TECHNICAL MANUAL

CALIBRATION PROCEDURE

FOR

SPECTRUM ANALYZER

AN930, AN930A, AN930A OPT08/OPT09

(IFR)

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SPECTRUM ANALYZER

AN930, AN930A, AN930A OPT08/OPT09

(IFR)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency Accuracy		
Reference Oscillator	Range: 100 MHz Accuracy: (STD) Accuracy: ±3 X 10^{-6} in the first year; * ±1 X 10^{-6} every year thereafter; Aging/year: ±3 X 10^{-6} in the first year; ±1 X 10^{-6} every year thereafter; Temperature: <5 X 10^{-7} ** Accuracy: (AN930A OPT 09) Accuracy: ±1 X 10^{-6} in the first year; * ±5 X 10^{-7} every year thereafter; Aging/year: ±1 X 10^{-6} in the first year; ±5 X 10^{-7} thereafter; Temperature: ±2 X 10^{-8} **	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: ±(3% of Span Width + Reference Oscillator Accuracy + 50% of RBW)	Compared to a known frequency
Frequency Span Width	Range: 0 Hz; 10 Hz to 2 GHz/div (2.2 GHz/div for AN930A) in 1-2-5 sequence; 2.2 GHz/div in FULL SPAN; 0 Hz to 22 GHz in Start/Stop Accuracy: ±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 Accuracy: ±(Frequency Standard Accuracy + Counter Resolution); Sensitivity: (at 100 MHz with 0 dB attenuation) ≤-85 dBm with 3 kHz BW, (≥10 dB gain, AN930); ≤-65 dBm with 5 MHz BW, (≥0 dB gain, AN930)	Frequency compared to a known frequency. Sensitivity compared to a known signal level
Average Noise Level	Range: 9 kHz to 22 GHz Accuracy: (AN930) (300 Hz RBW, 10 Hz VBW) ≤-70 dBm, 9 to 100 kHz; ≤-100 dBm, 100 kHz to 10 MHz; ≤-120 dBm, 10 MHz to 2.9 GHz; ≤-110 dBm, 2.9 to 12 GHz; ≤-105 dBm, 12 to 22 GHz Accuracy: (AN930A) (300 Hz RBW, 10 Hz VBW) ≤-95 dBm, 9 to 100 kHz; ≤-115 dBm, 100 kHz to 2.9 GHz; ≤-110 dBm, 2.9 to 12 GHz; ≤-105 dBm, 12 to 22 GHz Accuracy: (AN930A) (3 Hz RBW, VBW N/A) ≤-115 dBm, 9 to 100 kHz; ≤-135 dBm, 100 kHz to 2.9 GHz; ≤-130 dBm, 2.9 to 12 GHz; ≤-125 dBm, 12 to 22 GHz	Measured on TI
Display Linearity	Range: 1, 2, 5 and 10 dB/div; Linear Accuracy: 5 or 10 dB/div: ±0.15 dB/dB, ≤±1.5 dB over 8 div; 1 or 2 dB/div: ±0.5 dB over 8 div; Linear: ±2% of Reference Level, RBW ≤5 MHz; ±10% of Reference Level with <10 dB IF gain, RBW 10 and 30 MHz	Compared to a known signal level

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
IF Gain	Range: ≤5 MHz RBW: -10 to +65 dB Accuracy: ±0.25 dB, 0 to +20 dB; ±0.5 dB, +20 to +65 dB Range: 10 and 30 MHz RBW: 0 to +20 dB Accuracy: ±3 dB nominal for AN930; ±2 dB nominal for AN930A	Compared to a known signal level
Attenuator	Range: 0 to 60 dB Accuracy: (AN930) ±0.5 dB or ±2% of dB setting, whichever is greater, 0.1 MHz to 3 GHz; ±1 dB or ±4% of dB setting, whichever is greater, 3 to 18 GHz; ±2 dB or ±7% of setting, whichever is greater, 18 to 22 GHz Accuracy: (AN930A) ±0.5 dB or ±2% of dB setting, whichever is greater, 9 kHz to 2.9 GHz; ±1 dB or ±4% of dB setting, whichever is greater, 2.9 to 18 GHz; ±1.5 dB or ±7% of setting, whichever is greater, 18 to 22 GHz	
Frequency Response	Range: 9 kHz to 22 GHz 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	

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
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, ±20% of RBW setting; 100 kHz (300 kHz for AN930A) to 5 MHz, ±30% of RBW setting; 10 and 30 MHz, ±30% of RBW setting Range: (OPT 08) Adds: 1 kHz and 1 MHz at 3 dB; 200 Hz , 9 and 120 kHz at 6 dB Accuracy: 1 kHz, ±20% of RBW setting; 1 MHz, ±30% of RBW setting; 200 Hz, 9 and 120 kHz, ±10% of RBW setting	-3 dB points are measured on TI
Selectivity	Range: -60 dB to -3 dB ratio Accuracy: (AN930) <5:1 at 3 kHz to 5 MHz RBW; <12:1 at 200 Hz to 1 kHz RBW Range: -60 to -3 dB, -60 to -6 dB, -50 to -3 dB and -50 to -6 dB ratios Accuracy: (AN930A and AN930A OPT 08) -60 to -3 dB ratio: <5:1 at 3, 30 and 300 kHz, 1 and 5 MHz RBW; <12:1 at 1 kHz RBW; -60 to -6 dB ratio: <5:1 at 9 and 120 kHz; -50 to -3 dB ratio: <10:1 at 300 Hz; -50 to -6 dB ratio: <10:1 at 200 Hz	10 dB/div Bandwidth is measured, then divided by the 1 dB/div Bandwidth
Resolution Bandwidth Switching Error	Range: 3, 10, 30, 100 and 300 Hz, 3, 30 and 300 kHz, 5 MHz (add 10 and 30 MHz for AN930A) Accuracy: (Referenced to 30 kHz RBW) ±0.5 dB, 1 kHz to 5 MHz RBW; ±1.0 dB, <1 kHz RBW; ±2.0 dB, 10 and 30 MHz	Measured on TI

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Sweep Time	Range: 200 ns to 10 s/div in a 1-2-5 sequence, Span = 0, resolution reduced <2 μs/div Accuracy: ±1% of FS; ±1% of FS, ≥2 μs/div for AN930A	Compared to a known signal
Residual Responses	Range: 9 kHz to 22 GHz (Input terminated with 50 Ω) Accuracy: ≤-90 dBm, 9 to 100 kHz; ≤-100 dBm, 100 kHz to 22 GHz	Measured on TI
Scope Mode		
Amplitude	Range: 5 mV to 5 V/div in 1-2-5 sequence Accuracy: ±3% of setting	Compared to a known signal level
Bandwidth	Range: DC to ≥5 MHz Accuracy: Down not more than 3 dB at sweeptime ≤2 μs/div	Apply a constant amplitude signal while changing frequency. Vertical deflection compared to deflection at reference frequency

* 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.

