

TECHNICAL MANUAL
CALIBRATION PROCEDURE
FOR
SYNTHESIZED SIGNAL GENERATOR
7200 ()
(GIGA-TRONICS)



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Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Spectral Purity (Cont.)	@100 kHz offset, <-100 dBc, 0.01 to <2.0 GHz; <-105 dBc, 2.0 to <8.0 GHz; <-100 dBc, 8.0 to <20.0 GHz; <-95 dBc, 20.0 to 26.5 GHz Residual FM: (30 Hz to 3 kHz): <30 Hz, 0.01 to <2.0 GHz; <20 Hz, 2.0 to <8.0 GHz; <40 Hz, 8.0 to <20.0 GHz; <60 Hz, 20.0 to 26.5 GHz; (50 Hz to 15 kHz): <200 Hz, 0.01 to <2.0 GHz; <150 Hz, 2.0 to <8.0 GHz; <300 Hz, 8.0 to <20.0 GHz; <450 Hz, 20.0 to 26.5 GHz	Measured with a Phase Noise Measurement System
RF Level	Range: -110 to +10 dBm Accuracy: ± 1.0 dB Flatness: ± 1.0 dB to <20.0 GHz ± 2.0 dB, 20.0 to 26.5 GHz (± 0.1 dB per 10 dB step)	Measured with a Power Meter and a Microwave Measurement System
Pulse Modulation	Range: 0.01 to 26.5 GHz Accuracy: ON/OFF Ratio: >80 dB Rise/Fall Time: <10 ns (OPT 024)	RF output verified with a Spectrum Analyzer, Detected output verified with Oscilloscope
Amplitude Modulation	Range: 0 to >90% depth Accuracy: $\pm 5\%$ Distortion: <10% @ 50% depth and ≤ 50 kHz rate, <2% @ 50% depth and ≤ 1 kHz rate	Measured with a Measuring Receiver
Frequency Modulation	Rate: 10 Hz to 10 MHz Accuracy: 5.0%	Measured with a Spectrum Analyzer

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Internal Modulation Source (OPT 024)	Range: 1 Hz to 100 kHz (AM), 10 Hz to 1 MHz (FM) Accuracy: ± 0.001 Hz	Measured with a Electronic Counter and an Oscilloscope

2 EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment	Sub- Item
2.1 FREQUENCY COUNTER	Range: 0.01 to 26.5 GHz Accuracy: 5×10^{-10}	Hewlett-Packard 5343A	As available
2.2 SPECTRUM ANALYZER	Range: 0.01 to 26.5 GHz Accuracy: ± 1.0 dB	Hewlett-Packard 8566A	As available
2.3 POWER METER	Range: 10 mW Accuracy: $\pm 2.0\%$	Hewlett-Packard 436A	As available
2.4 POWER SENSOR	Range: 0.01 to 18.0 GHz Accuracy: $\pm 2.7\%$ at 10 to 50 MHz; $\pm 2.5\%$ at 50 MHz to 8.0 GHz; $\pm 3.0\%$ at 8.0 GHz to 12.0 GHz; $\pm 3.3\%$ at 12.0 to 18.0 GHz	Hewlett-Packard 8481A	As available
2.5 POWER SENSOR	Range: 18.0 to 26.5 GHz Accuracy: $\pm 4.4\%$ at 18.0 to 26.5 GHz	Hewlett-Packard 8485A	As available
2.6 MICROWAVE MEASUREMENT SYSTEM	Range: 2.0 to 26.5 GHz Accuracy: AM: 50% depth, $\pm 1\%$ @ 1 kHz dB: $\pm(0.02 \text{ dB} + 0.02 \text{ dB}/10 \text{ dB})$	Hewlett-Packard 8902MS	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.7 OSCILLOSCOPE	Range: Bandwidth, DC to 200 MHz Accuracy: $\pm 3.0\%$	Tektronix 7904 w/ 7A26 & 7B92A	As available
2.8 DETECTOR	Range: 0.01 to 26.5 GHz Accuracy: N/A	Hewlett-Packard 8473C	As available
2.9 TERMINATION	Range: 50 Ω Accuracy: $\pm 2.0\%$	Stock Item	
2.10 FREQUENCY DIFFERENCE METER	Range: Operational Accuracy: N/A	Austron 527E	As Available
2.11 FREQUENCY STANDARD	Range: 5 MHz Accuracy: $\pm 1 \times 10^{-11}$	Hewlett-Packard 5061A	
2.12 FUNCTION GENERATOR	Range: 1 MHz @ 5.0 V Accuracy: $\pm 0.5\%$	Hewlett-Packard 3325A	As Available
2.13 AUDIO ANALYZER	Range: 20 to 50 kHz Accuracy: $< 0.1\%$	Hewlett-Packard 8903B	

