TECHNICAL MANUAL

CALIBRATION PROCEDURE

FOR

COMMUNICATION SERVICE MONITOR

2948B OPT3

(AEROFLEX)

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COMMUNICATION SERVICE MONITOR

2948B OPT3

(AEROFLEX)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency Standard	Range: 10 MHz Accuracy: (OCXO) Accuracy: ±1 X 10^{-7}; *[1] Aging/year: <1 X 10^{-7}; Temperature: <5 X 10^{-8} (0 to +55 °C) *[2]	Verified with a Frequency Standard and Electronic Counter
Display	Range: 400 kHz to 1.05 GHz Accuracy: ±1 count of LSD	Verified during Frequency Standard Calibration
RF Signal Generator		
Frequency	Range: 400 kHz to 1.05 GHz Accuracy: Same as Frequency Standard	
Output Level	Range: -141 to -21 dBm, N-type connector; -115 to +5 dBm, BNC connector Accuracy: ±2 dB, for levels >-127 dBm, to 1 GHz on N-type connector	Measured with a Power Meter and Power Sensor and Microwave Measurement Receiver
Spectral Purity		
Residual FM	Range: 400 kHz to 1.05 GHz Accuracy: <6 Hz rms, 0.3 to 3.4 kHz Bandwidth, ≤500 MHz; <12 Hz rms, 0.3 to 3.4 kHz Bandwidth, >500 MHz to 1.05 GHz	Measured with Microwave Measurement Receiver
Harmonics	Range: 400 kHz to 1.05 GHz Accuracy: <-25 dBc	Measured with Spectrum Analyzer
Spurious Signals	Range: 400 kHz to 1.05 GHz Accuracy: <-50 dBc	

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
RF Signal Generator *(Cont.)*		
Spectral Purity *(Cont.)*		
Single Sideband Phase Noise	Range: 400 kHz to 1.05 GHz Accuracy: 20 kHz offset: <-112 dBc/Hz, ≤500 MHz; <-108 dBc/Hz, >500 MHz to 1.05 GHz	Measured with Phase Noise Measurement System
Amplitude Modulation (Internal)	Range: 400 kHz to 1.05 GHz, 0 to 99% depth at 5 Hz to 33 kHz modulation frequency Accuracy: Carrier frequency, 1.5 to 400 MHz: (1 kHz modulation frequency): ±5% of setting, at 50% depth; ±(7% of setting + 1 digit); (50 Hz to 15 kHz modulation frequency): ±(15% of setting + 1 digit)	Measured with Microwave Measurement Receiver
Frequency Modulation (Internal)	Range: 400 kHz to 1.05 GHz, 75 kHz maximum deviation at 5 Hz to 33 kHz modulation Accuracy: (1 kHz modulation frequency): ±7% of setting; (50 Hz to 15 kHz modulation frequency): ±10% of setting	
Audio Analyzer		
Audio Voltmeter	Range: 0 to 100 mV to 0 to 100 V rms in a 1, 3 and 10 sequence, DC and 50 Hz to 50 kHz, AC only: 50 Hz to 50 kHz Accuracy: DC: ±(1% of ind + 50 mVDC) up to 40 VDC; AC: ±(3% of ind + 3 mV rms + resolution), up to 30 V rms, (Resolution is 1 mV or 1% of reading)	Verified with a Meter Calibrator
Audio Oscilloscope Voltage	Range: 10 mV to 20 V/div in a 1, 2 and 5 sequence, DC to 50 kHz, 3 Hz to 50 kHz AC coupled Accuracy: ±5% of FS	

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Audio Analyzer *(Cont.)*		
Audio Frequency Meter	Range: 20 Hz to 50 kHz Accuracy: ±(Same as Frequency Standard + 1 digit + resolution), (Resolution is 0.1 Hz at <10 kHz and 1 Hz at ≥10 kHz)	Verified during Frequency Standard Calibration
Audio Distortion Meter	Range: 1 kHz, 0 to 10% and 0 to 30% Accuracy ±(1 dB of ind + 0.5% distortion)	Measured internal with two signals applied
Audio Sinad Meter	Range: 1 kHz, 0 to 18 and 0 to 50 dB Accuracy: ±1 dB	
Audio S/N Meter	Range: 0 to 30 dB and 0 to 100 dB Accuracy: ±1 dB	Verified as part of the Distortion and Sinad Meter calibration
RF Frequency Meter	Range: 400 kHz to 1.05 GHz (manually tuned) Accuracy: ±(Same as Frequency Standard + resolution, (Resolution is 1 Hz or 10 Hz, up to 1.05 GHz, selectable, and 0.1 Hz, 1 Hz or 10 Hz, up to 999 MHz, selectable)	Verified during Frequency Standard Calibration
RF Power Meter	Range: (N-type): 5 mW to 150 W for frequencies 200 kHz to 1.05 GHz; (BNC antenna): 0.05 to 250 mW *[2] Accuracy: ±(10% of ind + resolution), (N-type), up to 1 GHz, (Resolution is 0.1 dB)	Verified with a Synthesized Signal Generator and Microwave Measurement Receiver and High Power High Frequency RF Amplifier System