** Typical or operational specification. Not calibrated.

2 EQUIPMENT REQUIREMENTS:

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1	FREQUENCY STANDARD	Range: 10 MHz Accuracy: ≤1.25 X 10^{-7}	Arbiter 1083B	As available
2.2	ELECTRONIC COUNTER	Range: 100 MHz Accuracy: ±1 count of LSD	Hewlett-Packard 5345A	
2.3	SYNTHESIZED SWEEPER	Range: 50 MHz to 22 GHz, -35 to +3 dBm Accuracy: ±1 count of LSD	Hewlett-Packard 8340B	

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.4	POWER SENSOR	Range: 100 MHz, -31 to -29 dBm Accuracy: ±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) ±3.5%, 50 to 100 MHz; ±3.3%, 100 MHz to 2 GHz; ±3.4%, 2 to 8 GHz; ±3.8%, 8 to 12 GHz; ±4.1%, 12 to 18 GHz; ±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; -30 dBm Accuracy: ±1.25% of frequency setting	Hewlett-Packard 3325B	
2.8	SYNTHESIZED LEVELED GENERATOR	Range: -80 to +13 dBm, 50 MHz Accuracy: ±0.025 dB, +3.02 to +13 dBm; ±0.0375 dB, -6.98 to +3.01 dBm; ±0.1 dB, -80 to -6.99 dBm Range: 9 kHz to 50 MHz (Flatness) Accuracy: ±0.375 dB	Hewlett-Packard 3335A	
2.9	POWER METER	Range: -31 to -29 dBm, 100 MHz; -30 to -10 dBm, 50 MHz to 22 GHz Accuracy: ±2% of indication *	Hewlett-Packard 436A	

See footnote at end of Equipment Requirements.

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.10 TERMINATION	Range: 50 Ω Accuracy: N/A	Hewlett-Packard 908A	
2.11 SIGNAL GENERATOR	Range: 500 MHz, -22 dBm Accuracy: N/A	Hewlett-Packard 8663A	
2.12 ATTENUATOR	Range: 20 dB at 50 MHz Accuracy: N/A	Hewlett-Packard 8491B OPT 020	
2.13 OSCILLOSCOPE CALIBRATOR	Range: 20 m to 20 V p-p, 1 kHz squarewave Accuracy: ±0.18% of applied for 20 m, 0.2, 2 and 20 V p-p; ±0.15% of applied for 50 m, 0.1, 0.5, 1, 5 and 10 V p-p Range: 200 n to 5 s Accuracy: ±0.25% of frequency setting Range: 1 kHz to ≥5 MHz leveled sine wave at 4 V p-p Accuracy: ±5% of applied	Tektronix 9500B/3200AF	
2.14 FEEDTHROUGH TERMINATION	Range: 50 Ω, 1 kHz to 5 MHz Accuracy: ±2.0% of nominal	Tektronix 011-0049-01	

* 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.

WARNING

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 CUTOFF switch (rear panel) to |. Set TI POWER APPLIED/ON switch to ON.

3.3 TI will initiate a Power-up Self Test. A normal functioning TI will beep twice and display the IFR logo briefly before entering the Center Frequency Operation Screen. If an error message is displayed or the TI fails to beep, this indicates an abnormal condition. If this occurs, set TI POWER APPLIED/ON switch to APPLIED, wait about 30 seconds, then switch to ON. If the error re-occurs, refer to appropriate Commercial Data for corrective action.

3.4 Allow the TI a 15 minute 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 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**, *RBW* and set to 30 **kHz**. The **AMPLITUDE BW** key is a Hardkey, the RBW is a Softkey (Menu key), the 3 and 0 are entries using the DATA key pad, then push the **kHz** key which is also a part of the DATA keys.

3.7 Perform TI Self Test as follows:

3.7.1 Press TI **MEMORY CONFIG**, then *DIAG*.

3.7.2 Using the TI ⇑, ⇓, ⇐ and ⇒ keys and the TI Control Knob, select the first test listed on the TI screen.

3.7.3 Toggle TI *SELECT* until this appropriate test is listed as TEST on the TI screen.

3.7.4 Repeat steps 3.7.2 and 3.7.3 for each remaining test listed on the TI screen.

3.7.5 Press TI *TEST*.

3.7.6 Once the TI is finished, verify that each test status indicates PASSED on the TI screen.

3.7.7 Press TI *RETURN*, then *RETURN* again.

3.8 Make copies of Tables 11 through 20 and 23 through 25 for use as Calibration 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 REF OUT CALIBRATION:

4.1.1 Connect Frequency Standard 10 MHz REF OUT to the Electronic Counter EXT FREQ STD INPUT (1-10 MHz). Set Electronic Counter INT STD/EXT STD switch to EXT STD.

4.1.2 Connect TI REF OUT to the Electronic Counter CHANNEL A input. Set Electronic Counter 50Ω/1MΩ switch to 50Ω.

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.

4.1.3 Adjust Electronic Counter controls as required for a stable display indication and then push RESET. Verify Electronic Counter indication is 99 999 700 to 100 000 300 Hz ±1 count of LSD if within the first year of service and 99 999 900 to 100 000 100 Hz ±1 count of LSD thereafter for the STD TI or 99 999 900 to 100 000 100 Hz ±1 count of LSD if within the first year of service 99 999 950 to 100 000 050 Hz ±1 count of LSD thereafter for the AN930A OPT 09 TI.

4.1.4 Set Electronic Counter INT STD/EXT STD switch to INT STD and disconnect test setup.

4.1.5 To ensure reliability of the TI, the following action will be taken: If 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 TI failed, perform the applicable steps listed in Appendix A and enter appropriate ADJUSTMENT ACTION into the Maintenance Data Collection System.

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

4.1.7 Set the TI controls as follows:

FREQUENCY CENTER	100 **MHz**
AMPLITUDE SCALE	1 **dB**
FREQUENCY SPAN	200 **kHz**

4.1.8 Using the TI Control Knob, adjust the TI gain to place the peak of the signal at a convenient reference line.

4.1.9 Disconnect the cable from the TI REF OUT connector and connect to the Synthesized Sweeper RF OUT connector using the same cable.

4.1.10 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 4.1.8. Do not change the Synthesized Sweeper output controls for the remainder of this para.

4.1.11 Disconnect the cable from the Synthesized Sweeper.

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

4.1.13 Connect the Power Sensor (2.4) to the Synthesized Sweeper.

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

4.1.15 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.

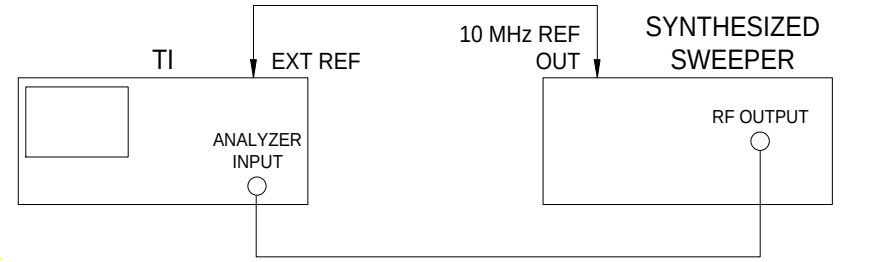

Figure 1.

4.2.2 Press TI **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.2.3 Set the TI controls as follows:

MEMORY CONFIG	
3	
ENTER	
9	
ENTER	
⇑ or ⇓	To toggle the reference to EXT
ENTER	

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	
BW	First value listed in the Bandwidth column of Table 2
COUPLE	*UNCOUPLE* (*COUPLE* not highlighted)

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	-30 dBm

4.2.6 Press the TI **MODE MARKER,** *PEAK**, then <*PEAK or PEAK*> as necessary to place the active marker at the peak of the displayed signal.