3 PRELIMINARY OPERATIONS:

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

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.

3.2 Connect TI and test equipment to the appropriate power source, set the POWER switches to ON and allow the TI a 2 hour warm-up period.

NOTE

The TI may require up to 72 hours for the warm-up period if the TI has been disconnected from the power source for an extended period of time.

3.3 Perform the TI Self Test by pressing the TI SHIFT key followed by the TEST key. Then select 10 GHz and wait for unit to read PASS. Then repeat for 1 GHz, 100 MHz, 10 MHz, and 1 MHz. Verify that all the test parameters pass.

3.4 TIME BASE AGING OFFSET CHECK:

3.4.1 Standardize the Frequency Difference Meter. Connect the TI 10 MHz REF OUT (on the rear) to the Frequency Difference Meter input.

3.4.2 Frequency Difference Meter should indicate $\leq \pm 1 \times 10^{-9}$. If not, adjust the TI high stability oscillator (located next to the fan assembly) so that the indication is within the Table 1 specifications.

3.4.3 Allow the TI a minimum of one hour after adjustment for the oscillator to restabilize and repeat steps 3.4.1 and 3.4.2 as needed.

3.4.4 Disconnect all equipment from the TI.

3.4.5 Use only that portion of procedure that applies to the TI being calibrated.

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 FREQUENCY CALIBRATION:

4.1.1 Connect TI RF OUT connector to the appropriate Electronic Counter INPUT connector and the Electronic Counter timebase out to the TI REF IN.