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Amplitude Modulation	Range: 400 kHz to 1.05 GHz, 10 Hz to 15 kHz modulation frequency	
AM Depth	Range: 0 to 99% (manually tuned); 0 to 90%, <100 MHz; 0 to 80%, 100 to 400 MHz Accuracy: ±(5% of setting + 1 digit) at 1 kHz; ±(8.5% of setting + 1 digit) 50 Hz to 10 kHz	Verified with Microwave Measurement Receiver
Residual AM *[3]	Range: 400 kHz to 1.05 GHz Accuracy: <1% AM, 300 Hz to 3.4 kHz Bandwidth	Not Calibrated
Frequency Modulation	Range: 400 kHz to 1.05 GHz, 10 Hz to 15 kHz modulation frequency	
Deviation	Range: 0 to 75 kHz Accuracy: ±(5% of setting + resolution), at 1 kHz modulation frequency, (Resolution is 10 Hz <2 kHz deviation, and 1% >2 kHz deviation); *[3] ±(7.5% of setting + resolution), 50 Hz to 10 kHz modulation frequency, (Resolution is 10 Hz <2 kHz deviation, and 1% >2 kHz deviation) *[3]	Verified with Microwave Measurement Receiver
Residual FM *[3]	Range: 400 kHz to 1.05 GHz Accuracy: <30 Hz, 300 Hz to 3.4 kHz Bandwidth	Not Calibrated
RF Spectrum Analyzer	Range: 400 kHz to 1.05 GHz, -50 to + 52 dBm	
Level Flatness	Range: 80 dB Accuracy: ±(2 dB + resolution), (10 dB/div), (Resolution is 0.1 dB on 2 dB/division, and 0.5 dB on 10 dB/division)	Measured with a Signal Generator and Microwave Measurement Receiver

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Audio Generator		
Frequency	Range: 5 Hz to 33 kHz Accuracy: 0.01 Hz, at <180 Hz; 0.1 Hz, at >180 Hz	Verified during Frequency Standard Calibration
Level	Range: 0.1 mV to 4 V rms Accuracy: ±(5% of setting + resolution), 50 Hz to 15 kHz, (Resolution is 0.1 mV at <409 mV, and 1 mV at >409 mV)	Measured with Digital Multimeter
Level Distortion	Range: 0.1 mV to 4 V rms Accuracy: <0.5% at 1 kHz; <1% at 50 Hz to 15 kHz	Measured with Audio Analyzer

*[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. For a TI with a settability specification, the accuracy specification is found by adding the settability specification to the one year aging specification.

*[2] Typical or Operational Specification. Not calibrated.

*[3] See step 3.7.

2 EQUIPMENT REQUIREMENTS:

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1	FREQUENCY STANDARD	Range: 10 MHz Accuracy: <2.5 X 10^{-8}	Arbiter 1083B	
2.2	ELECTRONIC COUNTER	Range: 400 kHz to 1050 MHz Accuracy: ±1 count of LSD	Agilent 53132A OPT 030	

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.3	MICROWAVE MEASUREMENT RECEIVER (MMR)	Range: -140 to -21 dBm, 10.1 to 1000 MHz Accuracy: *[1] Relative Tuned RF Level: Residual Noise to Max power, ±(0.015 dB + 0.005 dB/10 dB); Minimum Power to Residual Noise Threshold, ±(Cumulative Error + 0.0012 X (Input Power - Residual Noise Threshold Power)[2]); Range 2, ±0.031 dB; *[2] Range 3, ±0.031 dB *[3] Range: (AM depth) 50% depth at 1 kHz Accuracy: ±1.25% of rdg Range: (FM deviation) 0.1 to 75 kHz Accuracy: ±1.50% of rdg Range: (Audio Filters) 50 Hz to >20 kHz Accuracy: 50 Hz High-Pass Filter, <1% at rates ≥200 Hz; 300 Hz High-Pass Filter, <1% at rates ≥1 kHz; 3 kHz Low-Pass Filter, <1% at rates ≤1 kHz; 15 kHz Low-Pass Filter, <1% at rates ≤10 kHz;	Agilent N5530SE26	
2.4	POWER METER	Range: -21 to +15 dBm Accuracy: *[4]	Hewlett-Packard E4418B	
2.5	POWER SENSOR	Range: 10 to 1000 MHz Accuracy: (all % are of charted value) *[1] ±2.0%, 10 to ≤30 MHz; ±2.4%, >30 MHz to ≤1.0 GHz	Hewlett-Packard E4412A	

See footnotes at the end of the Equipment Requirements.

