3.10 Press TI *RETURN*, *MKR SEL*, then *MKR 1* as necessary to turn TI markers to off.

Table 3.

Center Freq (Hz)	Frequency 1 (Hz)	Frequency 2 (Hz)	Span/Div (Hz)	Limits (Hz)
10 G	2 G	18 G	2 G	15.0 to 17.0 G
	6 G	14 G	1 G	7.5 to 8.5 G
	8 G	12 G	500 M	3.75 to 4.25 G
	9.2 G	10.8 G	200 M	1.5 to 1.7 G
1 G	600 M	1.4 G	100 M	750 to 850 M
	800 M	1.2 G	50 M	375 to 425 M
	920 M	1.08 G	20 M	150 to 170 M
100 M	60 M	140 M	10 M	75 to 85 M
	80 M	120 M	5 M	37.5 to 42.5 M
	92 M	108 M	2 M	15.0 to 17.0 M
10 M *	6 M	14 M	1 M	7.5 to 8.5 M
	8 M	12 M	500 k	3.75 to 4.25 M
	9.2 M	10.8 M	200 k	1.5 to 1.7 M

See footnote at end of Table.

Table 3. (Cont.)

Center Freq (Hz)	Frequency 1 (Hz)	Frequency 2 (Hz)	Span/Div (Hz)	Limits (Hz)
1 M	600 k	1.4 M	100 k	750 to 850 k
	800 k	1.2 M	50 k	375 to 425 k
	920 k	1.08 M	20 k	150 to 170 k
100 k	60 k	140 k	10 k	75 to 85 k
	80 k	120 k	5 k	37.5 to 42.5 k
	92 k	108 k	2 k	15 to 17 k
10 k	6 k	14 k	1 k	7.5 to 8.5 k
	8 k	12 k	500	3.75 to 4.25 k
	9.2 k	10.8 k	200	1.5 to 1.7 k
1 k	600	1.4 k	100	750 to 850
	800	1.2 k	50	375 to 425
	920	1.08 k	20	150 to 170
	960	1.04 k	10	75 to 85

* Set the Synthesized Sweeper for minimum output. Disconnect the Synthesized Sweeper from the TI and replace with the Frequency Synthesizer with the timebases connected as in Figure 1.

4.3.11 Repeat steps 4.3.3 through 4.3.10 for the remaining values listed in Table 3.

4.3.12 Set the Frequency Synthesizer for minimum output and disconnect test setup.

4.4 FREQUENCY COUNTER CALIBRATION:

4.4.1 Connect equipment as shown in Figure 1.

4.4.2 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.4.3 Set the TI controls as follows:

UTILITY

3

ENTER

6

ENTER

↑ or ↓

To toggle the reference to EXT

4.4.4 Set the TI controls as follows:

FREQUENCY CENTER 100 M

FREQUENCY SPAN

ZERO

AMPLITUDE ATTEN

COUPLE

0 **x1**

4.4.5 Set the Synthesized Sweeper for 100 MHz at -30 dBm.

4.4.6 Set the TI controls as follows:

MODE AUX

COUNTER

CTR RES

First values listed in the Resolution column of Table 4

4.4.7 Verify the TI CTR indication (located at top right of TI CRT) is within the Limits column of Table 4.

Table 4.

Resolution (Hz)	Limits (MHz)
1 k	99.999 to 100.001
100	99.999 9 to 100.000 1
10	99.999 99 to 100.000 01
1	99.999 999 to 100.000 001

4.4.8 Repeat steps 4.4.6 and 4.4.7 for the remaining values listed in Table 4.

4.4.9 Set the TI controls as follows:

FREQUENCY CENTER 120 M

AMPLITUDE REF -30 **x1**

AMPLITUDE BW

BW 5 M

- 4.4.10 Set the Synthesized Sweeper to 120 MHz.
- 4.4.11 Decrease the Synthesized Sweeper output controls until the TI CTR indication changes either -5 or +5 Hz.
- 4.4.12 Verify the Synthesized Sweeper indicates ≤ -65 dBm.
- 4.4.13 Press TI **AMPLITUDE BW** and set to 3 k.
- 4.4.14 Decrease the Synthesized Sweeper output controls until the TI CTR indication changes either -5 or +5 Hz.
- 4.4.15 Verify the Synthesized Sweeper indicates ≤ -85 dBm.
- 4.4.16 Set the Synthesized Sweeper for minimum output and disconnect test setup.
- 4.4.17 Set the TI controls as follows:

AUX MODE

COUNTER To deactivate Counter Mode

UTILITY

3

ENTER

6

ENTER

↑ or ↓ To toggle the reference to INT

- 4.4.18 Set the Synthesized Sweeper for minimum output and disconnect test setup.

4.5 AVERAGE NOISE LEVEL CALIBRATION:

- 4.5.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.
- 4.5.2 Connect the Termination to TI ANALYZER INPUT connector.
- 4.5.3 Set the TI controls as follows:

FREQUENCY CENTER First value listed in the Applied column of Table 5

FREQUENCY SPAN 1 k

AMPLITUDE ATTEN

COUPLE

0 **x1**

AMPLITUDE REF	-60 x1
AMPLITUDE BW	300 x1
<i>VBW</i>	10 x1

NOTE

Disregard any spurs and verify the noise level only.

4.5.4 Verify the Average Noise Level as displayed on TI CRT is within the value listed in the Limits column of Table 5.

4.5.5 Press TI **FREQUENCY CENTER** and set to the next value listed in the Applied column of Table 5.

4.5.6 Verify the Average Noise Level as displayed on TI CRT is within the value listed in the Limits column of Table 5.

4.5.7 Repeat steps 4.5.5 and 4.5.6 for the remaining values listed in Table 5.

Table 5.

Applied (Hz)	Limits (dBm)
9 k	≤-95
60 k	≤-95
99 k	≤-95
101 k	≤-115
9.9 M	≤-115
10 M	≤-115
11 M	≤-115
2.8 G	≤-115
3.1 G	≤-110
7.5 G	≤-110
11.9 G	≤-110
12.1 G	≤-105
17 G	≤-105
22 G	≤-105

4.5.8 Set the TI controls as follows:

FREQUENCY CENTER	First value listed in the Applied column of Table 6
FREQUENCY SPAN	20 x1
AMPLITUDE ATTEN	
<i>COUPLE</i>	
0	x1
AMPLITUDE REF	-90 x1
AMPLITUDE BW	3 x1
<i>VBW</i>	100 k

4.5.9 Verify the Average Noise Level as displayed on TI CRT is within the value listed in the Limits column of Table 6.

4.5.10 Press TI **FREQUENCY CENTER** and set to the next value listed in the Applied column of Table 6.

4.5.11 Verify the Average Noise Level as displayed on TI CRT is within the value listed in the Limits column of Table 6.

4.5.12 Repeat steps 4.5.10 and 4.5.11 for the remaining values listed in Table 6.

Table 6.

Applied (Hz)	Limits (dBm)
9 k	≤-115
60 k	≤-115
99 k	≤-115
101 k	≤-135
9.9 M	≤-135
10 M	≤-135
11 M	≤-135
2.8 G	≤-135
3.1 G	≤-130
7.5 G	≤-130

Table 6. (Cont.)

Applied (Hz)	Limits (dBm)
11.9 G	≤-130
12.1 G	≤-125
17 G	≤-125
22 G	≤-125

4.5.13 Disconnect test setup.

4.6 DISPLAY LINEARITY CALIBRATION:

4.6.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.6.2 Connect the Synthesized Leveled Generator to TI ANALYZER INPUT connector through one Attenuator (2.15).

4.6.3 Set the TI controls as follows:

FREQUENCY CENTER	50 M
FREQUENCY SPAN	1 M
AMPLITUDE SCALE	5 x1
AMPLITUDE REF	3 x1

4.6.4 Set the Synthesized Leveled Generator to 50 MHz at +13.01 dBm.

4.6.5 Set the TI controls as follows:

DISPLAY	
<i>SWEEP AVERAGE</i>	16 x1
<i>AVERAGE</i>	Wait for completion of the averaging cycle
MODE MARKER	
<i>MKR→PK</i>	

4.6.6 Press TI **AMPLITUDE REF** and adjust the TI Control Knob for a reference at the top graticule line of the TI screen. Record the Marker indication for the first applied value in the Actual column of Table 7.

4.6.7 Press the Synthesized Leveled Generator **AMPL INCR** key and set to 1 dB.

4.6.8 Press TI **DISPLAY**, then *AVERAGE* as necessary to turn off the TI averaging cycle.

4.6.9 Press the Synthesized Leveled Generator **AMPLITUDE** key, then press the \Downarrow step key to set the Synthesized Leveled Generator amplitude to the next value listed in Applied column of Table 7.