4.1.2 Press the TI SHIFT and RESET keys. Enter 1, 0 and MHz, then press LEVEL and enter -, 1, 0, dBm.

4.1.3 Set the Electronic Counter resolution and level controls for a repeatable and reliable indication.

4.1.4 The Electronic Counter must indicate 10 MHz ± 1 Hz, \pm the counter resolution.

4.1.5 Increase the TI FREQUENCY by 50 MHz increments up to 1 GHz.

4.1.6 The Electronic Counter must indicate the correct stepped frequency ± 1 Hz, \pm the counter resolution.

4.1.7 Set the TI FREQUENCY to 2.001 GHz. Repeat step 4.1.6.

4.1.8 Increase the TI FREQUENCY by 2.0 GHz increments to the maximum frequency output. Repeat step 4.1.6 for each step.

4.1.9 Disconnect the Electronic Counter from the TI.

4.2 SPECTRAL PURITY CALIBRATION:

4.2.1 Connect TI RF OUT connector to the Spectrum Analyzer RF INPUT connector.

- 4.2.2 Press SHIFT, RESET on the TI. Set TI FREQUENCY for 0.01 GHz.
- 4.2.3 Adjust the Spectrum Analyzer controls as required to view the carrier frequency and several harmonics on the CRT.
- 4.2.4 Set the Spectrum Analyzer controls to place the peak of the carrier signal at a convenient reference level.
- 4.2.5 Verify the peaks of the carrier harmonics and sub-harmonics are at least 25.0 dB below the peak of the carrier.
- 4.2.6 Verify the peaks of the carrier non-harmonics are at least 55.0 dB below the peak of the carrier.
- 4.2.7 Repeat steps 4.2.3 through 4.2.6 incrementing the TI FREQUENCY in 0.010 GHz steps up to 0.05 GHz.
- 4.2.8 Set TI FREQUENCY to 2.0 GHz.
- 4.2.9 Adjust the Spectrum Analyzer controls as required to view the carrier frequency and several harmonics on the CRT.
- 4.2.10 Set the Spectrum Analyzer controls to place the peak of the carrier signal at a convenient reference level.
- 4.2.11 Verify the peaks of the carrier harmonics and sub-harmonics are at least 55.0 dB below the peak of the carrier.
- 4.2.12 Verify the peaks of the carrier non-harmonics are at least 55.0 dB below the peak of the carrier.
- 4.2.13 Repeat steps 4.2.3 through 4.2.7 incrementing the TI FREQUENCY in 2.0 GHz steps for the frequency range of the TI being calibrated. (You will only be able to see one harmonic of these frequencies due to the limits of the Spectrum Analyzer.)
- 4.2.14 Set the TI RF OUTPUT to minimum. Disconnect Spectrum Analyzer from TI.
- 4.2.15 Set the TI FREQUENCY to 1 GHz.
- 4.2.16 Phase Noise Measurement System automation package, CPIN number 88M-3048MS/NOISE-F001-00A-001, is used to calibrate single-sideband phase noise. The Main Menu should be present on the screen when the computer is turned on.
- 4.2.17 On Phase Noise Measurement System select Type/Range of Measurement to obtain the Measurement Type and Frequency Range Specifications. Select Phase Noise Using Phase Lock Loop Measurement type. Set Start Freq to 10 Hz, Stop Freq to 100.0 E+03 (100 kHz), and Average to 4. Press ESC to return to Main Menu. Select Instrument Control and select Dn Converter 11729C System CTRL (If needed). Press ESC to return to Main Menu.
- 4.2.18 On Phase Noise Measurement System select Parameters to obtain the Source and Interface Entry Menu. Select Low Frequency Phase Detector (5 MHz to 1600 MHz). Select the following:

Carrier Frequency	1.0 E+09 Hz
Detector Input Frequency	1.0 E+09 Hz
VCO Tune Constant	5 Hz/Volt
Center Voltage of VCO Tune Curve	0 Volts
Tuning Range of VCO	10 Volts
VCO Tune Port Input Resistance	1.E+06 Ohms

Press ESC to return to Main Menu when done with selections.

NOTE

The VCO Tune Constant is obtained by the following formula:

$$\text{VCO Tune Constant} = 5 \text{ E}^{-9} \times \text{Carrier Frequency}$$

$$\text{example: } 1 \text{ E}^{+9} \times 5 \text{ E}^{-9} = \text{Hz / Volts}$$

4.2.19 On Phase Noise Measurement System select Calibration Technique and press F2 to select Calculate from Expected Tune. Press ESC to return to the Main Menu.

4.2.20 On Phase Noise Measurement System select Instrument Control to obtain the source control for Measurement Using a Phase Lock Loop Menu. Select UUT USER'S SRCE MANUAL CTRL and REF SOURCE 8663A SYSTEM CTRL. Set Start Freq to 10 Hz, Stop Freq to 100.0 E+03 (100 kHz). Press ESC to return to the Main Menu.

4.2.21 On Phase Noise Measurement System press Define Graph. Enter graph title as appropriate for your setup. Enter in the proper blocks the following data:

Minimum X coordinate	10
Maximum X coordinate	100 E+03 Hz
Maximum Y coordinate	-30
Minimum Y coordinate	-110

Select Single Sideband Phase Noise (dBc/Hz) for Graph Type. Press ESC to return to the Main Menu.

4.2.22 On Phase Noise Measurement System select New Measurement. Press Y. The equipment should be connected as shown on the Display screen. Set TI RF ON/OFF to ON. Verify a Beat Note below the value on the screen is present on the Signal Analyzer. Then press F1 Proceed softkey.

NOTE

When needing to up or down range the Analyzers use the $\uparrow\downarrow$ keys to control the 3561A Dynamic Signal Analyzer and the $\leftarrow \rightarrow$ keys to control the Spectrum Analyzer.

4.2.23 When REF #11 appears on the screen press P to proceed. The Phase Noise Measurement System should proceed without error. If the Theoretical And Actual Loop Suppression Factors chart appears on the Display screen and none of the factors are highlighted proceed by pressing F1.

4.2.24 The Phase Noise Plot should appear on the Display screen. After Measurement Complete the phase noise plot and spurious signals must be less than the specifications listed in Table 1. If desired the Marker function may be used to obtain specific offset frequencies and phase noise measurements on the graph. Press M twice to obtain the Marker function.