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.6	SPECTRUM ANALYZER	Range: 400 kHz to 5.0 GHz Accuracy: ±1.6 dB	Agilent E4440A	
2.7	PHASE NOISE MEASUREMENT SYSTEM	Range: 100 MHz to 1.0 GHz Accuracy: 20 kHz Offset, ±2 dB	Agilent E5504B	
2.8	METER CALIBRATOR	Range: DC, 0 to 80 V; AC, 30 mV to 30 V rms, 50 Hz to 50 kHz Accuracy: DC, ±0.25% of setting; AC, ±1.0% of setting	Fluke 5700AOPT03	
2.9	DIGITAL MULTIMETER	Range: 0 to 1.051 V rms, 50 Hz to 1 kHz Accuracy: ±1.25% of ind	Hewlett-Packard 3458A	
2.10	RF REFERENCE SOURCE (2 EA)	Range: -60 to +13.01 dBm, 100 Hz to 10.05 MHz Accuracy: ±0.625 dB	Fluke 9640A	
2.11	POWER DIVIDER	Range: 400 Hz to 1 kHz Accuracy: N/A	Weinschel 1506A	
2.12	SYNTHESIZED SIGNAL GENERATOR	Range: 10 MHz to 1.0 GHz, at +15 dBm Accuracy: N/A	Agilent E8257D OPT1EA, w/o OPT 1E1 and H43	
2.13	RF POWER MEASUREMENT SET	Range: 10 to 1000 MHz, 0 to 100 W Accuracy: ±3.0% of rdg	Bird 4421A300	
2.14	HIGH POWER HIGH FREQUENCY RF AMPLIFIER SYSTEM	Range: 10 to 1000 MHz, 0 to 100 W Accuracy: N/A	PST Corp BHED1719-1000/4006	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.15 SIGNAL GENERATOR	Range: 10 MHz to 1 GHz, at -10 to 0 dBm Accuracy: N/A	Hewlett-Packard 8662A	
2.16 POWER SPLITTER	Range: 10 MHz to 1 GHz Accuracy: N/A	Hewlett-Packard 11667A	
2.17 AUDIO ANALYZER	Range: 50 Hz to 15 kHz Accuracy: ±1 dB	Hewlett-Packard 8903B	
2.18 FEEDTHROUGH TERMINATION	Range: 50 Ω Accuracy: N/A	As Available	

*[1] A worst case TAR of 3.6:1 is the result of the Root Sum Square (RSS) value of the MMR and the Power Sensor when performing the TI RF Signal Generator Output Level Calibration for levels <-123 dBm.

*[2] This specification applies when the MMR enters Range 2. Range 2 is entered when the Range 1 Signal to Noise Ratio (SNR) falls between 50 and 28 dB. The SNR value is tuning dependent. Range 2 will be displayed on the MMR when the range is entered.

*[3] This specification, in addition to the Range 2 error, applies when the MMR enters Range 3. Range 3 is entered when the Range 2 SNR falls between 50 and 28 dB. The SNR value is tuning dependent. Range 3 will be displayed on the MMR when the range is entered.

*[4] Power Meter Accuracy included in Power Sensor Accuracy.

3 PRELIMINARY OPERATIONS:

3.1 Review and become familiar with the 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. If not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

3.2 Connect all test equipment to appropriate power sources. Set all POWER switches to ON and allow test equipment warm-up period per manufacturer.

3.3 Connect TI to appropriate power source. Set POWER switch to ON and allow a 30 minute warm-up period.

3.4 The TI Hardkeys are shown in uppercase in this procedure, all Softkeys and Menu keys are in lower case with Initial Caps.

3.5 Perform only those sections applicable to TI under tests.

3.6 To eliminate the number of key presses that the user needs to make to obtain the correct instrument settings, each section assumes that the instrument is being configured from the TI factory default power on state. To ensure this occurs, initially press the following keys:

3.6.1 Press HELP/SETUP.

3.6.2 Press Setup.

3.6.3 Press Setup page 2.

3.6.4 Toggle the Power Up From menu key until Preset Store 1 is shown highlighted in inverse video.

3.6.5 Set TI POWER switch to OFF. Set TI POWER switch to ON and allow a 30 minute warm-up time. The TI should now be in the factory default power on state.

3.7 The TI RF Input Residual AM and Residual FM will not be calibrated. Because the Residual FM is not calibrated, the RF Input FM Deviation is not calibrated <1 kHz deviation. Annotate and attach a Limited Certification Label stating: RF Input Residual AM and Residual FM not calibrated. RF Input FM Deviation not calibrated <1 kHz deviation.

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

NOTE

Whenever a measurement is made with MMR at a carrier frequency of <20 MHz, the RF coupling must be set to DC. The 50 GHz MMR RF coupling is always DC. The 26.5 GHz MMR RF coupling must be set to DC.

3.9 Set MMR for the Factory Preset. Preset the MMR. Perform Align All Now.

NOTE

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

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 STANDARD CALIBRATION:

NOTE

Adjustment of the Time Base Oscillator is normal due to the Aging Rate of the crystal. 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 Electronic Counter Ref In.

4.1.2 Connect TI BNC Output to Electronic Counter CHANNEL 1 input connector and set Electronic Counter Impedance switch to 50 Ω. On the TI, press the RF IN/OUT SELECT to select the BNC output.