4.6.10 Press TI **DISPLAY**, then *AVERAGE* and wait for completion of the averaging cycle.

4.6.11 Use the TI *MKR*→*PK* function as necessary to keep the displayed marker at the peak of the signal.

4.6.12 Record the TI Marker indication for the corresponding applied value in the Actual column of Table 7.

4.6.13 Calculate the difference between each consecutive TI Marker indication recorded in step 4.6.12 using the following formula:

$$(A - B) + 1 = Diff (dB)$$

Where:

A = present TI marker reading

B = previous TI marker reading

4.6.14 Record the result of step 4.6.13 for the appropriate applied value in the Diff column of Table 7.

4.6.15 Verify the result is within the limits listed in the Limits column of Table 7.

Table 7.

Applied (dBm)	Nominal (dBm)	Actual (dBm)	Act - Nom (dBm)	Diff (dB)	Limit (dB)
+13.01	+3.01	_____	_____	_____	N/A
+12.01	+2.01	_____	_____	_____	-0.2 to +0.2
+11.01	+1.01	_____	_____	_____	-0.2 to +0.2
+10.01	+0.01	_____	_____	_____	-0.2 to +0.2
+9.01	-0.99	_____	_____	_____	-0.2 to +0.2
+8.01	-1.99	_____	_____	_____	-0.2 to +0.2
+7.01	-2.99	_____	_____	_____	-0.2 to +0.2
+6.01	-3.99	_____	_____	_____	-0.2 to +0.2
+5.01	-4.99	_____	_____	_____	-0.2 to +0.2
+4.01	-5.99	_____	_____	_____	-0.2 to +0.2
+3.01	-6.99	_____	_____	_____	-0.2 to +0.2
+2.01	-7.99	_____	_____	_____	-0.2 to +0.2

Table 7. (Cont.)

Applied (dBm)	Nominal (dBm)	Actual (dBm)	Act - Nom (dBm)	Diff (dB)	Limit (dB)
+1.01	-8.99	_____	_____	_____	-0.2 to +0.2
+0.01	-9.99	_____	_____	_____	-0.2 to +0.2
-0.99	-10.99	_____	_____	_____	-0.2 to +0.2
-1.99	-11.99	_____	_____	_____	-0.2 to +0.2
-2.99	-12.99	_____	_____	_____	-0.2 to +0.2
-3.99	-13.99	_____	_____	_____	-0.2 to +0.2
-4.99	-14.99	_____	_____	_____	-0.2 to +0.2
-5.99	-15.99	_____	_____	_____	-0.2 to +0.2
-6.99	-16.99	_____	_____	_____	-0.2 to +0.2
-7.99	-17.99	_____	_____	_____	-0.2 to +0.2
-8.99	-18.99	_____	_____	_____	-0.2 to +0.2
-9.99	-19.99	_____	_____	_____	-0.2 to +0.2
-10.99	-20.99	_____	_____	_____	-0.2 to +0.2
-11.99	-21.99	_____	_____	_____	-0.2 to +0.2
-12.99	-22.99	_____	_____	_____	-0.2 to +0.2
-13.99	-23.99	_____	_____	_____	-0.2 to +0.2
-14.99	-24.99	_____	_____	_____	-0.2 to +0.2
-15.99	-25.99	_____	_____	_____	-0.2 to +0.2
-16.99	-26.99	_____	_____	_____	-0.2 to +0.2
-17.99	-27.99	_____	_____	_____	-0.2 to +0.2
-18.99	-28.99	_____	_____	_____	-0.2 to +0.2
-19.99	-29.99	_____	_____	_____	-0.2 to +0.2
-20.99	-30.99	_____	_____	_____	-0.2 to +0.2
-21.99	-31.99	_____	_____	_____	-0.2 to +0.2

Table 7. (Cont.)

Applied (dBm)	Nominal (dBm)	Actual (dBm)	Act - Nom (dBm)	Diff (dB)	Limit (dB)
-22.99	-32.99	_____	_____	_____	-0.2 to +0.2
-23.99	-33.99	_____	_____	_____	-0.2 to +0.2
-24.99	-34.99	_____	_____	_____	-0.2 to +0.2
-25.99	-35.99	_____	_____	_____	-0.2 to +0.2

4.6.16 Algebraically subtract the Nominal value from the Actual value for the appropriate applied value in Table 7.

4.6.17 Record the result of step 4.6.16 for the appropriate applied value in the Act - Nom column of Table 7.

4.6.18 Repeat steps 4.6.8 through 4.6.17 for the remaining values listed in Table 7.

4.6.19 Algebraically subtract the most negative value from the most positive value in the Act - Nom column of Table 7.

4.6.20 Verify the result of step 4.6.19 is ± 1.5 dB.

4.6.21 Press TI **DISPLAY**, then *AVERAGE* as necessary to turn off the TI averaging cycle.

4.6.22 Press TI *RETURN*, *MKR SEL*, then *MKR 1* as necessary to turn off the TI markers.

4.6.23 Press TI **AMPLITUDE SCALE**, then set to 1 **x1**.

4.6.24 Repeat steps 4.6.4 and 4.6.5.

4.6.25 Press TI **AMPLITUDE REF** and adjust the TI Control Knob for a reference at the top graticule line of the TI screen. Record the Marker indication for the first applied value in the Actual column of Table 8.

4.6.26 Press the Synthesized Leveled Generator **AMPL INCR** key and set to 1 dB.

4.6.27 Press TI **DISPLAY**, then *AVERAGE* as necessary to turn off the TI averaging cycle.

4.6.28 Press the Synthesized Leveled Generator **AMPLITUDE** key, then press the \Downarrow step key to set the Synthesized Leveled Generator amplitude to the next value listed in Applied column of Table 8.

4.6.29 Press TI **DISPLAY**, then *AVERAGE* and wait for completion of the averaging cycle.

4.6.30 Record the TI Marker indication for the corresponding applied value in the Actual column of Table 8.

4.6.31 Algebraically subtract the value recorded in 4.6.25 from the current TI Marker indication.

4.6.32 Record the result of step 4.6.31 for the appropriate applied value in the Diff column of Table 8.

4.6.33 Verify the result is within the limits listed in the Limits column of Table 8.

Table 8.

Applied (dBm)	Actual (dBm)	Diff (dB)	Limit (dB)
+13.01	<u>(Ref)</u>	<u>N/A</u>	N/A
+12.01	<u> </u>	<u> </u>	-1.50 to -0.50
+11.01	<u> </u>	<u> </u>	-2.50 to -1.50
+10.01	<u> </u>	<u> </u>	-3.50 to -2.50
+9.01	<u> </u>	<u> </u>	-4.50 to -3.50
+8.01	<u> </u>	<u> </u>	-5.50 to -4.50
+7.01	<u> </u>	<u> </u>	-6.50 to -5.50
+6.01	<u> </u>	<u> </u>	-7.50 to -6.50
+5.01	<u> </u>	<u> </u>	-8.50 to -7.50

4.6.34 Repeat steps 4.6.27 through 4.6.33 for the remaining values listed in Table 8.

4.6.35 Press TI **DISPLAY**, then *AVERAGE* as necessary to turn off the TI averaging cycle.

4.6.36 Press TI *RETURN*, *MKR SEL*, then *MKR 1* as necessary to turn off the TI markers.

4.6.37 Set the TI controls as follows:

AMPLITUDE SCALE

LINEAR

UNITS

VOLTS

RETURN

AMPLITUDE REF

223.6 mV

4.6.38 Set the Synthesized Leveled Generator to 50 MHz at +10 dBm.

4.6.39 Set the TI controls as follows:

DISPLAY

AVERAGE

Wait for completion of the averaging cycle

MODE MARKER*MKR*→*PK*

4.6.40 Set the Synthesized Leveled Generator amplitude controls for a TI M 1 indication as close as possible to 0.2236 V.

4.6.41 Press the Synthesized Leveled Generator AMPL INCR key and set to 6 dB.

4.6.42 Press TI **DISPLAY**, then *AVERAGE* as necessary to turn off the TI averaging cycle.

4.6.43 Press the Synthesized Leveled Generator AMPLITUDE key, then press the ↓ step key to set the Synthesized Leveled Generator amplitude to the next value listed in Applied column of Table 9.

4.6.44 Press TI **DISPLAY**, then *AVERAGE* and wait for completion of the averaging cycle.

4.6.45 Verify the TI M 1 amplitude indicates within the values listed in the Limits column of Table 9.

Table 9.