NOTE

The $\leftarrow \rightarrow$ keys are the fine controls for moving the cursor and the $\uparrow\downarrow$ keys are the course controls for moving the cursor.

4.2.25 To print the TI Phase Noise plot and the pertinent measurement parameters on Phase Noise Measurement System press SHIFT and F4 keys. Press ESC to return to the Main Menu.

4.2.26 On the Phase Noise Measurement System select Manipulate Results, then Trace Integration, and using the F7 key select $S_{\mu}(f)$ for Data Type. Set Start Freq. to 50 Hz and Stop Freq. to 15 kHz. Press F3 to evaluate (the cursor must be on the same line). The Residual FM must be less than the specifications listed in Table 1. Repeat this step to check the Residual FM specifications from 30 Hz to 3 kHz.

4.2.27 On the Phase Noise Measurement System select Parameters to change Carrier Frequency, and Detector Input Freq. Repeat steps 4.2.17 through 4.2.26 for 2.0, 4.0, 7.9, 12.0 and 18.0 GHz.

4.2.28 Return to Main Menu and select System Configuration. Then select Instrument Addresses and move cursor to the Down Converter. Tab to the Serial #/Options column and type in H33. Press ESC twice to return to the Main Menu.

4.2.29 From the Main Menu select Parameters. Change the Carrier Frequency to 20 GHz, Detector Input Freq to 600 MHz, and VCO Tune Constant to 100 Hz/Volt. Press ESC. Press TI Frequency and 20 GHz keys.

4.2.30 Select New Measurement. Select Y at the prompt.

4.2.31 Connect Bandpass Filter as identified on CRT if instructed. Press P for Proceed.

4.2.32 Connect equipment as shown in Figure 1. Disregard the figure on the CRT. Set Carrier Noise Test Set Normal/mm switch to mm.