4.2.7 Verify the TI M 1 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 (MHz)	Bandwidth (Hz)	Limits (GHz)
1.5	20	5 M	1.491 5 to 1.508 5
1.5	1	300 k	1.499 55 to 1.500 45
1.5	0.5	30 k	1.499 83 to 1.500 17
4	20	5 M	3.991 5 to 4.008 5
4	1	300 k	3.999 55 to 4.000 45
4	0.5	30 k	3.999 83 to 4.000 17
9	20	5 M	8.991 5 to 9.008 5
9	1	300 k	8.999 55 to 9.000 45
9	0.5	30 k	8.999 83 to 9.000 17
16	20	5 M	15.991 5 to 16.008 5
16	1	300 k	15.999 55 to 16.000 45
16	0.5	30 k	15.999 83 to 16.000 17
21	20	5 M	20.991 5 to 21.008 5
21	1	300 k	20.999 55 to 21.000 45
21	0.5	30 k	20.999 83 to 21.000 17

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 **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.3.2 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

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

4.3.4 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).

4.3.5 Set the TI controls as follows:

MODE MARKER	
*PEAK**	
<PEAK or PEAK>	As necessary to place the active marker at the peak of the displayed signal.

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

4.3.7 Press TI *RETURN, MKR 2*, and use the TI Control Knob to superimpose the active marker over the displayed signal.

4.3.8 Press TI *DELTA* and verify the TI Δ marker frequency indication is within the values listed in the Limits column of Table 3.

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

Table 3. (Cont.)

Center Freq (Hz)	Frequency 1 (Hz)	Frequency 2 (Hz)	Span/Div (Hz)	Limits (Hz)
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
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.

4.3.9 Press TI *MKR 1* and *MKR 2* as necessary to turn off the TI markers.

4.3.10 Repeat steps 4.3.2 through 4.3.8 for the remaining values listed in Table 3.

4.3.11 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 **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.4.3 Set the TI controls as follows:

FREQUENCY SPAN

ZERO

AMPLITUDE ATTEN 0 **dB**, *INT*

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

4.4.5 Press TI **MODE AUX**.

4.4.6 Press TI *CTR**.

4.4.7 Set the TI counter resolution to the first value listed in the Resolution column of Table 4.

4.4.8 Verify the TI CTR indication is within the first values listed in 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

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

4.4.10 Press TI **AMPLITUDE BW**, *BW*, then 5 **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**, *BW*, then 3 **kHz**.

4.4.14 Press TI **AMPLITUDE GAIN**, then 10 **dB**.

4.4.15 Decrease the Synthesized Sweeper output controls until the TI CTR indication changes either -5 or +5 Hz.

4.4.16 Verify the Synthesized Sweeper indicates ≤-85 dBm.

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

4.4.18 Set the TI controls as follows:

AUX MODE

*CTR**

1 Hz

MEMORY CONFIG

3

ENTER

9

ENTER

⇑ or ⇓ — To toggle the reference to INT

ENTER

RETURN

MEMORY CONFIG

4.5 AVERAGE NOISE LEVEL CALIBRATION:

4.5.1 Press TI **MEMORY SETUP**, then *INIT* 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 **kHz**
AMPLITUDE GAIN	50 **dB**
AMPLITUDE BW	300 **Hz**
COUPLE	*UNCOUPLE* (*COUPLE* not highlighted)
VIDEO	10 **Hz**

4.5.4 Press the TI **MODE MARKER**, then *MKR 1*. Using the DATA ENTRY keys, set the TI marker 1 to the first value listed in the Applied column of Table 5.

4.5.5 Verify the TI MRK 1 amplitude is within the value listed in the Limits column of Table 5.

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

4.5.7 Repeat steps 4.5.4 through 4.5.6 for the remaining values listed in Table 5.

Table 5.

	Limits (dBm)	
Applied (Hz)	**AN930**	**AN930A**
9 k	≤-70	≤-95
60 k	≤-70	≤-95
100 k	≤-70	≤-95
101 k	≤-100	≤-115
9.9 M	≤-100	≤-115
10 M	≤-120	≤-115
11 M	≤-120	≤-115
2.9 G	≤-120	≤-115
3.0 G	≤-110	≤-110
7.5 G	≤-110	≤-110
12 G	≤-110	≤-110
13 G	≤-105	≤-105
17 G	≤-105	≤-105
22 G	≤-105	≤-105

4.5.8 For TI AN930A, proceed to step 4.5.9. Otherwise, proceed to step 4.5.10

4.5.9 Set the TI **FREQUENCY SPAN** to 20 **Hz** and **AMPLITUDE BW** to 3 **Hz.**

4.5.10 Set the TI **FREQUENCY CENTER** to the first value listed in the Applied column of Table 6.

4.5.11 Repeat steps 4.5.4 through 4.5.7 using Table 6.

Table 6.

Applied (Hz)	Limits (dBm)
9 k	≤-115
60 k	≤-115
100 k	≤-115
101 k	≤-135
9.9 M	≤-135
10 M	≤-135
11 M	≤-135
2.9 G	≤-135
3.0 G	≤-130
7.5 G	≤-130
12 G	≤-130
13 G	≤-125
17 G	≤-125
22 G	≤-125

4.5.12 Disconnect test setup.

4.6 DISPLAY LINEARITY CALIBRATION:

4.6.1 Press TI **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.6.2 Connect the Synthesized Leveled Generator OUTPUT 50 Ω to the TI ANALYZER INPUT connector though the Attenuator.

4.6.3 Set the TI controls as follows:

FREQUENCY CENTER	50 **MHz**
FREQUENCY SPAN	1 **MHz**
AMPLITUDE SCALE	5 **dB**
AMPLITUDE BW	300 **kHz**
COUPLE	*UNCOUPLE* (*COUPLE* not highlighted)

VIDEO	100 **Hz**
AMPLITUDE GAIN	0 **dB,** *INT*
AMPLITUDE ATTEN	10 **dB,** *INT*

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

4.6.5 Set the TI controls as follows:

MODE MARKER

MKR 1

4.6.6 Press TI **AMPLITUDE GAIN** and adjust the TI Control Knob for a reference at the top graticule line of the TI screen.

4.6.7 Adjust the TI Control Knob for maximum amplitude as indicated by the TI M 1 amplitude readout.

4.6.8 Press TI **MODE MARKER**, *REF**, then *+REF*.

4.6.9 Press the Synthesized Leveled Generator AMPL INCR key and set to 1 dB. Press the AMPLITUDE key, then press the ⇓ step key to set the Synthesized Leveled Generator amplitude to the next value listed in Applied column of Table 7.

4.6.10 Verify the TI M 1 marker amplitude indicates within the values listed in the Limits column of Table 7.

Table 7.

Applied (dB)	**Limits (dB)**
0	Reference
-2	-2.3 to -1.7
-4	-4.6 to -3.4
-6	-6.9 to -5.1
-8	-9.2 to -6.8
-10	-11.5 to -8.5
-11	-12.5 to -9.5
-12	-13.5 to -10.5
-13	-14.5 to -11.5
-14	-15.5 to -12.5
-15	-16.5 to -13.5

Table 7. (Cont.)

