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TECHNICAL MANUAL

CALIBRATION PROCEDURE

FOR

MODULATION METER

ME-523/U

(WAYNE KERR)

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MODULATION METER

ME-523/U

(WAYNE KERR)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Reference Oscillator	Range: 10 MHz Accuracy: $\pm 2.16 \times 10^{-6}$; *[1] Aging/month: $\pm 1.8 \times 10^{-7}$; Temperature: $\leq 1 \times 10^{-6}$ (0 to 55 °C) *[2]	Compared to a Frequency Standard
Carrier Frequency	Range: 150 kHz to 1.8 GHz Accuracy: ±(Reference Oscillator + 3 counts of LSD)	Measured on an Electronic Counter
Carrier Sensitivity	Range: 150 kHz to 1.8 GHz Accuracy: ≤-25 dBm, 500 kHz to 500 MHz; ≤-20 dBm, 500 MHz to 1 GHz; ≤-10 dBm, 1 to 1.8 GHz	Verified with a Signal Generator at a monitored level
Amplitude Modulation		
Depth	Range: 150 kHz to 1.8 GHz, 0 to 99% Rates: 30 Hz to 10 kHz, 150 kHz to 10 MHz; 30 Hz to 50 kHz, 10 MHz to 1.8 GHz Accuracy: (>5% AM) ±(2.5% of rdg + 1 count of LSD)	Compared to a Measuring Receiver
Distortion	Range: 150 kHz to 1.8 GHz, 0 to 99% Rates: 30 Hz to 10 kHz, 150 kHz to 10 MHz; 30 Hz to 50 kHz, 10 MHz to 1.8 GHz Accuracy: <0.3% THD, 5 to 49.9% AM; <0.6% THD, 50 to 95% AM	Compared to an AM/FM Test Source

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency Modulation		
Deviation	Range: 250 kHz to 1.8 GHz Deviation: 0 to 40 kHz, 250 kHz to 10 MHz; 0 to 400 kHz, 10 MHz to 1.8 GHz Rates: 30 Hz to 10 kHz, 250 kHz to 10 MHz; 30 Hz to 200 kHz, 10 MHz to 1.8 GHz Accuracy: ±(3% of rdg + 1 count of LSD)	Compared to a Measuring Receiver
Distortion	Range: 10 MHz to 1.8 GHz Rates: 30 Hz to 20 kHz Deviation: 0 to 100 kHz Accuracy: <0.15% THD	Compared to an AM/FM Test Source
Phase Modulation	Range: 10 MHz to 1.8 GHz Deviation: 0 to 50 rad Rates: 300 Hz to 4 kHz Accuracy: ±(3% of rdg + 3 counts of LSD) *3	Compared to a Measuring Receiver
Power Measurement	Range: +10 to +30 dBm *4 Accuracy: ±3 dB	Compared to a Power Meter and Power Sensor
Audio Frequency	Range: 30 Hz to 100 kHz Accuracy: ±(Reference Oscillator + 1 count of LSD)	Verified during Reference Oscillator Calibration

*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 See step 3.6.

*4 Maximum Power Measurement is +20 dBm without 10 dB Attenuator which accompanies TI and is located inside the right rear handle. With the 10 dB Attenuator, the maximum Power Measurement is +30 dBm.

2 EQUIPMENT REQUIREMENTS:

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1	FREQUENCY STANDARD	Range: 10 MHz Accuracy: $\pm 4.5 \times 10^{-8}$	Arbiter 1083B	Austron 2100F
2.2	ELECTRONIC COUNTER	Range: 10 MHz; 10 Hz to 1 MHz Accuracy: 10 MHz, ±1 count of LSD; 10 Hz to 1 MHz, $\pm 2.5 \times 10^{-6}$	Hewlett-Packard 5345A	
2.3	SIGNAL GENERATOR	Range: (Frequency and Amplitude) 500 kHz to 1.8 GHz, -31 to +16 dBm Accuracy: Frequency: N/A Amplitude: N/A Range: (Amplitude Modulation) 1 MHz to 1.8 GHz, 10 to 90%, 100 Hz to 10 kHz Rates Accuracy: N/A Range: (Frequency Modulation) 1 MHz to 1.8 GHz Maximum Deviation: 1 MHz, 10 to 40 kHz; 10.1 MHz, 10 to 100 kHz; 1 GHz, 10 to 200 kHz; 1.8 GHz, 10 to 400 kHz Rates: 100 Hz to 10 kHz Accuracy: N/A	Hewlett-Packard 8663A	
2.4	SIGNAL GENERATOR	Range: (Phase Modulation) 10.1 MHz to 1 GHz Deviation: 10 to 50 rad Rates: 300 Hz to 4 kHz Accuracy: N/A	Rohde & Schwarz SMY01 (p/o FMAV)	