Applied (dBm)	Nominal (dBm)	Limits (V)
+10	0	0.2236 (ref)
+4	-6	0.1076 to 0.1165
-2	-12	0.0517 to 0.0606
-8	-18	0.0237 to 0.0326

4.6.46 Repeat step 4.6.42 through 4.6.45 for the remaining values listed in Table 9.

4.6.47 Set the TI controls as follows:

FREQUENCY SPAN 10 M

AMPLITUDE BW 10 M

4.6.48 Press TI **DISPLAY**, then *AVERAGE* as necessary to turn off the TI averaging cycle.

4.6.49 Press TI *RETURN*, *MKR SEL*, then *MKR 1* as necessary to turn off the TI markers.

4.6.50 Repeat steps 4.6.38 through 4.6.46 utilizing Table 10.

Table 10.

Applied (dBm)	Nominal (dBm)	Limits (V)
+10	0	0.2236 (ref)
+4	-6	0.0897 to 0.1344
-2	-12	0.0338 to 0.0785
-8	-18	0.0058 to 0.0505

4.6.51 Set the Synthesized Leveled Generator for minimum output and disconnect test setup.

4.7 IF GAIN CALIBRATION:

4.7.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.7.2 Connect the Synthesized Leveled Generator to TI ANALYZER INPUT connector through Step Attenuators (2.19) and (2.20).

4.7.3 Set the TI controls as follows:

FREQUENCY CENTER	50 M
FREQUENCY SPAN	10 kHz
AMPLITUDE VBW	100 x1
AMPLITUDE SCALE	1 x1
AMPLITUDE REF	-10 x1
AMPLITUDE ATTEN	
<i>COUPLE</i>	
10	x1

4.7.4 Set the Synthesized Leveled Generator to 50 MHz at 0 dBm.

4.7.5 Set the TI controls as follows:

MODE MARKER
<i>MKR →PK</i>

4.7.6 Adjust the Step Attenuators (2.19) and (2.20) to place the signal 2 to 3 div below top reference. Record the TI Marker indication.

4.7.7 Press the Synthesized Leveled Generator **AMPL INCR** key and set to 10 dB.

4.7.8 Press the Synthesized Leveled Generator **AMPLITUDE** key, then press the \Downarrow step key to set the Synthesized Leveled Generator amplitude to the next nominal value listed in Applied column of Table 11.

4.7.9 Press TI **AMPLITUDE REF** and set to the first value listed on the TI Ref Lvl column of Table 11.

4.7.10 Press TI **MODE MARKER**, *RETURN* then *MKR*→*PK* to place the marker to the peak of the displayed signal. Record the Marker indication.

4.7.11 Subtract the TI Marker indication recorded in step 4.7.10 from the previous marker indication. The result must be within the values listed in the Limits column of Table 11.

Table 11.

Applied (dBm)	TI Ref Lvl (dB)	Limits (dB)
0	-10	Reference
-10	-20	9.75 to 10.25
-20	-30	9.75 to 10.25
-40	-50	19.5 to 20.5
-50	-60	9.5 to 10.5
-60	-70	9.5 to 10.5
-70	-80	9.5 to 10.5
-75 *	-85	4.5 to 5.5

* Set the Synthesized Leveled Generator to increment by 5 dB for the last step.

4.7.12 Repeat steps 4.7.8 through 4.7.11 for the remaining values listed in Table 11.

4.7.13 Set the TI controls as follows:

FREQUENCY SPAN 10 M

AMPLITUDE BW 10 M

AMPLITUDE SCALE

UNITS

WATTS

dB

AMPLITUDE ATTN

COUPLE

MODE MARKER

MKR SEL

MKR 1, as necessary to turn off TI markers

AMPLITUDE REF

-20 **x1**

4.7.14 Repeat steps 4.7.4 through 4.7.11 utilizing Table 12.

Table 12.

Applied (dBm)	TI Ref Lvl (dB)	Limits (dB)
-10	-20	Reference
-20	-30	8 to 12
-30	-40	8 to 12

4.7.15 Set the Synthesized Leveled Generator for minimum output and disconnect the test setup.

4.8 ATTENUATOR CALIBRATION:

4.8.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.8.2 Connect the Synthesized Leveled Generator to TI ANALYZER INPUT connector through one Attenuator (2.15). Set the Synthesized Leveled Generator to -60 dBm at 50 MHz.

4.8.3 Set the TI controls as follows:

FREQUENCY CENTER	50 M
FREQUENCY SPAN	20 k
AMPLITUDE SCALE	1 x1
AMPLITUDE ATTEN	0 x1
AMPLITUDE REF	-68 x1
MODE MARKER	
<i>MKR→PK</i>	

4.8.4 Adjust the TI Control Knob for maximum amplitude as indicated by the TI M 1 amplitude indication.

4.8.5 Press TI *MODE MARKER*, *MKR→PK*. Record the Marker indication.

4.8.6 Press the Synthesized Leveled Generator **AMPL INCR** key and set to 10 dB.

4.8.7 Press TI **AMPLITUDE ATTEN** and set to the first value listed in the TI Attenuator column of Table 13.

4.8.8 Press the Synthesized Leveled Generator AMPLITUDE key, then press the \Downarrow step key to set the Synthesized Leveled Generator amplitude to the next nominal value listed in Applied column of Table 13.

4.8.9 Press TI *MODE MARKER*, then *MKR*→*PK* to place the TI Marker to the peak of the displayed signal. Subtract the current Marker reading from the previous Marker reading.

Table 13.

TI Attenuator (dB)	Applied (dBm)	Limits (dB)
0	-60	Reference
10	-50	9.5 to 10.5
20	-40	9.5 to 10.5
30	-30	9.4 to 10.6
40	-20	9.2 to 10.8
50	-10	9.0 to 11.0
60	0	8.8 to 11.2

4.8.10 Verify the result from step 4.8.9 is within the values listed in the Limits column of Table 13 from nominal 10 dB step.

4.8.11 Repeat steps 4.8.7 through 4.8.10 for the remaining values listed in Table 13.

4.8.12 Set the Synthesized Level Generator for minimum output and disconnect test setup.

4.9 FREQUENCY RESPONSE CALIBRATION:

4.9.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.9.2 Standardize and zero the Power Meter and the Power Sensor (2.5).

4.9.3 Connect the equipment as shown in Figure 2 with the Power Sensor (2.5) connected to the Power Splitter.

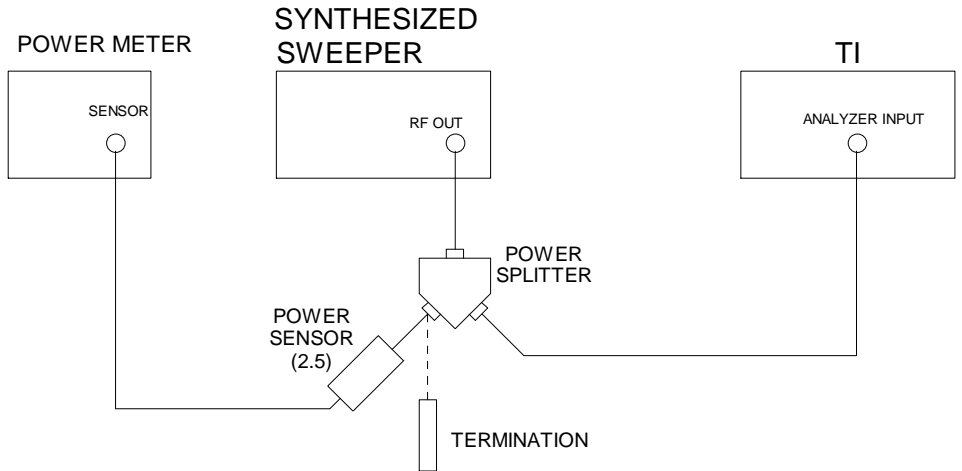


Figure 2.

NOTE

Throughout this para, ensure the Power Meter Cal Factor is set to the appropriate value as charted on the Power Sensor (2.5).