Applied (dB)	Limits (dB)
-16	-17.5 to -14.5
-17	-18.5 to -15.5
-18	-19.5 to -16.5
-19	-20.5 to -17.5
-20	-21.5 to -18.5
-21	-22.5 to -19.5
-22	-23.5 to -20.5
-23	-24.5 to -21.5
-24	-25.5 to -22.5
-25	-26.5 to -23.5
-26	-27.5 to -24.5
-27	-28.5 to -25.5
-28	-29.5 to -26.5
-29	-30.5 to -27.5
-30	-31.5 to -28.5
-31	-32.5 to -29.5
-32	-33.5 to -30.5
-33	-34.5 to -31.5
-34	-35.5 to -32.5
-35	-36.5 to -33.5
-36	-37.5 to -34.5
-37	-38.5 to -35.5
-38	-39.5 to -36.5
-39	-40.5 to -37.5
-40	-41.5 to -38.5

4.6.11 Repeat steps 4.6.9 and 4.6.10 for the remaining values listed in Table 7.

4.6.12 Press TI **MODE MARKER**, then *MKR 1* to turn off the TI markers.

4.6.13 Press TI **AMPLITUDE SCALE**, then 1 **dB**.

4.6.14 Repeat steps 4.6.4 through 4.6.8.

4.6.15 Press the Synthesized Leveled Generator AMPL INCR key and set to 1 dB. Press the AMPLITUDE key, then press the ⇓ step key to set the Synthesized Leveled Generator amplitude to the next value listed in Applied column of Table 8.

4.6.16 Verify the TI M 1 marker amplitude indicates within the values listed in the Limits column of Table 8.

Table 8.

Applied (dB)	Limits (dB)
0	Reference
-1	-1.5 to -0.5
-2	-2.5 to -1.5
-3	-3.5 to -2.5
-4	-4.5 to -3.5
-5	-5.5 to -4.5
-6	-6.5 to -5.5
-7	-7.5 to -6.5
-8	-8.5 to -7.5

4.6.17 Repeat steps 4.6.15 and 4.6.16 for the remaining values listed in Table 8.

4.6.18 Set the TI controls as follows:

AMPLITUDE SCALE

LIN

*UNITS **

mV

RETURN

AMPLITUDE GAIN -0.1 **dB**, *INT*

AMPLITUDE ATTEN 10 **dB**, *INT*

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

4.6.20 Press TI **MODE MARKER**, then *MKR 1*. Adjust the TI Control Knob for maximum amplitude as indicated by the TI M 1 amplitude readout.

4.6.21 Set the Synthesized Leveled Generator amplitude controls for a TI M 1 indication as close as to possible 22.4 mV.

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

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

Table 9.

Applied (Nominal dBm)	Limits (mV)
0	22.4 (ref)
-6	10.8 to 11.7
-12	5.2 to 6.1
-18	2.4 to 3.3

4.6.24 Repeat step 4.6.22 and 4.6.23 for the remaining values listed in Table 9.

4.6.25 Set the TI controls as follows:

FREQUENCY SPAN	10 **MHz**
AMPLITUDE BW	10 **MHz**
AMPLITUDE GAIN	9.9 **dB**, *INT*
AMPLITUDE ATTEN	20 **dB**, *INT*

4.6.26 Repeat steps 4.6.19 through 4.6.24 utilizing Table 10.

Table 10.

Applied (Nominal dBm)	Limits (mV)
0	22.4 (ref)
-6	9.0 to 13.4
-12	3.4 to 7.9
-18	0.6 to 5.1

4.6.27 Set the Synthesized Leveled Generator for minimum output.

4.7 IF GAIN CALIBRATION:

4.7.1 Press TI **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.7.2 Set the TI controls as follows:

FREQUENCY CENTER	50 **MHz**
FREQUENCY SPAN	1 **kHz**
AMPLITUDE BW	1 **kHz**
COUPLE	*UNCOUPLE* (*COUPLE* not highlighted)
VIDEO	100 **Hz**
AMPLITUDE SCALE	1 **dB**
AMPLITUDE GAIN	-10 **dB,** *INT*

4.7.3 Set the Synthesized Leveled Generator to 50 MHz at -1.0 dBm.

4.7.4 Set the TI controls as follows:

MODE MARKER
MKR 1

4.7.5 Adjust the TI Control Knob for maximum amplitude as indicated by the TI M 1 amplitude indication. Record the TI M 1 indication in the TI M 1 column of Table 11 as ref.

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

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

4.7.8 Press TI **AMPLITUDE GAIN** and set to the first value listed on the TI Gain column of Table 11.

4.7.9 Press TI **MODE MARKER,** *PEAK* *, then <*PEAK or PEAK*> as necessary to place the TI M 1 marker to the peak of the displayed signal. Record the TI M 1 amplitude indication in the TI M 1 column of Table 11 for the appropriate applied value.

Table 11.

Applied (dBm)	TI Gain (dB)	TI M 1 (dB)	Limits (dB)
-1	-10	_____ (ref)	Reference
-11	0	_____	-0.25 to +0.25
-21	+10	_____	-0.25 to +0.25

Table 11. (Cont.)

Applied (dBm)	TI Gain (dB)	TI M 1 (dB)	Limits (dB)
-31	+20	_____	-0.25 to +0.25
-41	+30	_____	-0.50 to +0.50
-51	+40	_____	-0.50 to +0.50
-61	+50	_____	-0.50 to +0.50
-71	+60	_____	-0.50 to +0.50
-76 *	+65	_____	-0.50 to +0.50

* This setting must be manually entered into the Synthesized Leveled Generator.

4.7.10 Repeat steps 4.7.7 through 4.7.9 for the remaining values listed in Table 11.

4.7.11 From the recorded values in Table 11, calculate the TI IF Gain as follows:

IF Gain = (Current Value - Previous Value) + 10 dB (for last step,
IF Gain = (Current Value - Previous Value) + 5 dB)

4.7.12 Verify the results of step 4.7.11 are within the values listed in the Limits column of Table 11 for the appropriate TI Gain setting.

4.7.13 Set the TI controls as follows:

FREQUENCY SPAN	10 **MHz**
AMPLITUDE BW	10 **MHz**
MODE MARKER	*MKR 1*, as necessary to turn off TI markers
AMPLITUDE GAIN	0 **dB,** *INT*
AMPLITUDE SCALE	
LIN	
UNITS *	
dB	

4.7.14 Set the Synthesized Leveled Generator to 50 MHz at -13.0 dBm.

4.7.15 Repeat steps 4.7.4 through 4.7.12 utilizing Table 12.

Table 12.

Applied (dBm)	TI Gain (dB)	TI M 1 (dB)	Limits (dB) AN930	AN930A
-13	0	_____ (ref)	Reference	Reference
-23	+10	_____	-3.0 to +3.0	-2.0 to +2.0
-33	+20	_____	-3.0 to +3.0	-2.0 to +2.0

4.7.16 Set the Synthesized Leveled Generator for minimum output. Disconnect the test setup.

4.8 ATTENUATOR CALIBRATION:

4.8.1 Press TI **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.8.2 Connect the Synthesized Leveled Generator OUTPUT 50 Ω to the TI ANALYZER INPUT connector. Set the Synthesized Leveled Generator to -60 dBm at 50 MHz.