4.1.3 On the TI, press Rx TEST. Press RF Gen and set controls as follows:

FREQ	10 MHz
LEVEL	-10 dBm

NOTE

Ensure the TI Modulation Generators MOD1 and MOD2 are off.

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 twelve month values regardless of the length of the calibration interval for this TI in T.O. 33K-1-100-1/2.

4.1.4 Adjust the Electronic Counter controls as required for a stable display indication and then push RESET. Verify the Electronic Counter indication is 9 999 999 to 10 000 001 Hz.

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 the applicable code into the Maintenance Data Collection System. If TI failed, perform the applicable steps listed in Appendix A and enter the applicable code into the Maintenance Data Collection System.

4.1.6 Set TI output to minimum and disconnect test setup.

4.1.7 Connect Electronic Counter 10 MHz Out to the TI EXT. STD 1/2/5/10 MHz input (rear panel).

4.1.8 Connect TI BNC Output to Electronic Counter CHANNEL 1 input connector.

4.1.9 On the TI, press the RF IN/OUT SELECT to select the BNC output.

4.1.10 On the TI, press Rx TEST. Press RF Gen and set controls as follows:

FREQ	400 kHz
LEVEL	-10 dBm

4.1.11 Set Electronic Counter for a 1 Hz resolution frequency measurement.

4.1.12 The Electronic Counter must indicate within 399 999 to 400 001 Hz.

4.1.13 Repeat steps 4.1.10 through 4.1.12 for the remaining values listed in Table 2. Use the appropriate Electronic Counter input for the TI frequency being measured.

Table 2.

TI Freq (MHz)	Frequency Counter Limits (Hz)
0.400	399 999 to 400 001
111.11111	111 111 109 to 111 111 111
122.22222	122 222 219 to 122 222 221
133.33333	133 333 329 to 133 333 331
144.44444	144 444 439 to 144 444 441
155.55555	155 555 549 to 155 555 551
166.66666	166 666 659 to 166 666 661
177.77777	177 777 769 to 177 777 771
188.88888	188 888 879 to 188 888 881
500.00000	499 999 999 to 500 000 001
1050.00000	1049 999 999 to 1050 000 001

4.1.14 Set TI output to minimum and disconnect test setup.

4.2 RF SIGNAL GENERATOR CALIBRATION:

4.2.1 OUTPUT LEVEL CALIBRATION:

4.2.1.1 Connect MMR 10 MHz OUT (SWITCHED) to the TI EXT. STD 1/2/5/10 MHz input (rear panel).

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

4.2.1.3 Standardize Power Meter and Power Sensor. Set Power Meter to measure in the dBm mode.

NOTE

Ensure the Power Sensor Calibration Factors have been programmed into the Power Meter memory. Select the appropriate Power Sensor file throughout the Calibration Process.

4.2.1.4 Connect TI N-type Output connector to the Power Sensor input. On the TI, press the RF IN/OUT SELECT to select the N-type output/antenna input mode.

4.2.1.5 On the TI, press Rx TEST. Press RF Gen and set controls as follows:

FREQ	10.1 MHz
LEVEL	-21 dBm

NOTE

All TI modulation and noise measurements should be switched off.

4.2.1.6 Verify the Power Meter indication is within the corresponding values listed in the Limits column of Table 3. Record the Power Meter indication.

4.2.1.7 Set TI output to minimum and disconnect Power Sensor from test setup.

4.2.1.8 Connect TI N-type Output connector to the MMR RF INPUT 50 Ω.

4.2.1.9 On the TI, press TI Level, then set to the first value listed in the TI Level column of Table 3.

4.2.1.10 Set MMR frequency to the TI frequency.

NOTE

For Tuned RF Level measurements do not change the signal level during the Range 2 Switch Level Cal Factor and Range 3 Switch Level Cal Factor calibration. Wait for the red calibrating message to disappear before continuing. Use this method throughout the Calibration Process when making Tuned RF Level measurements.

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

4.2.1.12 Set MMR to Set Ref.

4.2.1.13 Allow the MMR Tuned RF Level indication to settle.

4.2.1.14 Set MMR Ext RF Atten to the value recorded, in dB, in step 4.2.1.6 for the frequency being verified.

4.2.1.15 Press TI Level, then set to the next value listed in the TI Level column of Table 3.

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

4.2.1.17 Repeat steps 4.2.1.15 and 4.2.1.16 for the remaining values listed in the TI Level column of Table 3 for the frequency being verified.

Table 3.