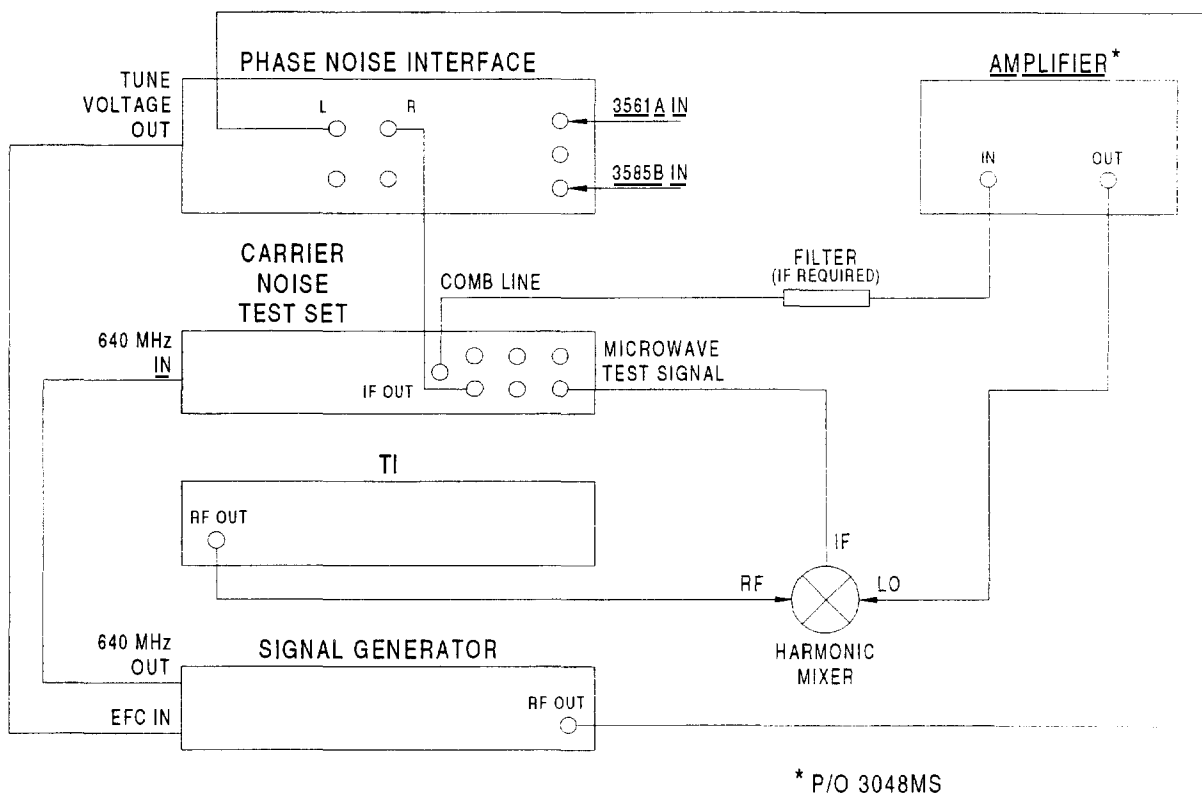


Figure 1.

4.2.33 Verify a Beat Note below the value on the screen is present on the Signal Analyzer. Then press F1 Proceed softkey.

4.2.34 If REF #11 appears on the screen press P to proceed. The Phase Noise Measurement System should proceed without error and the Phase Noise Plot should appear on the display screen.

4.2.35 The Phase Noise Plot must be less than the specifications in Table 1. If desired, the Marker function may be used to obtain specific offset frequencies and phase noise measurements on the graph. Press M to obtain the Marker function.

4.2.36 To print the TI Phase Noise Plot and the pertinent measurement parameters on Phase Noise Measurement System press SHIFT and F4 keys.

4.2.37 Press TI RF OUTPUT RF key to turn output Off (RF key light extinguished) and disconnect test setup.

4.3 RF LEVEL CALIBRATION:

4.3.1 Standardize the Power Meter and Sensor. Connect the Power Meter with proper Sensor to TI RF OUTPUT connector.

4.3.2 Set TI FREQUENCY and RF LEVEL to the first value listed in the Applied column of Table 2.

4.3.3 The Power Meter must indicate between the corresponding values listed in the Limits column of Table 2.

Table 2.

Applied (dBm)	Limits (dBm)
10.0 dBm @ 0.01 GHz	9.0 to 11.0
10.0 dBm @ 1.0 GHz	9.0 to 11.0
10.0 dBm @ 2.0 GHz	9.0 to 11.0
10.0 dBm @ 4.0 GHz	9.0 to 11.0
10.0 dBm @ 6.0 GHz	9.0 to 11.0
10.0 dBm @ 8.0 GHz	9.0 to 11.0
10.0 dBm @ 10.0 GHz	9.0 to 11.0
10.0 dBm @ 12.0 GHz	9.0 to 11.0
10.0 dBm @ 14.0 GHz	9.0 to 11.0
10.0 dBm @ 16.0 GHz	9.0 to 11.0
10.0 dBm @ 18.0 GHz	9.0 to 11.0
10.0 dBm @ 20.0 GHz	9.0 to 11.0
10.0 dBm @ 22.0 GHz	8.0 to 12.0
10.0 dBm @ 24.0 GHz	8.0 to 12.0
10.0 dBm @ 26.5 GHz	8.0 to 12.0

4.3.4 Repeat steps 4.3.2 and 4.3.3 for the remaining values listed in the Applied column of Table 2.

4.3.5 Set TI FREQUENCY to 0.01 GHz and the RF LEVEL to 0.0 dBm.

4.3.6 The Power Meter must indicate between -1.0 to 1.0 dBm. Record the Power Meter indication.

4.3.7 Increase the TI FREQUENCY in 500.0 MHz steps to the maximum frequency range of the TI. At each frequency the Power Meter must indicate within ± 1.0 dB (± 2.0 dB for frequencies above 20 GHz) of the value recorded in step 4.3.6.

4.3.8 Set TI for minimum output and disconnect the test setup.

4.3.9 Set TI FREQUENCY to 2.0 GHz and the RF LEVEL to 0.0 dBm.

4.3.10 Standardize the Measuring Receiver Tuned RF Level Calibration at 2.0 GHz and set for TRFL measurement. Verify the Measuring Receiver contains the correct CAL FACTORS for the Sensor Module being used. Standardize the Microwave Measurement System Sensor Module.