4.8.3 Set the TI controls as follows:

FREQUENCY CENTER 50 **MHz**

FREQUENCY SPAN 20 k**Hz**

AMPLITUDE SCALE 1 **dB**

AMPLITUDE ATTEN 0 **dB**, *INT*

AMPLITUDE GAIN 28 **dB,** *INT*

MODE MARKER

MKR 1

4.8.4 Adjust the TI Control Knob for maximum amplitude as indicated by the TI M 1 amplitude indication. Record the TI M 1 indication in the TI M 1 column of Table 13 as ref.

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

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

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

4.8.8 Press TI **MODE MARKER,** *PEAK* *, then <*PEAK or PEAK*> as necessary to place the TI M 1 marker to the peak of the displayed signal. Record the TI M 1 amplitude indication in the TI M 1 column of Table 13 for the appropriate applied value.

Table 13.

TI Attenuator (dB)	Applied (dBm)	TI M 1 (dB)	Limits (dB)
0	-60	_____ (ref)	Reference
10	-50	_____	-0.5 to +0.5
20	-40	_____	-0.5 to +0.5
30	-30	_____	-0.6 to +0.6
40	-20	_____	-0.8 to +0.8
50	-10	_____	-1.0 to +1.0
60	0	_____	-1.6 to +1.6

4.8.9 Repeat steps 4.8.6 through 4.8.8 for the remaining values listed in Table 13.

4.8.10 From the values recorded in Table 13, calculate the TI Attenuator Error as follows:

Attenuator Error = (Current Value - Previous Value) - 10 dB

4.8.11 Verify the results of step 4.8.10 are within the values listed in the Limits column of Table 13 for the appropriate TI Attenuator setting.

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 **MEMORY SETUP**, then *INIT* 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.

4.9.4 Set the Synthesized Leveled Generator controls as follows:

FREQUENCY	50 MHz
AMPLITUDE	-18.0 dBm

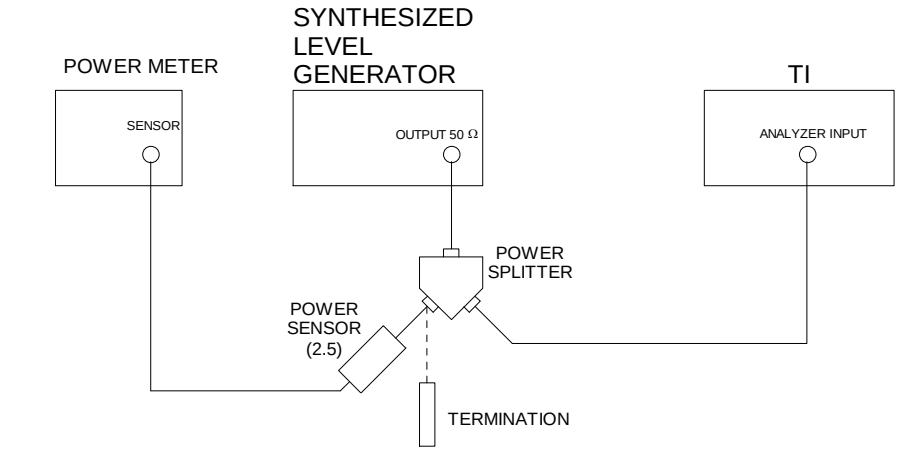

Figure 2.

NOTE

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

4.9.5 Set the TI controls as follows:

FREQUENCY CENTER	50 **MHz**
FREQUENCY SPAN	20 k**Hz**
AMPLITUDE SCALE	1 **dB**
AMPLITUDE ATTEN	10 **dB,** *INT*
AMPLITUDE GAIN	0 **dB,** *INT*
MODE MARKER	
MKR 1	

4.9.6 Adjust the TI Control Knob for maximum amplitude as indicated by the TI M 1 amplitude readout.

4.9.7 Set Synthesized Leveled Generator amplitude controls for a TI M 1 amplitude indication of -24 dBm ±0.1 dB.

4.9.8 Set the TI REF level to -20 dBm.

4.9.9 Press the Power Meter MODE dB [REF] key.

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

4.9.11 Set the Synthesized Leveled Generator frequency to the first value listed in the Applied column of Table 14.

4.9.12 Press TI **FREQUENCY CENTER** and set to the first value listed in the Applied column of Table 14.

4.9.13 Press TI **MODE MARKER**, then using the TI Control Knob, set the TI M 1 cursor on top of the displayed signal.

4.9.14 Algebraically subtract -24 dB to the TI M 1 amplitude indication and record results in a copy of Table 14.

4.9.15 Repeat steps 4.9.11 through 4.9.14 for the remaining values listed in Table 14.

Table 14.

Applied (Hz)	TI M 1 (dB)
9 k	_____
20 k	_____
50 k	_____
75 k	_____
100 k	_____
1 M	_____
5 M	_____
10 M	_____
20 M	_____

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

4.9.17 Connect equipment as shown in Figure 2 with Power Sensor (2.5) connected to Power Splitter, except replace the Synthesized Leveled Generator with the Synthesized Sweeper.

4.9.18 Set the Synthesized Sweeper as follows:

CW	50 MHz
POWER LEVEL	-18.0 dBm

4.9.19 Set the Synthesized Sweeper amplitude controls as close as possible for a 0.0 dB indication on the Power Meter.

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

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

4.9.22 Press TI **MODE MARKER**, then using the TI Control Knob, set the TI MKR 1 cursor on top of the displayed signal.

4.9.23 Adjust Synthesized Sweeper amplitude controls for a TI M 1 amplitude indication of -24 dBm ±0.1 dB.

4.9.24 Record the Power Meter indication as the opposite polarity value in the Power Meter column in a copy of Table 15.

4.9.25 Repeat steps 4.9.20 through 4.9.24 for the remaining applied values listed in Table 15.

Table 15.

Applied (MHz)	Power Meter (dB)
75	_____
175	_____
275	_____
375	_____
475	_____
575	_____
675	_____
775	_____
875	_____
975	_____
1075	_____
1175	_____
1275	_____
1375	_____
1500	_____
1525	_____
1625	_____
1725	_____

Table 15. (Cont.)

Applied (MHz)	Power Meter (dB)
1925	_____
2125	_____
2325	_____
2525	_____
2725	_____
2900	_____

4.9.26 Set the Synthesized Sweeper frequency to the first value listed in the Applied column of Table 16.

4.9.27 Press the TI **FREQUENCY CENTER** and set to the first value listed in the Applied column of Table 16.

4.9.28 Press TI **MODE MARKER**, then using the TI Control Knob, set the TI MKR 1 cursor on top of the displayed signal.

4.9.29 Press TI **AMPLITUDE GAIN**, then *PS AUTO*.

4.9.30 Adjust Synthesized Sweeper amplitude controls for a TI Marker amplitude indication of -24 dBm ±0.1 dB.

4.9.31 Record the Power Meter indication as the opposite polarity value in the Power Meter column in a copy of Table 16.

4.9.32 Repeat steps 4.9.26 through 4.9.31 for the remaining applied values listed in Table 16.

Table 16.