TI Freq (MHz)	TI Level (dBm)	Limits (dB)
10.1	-21	-23 to -19
10.1	-25	-27 to -23
10.1	-30	-32 to -28
10.1	-40	-42 to -38
10.1	-50	-52 to -48
10.1	-60	-62 to -58
10.1	-70	-72 to -68
10.1	-80	-82 to -78
10.1	-90	-92 to -88
10.1	-100	-102 to -98
10.1	-110	-112 to -108
10.1	-120	-122 to -118
10.1	-125	-127 to -123
500	-21	-23 to -19
500	-25	-27 to -23
500	-30	-32 to -28
500	-40	-42 to -38
500	-50	-52 to -48
500	-60	-62 to -58
500	-70	-72 to -68
500	-80	-82 to -78
500	-90	-92 to -88
500	-100	-102 to -98
500	-110	-112 to -108
500	-120	-122 to -118
500	-125	-127 to -123

Table 3. (Cont.)

TI Freq (MHz)	TI Level (dBm)	Limits (dB)
1000	-21	-23 to -19
1000	-25	-27 to -23
1000	-30	-32 to -28
1000	-40	-42 to -38
1000	-50	-52 to -48
1000	-60	-62 to -58
1000	-70	-72 to -68
1000	-80	-82 to -78
1000	-90	-92 to -88
1000	-100	-102 to -98
1000	-110	-112 to -108
1000	-120	-122 to -118
1000	-125	-127 to -123

4.2.1.18 Disconnect TI N-type Output connector from the MMR RF INPUT 50 Ω. Set MMR Ext RF Atten to 0 dB.

4.2.1.19 Repeat steps 4.2.1.4 through 4.2.1.18, except in step 4.2.1.4 , on the TI, press the RF IN/OUT SELECT to select the N-type output/N-type input mode.

4.2.1.20 Repeat steps 4.2.1.4 through 4.2.1.19 for TI Freq 500 and 1000 MHz.

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

4.2.1.22 Set TI output to minimum and disconnect test setup.

4.2.2 SPECTRAL PURITY CALIBRATION:

4.2.2.1 RESIDUAL FM CALIBRATION:

4.2.2.1.1 Connect TI BNC Output connector to the MMR RF INPUT 50 Ω. On the TI, press RF IN/OUT SELECT to select the BNC output.

4.2.2.1.2 Set MMR to Measuring Receiver mode.

4.2.2.1.3 On the TI, press Rx TEST. Press RF Gen and set controls as follows:

FREQ	1000 MHz
LEVEL	0 dBm

NOTE

All TI modulation and noise measurements should be switched off.

4.2.2.1.4 Set MMR Frequency to the TI frequency.

4.2.2.1.5 Set MMR controls, as required, to measure FM Deviation. Set High Pass Filter to 300 Hz, Low Pass Filter to 3 kHz and Detector to RMS.

4.2.2.1.6 Verify the MMR FM Deviation indication is within the corresponding value listed in the Limits column of Table 4.

4.2.2.1.7 Set TI FREQ to the next value listed in the TI Freq column of Table 4.

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

4.2.2.1.9 Repeat steps 4.2.2.1.5 through 4.2.2.1.8, as required, for the remaining values listed in Table 4.

Table 4.

TI Freq (MHz)	Limits (Hz rms)
1000	<12
750	<12
500	<6
250	<6
10	<6

4.2.2.1.10 Set TI output to minimum and disconnect test setup.

4.2.2.2 HARMONICS AND SPURIOUS SIGNALS CALIBRATION:

4.2.2.2.1 Connect BNC Output connector to the Spectrum Analyzer RF INPUT 50 Ω connector.

4.2.2.2.2 On the TI, press Rx TEST and then press RF Gen and set controls as follows:

FREQ	0.4 MHz
LEVEL	0 dBm

NOTE

All TI modulation and noise measurements should be switched off.

4.2.2.2.3 Set Spectrum Analyzer as required to measure the carrier and at least 4 harmonics.

4.2.2.2.4 Verify the level of the Harmonics are within the values listed in the Harmonics Limits column of Table 5.

4.2.2.2.5 Set Spectrum Analyzer controls as necessary to measure the Spurious Signals.

4.2.2.2.6 Verify the level of the Spurious Signals are within the limits listed in the Spurious Signals Limits column of Table 5.

4.2.2.2.7 Repeat steps 4.2.2.2.2 through 4.2.2.2.6 for the remaining values listed in Table 5.

Table 5.

	Limits	
TI Freq (MHz)	**Harmonics (dBc)**	**Spurious Signals (dBc)**
0.4	<-25	<-50
1.0	<-25	<-50
10	<-25	<-50
100	<-25	<-50
250	<-25	<-50
500	<-25	<-50
750	<-25	<-50
1000	<-25	<-50

4.2.2.2.8 Set TI output to minimum, then press ON/OFF to OFF and disconnect test setup.

4.2.2.3 SINGLE SIDEBAND PHASE NOISE CALIBRATION:

CAUTION

Do not connect outputs of Phase Noise Measurement System Reference Source or TI to the Inputs of the Phase Noise Measurement System until connect diagram appears on screen. Damage to the Phase Noise Measurement System can result if Reference Source or TI output power is applied to the system before the connect diagram is shown. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

4.2.2.3.1 Verify the Phase Noise Measurement System is using the current Software Package 88M-E5504B/NOISE-F001-01A Systems, with the latest revision, as per ACPINS. The Desktop should be present on the screen when the computer is turned on.