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.5	MICROWAVE MEASUREMENT SYSTEM	Range: (Amplitude Modulation) 1 MHz to 1.8 GHz, 10 to 90% AM Rates: 100 Hz to 10 kHz Accuracy: (1 MHz, 10 to 90% Rates: 100 Hz to 10 kHz) ±1.75% of rdg TAR: 1.4:1 Accuracy: (10.1 MHz to 1.8 GHz, 10 to 90%, Rates: 100 Hz to 10 kHz) ±0.75% of rdg TAR: 3.3:1 Range: (Frequency Modulation) 1 MHz to 1.8 GHz, Deviation: 10 to 400 kHz Rates: 100 Hz to 100 kHz Accuracy: (1 MHz, Deviation: 10 to 40 kHz Rates: 100 Hz to 10 kHz) ±1.75% of rdg TAR: 1.7:1 Accuracy: (10.1 MHz to 1.8 GHz, Deviation: 10 to 400 kHz Rates: 100 Hz to 100 kHz) ±0.75% of rdg Range: (Phase Modulation) 10.1 MHz to 1.0 GHz, Deviation: 0 to 50 rad Rates: 300 Hz to 4 kHz Accuracy: ±2.75% of rdg TAR: 1.1:1	Hewlett-Packard 8902MS	
2.6	SYNTHESIZED FUNCTION GENERATOR	Range: 100 Hz to 100 kHz; 0.6 mV to 6 V rms Accuracy: Frequency: ±0.3% of setting Level: N/A	Hewlett-Packard 3325B	

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.7	AM/FM TEST SOURCE	Range: (Carrier Frequency) AM, 12.5 MHz; FM, 400 MHz Accuracy: (Distortion) AM: <50% AM, <0.075% THD; 50 to 90% AM, <0.15% THD FM: <0.0375% THD	Hewlett-Packard 11715A	
2.8	AUDIO ANALYZER	Range: Source: 30 Hz to 20 kHz, 1 mV to 3 V p-p Distortion: 0 to 100%, 30 Hz to 20 kHz Accuracy: Distortion: ±1 dB; Source: N/A	Hewlett-Packard 8903B	
2.9	POWER METER	Range: -25 to 0 dBm Accuracy: ±2% of indication	Hewlett-Packard 436A	
2.10	POWER SENSOR	Range: 600 kHz to 1.8 GHz, -25 to 0 dBm Accuracy: (All % of Charted Cal Factor) ±2.1%, 600 kHz to 1 MHz; ±2.0%, 1 to 10 MHz; ±2.7%, 10 to 50 MHz; ±2.5%, 50 MHz to 1.8 GHz	Hewlett-Packard 8482A	
2.11	ATTENUATOR	Range: 1 MHz to 1.8 GHz, 10 dB Accuracy: N/A	Hewlett-Packard 8491A OPT 010	
2.12	POWER SPLITTER	Range: 1 MHz to 1.8 GHz Accuracy: N/A	Hewlett-Packard 11667A	
2.13	FREQUENCY DIFFERENCE METER	Range: 1×10^{-7} to 1×10^{-11} Accuracy: N/A	Tracor 527E	

3 PRELIMINARY OPERATIONS:

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

3.3 Connect the TI to appropriate power source. Set the TI POWER ON/OFF switch to ON, then the TI will perform a self-test. Ensure all self-tests pass and the TI displays SEARCHING. Allow a 30 minute warm-up period.

3.4 The procedure is written to Army contract specifications for the ME-523/U only.

3.5 Using the TI keypad, press #, 9 and 9. This will clear all store locations. The TI will be restored to the default settings. This command also resets the AM and FM Self-Alignment. Initiate a Self-Alignment (CAL) after this command is entered and before performing the AM, FM and PM calibrations, by pressing #, 0 and 7.

3.6 Due to the lack of standards, the TI Phase Modulation will only be verified up to a carrier frequency of 1000 MHz. Annotate and attach a Limited Certification Label accordingly.

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 REFERENCE OSCILLATOR CALIBRATION:

NOTE

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

4.1.1 Connect Frequency Standard 10 MHz REF OUT to the 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 10 MHz REF INPUT/OUTPUT 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 Set the Electronic Counter controls as required for a stable indication and then push RESET. Verify Electronic Counter indication is 9 999 978.4 to 10 000 021.6 Hz.

4.1.4 Set the 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.

4.2 CARRIER FREQUENCY CALIBRATION:

4.2.1 Connect the Signal Generator (2.3) RF OUTPUT to the TI RF INPUT. Connect the Signal Generator (2.3) 10 MHz REFERENCE OSCILLATOR OUTPUT to the TI 10 MHz REF INPUT/OUTPUT. Using the TI keypad, set the TI to external frequency reference by pressing 1, #, 0 and 6. The TI will momentarily display External reference selected.

4.2.2 Set the Signal Generator (2.3) frequency to the first value listed in the Applied column of Table 2 at 0.0 dBm.

4.2.3 The TI should automatically tune to the applied signal. If the TI does not tune to the applied signal, set the TI to the manual mode by pressing the TI CARR FREQ key, then enter the first value listed in the Applied column of Table 2 to the nearest 10 kHz , then press the MHz key.

4.2.4 Verify the TI FREQUENCY display indicates within the values listed in the Limits column of Table 2.

4.2.5 If the TI was set to the manual mode, press the TI AUTO key.

4.2.6 Repeat steps 4.2.2 through 4.2.5, as required, for the remaining corresponding values listed in Table 2.

Table 2.