4.3.11 Connect Sensor Module to the TI RF OUTPUT and verify 0 dBm indication on the Measuring Receiver.

4.3.12 Set TI RF LEVEL to each value listed in the Applied column of Table 3. Verify the Measuring Receiver indication is within the Limits column for each amplitude applied.

Table 3.

Applied (dBm)	Limits (dB)
0	Reference
-10.0	-11.1 to -8.9
-20.0	-21.2 to -18.8
-30.0	-31.3 to -28.7
-40.0	-41.4 to -38.6
-50.0	-51.5 to -48.5
-60.0	-61.6 to -58.4
-70.0	-71.7 to -68.3
-80.0	-81.8 to -78.2
-90.0	-91.9 to -88.1
-100.0	-102.0 to -98.0
-110.0	-112.1 to -107.9

NOTE

Calibration of the TI RF LEVEL will be limited to the dynamic range of the Measuring Receiver. Annotate on a Limited Certification Label that portion of the OUTPUT not calibrated.

4.3.13 Disconnect TI from the Measuring Receiver.

4.4 PULSE MODULATION CALIBRATION:

4.4.1 Connect TI RF OUTPUT to Spectrum Analyzer RF INPUT.

4.4.2 Set TI FREQUENCY to 0.01 GHz and RF OUTPUT LEVEL to +10 dBm.

4.4.3 Adjust Spectrum Analyzer as required to display the TI signal.

4.4.4 Turn on the external pulse modulation of the TI by pressing PM, MODE, EXT. Terminate PM input with the Termination. Turn the pulse modulation on and off by pressing the TI EXT button. The change in level as observed on the Spectrum Analyzer must be greater than 80 dB.

4.4.5 Set TI PULSE MODULATION to OFF and repeat steps 4.4.2 through 4.4.4 incrementing the TI FREQUENCY to .05, 2.0, 4.0, 7.9, 12.0, 18.0, 20.0 and 26.5 GHz respectively.

4.4.6 Set TI RF OUTPUT to minimum and disconnect Spectrum Analyzer. For OPT 024, proceed to step 4.4.7. For TIs without OPT 024 proceed to para 4.5.

4.4.7 Turn on the pulse modulation of the TI by pressing PM, MODE, INT. Using the TI DATA ENTRY KNOB change the RATE to 1 MHz, WIDTH to 0.5 μ s, then press ON.

4.4.8 Connect TI RF OUTPUT to Detector. Connect Detector output to Oscilloscope CH 1 INPUT through the Termination.

4.4.9 Set TI RF LEVEL to 10.0 dB.

4.4.10 Adjust Oscilloscope controls as necessary to measure the Rise and Fall Time. The Rise and Fall Time measured between the 10 and 90% points of the signal must be <10 ns.

4.4.11 Repeat steps 4.4.9 and 4.4.10 incrementing the TI FREQUENCY in 2.0 GHz steps for the frequency range of the TI being calibrated.

4.4.12 Set TI RF OUTPUT LEVEL to minimum and disconnect test setup.

4.5 AMPLITUDE MODULATION CALIBRATION:

4.5.1 Calibrate the Measuring Receiver AM using its built-in AM Calibrator. Ensure the Microwave Measurement System is connected appropriately. Connect TI RF OUTPUT to Microwave Converter INPUT. Set LO for +13 dBm OUTPUT and FREQUENCY to 2120.53 MHz.

4.5.2 On the Measuring Receiver key in 27.3 SPCL and then key in 2120.53 MHz. The Measuring Receiver is now in Frequency Offset mode. Set the Measuring Receiver to measure AM.

4.5.3 On the Measuring Receiver press the PEAK + and PEAK - Detector simultaneously and set the High Pass and Low Pass Filters to OFF.