4.2.2.3.2 Access the Phase Noise Calibration Program.

4.2.2.3.3 On the Phase Noise Measurement System, select System then Server Hardware Connections. Select Sources tab, set Reference Source to Agilent Z5641_K02 and Slave Source to Agilent E8257D.

4.2.2.3.4 Select Define, then select Measurement.

4.2.2.3.5 On Phase Noise Measurement System, select Preset. Select Yes. Set Offset Frequency Range Start Offset to 10E+3 Hz and Stop Offset to 50E+3 Hz.

4.2.2.3.6 On Phase Noise Measurement System, select Sources. Select Preset. Select Yes. Set the following:

Carrier Source	
Frequency	1E+9 Hz
Power	0 dBm
Reference Source	
Power	16 dBm
VCO Tuning Parameters	
Nominal Tune Constant	100 Hz/Volt
Tune Range +/-	5 Volts
Input Resistance	600 Ohms

4.2.2.3.7 On Phase Noise Measurement System, select Cal. Select Preset. Select Yes. Select Calculate from expected VCO tune constant using tune port resistance. De-select Verify calculated phase locked loop suppression.

4.2.2.3.8 On Phase Noise Measurement System, select Block Diagram. Select Preset. Select Yes. Select VCO Tune Mode DCFM.

4.2.2.3.9 On Phase Noise Measurement System, select Test Set. Select Preset. Select Yes. Set LNA Low Pass Filter to 200 kHz and de-select Auto.

4.2.2.3.10 On Phase Noise Measurement System, select Graph. Select Preset. Select Yes. Enter graph title as appropriate for the set-up. Set X Scale Minimum to 10 kHz and X Scale Maximum to 50 kHz. Select Close.

CAUTION

PC Digitizer (P/O Phase Noise Measurement System) INPUT and OUTPUT connectors are fragile. Damage can occur to the PC Digitizer INPUT and OUTPUT connectors and cables while connected if tension is applied. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

4.2.2.3.11 On Phase Noise Measurement System, select Measure. Select New Measurement. Select Yes when prompted to perform a new calibration and measurement. When Verify Connections diagram appears on screen, ignore on-screen diagram.

4.2.2.3.12 Connect equipment as shown in Figure 1 and on the TI, press Rx TEST, RF Gen and set controls as follows:

FREQ	1000 MHz
LEVEL	0 dBm
ON/OFF	ON

NOTE

All TI modulation and noise measurements should be switched off.

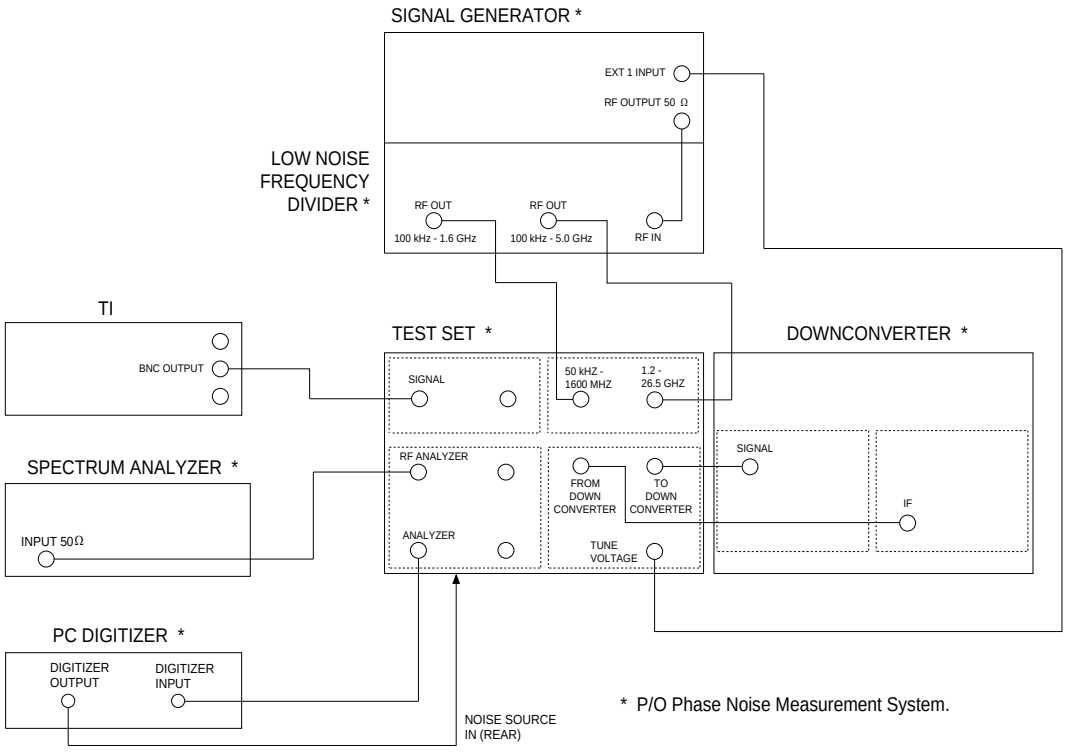


Figure 1.