Applied (Hz)	Limits (Hz)
500 k	499.97 to 500.03 k
1 M	999.97 k to 1.000 03 M
10 M	9.999 97 to 10.000 03 M
50 M	49.999 97 to 50.000 03 M
200 M	199.999 97 to 200.000 03 M
500 M	499.999 97 to 500.000 03 M
1 G	999.999 97 to 1000.000 3 M
1.5 G	1499.999 7 to 1500.000 3 M

4.2.7 Set the Signal Generator (2.3) output level to minimum and leave the test setup connected.

4.3 CARRIER SENSITIVITY CALIBRATION:

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

4.3.2 Disconnect the Signal Generator (2.3) RF OUTPUT from the TI RF INPUT.

4.3.3 Connect the Signal Generator (2.3) RF OUTPUT through the Power Sensor to the Power Meter. Set the Power Meter CAL FACTOR to the appropriate value listed on the Power Sensor for the frequency being verified.

4.3.4 Set the Signal Generator (2.3) to the first value listed in the Applied Frequency column of Table 3. Set the Signal Generator (2.3) output level for the first value listed in the Applied Level column of Table 3 as monitored on the Power Meter.

4.3.5 Disconnect the Signal Generator (2.3) from the Power Meter and Power Sensor.

4.3.6 Connect the Signal Generator (2.3) RF OUTPUT to the TI RF INPUT.

4.3.7 Press the TI CARR FREQ key and, using the TI keypad, set to the first value listed in the Applied Frequency column of Table 3.

NOTE

The TI Carrier Frequency accuracy was checked in para 4.2. In para 4.3 the input sensitivity of the TI is checked to verify the TI will operate across the required frequency range at a minimum voltage level.

NOTE

If the TI FREQUENCY and LEVEL/DATA ENTRY displays a message RF input level low or offtune, the TI is not locked on to the applied frequency and requires maintenance action.

4.3.8 Verify the TI FREQUENCY display window displays a stable and reliable indication close to the applied value.

4.3.9 Disconnect the Signal Generator (2.3) RF OUTPUT from the TI RF INPUT.

4.3.10 Repeat steps 4.3.3 through 4.3.9 for the remaining corresponding values listed in Table 3.

Table 3.

Applied Frequency (Hz)	Applied Level (dBm)
600 k	-25
10 M	-25
495 M	-25
505 M	-20
750 M	-20
995 M	-20
1050 M	-10
1500 M	-10
1800 M	-10

4.3.11 Using the TI keypad, enter #, 0 and 6 to set the TI to internal frequency reference.

4.3.12 Set the Signal Generator (2.3) output level to minimum and disconnect the test setup.

4.4 AMPLITUDE MODULATION CALIBRATION:

NOTE

The TI Self-Alignment (CAL) needs to be performed only once during this para or every 30 minutes while taking measurements.

4.4.1 Using the TI keypad, press #, 9 and 9. Perform the TI Self-Alignments by using the TI keypad and entering #, 0 and 7. The Self-Alignment will take about 20 s.

4.4.2 Using the TI keypad, press 4, #, 6 and 6. The TI will display 16 averages selected.

4.4.3 Connect equipment as shown in Figure 1.

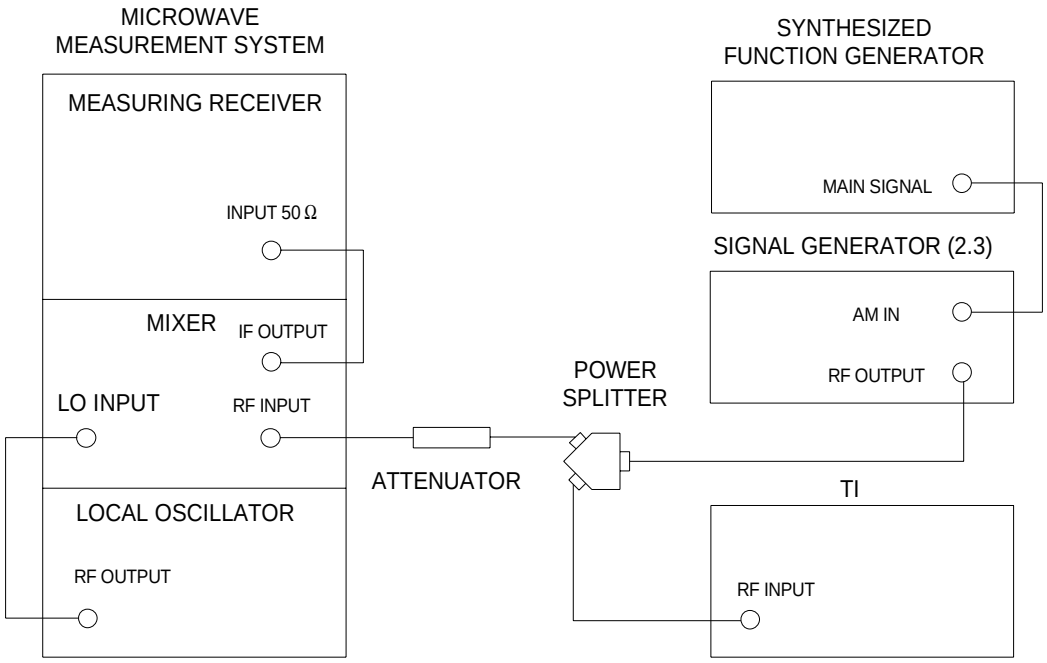

Figure 1.