4.9.4 Set the Synthesized Sweeper controls as follows:

FREQUENCY	100 MHz
AMPLITUDE	-8.0 dBm

4.9.5 Set the TI controls as follows:

FREQUENCY CENTER	100 M
FREQUENCY SPAN	20 M
AMPLITUDE SCALE	1 x1
AMPLITUDE ATTEN	
<i>COUPLE</i>	
10	x1
AMPLITUDE REF	-10 x1
MODE MARKER	
<i>MKR→PK</i>	

4.9.6 Set Synthesized Sweeper amplitude controls for a TI M 1 amplitude indication of -14 dBm ±0.1 dB.

- 4.9.7 Press the Power Meter MODE dB [REF] key.
- 4.9.8 Set the Synthesized Sweeper frequency to the first value listed in the Applied column of Table 14.
- 4.9.9 Press TI **FREQUENCY CENTER** and set to the first value listed in the Applied column of Table 14.
- 4.9.10 Use the TI *MKR*→*PK* function as necessary to keep the displayed marker at the peak of the signal.
- 4.9.11 Adjust the Synthesized Sweeper output controls for as close to 0.00 dB as possible as displayed on the Power Meter.
- 4.9.12 Verify the TI M 1 indication is within the values listed in the Limits column of Table 14.
- 4.9.13 Repeat steps 4.9.8 through 4.9.12 for the remaining values listed in Table 14.

Table 14.

Applied (MHz)	Limits (dBm)
75	-15.5 to -12.5
175	-15.5 to -12.5
275	-15.5 to -12.5
375	-15.5 to -12.5
475	-15.5 to -12.5
575	-15.5 to -12.5
675	-15.5 to -12.5
775	-15.5 to -12.5
875	-15.5 to -12.5
975	-15.5 to -12.5
1075	-15.5 to -12.5
1175	-15.5 to -12.5
1275	-15.5 to -12.5
1375	-15.5 to -12.5
1500	-15.5 to -12.5
1525	-15.5 to -12.5
1625	-15.5 to -12.5

Table 14. (Cont.)

Applied (MHz)	Limits (dBm)
1725	-15.5 to -12.5
1925	-15.5 to -12.5
2125	-15.5 to -12.5
2325	-15.5 to -12.5
2525	-15.5 to -12.5
2725	-15.5 to -12.5
2900	-15.5 to -12.5

4.9.14 Set the Synthesized Sweeper frequency to the first value listed in the Applied column of Table 15.

4.9.15 Press the TI **FREQUENCY CENTER** and set to the first value listed in the Applied column of Table 15.

4.9.16 Press TI **AMPLITUDE REF**, then *PS AUTO*.

4.9.17 Press TI **MODE MARKER**, then *MKR*→*PK* to place the TI Marker to the peak of the displayed signal.

4.9.18 Adjust the Synthesized Sweeper output controls for as close to 0.00 dB as possible as displayed on the Power Meter.

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

4.9.20 Repeat steps 4.9.14 through 4.9.19 for the remaining values listed in Table 15.

Table 15.

Applied (GHz)	Limits (dBm)
2.95	-16.0 to -12.0
3.05	-16.0 to -12.0
3.1	-16.0 to -12.0
3.3	-16.0 to -12.0
3.5	-16.0 to -12.0
3.7	-16.0 to -12.0
3.9	-16.0 to -12.0

Table 15. (Cont.)

Applied (GHz)	Limits (dBm)
4.1	-16.0 to -12.0
4.3	-16.0 to -12.0
4.5	-16.0 to -12.0
4.7	-16.0 to -12.0
4.9	-16.0 to -12.0
5.1	-16.0 to -12.0
5.3	-16.0 to -12.0
5.5	-16.0 to -12.0
5.7	-16.0 to -12.0
5.9	-16.0 to -12.0
6.1	-16.0 to -12.0
6.3	-16.0 to -12.0
6.5	-16.0 to -12.0
6.7	-16.0 to -12.0
6.75	-16.0 to -12.0
6.8	-16.0 to -12.0
7.0	-16.0 to -12.0
7.4	-16.0 to -12.0
7.8	-16.0 to -12.0
8.2	-16.0 to -12.0
8.6	-16.0 to -12.0
9.0	-16.0 to -12.0
9.4	-16.0 to -12.0
9.8	-16.0 to -12.0
10.2	-16.0 to -12.0

Table 15. (Cont.)

Applied (GHz)	Limits (dBm)
11.0	-16.0 to -12.0
11.4	-16.0 to -12.0
11.8	-16.0 to -12.0
12.0	-16.0 to -12.0

4.9.21 Repeat step 4.9.20 for the values listed in Table 16.

Table 16.

Applied (GHz)	Limits (dBm)
12.1	-17.0 to -11.0
12.2	-17.0 to -11.0
12.4	-17.0 to -11.0
12.6	-17.0 to -11.0
12.8	-17.0 to -11.0
13.2	-17.0 to -11.0
13.25	-17.0 to -11.0
13.3	-17.0 to -11.0
13.7	-17.0 to -11.0
14.1	-17.0 to -11.0
14.5	-17.0 to -11.0
14.9	-17.0 to -11.0
15.3	-17.0 to -11.0
15.7	-17.0 to -11.0
16.1	-17.0 to -11.0
16.5	-17.0 to -11.0
16.9	-17.0 to -11.0

Table 16. (Cont.)

Applied (GHz)	Limits (dBm)
17.3	-17.0 to -11.0
17.7	-17.0 to -11.0
18.0	-17.0 to -11.0

4.9.22 Repeat steps 4.9.20 for the values listed in Table 17.

Table 17.

Applied (GHz)	Limits (dBm)
18.1	-18.0 to -10.0
18.3	-18.0 to -10.0
18.5	-18.0 to -10.0
18.9	-18.0 to -10.0
19.3	-18.0 to -10.0
19.7	-18.0 to -10.0
20.1	-18.0 to -10.0
20.5	-18.0 to -10.0
20.9	-18.0 to -10.0
21.3	-18.0 to -10.0
21.7	-18.0 to -10.0
22.0	-18.0 to -10.0

4.9.23 Set the Synthesized Sweeper for minimum output.

4.9.24 Disconnect the Synthesized Sweeper from the Power Splitter and replace the Synthesized Sweeper with the Synthesized Leveled Generator.

4.9.25 Set the TI **FREQUENCY CENTER** to 75 M, **FREQUENCY SPAN** to 20 kHz and **FREQUENCY BW** to 3 kHz.

4.9.26 Set the Synthesized Leveled Generator frequency to 75 MHz.

4.9.27 Adjust the Synthesized Leveled Generator output controls for as close to 0.00 dB as possible as displayed on the Power Meter.

4.9.28 Press TI *MKR*→*PK* to place the TI Marker to the peak of the displayed signal.

4.9.29 Disconnect the Power Sensor (2.5) from the Power Splitter and connect the Termination to the unused port of the Power Splitter.

4.9.30 Set the Synthesized Leveled Generator frequency to the first value listed in the Applied column of Table 18.

4.9.31 Press the TI **FREQUENCY CENTER** and set to the first value listed in the Applied column of Table 18.

4.9.32 Press TI *MKR*→*PK* to place the TI Marker to the peak of the displayed signal.

4.9.33 Verify the TI Marker indication is within the values listed in the Limits column of Table 18.

4.9.34 Repeat steps 4.9.30 through 4.9.33 for the remaining values listed in Table 18.

Table 18.

Applied (Hz)	Limits (dB)
50 M	-15.5 to -12.5
20 M	-15.5 to -12.5
10 M	-15.5 to -12.5
5 M	-15.5 to -12.5
1 M	-15.5 to -12.5
100 k	-15.5 to -12.5
75 k	-15.5 to -12.5
50 k	-15.5 to -12.5
20 k	-15.5 to -12.5
9 k	-15.5 to -12.5

4.9.35 Set the Synthesized Leveled Generator for minimum output and disconnect test setup.

4.10 RESOLUTION BANDWIDTH AND SELECTIVITY CALIBRATION:

4.10.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.10.2 Connect equipment as shown in Figure 3.

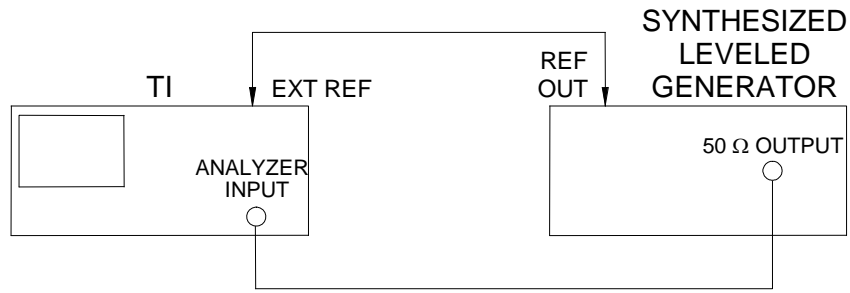


Figure 3.