4.2.2.3.13 On Phase Noise Measurement System, select Continue.

4.2.2.3.14 Verify the Phase Noise Plot at 20 kHz offset is within the limits listed in the Limits column of Table 6. If desired, the Marker icon may be used to obtain specific offset frequency and phase noise measurements on the graph. Press M to obtain the Marker function.

4.2.2.3.15 Set TI ON/OFF to OFF.

4.2.2.3.16 On Phase Noise Measurement System select Sources to change Carrier Source Frequency to the next value listed in the Carrier Source Frequency column of Table 6. Set VCO Tuning Parameters Nominal Tune Constant to value listed in the Nominal Tune Constant column of Table 6.

4.2.2.3.17 Repeat steps 4.2.2.3.10 through 4.2.2.3.15, except in step 4.2.2.3.12, press TI Rx TEST, RF Gen and set to the next value listed in the Applied column of Table 6.

Table 6.

Carrier Source Frequency	Nominal Tune Constant	Applied (MHz)	Limits (dBc/Hz)
1E+9 Hz	100 Hz/Volt	1000	<-108
750E+6 Hz	75 Hz/Volt	750	<-108
500E+6 Hz	50 Hz/Volt	500	<-112
250E+6 Hz	25 Hz/Volt	250	<-112
100E+6 Hz	10 Hz/Volt	100	<-112

4.2.2.3.18 Repeat steps 4.2.2.3.16 and 4.2.2.3.17 as required, for remaining frequencies listed in the Applied column of Table 6.

4.2.2.3.19 Set TI output to minimum and disconnect TI from the Phase Noise Measurement System.

4.2.3 AMPLITUDE MODULATION CALIBRATION: (Internal)

4.2.3.1 Connect TI BNC Output connector to the MMR RF INPUT 50 Ω. Set MMR to Measuring Receiver mode.

4.2.3.2 On the TI, press Rx TEST, RF Gen and set controls as follows:

FREQ	First value listed in the TI Freq column of Table 7
LEVEL	-15 dBm
ON/OFF	ON

4.2.3.3 Set MMR Frequency to the TI carrier frequency.

4.2.3.4 On the TI, press TI Mod Gen and set controls as follows:

Gen 1/Gen 2	Gen 2
FREQ	First value listed in the Gen 2 Freq column of Table 7 for the frequency being verified
LEVEL	First value listed in the Gen 2 Level column of Table 7 for the frequency being verified

4.2.3.5 Set MMR controls, as required, to measure AM Depth. Set High Pass Filter and Low Pass Filter to the corresponding values listed in Filters HP and LP columns of Table 7 and the Detector to Peak + - / 2.

4.2.3.6 Allow the MMR AM Depth indication to settle. Verify the MMR AM Depth indication is within the corresponding values listed in the Limits column of Table 7.

4.2.3.7 Repeat steps 4.2.3.4 through 4.2.3.6, as required, for the remaining corresponding values listed in Table 7 for the frequency being verified.

4.2.3.8 On the TI, press Rx TEST, RF Gen and set FREQ to the next value listed in the TI Freq column of Table 7.

4.2.3.9 Set MMR Frequency to the TI carrier frequency. Restart the MMR.

4.2.3.10 Repeat steps 4.2.3.4 through 4.2.3.7 for the remaining corresponding values listed in Table 7.

Table 7.

TI Freq (MHz)	Gen 2 Freq (kHz)	Gen 2 Level (%)	Filters HP (Hz)	Filters LP (Hz)	Limits (%) *
10	0.05	30	none	3 k	24.5 to 35.5
10	0.05	50	none	3 k	41.5 to 58.5
10	0.05	80	none	3 k	67 to 93
10	1	30	300	3 k	26.9 to 33.1
10	1	50	300	3 k	47.5 to 52.5
10	1	80	300	3 k	73.4 to 86.6
10	5	30	400	15 k	24.5 to 35.5
10	5	50	400	15 k	41.5 to 58.5
10	5	80	400	15 k	67 to 93
10	15	30	400	30 k	24.5 to 35.5

See footnote at end of Table.

Table 7. (Cont.)

TI Freq (MHz)	Gen 2 Freq (kHz)	Gen 2 Level (%)	Filters HP (Hz)	Filters LP (Hz)	Limits (%) *
10	15	50	400	30 k	41.5 to 58.5
10	15	80	400	30 k	67 to 93
350	0.05	30	none	3 k	24.5 to 35.5
350	0.05	50	none	3 k	41.5 to 58.5
350	0.05	80	none	3 k	67 to 93
350	1	30	300	3 k	26.9 to 33.1
350	1	50	300	3 k	47.5 to 52.5
350	1	80	300	3 k	73.4 to 86.6
350	5	30	400	15 k	24.5 to 35.5
350	5	50	400	15 k	41.5 to 58.5
350	5	80	400	15 k	67 to 93
350	15	30	400	30 k	24.5 to 35.5
350	15	50	400	30 k	41.5 to 58.5
350	15	80	400	30 k	67 to 93

* Limits shown are calculated and may not reflect the actual resolution of the MMR.