4.4.4 Press the Signal Generator (2.3) FREQUENCY key and set to the first value listed in the Applied Freq column of Table 4. Press the AMPLITUDE key and set to +6 dBm.

4.4.5 Press the Measuring Receiver (p/o Microwave Measurement System) INSTR PRESET. Press the Measuring Receiver FREQ key.

4.4.6 Ensure the Measuring Receiver indication is close to the Signal Generator (2.3) frequency set in step 4.4.4.

Table 4.

Applied Freq (Hz)	Applied Rate (Hz)	Applied Depth (%)	TI HP Filter (Hz)	TI LP Filter (Hz)	Measuring Receiver HP Filter (Hz)	Measuring Receiver LP Filter (Hz)	Limits (%)
1.0 M	100	10.00	10	3 k	None	3 k	9.749 to 10.26
		30.00	10	3 k	None	3 k	29.24 to 30.76
		50.0	10	3 k	None	3 k	48.74 to 51.26
		70.0	10	3 k	None	3 k	68.24 to 71.76
		90.0	10	3 k	None	3 k	87.74 to 92.26
	1.0 k	10.00	50	3 k	50	3 k	9.749 to 10.26
		30.00	50	3 k	50	3 k	29.24 to 30.76
		50.0	50	3 k	50	3 k	48.74 to 51.26
		70.0	50	3 k	50	3 k	68.24 to 71.76
		90.0	50	3 k	50	3 k	87.74 to 92.26
	10.0 k	10.00	300	75 k	300	15 k	9.749 to 10.26
		30.00	300	75 k	300	15 k	29.24 to 30.76
		50.0	300	75 k	300	15 k	48.74 to 51.26
		70.0	300	75 k	300	15 k	68.24 to 71.76
		90.0	300	75 k	300	15 k	87.74 to 92.26

Table 4. (Cont.)

Applied Freq (Hz)	Applied Rate (Hz)	Applied Depth (%)	TI HP Filter (Hz)	TI LP Filter (Hz)	Measuring Receiver HP Filter (Hz)	Measuring Receiver LP Filter (Hz)	Limits (%)
10.1 M	100	10.00	10	3 k	None	3 k	9.749 to 10.26
		30.00	10	3 k	None	3 k	29.24 to 30.76
		50.0	10	3 k	None	3 k	48.74 to 51.26
		70.0	10	3 k	None	3 k	68.24 to 71.76
		90.0	10	3 k	None	3 k	87.74 to 92.26
	1.0 k	10.00	50	3 k	50	3 k	9.749 to 10.26
		30.00	50	3 k	50	3 k	29.24 to 30.76
		50.0	50	3 k	50	3 k	48.74 to 51.26
		70.0	50	3 k	50	3 k	68.24 to 71.76
		90.0	50	3 k	50	3 k	87.74 to 92.26
	10.0 k	10.00	300	75 k	300	15 k	9.749 to 10.26
		30.00	300	75 k	300	15 k	29.24 to 30.76
		50.0	300	75 k	300	15 k	48.74 to 51.26
		70.0	300	75 k	300	15 k	68.24 to 71.76
		90.0	300	75 k	300	15 k	87.74 to 92.26

Table 4. (Cont.)

Applied Freq (Hz)	Applied Rate (Hz)	Applied Depth (%)	TI HP Filter (Hz)	TI LP Filter (Hz)	Measuring Receiver HP Filter (Hz)	Measuring Receiver LP Filter (Hz)	Limits (%)
1000 M	100	10.00	10	3 k	None	3 k	9.749 to 10.26
		30.00	10	3 k	None	3 k	29.24 to 30.76
		50.0	10	3 k	None	3 k	48.74 to 51.26
		70.0	10	3 k	None	3 k	68.24 to 71.76
		90.0	10	3 k	None	3 k	87.74 to 92.26
	1.0 k	10.00	50	3 k	50	3 k	9.749 to 10.26
		30.00	50	3 k	50	3 k	29.24 to 30.76
		50.0	50	3 k	50	3 k	48.74 to 51.26
		70.0	50	3 k	50	3 k	68.24 to 71.76
		90.0	50	3 k	50	3 k	87.74 to 92.26
	10.0 k	10.00	300	75 k	300	15 k	9.749 to 10.26
		30.00	300	75 k	300	15 k	29.24 to 30.76
		50.0	300	75 k	300	15 k	48.74 to 51.26
		70.0	300	75 k	300	15 k	68.24 to 71.76
		90.0	300	75 k	300	15 k	87.74 to 92.26

Table 4. (Cont.)