4.10.3 Set the TI controls as follows:

UTILITY

3

ENTER

6

ENTER

↑ or ↓

To toggle the reference to EXT

ENTER

FREQUENCY CENTER

50 M

AMPLITUDE SCALE

1 x1

AMPLITUDE REF

-10 x1

4.10.4 Set the Synthesized Leveled Generator for 50 MHz at -10 dBm.

4.10.5 Set the TI controls as follows:

FREQUENCY SPAN

First value listed in the TI Span/Div column of Table 19

AMPLITUDE BW

First value listed in the TI BW column of Table 19

CPL RBW

Uncouple RBW from SPAN

MODE MARKER

MKR → *PK*

4.10.6 Set TI controls as necessary to select the Δ Marker.

4.10.7 Adjust the TI Control Knob CW for a TI Δ M indication of 3.00 ± 0.1 dB down from the reference.

4.10.8 Record the TI Δ M frequency indication.

4.10.9 Adjust the TI Control Knob CCW until the TI Δ M indication peaks to 0.00 then back down to 3.00 ± 0.1 dB down from the reference.

4.10.10 Record the TI Δ M frequency indication.

4.10.11 Subtract the value recorded in step 4.10.10 from the value recorded in step 4.10.8. Record the result in the Actual 3 dB BW column of Table 19.

4.10.12 Verify the result of step 4.10.11 is within the values listed in the Limits column of Table 19.

Table 19.

TI Span/Div (Hz)	TI BW (Hz)	Actual 3 dB BW (Hz)	Limits (Hz)
2 M	5 M	_____	3.5 to 6.5 M
100 k	300 k	_____	210 to 390 k
10 k	30 k	_____	24 to 36 k
1 k	3 k	_____	2.4 to 3.6 k
300	300	_____	240 to 360

4.10.13 Press TI *RETURN*, *MKR SEL*, then *MKR 1* as necessary to turn the TI markers to off.

4.10.14 Repeat steps 4.10.5 through 4.10.13 for the remaining values listed in Table 19.

4.10.15 Set the TI **AMPLITUDE SCALE** to 10 **dB**.

4.10.16 Set the TI **AMPLITUDE BW** to the first value listed in the TI BW column of Table 20.

4.10.17 Set the TI **FREQUENCY SPAN** as necessary to view several div of width of the displayed signal at the -60 dB point.

4.10.18 Press TI **DISPLAY**. Set *SWEEP AVERAGE* to 6 and wait for completion of the averaging cycle.

4.10.19 Press **MODE MARKER**, *MKR*→*PK*, *DELTA*. Select the Δ Marker.

4.10.20 Adjust the TI Control Knob CW for a TI Δ M indication of 60.00 ± 0.1 dB down from the reference.

4.10.21 Record the TI Δ M frequency indication.

4.10.22 Adjust the TI Control Knob CCW until the TI Δ M indication peaks to 0.00 then back down to 60.00 ± 0.1 dB down from the reference.

4.10.23 Record the TI Δ M frequency indication.

4.10.24 Subtract the value recorded in step 4.10.23 from the value recorded in step 4.10.21. Record the result in the Actual 60 dB BW column of Table 20.

4.10.25 Press *TI RETURN*, *MKR SEL*, then *MKR 1* as necessary to turn off the TI markers.

Table 20.

TI BW (Hz)	Actual 60 dB BW (Hz)
5 M	_____
300 k	_____
30 k	_____
3 k	_____
300 *	_____

* For TI 300 Hz BW, adjust the TI Control Knob in steps 4.10.20 and 4.10.22 for a TI Δ M indication of 50 ± 0.1 dB down from the reference.

4.10.26 Repeat steps 4.10.16 through 4.10.25 for the remaining values listed in Table 20.

4.10.27 Divide each Actual 60 dB BW (50 dB BW for 300 Hz BW) value recorded in Table 20 by the appropriate Actual 3 dB BW value recorded in Table 19. Verify the resulting ratios are $<5:1$ for 3 kHz to 5 MHz RBW and $<10:1$ for 300 Hz RBW.

4.10.28 Set the TI controls as follows:

AMPLITUDE SCALE

LINEAR

UNITS

dB

4.10.29 Set the TI controls as follows:

AMPLITUDE BW

First value listed in the TI BW column of Table 21

FREQUENCY SPAN

First value listed in the TI Span/Div column of Table 21

4.10.30 Press TI **MODE MARKER**, then *MKR*→*PK*, then *DELTA*. Select the Δ Marker.

4.10.31 Adjust the TI Control Knob CW for a TI Δ M indication of 3.00 ± 0.1 dB down from the reference.

4.10.32 Record the TI Δ M frequency indication.

4.10.33 Adjust the TI Control Knob CCW until the TI ΔM indication peaks to 0.00, then back down to 3.00 ±0.1 dB down from the reference.

4.10.34 Record the TI ΔM frequency indication.

4.10.35 Subtract the value recorded in step 4.10.34 from the value recorded in step 4.10.32.

4.10.36 Verify the result of step 4.10.35 is within the values listed in the Limits column of Table 21.

4.10.37 Press TI *RETURN*, *MKR SEL*, then *MKR I* as necessary to turn the TI markers to off.

Table 21.

TI Span/Div (MHz)	TI BW (MHz)	Limits (MHz)
2	10	7 to 13
5	30	21 to 39

4.10.38 Repeat steps 4.10.29 through 4.10.36 for the remaining values listed in Table 21.

4.10.39 Set the Synthesized Leveled Generator for minimum output.

4.11 RESOLUTION BANDWIDTH SWITCHING ERROR CALIBRATION:

4.11.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.11.2 Set the TI controls as follows:

FREQUENCY CENTER	50 M
AMPLITUDE SCALE	2 x1
AMPLITUDE REF	-18 x1

4.11.3 Set the Synthesized Leveled Generator for 50 MHz at -20 dBm.

4.11.4 Set the TI controls as follows:

AMPLITUDE BW	First value listed in the TI BW column of Table 22
CPL RBW	Deselect
FREQUENCY SPAN	First value listed in the TI Span/Div column of Table 22
MODE MARKER	
<i>MKR</i> → <i>PK</i>	Record 30 kHz RBW Marker indication

4.11.5 Set the TI controls as follows:

AMPLITUDE BW

Next value listed in the TI BW column of Table 22

FREQUENCY SPAN

Next value listed in the TI Span/Div column of Table 22

MKR → *PK*

4.11.6 Subtract the current TI RBW Marker indication from 30 kHz RBW marker indication recorded in step 4.11.4. Verify the TI Marker indication is within the values listed in the Limits column of Table 22.

4.11.7 Repeat step 4.11.5 and 4.11.6 for the remaining values listed in Table 22.

Table 22.

TI BW (Hz)	TI Span/Div (Hz)	Limits (dB)
30 k	10 k	Reference
5 M	2 M	-0.5 to +0.5
300 k	100 k	-0.5 to +0.5
3 k	1 k	-0.5 to +0.5
300	300	-1.0 to +1.0

4.11.8 Set the TI controls as follows:

AMPLITUDE BW

CPL RBW

Deselected

RBW

First value listed in the TI BW column of Table 23

FREQUENCY SPAN

First value listed in the TI Span/Div column of Table 23

AMPLITUDE SCALE

LINEAR

Units

dB

MODE MARKER

MKR → *PK*

Record Marker Level for reference

4.11.9 Set the TI controls as follows:

AMPLITUDE BW

Next value listed in the TI BW column of Table 23

FREQUENCY SPAN

Next value listed in the TI Span/Div column of Table 23

MKR → *PK*

4.11.10 Subtract the current TI Marker Level from marker indication recorded in step 4.11.8. Verify the result is within the values listed in the Limits column of Table 23.

4.11.11 Repeat step 4.11.9 and 4.11.10 for the remaining values listed in Table 23.

Table 23.

TI BW (Hz)	TI Span/Div (Hz)	Limits (dB)
30 k	10 k	Reference
10 M	5 M	-2.0 to +2.0
30 M	10 M	-2.0 to +2.0

4.11.12 Set the Synthesized Leveled Generator for minimum output and disconnect test setup.

4.12 SWEEP TIME CALIBRATION:

4.12.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.12.2 Connect the equipment as shown in Figure 4.