Applied (GHz)	Power Meter (dB)
3.05	_____
3.1	_____
3.3	_____
3.5	_____
3.7	_____
3.9	_____
4.1	_____

Table 16. (Cont.)

Applied (GHz)	Power Meter (dB)
4.3	_____
4.5	_____
4.7	_____
4.9	_____
5.1	_____
5.3	_____
5.5	_____
5.7	_____
5.9	_____
6.1	_____
6.3	_____
6.5	_____
6.7	_____
6.75	_____
6.8	_____
7.0	_____
7.4	_____
7.8	_____
8.2	_____
8.6	_____
9.0	_____
9.4	_____
9.8	_____
10.2	_____
11.0	_____

Table 16. (Cont.)

Applied (GHz)	Power Meter (dB)
11.4	_____
11.8	_____
12.0	_____

4.9.33 Repeat steps 4.9.26 through 4.9.31 for the remaining applied values listed in Table 17.

Table 17.

Applied (GHz)	Power Meter (dB)
12.6	_____
12.8	_____
13.2	_____
13.25	_____
13.3	_____
13.7	_____
14.1	_____
14.5	_____
14.9	_____
15.3	_____
15.7	_____
16.1	_____
16.5	_____
16.9	_____
17.3	_____
17.7	_____
18.0	_____

4.9.34 Repeat steps 4.9.26 through 4.9.31 for the remaining applied values listed in Table 18.

Table 18.

Applied (GHz)	Power Meter (dB)
18.5	_____
18.9	_____
19.3	_____
19.7	_____
20.1	_____
20.5	_____
20.9	_____
21.3	_____
21.7	_____
22.0	_____

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

4.9.36 Verify the TI Frequency Response as follows:

4.9.36.1 From the values recorded in Tables 14 and 15, algebraically subtract the most negative from the most positive. Verify the result is ≤3.0 dB.

4.9.36.2 From the values recorded in Table 16, algebraically subtract the most negative from the most positive. Verify the result is ≤4.0 dB.

4.9.36.3 From the values recorded in Table 17, algebraically subtract the most negative from the most positive. Verify the result is ≤6.0 dB.

4.9.36.4 From the values recorded in Table 18, algebraically subtract the most negative from the most positive. Verify the result is ≤8.0 dB.

4.10 RESOLUTION BANDWIDTH AND SELECTIVITY CALIBRATION:

4.10.1 Press TI **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.10.2 Connect equipment as shown in Figure 3.

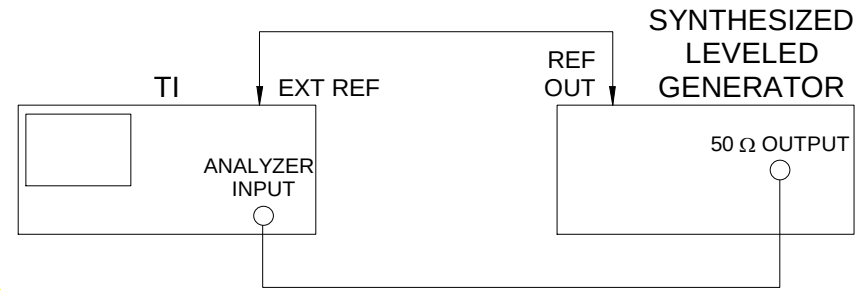

Figure 3.

4.10.3 Set the TI controls as follows:

MEMORY CONFIG	
3	
ENTER	
9	
ENTER	
⇑ or ⇓	to toggle the reference to EXT
RETURN	
MEMORY CONFIG	
FREQUENCY CENTER	50 **MHz**
AMPLITUDE SCALE	1 **dB**
AMPLITUDE GAIN	-10 **dB,** *INT*

4.10.4 Set the Synthesized Leveled Generator for 50 MHz at -20 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
COUPLE	*UNCOUPLE* (*COUPLE* not highlighted)
VIDEO	100 **Hz**

4.10.6 Adjust the Synthesized Leveled Generator amplitude controls to place the displayed signal on the TI top graticule line.

4.10.7 Press TI **MODE MARKER** and using the TI Control Knob, adjust for a TI M 1 indication of -23.00 ±0.1 dB if measuring a 3 dB RBW or -26.00 ±0.1 dB if measuring a 6 dB RBW. The marker should be on the left-hand skirt of the signal.

4.10.8 Press TI *MKR 2* and using the TI Control Knob, adjust the active cursor past -20.00 dB and back down to -23.00 ±0.1 dB if measuring a 3 dB RBW or -26.00 ±0.1 dB if measuring a 6 dB RBW. The marker should be on the right-hand skirt of the signal.

4.10.9 Press TI *DELTA*.

4.10.10 Verify the TI Δ frequency indication is within the values listed in the Limits column of Table 19.Record the value in the appropriate Actual 3 dB BW or Actual 6 dB BW column of Table 19.

4.10.11 Press TI *MKR 1* and *MKR 2* as necessary to turn off the TI markers.

Table 19.

TI Span/Div (Hz)	**TI BW (Hz)**	**Actual 3 dB BW (Hz)**	**Actual 6 dB BW (Hz)**	**Limits (Hz)**
2 M	5 M	_____	N/A	3.5 to 6.5 M
500 k	1 M *	_____	N/A	700 k to 1.3 M
100 k	300 k	_____	N/A	210 to 390 k
50 k	120 k *	N/A	_____	108 to 132 k
10 k	30 k	_____	N/A	24 to 36 k
5 k	9 k *	N/A	_____	8.1 to 9.9 k
1 k	3 k	_____	N/A	2.4 to 3.6 k
500	1 k *	_____	N/A	0.8 to 1.2 k
300	300	_____	N/A	240 to 360
201	200 *	N/A	_____	180 to 220

* For AN930A OPT 08 Only.

4.10.12 Repeat steps 4.10.5 through 4.10.11, as required, for the remaining values listed in Table 19.

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

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

4.10.15 Set the TI **FREQUENCY SPAN** as necessary to view several div of width of the displayed signal at the 60 dB or 50 dB point. Ensure the TI UNCAL light is not lit.

4.10.16 Adjust the Synthesized Leveled Generator amplitude controls to place the displayed signal on the TI top graticule line.

4.10.17 Using the TI Control Knob, adjust for a TI M 1 indication of -80.00 ±0.1 dB if measuring a 60 dB point or -70.00 ±0.1 dB if measuring a 50 dB point. The marker should be on the left-hand skirt of the signal.

4.10.18 Press TI *MKR 2* and using the TI Control Knob, adjust the active cursor past -20.00 dB and back down to -80.00 ±0.1 dB if measuring a 60 dB point or -70.00 ±0.1 dB if measuring a 50 dB point. The marker should be on the right-hand skirt of the signal

4.10.19 Press TI *DELTA*.

4.10.20 Record the TI Δ frequency value in the appropriate Actual 60 dB BW or Actual 50 dB BW column of Table 20.

4.10.21 Press TI *MKR 1* and *MKR 2* as necessary to turn off the TI markers.

Table 20.

TI BW (Hz)	Actual 60 dB BW (Hz)	Actual 50 dB BW (Hz)
5 M	_____	N/A
1 M *	_____	N/A
300 k	_____	N/A
120 k *	_____	N/A
30 k	_____	N/A
9 k *	_____	N/A
3 k	_____	N/A
1 k *	_____	N/A
300	_____ (AN930)	_____ (AN930A)
200 *	N/A	_____

* For AN930A OPT 08 Only.