Applied Freq (Hz)	Applied Rate (Hz)	Applied Depth (%)	TI HP Filter (Hz)	TI LP Filter (Hz)	Measuring Receiver HP Filter (Hz)	Measuring Receiver LP Filter (Hz)	Limits (%)
1800 M	100	10.00	10	3 k	None	3 k	9.749 to 10.26
		30.00	10	3 k	None	3 k	29.24 to 30.76
		50.0	10	3 k	None	3 k	48.74 to 51.26
		70.0	10	3 k	None	3 k	68.24 to 71.76
		90.0	10	3 k	None	3 k	87.74 to 92.26
	1.0 k	10.00	50	3 k	50	3 k	9.749 to 10.26
		30.00	50	3 k	50	3 k	29.24 to 30.76
		50.0	50	3 k	50	3 k	48.74 to 51.26
		70.0	50	3 k	50	3 k	68.24 to 71.76
		90.0	50	3 k	50	3 k	87.74 to 92.26
	10.0 k	10.00	300	75 k	300	15 k	9.749 to 10.26
		30.00	300	75 k	300	15 k	29.24 to 30.76
		50.0	300	75 k	300	15 k	48.74 to 51.26
		70.0	300	75 k	300	15 k	68.24 to 71.76
		90.0	300	75 k	300	15 k	87.74 to 92.26

4.4.7 Press the Measuring Receiver AM and +PEAK keys. Set the HP FILTER to the first value listed in the Measuring Receiver HP Filter column of Table 4. Set the Measuring Receiver LP FILTER to the first value listed in the Measuring Receiver LP Filter column of Table 4.

4.4.8 Set the Synthesized Function Generator Frequency to the first value listed in the Applied Rate column of Table 4.

4.4.9 Press the Signal Generator (2.3) AM and EXT DC keys, then set to the first value listed in the Applied Depth column of Table 4.

4.4.10 Set the Synthesized Function Generator Level for a Measuring Receiver indication of the first value listed in the Applied Depth column of Table 4.

4.4.11 Press the TI CARR FREQ key and, using the TI keypad, set to the first value listed in the Applied Freq column of Table 4.

4.4.12 Press the TI AM, ABS and + PEAK keys. Set the TI HIGH PASS FILTER to the first value listed in the TI HP Filter column of Table 4. Set the TI LOW PASS FILTER to the first value listed in the TI LP Filter column of Table 4.

4.4.13 Verify the TI indicates within the values listed in the Limits column of Table 4.

4.4.14 Repeat steps 4.4.7 through 4.4.13 for the remaining corresponding values listed in Table 4 for the Applied Frequency being verified.

4.4.15 Repeat steps 4.4.4 through 4.4.14 for the remaining values listed in the Applied Freq column of Table 4.

4.4.16 Set the Signal Generator (2.3) AMPLITUDE to minimum. Set the Signal Generator (2.3) AM to OFF. Set the Synthesized Function Generator Level to minimum. Disconnect test setup.

4.4.17 Connect equipment as shown in Figure 2.

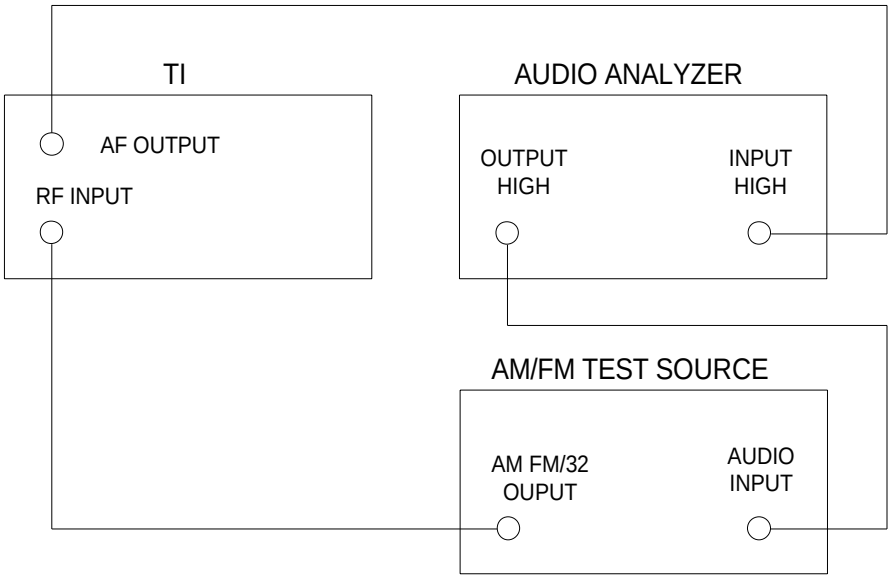

Figure 2.

4.4.18 Set the AM/FM Test Source CARRIER FREQUENCY TUNE to mid-range.

4.4.19 Press the TI CARR FREQ key and, using the TI keypad, set to 12.5 MHz.

4.4.20 Press the TI AM, ABS and + PEAK keys. Set the TI HIGH PASS FILTER to 10 Hz and set the TI LOW PASS FILTER to 15 kHz.

4.4.21 Set the Audio Analyzer frequency to the first value listed in the Applied Rate column of Table 5.

4.4.22 Set the Audio Analyzer output level for a TI indication of the value listed in the Applied Depth column of Table 5.

4.4.23 Set the Audio Analyzer for a distortion measurement.

4.4.24 Verify the Audio Analyzer indicates within the values listed in the Limits column of Table 5.

4.4.25 Repeat steps 4.4.21 through 4.4.24 for the remaining corresponding values listed in Table 5.

Table 5.

Applied Rate (Hz)	Depth (%)	Limits (%)
30	30	<0.3
	50	<0.6
	90	<0.6
1 k	30	<0.3
	50	<0.6
	90	<0.6
10 k	30	<0.3
	50	<0.6
	90	<0.6

4.4.26 Set the Audio Analyzer Level to minimum and disconnect test setup.

4.5 FREQUENCY MODULATION CALIBRATION:

NOTE

The TI Self-Alignment (CAL) needs to be performed only once during this para or every 30 minutes while taking measurements.