4.12.3 Set the Signal Generator controls as follows:

FREQUENCY

500 MHz

AMPLITUDE

-22 dBm

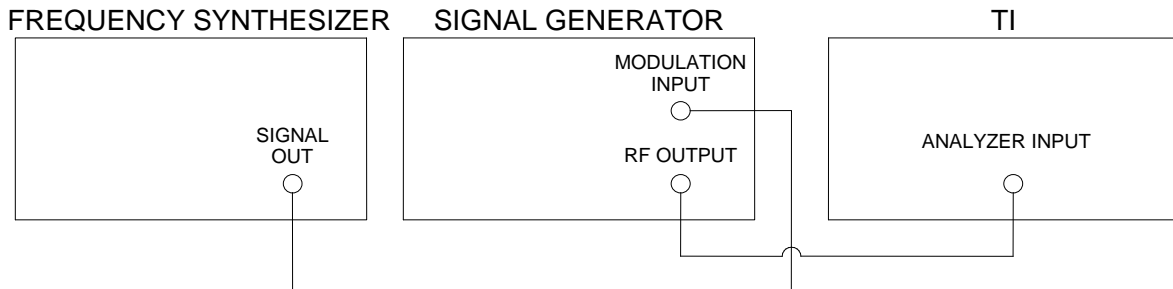


Figure 4.

4.12.4 Set the TI controls as follows:

FREQUENCY CENTER	500 M
FREQUENCY SPAN	
<i>ZERO</i>	
AMPLITUDE BW	300 k
MODE SWEEP	First value listed in the Sweep Time column of Table 24

4.12.5 Set the Frequency Synthesizer controls to the first value listed in the Applied column of Table 24 at 1.14 V p-p, triangle waveform output.

4.12.6 Adjust the Signal Generator amplitude for a mid-screen display on the TI CRT. Press the Signal Generator MOD EXT DC 90% button. Ensure the MODULATION HI or LO indication lights are not lit. If either light is illuminated, adjust the Frequency Synthesizer output level accordingly to extinguish the light.

4.12.7 Set the TI controls as follows:

SOURCE

VIDEO

RETURN

TRIG

LEVEL

4.12.8 Using the TI Control Knob, adjust the TI Trigger Level for a stable display.

4.12.9 Press TI **MODE SWEEP**, *MODE*, then *SINGLE ARM (2X)* and wait for the TI sweep to finish.

4.12.10 Press TI **MODE MARKER**, then *MKR SEL*, then *MKR 1*. Position MKR 1 on the 2nd signal peak from the far left graticule line using the TI Control Knob.

4.12.11 Press TI *RETURN*, *MKR SEL*, then *MKR 2*. Position MKR2 on the 10th signal peak from the far left graticule line using the TI Control Knob.

4.12.12 Subtract the TI MKR1 Time value from the MKR2 Time value. Verify the result is within the values listed in the Limits column of Table 24.

Table 24.

Sweep Time (s)	Applied (Hz)	Limits (s)
20 μ	50 k	158 to 162 μ
2 m	500	15.8 to 16.2 m
50 m	20	0.39 to 0.41
100 m	10	0.79 to 0.81
1	1	7.9 to 8.1
10	0.1	79.0 to 81.0

4.12.13 Press TI *MKR2*, *RETURN*, *MKR SEL*, then *MKR 1* as necessary to turn the TI markers to off.

4.12.14 Press TI **MODE SWEEP**, then *AUTO*.

4.12.15 Repeat steps 4.12.5 through 4.12.14 for the remaining values listed in Table 24.

4.12.16 Set the Frequency Synthesizer and Signal Generator for minimum output and disconnect test setup.

4.13 RESIDUAL RESPONSES CALIBRATION:

4.13.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.13.2 Connect the Termination to the TI ANALYZER INPUT connector.

4.13.3 Set the TI controls as follows:

AMPLITUDE REF	-40 x1
FREQUENCY START	First value listed in the Freq Start column of Table 25
FREQUENCY STOP	First value listed in the Freq Stop column of Table 25

NOTE

If necessary, uncouple RBW and VBW and adjust as needed to lower noise floor. Ensure the UNCAL light is not illuminated.

4.13.4 Verify any Residual Response is within the value listed in the Limits column of Table 25.

Table 25.

Freq Start (Hz)	Freq Stop (Hz)	Limits (dBm)
9 k	100 k	≤-90
100 k	1.5 G	≤-100
1.5 G	3.0 G	≤-100
3.0 G	4.4 G	≤-100
4.4 G	5.8 G	≤-100

4.13.5 Repeat steps 4.13.3 and 4.13.4 for the remaining values listed in Table 25.

4.13.6 Disconnect test setup.

4.14 **RESIDUAL FM CALIBRATION:**

4.14.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.14.2 Connect equipment as shown in Figure 5.

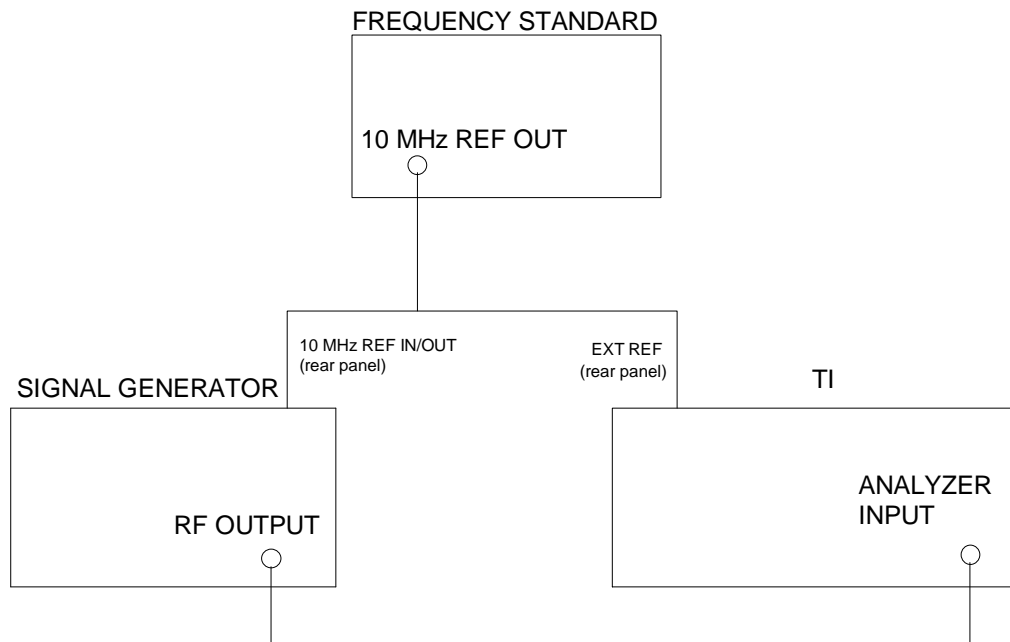


Figure 5.

4.14.3 Set the TI controls as follows:

UTILITY

3

ENTER

6

ENTER

↑ or ↓

To toggle the reference to EXT

4.14.4 Set the TI controls as follows:

FREQUENCY CENTER 50 M

FREQUENCY SPAN 0 x1

AMPLITUDE REF -20 x1

AMPLITUDE BW 300 x1

VBW 10 x1

AMPLITUDE SCALE 1 x1

MODE MARKER

MKR→PK

4.14.5 Set the Signal Generator to use the applied external reference, the set to 50 MHz and adjust the output controls for a TI MKR 1 indication of -20 dBm ±0.1 dB.

4.14.6 Set the Signal Generator frequency resolution as necessary to increase the frequency until the TI MKR 1 indication is -25 dBm ±0.1 dB (final resolution should be 0.1 Hz). Record the Signal Generator frequency indication to the nearest 0.1 Hz.

4.14.7 Repeat step 4.14.6 until the TI MKR 1 indication is -26 dBm ±0.1 dB. Record the Signal Generator frequency indication to the nearest 0.1 Hz.

4.14.8 Repeat step 4.14.6 until the TI MKR 1 indication is -27 dBm ±0.1 dB. Record the Signal Generator frequency indication to the nearest 0.1 Hz.

4.14.9 Subtract the value recorded in step 4.14.6 from the value recorded in step 4.14.7. Record the result.

4.14.10 Subtract the value recorded in step 4.14.7 from the value recorded in step 4.14.8. Record the result.

4.14.11 Calculate the TI Hz/dB factor using the following formula: Record the result.

$$\text{Hz/dB factor} = (\text{value recorded in step 4.14.10} + \text{value recorded in step 4.14.9}) \div 2$$

4.14.12 Set the Signal Generator for minimum output and disconnect the Frequency Standard from the test setup.

4.14.13 Set the TI controls as follows:

UTILITY

3

ENTER

6

ENTER

↑ or ↓

To toggle the reference to INT

FREQUENCY CENTER

50 M

FREQUENCY SPAN

5 k

AMPLITUDE BW

300 x1

MODE MARKER

MKR→PK

4.14.14 Set the Signal Generator to use the int ref. Set the Signal Generator for 50 MHz and a TI MKR 1 indication of -20 dBm \pm 0.1 dB.