4.5.4 Set the Function Generator output to 1 kHz at 1 V peak (0.707 rms) and connect to the TI AM INPUT.

4.5.5 Press the TI SHIFT and RESET. Set TI FREQUENCY to 2.0 GHz. Press AM, MODE, EXT, SCROLL, %, 99, % and ON.

4.5.6 Verify that the Measuring Receiver indicates at least 90% modulation.

- 4.5.7 Press the TI AM, 70 and % keys. Verify that the Measurement Receiver indicates between 66.5 and 73.5%.
- 4.5.8 Press the TI AM, 30 and % keys. Verify that the Measurement Receiver indicates between 28.5 and 31.5%.
- 4.5.9 Press the TI AM, 50 and % keys. Verify that the Measurement Receiver indicates between 47.5 and 52.5%.
- 4.5.10 Connect the Audio Analyzer to the Measurement Receiver Modulation Output and verify the distortion is <2%.
- 4.5.11 Set the Function Generator to 50 kHz. Verify with the Audio Analyzer the distortion is <10%.
- 4.5.12 Disconnect TI from the Measuring Receiver.

4.6 FREQUENCY MODULATION CALIBRATION:

- 4.6.1 Press TI SHIFT and RESET. Connect the TI RF Output to the Spectrum Analyzer input.
- 4.6.2 Connect the Function Generator to the TI FM MOD INPUT. Set the Function Generator for an output of 1 MHz at 2 V p-p.
- 4.6.3 Set the TI FREQ to 2.0 GHz and set the TI for External FM Modulation On at a 1000 kHz Rate.
- 4.6.4 Set the Spectrum Analyzer SPAN to 10 MHz (1 MHz/Div) and the other controls as needed to measure the positive and negative FM peak deviations on the Spectrum Analyzer. Both the positive and the negative peak deviations must be between 0.95 to 1.05 MHz.

4.7 INTERNAL MODULATION SOURCE CALIBRATION: (OPT 024 Only)

- 4.7.1 Connect the TI AM OUT (located on the rear panel of the TI) to the Electronic Counter input. Select the TI AM, INT, SQR keys. Set the TI AM RATE to 1 Hz.
- 4.7.2 Adjust the Electronic Counter controls to measure the period of the 1 Hz AM OUTPUT. The Electronic Counter indication should be between 0.999 to 1.001 s.
- 4.7.3 Set the TI AM RATE to 10 Hz and adjust the Electronic Counter for a stable indication and verify the indication is within the limitations of Table 4.
- 4.7.4 Set the TI AM RATE to the next setting listed in Table 4 and verify the reading is within the limitations of Table 4.

Table 4.

Applied Modulation	Limits (Hz)
10 Hz	9.999 to 10.001
100 Hz	99.999 to 100.001
1 kHz	999.999 to 1000.001
10 kHz	9999.999 to 10000.001

Table 4. (Cont.)

Applied Modulation	Limits (Hz)
100 kHz	99999.999 to 100000.001
1 MHz (FM only)	999999.999 to 1000000.001

4.7.5 Repeat step 4.7.4 for the remainder of Table 4.

4.7.6 Disconnect the Electronic Counter and connect the Modulation OUT to the Oscilloscope input.

4.7.7 Adjust the Oscilloscope controls for a proper display. Select the TI SQR, SIN and TRI and verify a proper waveform for each selection.

4.7.8 Disconnect the equipment from the TI and press the TI FM, INT and SQR. Connect the FM OUT to the Electronic Counter input.

4.7.9 Repeat steps 4.7.3. through 4.7.7 for the FM OUT.

4.7.10 Set all equipment for minimum output. Disconnect and secure all equipment.

4.7.11 TI RF LEVEL will be limited to the dynamic range of the Measuring Receiver. Annotate on a Limited Certification Label the portion of the OUTPUT not calibrated.

CALIBRATION PERFORMANCE TABLE

4.1 FREQUENCY CALIBRATION:

<u>Range (GHz)</u>	<u>Applied</u>	<u>Limits</u>
0.01 to 26.5	Entered Frequency	± 1 Hz

4.2 SPECTRAL PURITY CALIBRATION:

<u>Range (GHz)</u>	<u>Applied (dBm)</u>	<u>Limits (dBc)</u>
0.01 to 0.05	0.0	<-25
0.05 to 26.5	0.0	<-55

Spurious, Non-harmonics

<u>Range (GHz)</u>	<u>Applied (dBm)</u>	<u>Limits (dBc)</u>
0.01 to 26.5	0.0	<-55

CALIBRATION PERFORMANCE TABLE (Cont.)