4.5.1 Using the TI keypad, press #, 9 and 9. Perform the TI Self-Alignments by using the TI keypad and entering #, 0 and 7. The Self-Alignment will take about 20 s.

4.5.2 Using the TI keypad, press 4, #, 6 and 6. The TI will display 16 averages selected.

4.5.3 Connect equipment as shown in Figure 1 except connect the Synthesized Function Generator MAIN SIGNAL to the Signal Generator (2.3) FM IN.

4.5.4 Press the Signal Generator (2.3) FREQUENCY key and set to the first value listed in the Applied Freq column of Table 6. Press the AMPLITUDE key and set to +6 dBm.

4.5.5 Press the Measuring Receiver INSTR PRESET. Press the Measuring Receiver FREQ key.

4.5.6 Ensure the Measuring Receiver indication is close to the Signal Generator (2.3) frequency set in step 4.5.4.

4.5.7 Press the Measuring Receiver FM and +PEAK key. Set the HP FILTER to the first value listed in the Measuring Receiver HP Filter column of Table 6. Set the Measuring Receiver LP FILTER to the first value listed in the Measuring Receiver LP Filter column of Table 6.

4.5.8 Set the Synthesized Function Generator Frequency to the first value listed in the Applied Rate column of Table 6.

4.5.9 Press the Signal Generator (2.3) FM and EXT DC keys, then set to the first value listed in the Applied Deviation column of Table 6.

4.5.10 Set the Synthesized Function Generator Level for a Measuring Receiver indication of the first value listed in the Applied Deviation column of Table 6.

4.5.11 Press the TI CARR FREQ key and, using the TI keypad, set to the first value listed in the Applied Freq column of Table 6.

4.5.12 Press the TI FM, ABS and + PEAK keys. Set the TI HIGH PASS FILTER to the first value listed in the TI HP Filter column of Table 6. Set the TI LOW PASS FILTER to the first value listed in the TI LP Filter column of Table 6.

4.5.13 Verify the TI indicates within the values listed in the Limits column of Table 6.

Table 6.

Applied Freq (Hz)	Applied Rate (Hz)	Applied Deviation (kHz)	TI HP Filter (Hz)	TI LP Filter (Hz)	Measuring Receiver HP Filter (Hz)	Measuring Receiver LP Filter (Hz)	Limits (kHz)
1.0 M	100	10.00	10	3 k	None	3 k	9.699 to 10.31
		40.00	10	3 k	None	3 k	38.79 to 41.21
	1.0 k	10.00	50	3 k	50	3 k	9.699 to 10.31
		40.00	50	3 k	50	3 k	38.79 to 41.21
	10.0 k	10.00	300	75 k	300	15 k	9.699 to 10.31
		40.00	300	75 k	300	15 k	38.79 to 41.21
10.1 M	100	10.00	10	3 k	None	3 k	9.699 to 10.31
		40.00	10	3 k	None	3 k	38.79 to 41.21
	10.0 k	10.00	300	75 k	300	15 k	9.699 to 10.31
		40.00	300	75 k	300	15 k	38.79 to 41.21
		100.0	300	75 k	300	15 k	96.99 to 103.1
	100.0 k	10.00	300	300 k	300	None	9.699 to 10.31
		40.00	300	300 k	300	None	38.79 to 41.21
		100.0	300	300 k	300	None	96.99 to 103.1
1000 M	100	10.00	10	3 k	None	3 k	9.699 to 10.31
		40.00	10	3 k	None	3 k	38.79 to 41.21
		100.0	10	3 k	None	3 k	96.99 to 103.1

Table 6. (Cont.)

Applied Freq (Hz)	Applied Rate (Hz)	Applied Deviation (kHz)	TI HP Filter (Hz)	TI LP Filter (Hz)	Measuring Receiver HP Filter (Hz)	Measuring Receiver LP Filter (Hz)	Limits (kHz)
1000 M	10.0 k	10.00	300	75 k	300	15 k	9.699 to 10.31
		100.0	300	75 k	300	15 k	96.99 to 103.1
		200.0	300	75 k	300	15 k	193.9 to 206.1
	100.0 k	10.00	300	300 k	300	None	9.699 to 10.31
		100.0	300	300 k	300	None	96.99 to 103.1
		200.0	300	300 k	300	None	193.9 to 206.1
1800 M	100	10.00	10	3 k	None	3 k	9.699 to 10.31
		100.0	10	3 k	None	3 k	96.99 to 103.1
		200.0	10	3 k	None	3 k	193.9 to 206.1
	10.0 k	10.00	300	75 k	300	15 k	9.699 to 10.31
		200.0	300	75 k	300	15 k	193.9 to 206.1
		400.0	300	75 k	300	15 k	387.9 to 412.1
	100.0 k	10.00	300	300 k	300	None	9.699 to 10.31
		200.0	300	300 k	300	None	193.9 to 206.1
		400.0	300	300 k	300	None	387.9 to 412.1

4.5.14 Set the Signal Generator (2.3) AMPLITUDE to minimum. Set the Signal Generator (2.3) FM to OFF. Set the Synthesized Function Generator Level to minimum. Disconnect test setup.