4.10.22 Repeat steps 4.10.14 through 4.10.21 for the remaining values listed in Table 20.

4.10.23 Divide each Actual 60 dB or 50 dB BW value recorded in Table 20 by the appropriate Actual 3 dB or Actual 6 dB BW value recorded in Table 19. Verify the resulting is within the value listed in the Limits column of Table 21 for the TI being certified.

Table 21.

TI	TI BW (Hz)	Ratio (dB)	Limits
AN930	5 M	60:3	<12:1
	300 k	60:3	<12:1
	30 k	60:3	<12:1
	3 k	60:3	<12:1
	300	60:3	<12:1
AN930A	5 M	60:3	<12:1
	300 k	60:3	<12:1
	30 k	60:3	<12:1
	3 k	60:3	<12:1
	300	50:3	<10:1
AN930A OPT 08	5 M	60:3	<12:1
	1 M	60:3	<12:1
	300 k	60:3	<12:1
	120 k	60:6	<5:1
	30 k	60:3	<12:1
	9 k	60:6	<5:1
	3 k	60:3	<12:1
	1 k	60:3	<12:1
	300	50:3	<10:1
	200	50:6	<10:1

4.10.24 For TI AN930, proceed to step 10.25. Otherwise, proceed to step 4.10.34.

4.10.25 Set the TI controls as follows:

AMPLITUDE SCALE	
LIN	
*UNITS **	
dB	
AMPLITUDE ATTEN	10 **dB,** *INT*

4.10.26 Set the TI controls as follows:

FREQUENCY SPAN	First value listed in the TI Span/Div column of Table 22
AMPLITUDE BW	First value listed in the TI BW column of Table 22

4.10.27 Adjust the Synthesized Leveled Generator amplitude controls to place the displayed signal on the TI top graticule line.

4.10.28 Press TI **MODE MARKER,** then *MKR 1* and using the TI Control Knob, adjust for a TI M 1 indication of -23.00 ±0.1 dB. The marker should be on the left-hand skirt of the signal.

4.10.29 Press TI *MKR 2* and using the TI Control Knob, adjust the active cursor past -20.00 dB and back down to -23.00 ±0.1 dB. The marker should be on the right-hand skirt of the signal.

4.10.30 Press TI *DELTA*.

4.10.31 Verify the TI Δ frequency indication is within the values listed in the Limits column of Table 22.

4.10.32 Press TI *MKR 1* and *MKR 2* as necessary to turn off the TI markers.

Table 22.

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

4.10.33 Repeat steps 4.10.26 through 4.10.32 for the remaining values listed in Table 22.

4.10.34 Set the Synthesized Leveled Generator for minimum output.

4.11 RESOLUTION BANDWIDTH SWITCHING ERROR CALIBRATION:

4.11.1 Press TI **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.11.2 Set the TI controls as follows:

FREQUENCY CENTER	50 **MHz**
AMPLITUDE SCALE	
LIN	
UNITS *	
dB	

4.11.3 Set the Synthesized Leveled Generator for 50 MHz at -30 dBm.

4.11.4 Set the TI controls as follows:

AMPLITUDE BW	First value listed in the TI BW column of Table 23
COUPLE	*UNCOUPLE* (*COUPLE* not highlighted)
VIDEO	100 **Hz**
FREQUENCY SPAN	First value listed in the TI Span/Div column of Table 23

4.11.5 Adjust the Synthesized Leveled Generator amplitude controls to place the displayed signal 2 division below the TI top graticule line.

4.11.6 Press the TI **MODE MARKER,** *PEAK* *, then <*PEAK or PEAK*> as necessary to place the TI M 1 marker to the peak of the displayed signal.

4.11.7 Record the TI M 1 amplitude indication.

4.11.8 Set the TI **AMPLITUDE BW** the next value listed in the TI BW column of Table 23. Press the TI **FREQUENCY SPAN** key and set to the next value listed in the TI Span/Div column of Table 23.

4.11.9 Press the TI **MODE MARKER,** *PEAK* *, then <*PEAK or PEAK*> as necessary to place the TI M 1 marker to the peak of the displayed signal.

4.11.10 Record the M 1 amplitude indication.

4.11.11 Subtract the value recorded in step 4.11.10 from the value recorded in step 4.11.7. Verify the results are within the values listed in the Limits column of Table 23.

4.11.12 Repeat steps 4.11.8 through 4.11.11 for the remaining values listed in Table 23.

Table 23.

TI BW (Hz)	TI Span/Div (Hz)	Limits (dB)
30 k	10 k	Reference
30 M *	10 M	-2.0 to +2.0
10 M *	5 M	-2.0 to +2.0
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	250	-1.0 to +1.0
100	50	-1.0 to +1.0
30	50	-1.0 to +1.0
10	20	-1.0 to +1.0
3	20	-1.0 to +1.0

* For AN930A Only.

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

4.11.14 Set the TI controls as follows:

MEMORY CONFIG

3

ENTER

9

ENTER

⇑ or ⇓ To toggle the reference to INT

RETURN

MEMORY CONFIG

4.12 SWEEP TIME CALIBRATION:

4.12.1 Press TI **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.12.2 Connect the Oscilloscope Calibrator through the Active Head and Attenuator to the TI ANALYZER INPUT connector.

4.12.3 Set TI controls as follows:

FREQUENCY CENTER	First value listed in the TI Frequency column of Table 26
FREQUENCY SPAN	*ZERO*
AMPLITUDE BW	300 **kHz**
AMPLITUDE SCALE	2 **dB**
MODE SWEEP	First value listed in the TI Sweep Time column of Table 26

4.12.4 Set Oscilloscope Calibrator for pulsed time marks into 50 Ω at the first value listed in the Applied column of Table 26. Set Oscilloscope Calibrator OUTPUT ON/OFF to ON.

4.12.5 Set TI controls as follows:

MODE SWEEP	*SOURCE**
	VIDEO
	RETURN
	*TRIG**
	TRIG LVL

4.12.6 Using the TI Control Knob, adjust the TI Trigger Level for a stable display. It may be necessary to adjust TI Center Frequency to obtain suitable marker amplitude on the display.

4.12.7 Press TI **MODE SWEEP**, *MODE*, SNGL* then *ARM.* Allow sufficient time for the TI sweep to finish.

4.12.8 Press TI **MODE MARKER**, then *MKR 1.*

4.12.9 Using the TI Control Knob, adjust the TI MKR 1 so that it is superimposed on the 2nd signal peak from the far left graticule line.

4.12.10 Press TI *MKR 2* and using the TI Control Knob, adjust the TI active marker so that it is superimposed on the 10th signal peak from the far left graticule line.

4.12.11 Press TI *DELTA.*

4.12.12 Verify the TI Δ frequency indication is within the values listed in the Limits column of Table 24.

4.12.13 Press TI **MODE MARKER**, then *MKR 1* and *MKR 2* as necessary to turn off the TI markers.

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

4.12.15 Repeat steps 4.12.3 through 4.12.14 for the remaining values listed in Table 24.

Table 24.