4.2 SPECTRAL PURITY CALIBRATION (Cont.)

SSB Phase Noise

<u>Range (GHz)</u>	<u>Offset (kHz)</u>	<u>Limits (dBc)</u>
0.01 to <2.0	0.03	<-60
2.0 to <8.0	0.03	<-65
8.0 to <20.0	0.03	<-60
20.0 to 26.5	0.03	<-55
0.01 to <8.0	0.100	<-75
8.0 to 26.5	0.100	<-65
0.01 to <8.0	1	<-80
8.0 to <20.0	1	<-75
20.0 to 26.5	1	<-70
0.01 to <2.0	10	<-75
2.0 to <8.0	10	<-80
8.0 to <20.0	10	<-75
20.0 to 26.5	10	<-70
0.01 to <2.0	100	<-100
2.0 to <8.0	100	<-105
8.0 to <20.0	100	<-100
20.0 to 26.5	100	<-95

Residual FM

<u>Range (GHz)</u>	<u>Bandwidth</u>	<u>Limits (Hz)</u>
0.01 to <2.0	30 Hz to 3 kHz	<30
2.0 to <8.0	30 Hz to 3 kHz	<20
8.0 to <20.0	30 Hz to 3 kHz	<40
20.0 to 26.5	30 Hz to 3 kHz	<60
0.01 to <2.0	50 Hz to 15 kHz	<200
2.0 to <8.0	50 Hz to 15 kHz	<150
8.0 to <20.0	50 Hz to 15 kHz	<300
20.0 to 26.5	50 Hz to 15 kHz	<450

CALIBRATION PERFORMANCE TABLE (Cont.)

4.3 RF LEVEL CALIBRATION:

Max. Output

<u>Range (GHz)</u>	<u>Applied (dBm)</u>	<u>Limits (dBm)</u>
0.01 to 20.0	10.0	9.0 to 11.0

Flatness

<u>Range (GHz)</u>	<u>Applied (dBm)</u>	<u>Limits (dBm)</u>
0.01 to 20.0	0.0	-1.0 to 1.0

Attenuation

<u>Range (dBm)</u>	<u>Applied (dBm)</u>	<u>Limits (dBm)</u>
0 to -110	0.0	Reference
	-10.0	-11.1 to -8.9
	-20.0	-21.2 to -18.8
	-30.0	-31.3 to -28.7
	-40.0	-41.4 to -38.6
	-50.0	-51.5 to -48.5
	-60.0	-61.6 to -58.4
	-70.0	-71.7 to -68.3
	-80.0	-81.8 to -78.2
	-90.0	-91.9 to -88.1
	-100.0	-102.0 to -98.0
	-110.0	-112.1 to -107.9

4.4 PULSE MODULATION CALIBRATION:

ON/OFF Ratio

<u>Range (GHz)</u>	<u>Applied (dBm)</u>	<u>Limits (dB)</u>
0.01 to 20.0	10.0	>80

Rise/Fall Time (OPT 024)

<u>Range (GHz)</u>	<u>Applied (dBm)</u>	<u>Limits (ns)</u>
0.01 to 20.0	10.0	<10

CALIBRATION PERFORMANCE TABLE (Cont.)

4.5 AMPLITUDE MODULATION CALIBRATION:

Depth

<u>Range (kHz)</u>	<u>Applied (%)</u>	<u>Limits (%)</u>
1	99	≥ 90
1	70	66.5 to 73.5
1	50	47.5 to 52.5
1	30	28.5 to 31.5

Distortion

<u>Range (kHz)</u>	<u>Applied (%)</u>	<u>Limits (%)</u>
1	50	<2
50	50	<10

4.6 FREQUENCY MODULATION CALIBRATION:

<u>Range (kHz)</u>	<u>Applied (MHz Dev)</u>	<u>Limits (MHz)</u>
1000	1	0.95 to 1.05

4.7 INTERNAL MODULATION: (OPT 024 Only)

<u>Range (Hz)</u>	<u>Applied (Hz)</u>	<u>Limits (Hz)</u>
1 to 1 M	1.00 (AM only)	0.999 to 1.001
	10	9.999 to 10.001
	100	99.999 to 100.001
	1 k	999.999 to 1000.001
	10 k	9999.999 to 10000.001
	100 k	99999.999 to 100000.001
	1 M (FM only)	999999.999 to 1000000.001