4.5.15 Connect equipment as shown in Figure 2 except connect the AM/FM Test Source FM OUTPUT to the TI RF INPUT.

4.5.16 Set the AM/FM Test Source CARRIER FREQUENCY TUNE to mid-range.

4.5.17 Press the TI CARR FREQ key and, using the TI keypad, set to 400 MHz.

4.5.18 Press the TI FM, ABS and + PEAK keys. Set the TI HIGH PASS FILTER to 10 Hz and set the TI LOW PASS FILTER to 75 kHz.

4.5.19 Set the Audio Analyzer frequency to the first value listed in the Applied Rate column of Table 7.

4.5.20 Set the Audio Analyzer output level for a TI indication of the value listed in the Applied Deviation column of Table 7.

4.5.21 Set the Audio Analyzer for a distortion measurement.

4.5.22 Verify the Audio Analyzer indicates within the values listed in the Limits column of Table 7.

4.5.23 Repeat steps 4.5.19 through 4.5.22 for the remaining corresponding values listed in Table 7.

Table 7.

Applied Rate (Hz)	Deviation (kHz)	Limits (%)
30	30	<0.15
	50	<0.15
	100	<0.15
1 k	30	<0.15
	50	<0.15
	100	<0.15
10 k	30	<0.15
	50	<0.15
	100	<0.15
20 k	30	<0.15
	50	<0.15
	100	<0.15

4.5.24 Set the Audio Analyzer Level to minimum and disconnect test setup.

4.6 PHASE MODULATION CALIBRATION:

NOTE

The TI Self-Alignment (CAL) needs to be performed only once during this para or every 30 minutes while taking measurements.

4.6.1 Connect equipment as shown in Figure 3.

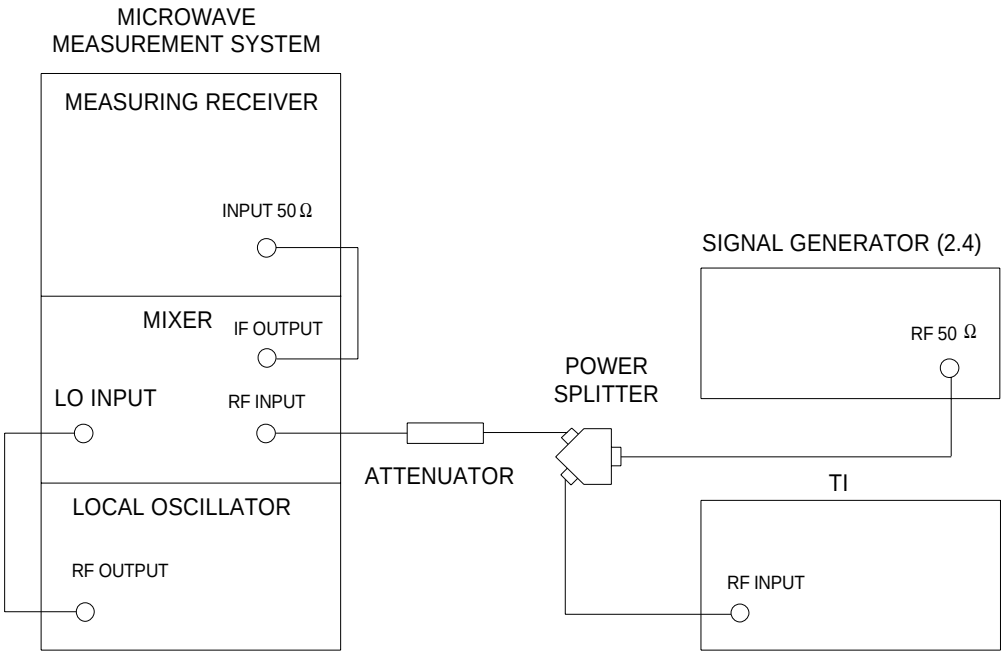

Figure 3.

4.6.2 Using the TI keypad, press #, 9 and 9. Perform the TI Self-Alignments by using the TI keypad and entering #, 0 and 7. The Self-Alignment will take about 20 s.

4.6.3 Using the TI keypad, press 4, #, 6 and 6. The TI will display 16 averages selected.

4.6.4 Press the Signal Generator (2.4) Preset. Press the RF key and set to the first value listed in the Applied Freq column of Table 8. Press the LEVEL key and set to +6 dBm.

4.6.5 Press the Measuring Receiver INSTR PRESET. Press the Measuring Receiver FREQ key.

4.6.6 Ensure the Measuring Receiver indication is close to the Signal Generator (2.4) frequency set in step 4.6.4.

4.6.7 Press the Measuring Receiver ϕM and +PEAK key. Set the HP FILTER to the first value listed in the Measuring Receiver HP Filter column of Table 8. Set the Measuring Receiver LP FILTER to the first value listed in the Measuring Receiver LP Filter column of Table 8.

Table 8.