Frequency (Hz)	Sweep Time (s)	Applied (s)	Limits (s)
5 M	200 n *	0.2 µ	1.58 to 1.62 µ
50 k	20 µ	20 µ	158 to 162 µ
500	2 m	2 m	15.8 to 16.2 m
20	50 m	50 m	395 to 405 m **
10	100 m	0.1	790 to 810 m
10	1	1	7.90 to 8.10
10	10	10	79.0 to 81.0

* For AN930 Only.

** Due to TI marker resolution, limits may have to be verified using the TI display.

4.12.16 Set the Oscilloscope Calibrator OUTPUT ON/OFF to OFF and disconnect test setup.

4.13 RESIDUAL RESPONSES CALIBRATION:

4.13.1 Press TI **MEMORY SETUP**, then *INIT* 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:

FREQUENCY START	9 kHz
FREQUENCY STOP	100 kHz
AMPLITUDE BW	*RBW* and *VIDEO*, as necessary
SWEEP TIME	As necessary to obtain a calibrated sweep

4.13.4 Verify any Residual Response is within the first 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	22 G	≤-100

4.13.5 Increase the TI **FREQUENCY START** and **FREQUENCY STOP** controls to cover the remaining frequency range in Table 25 in about 200 MHz increments. Adjust the **AMPLITUDE BW** and **SWEEP TIME** as necessary to maintain a calibrated sweep. Repeat step 4.13.4 for the remaining values in Table 25.

4.13.6 Disconnect test setup.

4.14 SCOPE MODE AMPLITUDE CALIBRATION:

4.14.1 Press TI **MEMORY SETUP**, then *INIT* to restore TI initial settings.

4.14.2 Connect the Oscilloscope Calibrator through the Active Head to the TI EXTERNAL INPUT connector.

4.14.3 Press TI **MODE AUX**, *EXT IN *, AC,* then *SCOPE*.

4.14.4 Press TI **AMPLITUDE SCALE** and using the TI control Knob, set to the first value listed in the TI Vertical Scale column of Table 26. Press TI **MODE SWEEP** and set to *500 μs*.

4.14.5 Set the Oscilloscope Calibrator for a 1 kHz squarewave into 1 MΩ at the first value listed in the Applied column of Table 26. Set the Oscilloscope Calibrator OUTPUT ON/OFF to ON.

4.14.6 Verify the applied signal is displayed on the TI screen.

4.14.7 Press TI **MODE MARKER**.

4.14.8 Using the TI Control Knob, adjust the TI MKR 1 so the marker is at the positive peak of the displayed signal.

4.14.9 Press TI *MKR 2*.

4.14.10 Using the TI Control Knob, adjust the TI MKR 2 so the marker is at the negative peak of the displayed signal.

4.14.11 Press TI *DELTA*.

4.14.12 Press TI **MODE SWEEP**, *MODE *, SNGL*, then *ARM.*

4.14.13 Press TI *ARM* several times and verify the TI Δ amplitude indicates within the values listed in the Limits column of Table 26.

4.14.14 Set the Oscilloscope Calibrator OUTPUT ON/OFF to OFF.

4.14.15 Press TI **AMPLITUDE SCALE** and using the TI control Knob, set to the next value listed in the TI Vertical Scale column of Table 26. Press TI **MODE SWEEP**, *MODE *, SNGL*, then *AUTO.*

4.14.16 Set the Oscilloscope Calibrator for a 1 kHz squarewave into 1 MΩ at the next value listed in the Applied column of Table 26. Set the Oscilloscope Calibrator OUTPUT ON/OFF to ON.

4.14.17 Verify the applied signal is displayed on the TI screen.

4.14.18 Press TI **MODE MARKER**, then *MKR 1*.

4.14.19 Using the TI Control Knob, adjust the TI MKR 1 so the marker is at the positive peak of the displayed signal.

4.14.20 Press TI *MKR 2*.

4.14.21 Using the TI Control Knob, adjust the TI MKR 2 so the marker is at the negative peak of the displayed signal.

4.14.22 Press TI **MODE SWEEP**, *MODE *, SNGL*, then *ARM*.

4.14.23 Press TI *ARM* several times and verify the TI Δ amplitude indicates within the values listed in the Limits column of Table 26.

4.14.24 Set the Oscilloscope Calibrator OUTPUT ON/OFF to OFF.

Table 26.

TI Vertical Scale (V/div)	Applied (V)	Limits (V)
5 m	20 m	19.8 to 20.2
10 m	50 m	49.7 to 50.3
20 m	0.1	99.4 to 100.6
50 m	0.2	198.5 to 201.5
100 m	0.5	497 to 503
200 m	1	0.994 to 1.006
500 m	2	1.985 to 2.015
1	5	4.97 to 5.03
2	10	9.94 to 10.06
5	20	19.85 to 20.15

4.14.25 Repeat steps 4.14.15 through 4.14.24 for the remaining values listed in Table 26.

4.14.26 Disconnect test setup.

4.15 SCOPE MODE BANDWIDTH CALIBRATION:

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

4.15.2 Press TI **AMPLITUDE SCALE** and using the TI Control Knob, set the TI vertical scale to 1 V/div.

4.15.3 Connect the Oscilloscope Calibrator through the Active Head and Feedthrough Termination to the TI EXTERNAL INPUT connector.

4.15.4 Set the Oscilloscope Calibrator OUTPUT ON/OFF to ON and the output for a 1 kHz leveled sine wave and 4 div of vertical display.

4.15.5 Increase the Oscilloscope Calibrator frequency until the TI display drops to 2.8 V p-p.

4.15.6 Press TI **MODE SWEEP** and using the TI Control Knob, reduce the TI sweep time as necessary for the best signal presentation.

4.15.7 Verify the 2.8 V p-p signal frequency is ≥5 MHz as indicated on the Oscilloscope Calibrator.

4.15.8 Set the Oscilloscope Calibrator OUTPUT ON/OFF to OFF and disconnect test setup.

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

CALIBRATION PERFORMANCE TABLE

Not Required

APPENDIX A

A-1 TIME BASE ADJUSTMENT: [Room Temperature Crystal Oscillator (RTXO)]

A-1.1 Set TI POWER APPLIED/ON switch to APPLIED and disconnect power source.

A-1.2 Remove the TI cover.

A-1.3 Connect TI to appropriate power source and set POWER APPLIED/ON switch to ON.

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

A-1.5 Set the TI controls as follows:

MEMORY CONFIG

3

ENTER

9

ENTER

⇑ or ⇓ To toggle the reference to INT

A-1.6 Connect Frequency Standard 10 MHz REF OUT to the Electronic Counter EXT FREQ STD INPUT (1-10 MHz). Set Electronic Counter INT STD/EXT STD switch to EXT STD.

A-1.7 Disconnect TI W25P1 cable from A4J5 connector.

A-1.8 Connect the Electronic Counter CHANNEL A input to the TI A4J5 connector. Set Electronic Counter 50Ω/1MΩ switch to 50Ω.

A-1.9 Adjust the TI Reference Oscillator Adjustment (A27C1) for an Electronic Counter 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 Disconnect the test setup.

A-1.12 Set TI POWER APPLIED/ON switch to APPLIED and disconnect power source. Replace the TI cover.

A-1.13 Connect TI to appropriate power source and set POWER APPLIED/ON switch to ON.

A-1.14 Continue with step 4.1.6.