4.14.15 Press TI **FREQUENCY CENTER**, then using the TI Control Knob, align the displayed signal to the center on the display.

4.14.16 Press TI *MKR→PK*, then set **FREQUENCY SPAN** to 0 x1.

4.14.17 Set the Signal Generator frequency resolution as necessary to increase the frequency until the TI MKR 1 indication is -26 dBm \pm 0.1 dB (final resolution should be 0.1 Hz). Record the Signal Generator frequency indication to the nearest 0.1 Hz.

4.14.18 Set the TI controls as follows:

AMPLITUDE BW

300 x1

VBW

100 x1

MODE SWEEP

20 m

SINGLE

ARM

4.14.19 Verify the TI average drift is $\leq \pm 1$ dB. If not, repeat step 4.14.17.

4.14.20 Record the TI p-p amplitude variation in 1 horizontal graticule (p-p response in dB for 20 ms).

4.14.21 Calculate the TI Residual FM as follows:

$$\text{Residual FM (in Hz p-p)} = \text{value recorded in step 4.14.11} \times \text{value recorded in step 4.14.20}$$

4.14.22 Verify the result of step 4.14.21 is <10 Hz p-p.

4.14.23 Set the Signal Generator for minimum output.

4.15 NOISE SIDEBANDS CALIBRATION:

4.15.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.15.2 Set the TI controls as follows:

FREQUENCY SPAN	5 k
AMPLITUDE REF	0 x1
AMPLITUDE BW	3 k
<i>VBW</i>	10 x1

4.15.3 Set the Signal Generator to the first value listed in the Frequency column of Table 26 at 0 dBm.

4.15.4 Press TI **FREQUENCY CENTER** and set to the first value listed in the Center Freq column of Table 26.

4.15.5 Press TI **AMPLITUDE REF** and use the TI Control Knob to adjust the displayed signal 0.5 div from the TI top graticule line.

4.15.6 Press TI **MODE MARKER**, then *MKR* → *PK*.

4.15.7 Press TI *DELTA*.

4.15.8 Set the TI active marker to the first value listed in the MKR 10 kHz offset column of Table 26 using the TI data entry keys.

NOTE

When calculating the TI limits for Noise Sidebands, the 34.8 dB correction factor normalizes the TI 3 kHz RBW filter to be equivalent to the 1 Hz RBW filter measurement.

4.15.9 Verify the TI ΔM indication + 34.8 dB is within the values listed in the Limits 10 kHz offset column of Table 26.

4.15.10 Set the TI active marker to the first value listed in the MKR 30 kHz offset column of Table 26 using the TI data entry keys.

4.15.11 Verify the TI ΔM indication + 34.8 dB is within the values listed in the Limits 30 kHz offset column of Table 26.

Table 26.

Frequency	Center Freq	MKR 10 kHz offset	MKR 30 kHz Offset	Limits	
				10 kHz Offset	30 kHz Offset
100 MHz	100.015 MHz	100.01 MHz	100.03 MHz	≥97 dB	≥101 dB
1.5 GHz	1.500015 GHz	1.500010 GHz	1.500030 GHz	≥92 dB	≥95 dB
2.9 GHz	2.900015 GHz	2.900010 GHz	2.900030 GHz	≥93 dB	≥100 dB

4.15.12 Press TI *RETURN*, *MKR SEL*, then *MKR 1* as necessary to turn the TI markers to off.

4.15.13 Repeat steps 4.15.3 through 4.15.11 for the remaining values listed in Table 26.

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

4.16 **HARMONIC DISTORTION CALIBRATION:**

4.16.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.

4.16.2 Standardize the Power Meter and Power Sensor (2.5). Connect equipment as shown in Figure 6.

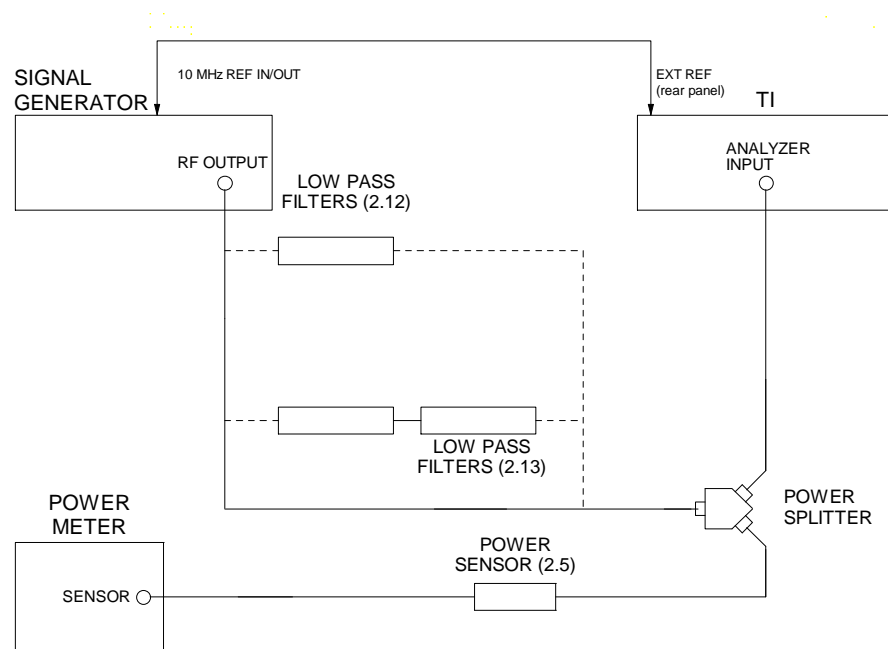


Figure 6.

4.16.3 Set the TI controls as follows:

FREQUENCY CENTER	40 M
FREQUENCY SPAN	50 k
AMPLITUDE ATTEN	10 x1
AMPLITUDE REF	-30 x1
AMPLITUDE BW	300 x1
UTILITY	
3	
<i>ENTER</i>	
6	
<i>ENTER</i>	
↑ or ↓	To toggle the reference to EXT

4.16.4 Set the Signal Generator for 40 MHz at -30 dBm as indicated on the Power Meter.

4.16.5 Press TI **MODE MARKER**, *MKR*→*PK*. Record the TI MKR 1 amplitude indication.

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

4.16.7 Insert the Low Pass Filter (2.12) between the Power Splitter and the Signal Generator.

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

4.16.9 Set the TI **FREQUENCY CENTER** to 80 M. Press TI *MKR*→*PK* and record the TI MKR 1 amplitude indication.

4.16.10 Verify the difference of the values recorded in step 4.16.5 and 4.16.9 is ≥ 70 dBm.

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

4.16.12 Disconnect the Low Pass Filter (2.12) from the test setup and reconnect the Signal Generator RF OUT to the Power Splitter.

4.16.13 Set the TI controls as follows:

FREQUENCY CENTER	2.95 G
FREQUENCY SPAN	50 k
AMPLITUDE ATTEN	10 x1
AMPLITUDE REF	-10 x1

- 4.16.14 Set the Signal Generator for 2.95 GHz at -10 dBm as indicated on the Power Meter.
- 4.16.15 Press *TI MKR*→*PK*. Record the TI MKR 1 amplitude indication.
- 4.16.16 Set the Signal Generator RF ON/OFF to OFF.
- 4.16.17 Insert the Low Pass Filters (2.13) between the Power Splitter and the Signal Generator.
- 4.16.18 Set the Signal Generator RF ON/OFF to ON.
- 4.16.19 Set the TI **FREQUENCY CENTER** to 5.9 **G** and **AMPLITUDE REF** to -40 **x1**. Press *TI MKR*→*PK* and record the TI MKR 1 amplitude indication.
- 4.16.20 Verify the difference of the values recorded in step 4.16.15 and 4.16.19 is ≥ 100 dBm.
- 4.16.21 Set the Signal Generator RF ON/OFF button to OFF and disconnect test setup.

4.17 THIRD ORDER INTERMODULATION CALIBRATION:

- 4.17.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.
- 4.17.2 Connect equipment as shown in Figure 7.