Applied Freq (Hz)	Applied Rate (Hz)	Applied Deviation (rad)	TI HP Filter (Hz)	TI LP Filter (Hz)	Measuring Receiver HP Filter (Hz)	Measuring Receiver LP Filter (Hz)	Limits (rad)
10.1 M	300	10.00	50	3 k	None	3 k	9.697 to 10.33
		30.00	50	3 k	None	3 k	29.07 to 30.93
		50.00	50	3 k	None	3 k	48.47 to 51.53
	1.0 k	10.00	50	3 k	50	3 k	9. 697 to 10.33
		30.00	50	3 k	50	3 k	29.07 to 30.93
		50.00	50	3 k	50	3 k	48.47 to 51.53
	4.0 k	10.00	300	15 k	300	15 k	9. 697 to 10.33
		30.00	300	15 k	300	15 k	29.07 to 30.93
		50.00	300	15 k	300	15 k	48.47 to 51.53
1000 M	300	10.00	50	3 k	None	3 k	9. 697 to 10.33
		30.00	50	3 k	None	3 k	29.07 to 30.93
		50.00	50	3 k	None	3 k	48.47 to 51.53
	1.0 k	10.00	50	3 k	50	3 k	9. 697 to 10.33
		30.00	50	3 k	50	3 k	29.07 to 30.93
		50.00	50	3 k	50	3 k	48.47 to 51.53
	4.0 k	10.00	300	15 k	300	15 k	9. 697 to 10.33
		30.00	300	15 k	300	15 k	29.07 to 30.93
		50.00	300	15 k	300	15 k	48.47 to 51.53

4.6.8 Press the TI CARR FREQ key and, using the TI keypad, set to the first value listed in the Applied Freq column of Table 8.

4.6.9 Press the TI PM, ABS and + PEAK keys. Set the TI HIGH PASS FILTER to the first value listed in the TI HP Filter column of Table 8. Set the TI LOW PASS FILTER to the first value listed in the TI LP Filter column of Table 8.

4.6.10 Press the Signal Generator (2.4) AF key to the first value listed in the Applied Rate column of Table 8. Press the ϕM key, then the INT/ON key. Set the ϕM to the first value listed in the Applied Deviation column of Table 8.

4.6.11 Using the Signal Generator (2.4) controls, set the Signal Generator (2.4) ϕM for a Measuring Receiver indication of the first value listed in the Applied Deviation column of Table 8.

4.6.12 Verify the TI indicates within the values listed in the Limits column of Table 8.

4.6.13 Repeat steps 4.6.4 through 4.6.12 for the remaining corresponding values listed in Table 8.

4.6.14 Set the Signal Generator (2.4) LEVEL to minimum. Set the Signal Generator (2.4) ϕM to OFF.

4.6.15 Disconnect the test setup.

4.7 POWER MEASUREMENT CALIBRATION:

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

4.7.2 Connect the Signal Generator (2.3) RF OUTPUT through the Power Sensor to the Power Meter. Set the Power Meter CAL FACTOR to the appropriate value listed on the Power Sensor for the frequency being verified.

4.7.3 Set the Signal Generator (2.3) to the first value listed in the Applied Frequency column of Table 9. Set the Signal Generator (2.3) output level for the first value listed in the Applied Level column of Table 9 as monitored on the Power Meter.

4.7.4 Disconnect the Signal Generator (2.3) from the Power Meter and Power Sensor.

4.7.5 Connect the Signal Generator (2.3) RF OUTPUT to the TI RF INPUT.

4.7.6 Press the TI CARR FREQ key and, using the TI keypad, set to the first value listed in the Applied Frequency column of Table 9.

4.7.7 Press the TI RF POWER, RF and ABS keys.

4.7.8 Verify the TI indicates within the values listed in the Limits column of Table 9.

4.7.9 Set the Signal Generator (2.3) output to minimum and disconnect from the TI RF INPUT.

4.7.10 Repeat steps 4.7.2 through 4.7.9 for the remaining corresponding values listed in Table 9.

Table 9.

Applied Frequency (Hz)	Applied Level (dBm)	Limits (dBm)
600 k	+16	+13 to +19
	+12	+9 to +15
10.1 M	+16	+13 to +19
	+12	+9 to +15
500 M	+16	+13 to +19
	+12	+9 to +15
1.0 G	+16	+13 to +19
	+12	+9 to +15
1.8 G	+16	+13 to +19
	+12	+9 to +15

4.7.11 Set the Signal Generator (2.3) output level to minimum.

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

4.7.13 Annotate and attach a Limited Certification Label per step 3.6.

CALIBRATION PERFORMANCE TABLE

Not Required

APPENDIX A

A-1 REFERENCE OSCILLATOR ADJUSTMENT: [Oven Controlled Crystal Oscillator (OCXO)]

A-1.1 Connect Frequency Standard 10 MHz FREQ OUT to Frequency Difference Meter (FDM) REF INPUT. Connect TI 10 MHz REF INPUT/OUTPUT to the FDM SIG INPUT connector.

A-1.2 Standardize the FDM as required. Set FDM METER RANGE switch as required for an on scale indication on the FDM.

A-1.3 Adjust TI Frequency Reference Adjustment (rear panel), as required for lowest possible null on the FDM meter.

A-1.4 Allow TI 10 MHz Reference Oscillator a minimum of one (1) hour to stabilize and repeat step A-1.3 as required.

A-1.5 Disconnect equipment from TI and continue with para 4.2.