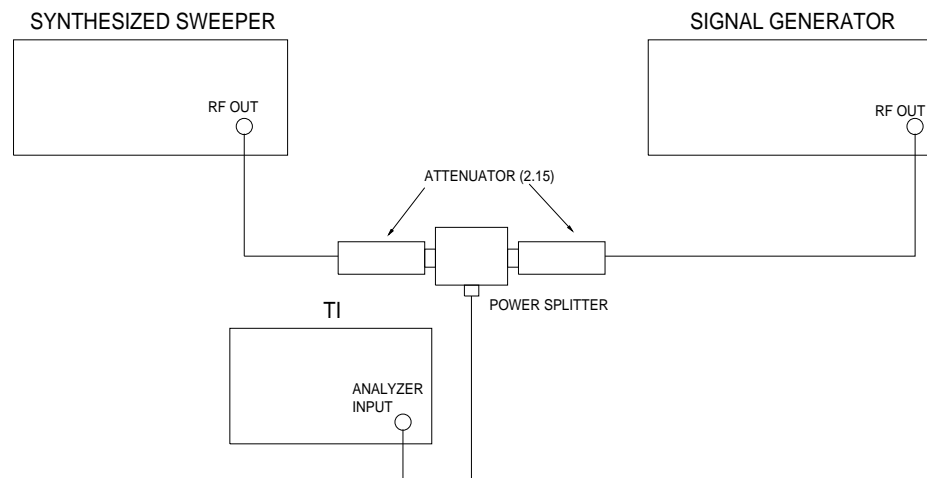


Figure 7.

- 4.17.3 Set the TI controls as follows:

FREQUENCY CENTER	2.4999 G
AMPLITUDE REF	-5 x1
FREQUENCY SPAN	5 k

AMPLITUDE BW	300 x1
<i>VBW</i>	100 x1

MODE MARKER

- 4.17.4 Set the Synthesizer Sweeper for 2.4999 GHz at -5 dBm.
- 4.17.5 Press TI *MKR*→*PK*.
- 4.17.6 Adjust the Synthesized Sweeper output controls for a TI MKR 1 amplitude indication of -10 dBm ±0.1 dB.
- 4.17.7 Set Synthesized Sweeper RF ON/OFF to OFF.
- 4.17.8 Set the Signal Generator for 2.49995 GHz at -5 dBm.
- 4.17.9 Press TI **FREQUENCY CENTER** and set to 2.49995 **G**.
- 4.17.10 Press TI *MKR*→*PK*.
- 4.17.11 Adjust the Signal Generator output controls for a TI MKR 1 amplitude indication of -10 dBm ±0.1 dB.
- 4.17.12 Set the Synthesized Sweeper RF ON/OFF to ON.
- 4.17.13 Press TI **FREQUENCY CENTER** and set to 2.5 **G**.
- 4.17.14 Press TI *MKR*→*PK* and record the TI MKR 1 amplitude indication.
- 4.17.15 Press TI **FREQUENCY CENTER** and set to 2.49985 **G**.
- 4.17.16 Press TI *MKR*→*PK* and record the TI MKR 1 amplitude indication.
- 4.17.17 Verify the values recorded in steps 4.17.14 and 4.17.16 are ≤-50 dBm.
- 4.17.18 Set the Synthesized Sweeper and Signal Generator for minimum output and disconnect test setup.

4.18 SCOPE MODE AMPLITUDE CALIBRATION:

- 4.18.1 Press TI **PRESET**, then *CONFIRM* to restore TI initial settings.
- 4.18.2 Connect the Calibration Generator to the TI EXTERNAL INPUT connector.
- 4.18.3 Press and release the Calibration Generator VARIABLE (OUT) button.
- 4.18.4 Set the TI controls as follows:

MODE AUX	
<i>SCOPE</i>	
<i>DC</i>	
MODE SWEEP	500 μ

4.18.5 Press TI **AMPLITUDE SCALE** and set to the first value listed in the TI Vertical Scale column of Table 27.

4.18.6 Set the Calibration Generator to the first value listed in the Applied column of Table 27.

4.18.7 Press TI **MODE AUX**, *SCOPE*, then *V POS*.

4.18.8 Using the TI Control Knob to control the TI vertical positioning of the displayed signal, adjust the Calibration Generator VARIABLE (OUT) button for the amount of vertical display listed in the Deflection column of Table 27.

4.18.9 Verify the Calibration Generator indicates within 6%.

Table 27.

TI Vertical Scale (V/div)	Applied (V p-p)	Deflection (div)
5 m	20 m	4
50 m	0.2	4
500 m	2	4
5	20	4

4.18.10 Repeat steps 4.18.5 through 4.18.9 for the remaining values listed in Table 27.

4.18.11 Set the Calibration Generator for minimum output and disconnect test setup.

4.19 SCOPE MODE BANDWIDTH CALIBRATION:

4.19.1 Press TI **AMPLITUDE SCALE** and using the TI arrow keys, set the TI vertical scale to 1 V/div.

4.19.2 Connect the Frequency Synthesizer through the Feedthrough Termination to the TI EXTERNAL INPUT connector.

4.19.3 Set the Frequency Synthesizer for 1 kHz and 4 div of vertical display.

4.19.4 Increase the Frequency Synthesizer frequency until the TI display drops to 2.8 V p-p.

4.19.5 Press TI **MODE SWEEP** and using the TI Control Knob, reduce the TI sweep time as necessary for the best signal presentation with a TI sweeptime setting of $\leq 2 \mu\text{s}/\text{div}$.

4.19.6 Verify the 2.8 V p-p signal frequency is $\geq 5 \text{ MHz}$ as indicated on the Frequency Synthesizer.

4.19.7 Set the Frequency Synthesizer for minimum output and disconnect test setup.

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

4.19.9 Annotate and attach a Limited Certification Label per steps 3.11 through 3.14.

CALIBRATION PERFORMANCE TABLE

Not Required

APPENDIX A**A-1 TIME BASE ADJUSTMENT:**

A-1.1 Set TI SUPPLY switch (front panel) to illuminate the SUPPLY  indicator and disconnect TI from power source.

A-1.2 Remove the TI cover.

A-1.3 Connect TI to appropriate power source. Set TI SUPPLY switch (front panel) to illuminate the SUPPLY | indicator.

A-1.4 Allow a 15 minute warm-up period.

A-1.5 Set the TI controls as follows:

UTILITY

3

x1

ENTER

6

ENTER

↑ or ↓

To toggle the reference to INT

UTILITY

Press twice to resume
normal TI operation

A.1.6 Connect the Frequency Standard 10 MHz REF OUT to the Measuring Receiver EXT REF IN. Set the Measuring Receiver to use an external frequency reference.

A-1.7 Disconnect TI W25P1 cable from A4J5 connector.


A-1.8 Connect the TI A4J5 connector through the Sensor Module to the Measuring Receiver. Set the Measuring Receiver to Frequency Counter mode.

A-1.9 Adjust the TI Reference Oscillator Adjustment (A4C47) for a Measuring Receiver indication as close as possible to 100 MHz.

A-1.10 Allow TI 100 MHz Reference Oscillator a minimum of one (1) hour to stabilize. Repeat step A-1.9 as required.

A-1.11 Return the Measuring Receiver to internal reference.

A-1.12 Disconnect the test setup and connect TI W25P1 cable to A4J5 connector.

A-1.13 Set TI SUPPLY switch (front panel) to illuminate the SUPPLY  indicator and disconnect TI from power source. Replace TI covers.

A-1.14 Connect TI to appropriate power source. Set TI SUPPLY switch (front panel) to illuminate the SUPPLY | indicator.

A-1.15 Allow a 15 minute warm-up period, then continue with step 4.1.8.

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

In step B-1.1, select either the Synthesized Level Generator or Synthesized Sweeper (Signal Source) that will generate the CF and 2 X CF listed in the Equipment Requirements for the Low Pass Filter being verified.

B-1.1 Connect the Signal Source through the Low Pass Filter being verified to the Spectrum Analyzer RF INPUT 50 Ω connector.

B-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.

B-1.3 On the Spectrum Analyzer, set the FREQUENCY to the CF for the Low Pass Filter listed in the Equipment Requirements.

B-1.4 Set the Spectrum Analyzer SPAN as necessary to view the signal with a baseline ≥ 60 dB from the top graticule line.

B-1.5 Press the Spectrum Analyzer PEAK SEARCH, MKR \rightarrow and MARKER \rightarrow CF buttons.

B-1.6 Press the Spectrum Analyzer PEAK SEARCH, MKR \rightarrow , MARKER \rightarrow REF LVL and MARKER Δ buttons.

B-1.7 Ensure the signal displayed on the Spectrum Analyzer CRT is at the top graticule line with a baseline ≥ 60 dB from the top graticule line. If the baseline is not ≥ 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.

B-1.8 Set the Signal Source frequency and Spectrum Analyzer FREQUENCY to 2 X CF listed in the Equipment Requirements.

B-1.9 Press the Spectrum Analyzer PEAK SEARCH. Verify the Spectrum Analyzer MKR Δ indicates \geq the rejection listed in the Equipment Requirements for the Low Pass Filter being verified.