4.2.3.11 Set TI output to minimum. Do not disconnect TI from the MMR.

4.2.4 <u>FREQUENCY MODULATION CALIBRATION:</u> (Internal)

4.2.4.1 On the TI, press Rx TEST and then RF Gen, and set controls as follows:

FREQ	0.5 MHz
LEVEL	0 dBm

4.2.4.2 For TI modulation, press TI Mod Gen and set controls as follows:

Gen 1/Gen 2	Gen 2
Freq	1 kHz
Level	10 kHz

4.2.4.3 Set MMR Frequency to the TI carrier frequency.

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

4.2.4.5 Verify the MMR FM Deviation indicates within Limits column of Table 8.

NOTE

The MMR measures FM Deviation with the default readout in Hz. The unit can be changed to kHz by selecting kHz in the Display Unit menu.

4.2.4.6 On the TI, press Rx TEST, RF Gen and set Freq to the next value listed in the TI Freq column of Table 8. Press Mod Gen, and set Gen 2 Level to the next value listed in the TI Mod LEVEL column of Table 8.

4.2.4.7 Set MMR Frequency to the TI carrier frequency. Restart the MMR.

4.2.4.8 Repeat steps 4.2.4.4 through 4.2.4.7 for the remaining values listed in Table 8.

Table 8.

TI Freq (MHz)	TI Mod LEVEL (kHz)	Limits (kHz)
0.5	10	9.30 to 10.70
10	20	18.60 to 21.40
10	50	46.50 to 53.50
10	70	65.10 to 74.90
10	10	9.30 to 10.70
100	10	9.30 to 10.70
500	10	9.30 to 10.70
750	10	9.30 to 10.70
1000	10	9.30 to 10.70

4.2.4.9 Repeat steps 4.2.4.1 through 4.2.4.8 using Table 9, except in step 4.2.4.2, set TI Mod Gen Freq to 100 Hz and in step 4.2.4.4, select and press MMR High Pass Filter to off and Low Pass Filter to 3 kHz.

4.2.4.10 Repeat steps 4.2.4.1 through 4.2.4.8 using Table 9, except in step 4.2.4.2, set TI Mod Gen Freq to 10 kHz and in step 4.2.4.4, select and press MMR High Pass Filter to 300 Hz and Low Pass Filter to 15 kHz.

Table 9.

TI Freq (MHz)	TI Mod LEVEL (kHz)	Limits (kHz)
0.5	10	9.00 to 11.00
10	20	18.00 to 22.00
10	50	45.00 to 55.00
10	70	63.00 to 77.00
10	10	9.00 to 11.00
100	10	9.00 to 11.00
500	10	9.00 to 11.00
750	10	9.00 to 11.00
1000	10	9.00 to 11.00

4.2.4.11 Set TI output to minimum and disconnect test setup.

4.3 AUDIO ANALYZER CALIBRATION:

4.3.1 AUDIO VOLTMETER CALIBRATION:

4.3.1.1 Connect TI AF INPUT to the Meter Calibrator OUTPUT HI and LO jacks.

4.3.1.2 On the TI press AF TEST then press Audio Meter, AF Filter and set controls as follows:

Low Pass	50 kHz LP
AC/DC	DC coupled is displayed

4.3.1.3 Set Meter Calibrator to the first value listed in the Applied column of Table 10. Set Meter Calibrator OPR/STBY switch to OPR.

4.3.1.4 The TI must indicate within the corresponding values listed in the TI Limits column of Table 10.

4.3.1.5 Set Meter Calibrator OPR/STBY to STBY.

4.3.1.6 Repeat steps 4.3.1.3 through 4.3.1.5 for the remaining values listed in Table 10.

Table 10.

Applied (VDC)	TI Limits (VDC)
5	4.90 to 5.10
10	9.85 to 10.15
20	19.75 to 20.25
40	39.55 to 40.45

4.3.1.7 On the TI, press AC/DC coupling until AC coupled is displayed.

4.3.1.8 Set Meter Calibrator output to the first values listed in the Meter Calibrator columns of Table 11.

4.3.1.9 Set Meter Calibrator OPR/STBY to OPR.

4.3.1.10 The TI must indicate within the corresponding values listed in the Limits column of Table 11.

4.3.1.11 Set Meter Calibrator OPR/STBY to STBY.

4.3.1.12 Repeat steps 4.3.1.8 through 4.3.1.11 for the remaining values listed in Table 11.

Table 11.

Meter Calibrator		
Voltage (VAC)	Frequency (Hz)	Limits (VAC)
30 m	1 k	25 to 35 m
200 m	1 k	189 to 211 m
1	1 k	0.957 to 1.043
1	50	0.957 to 1.043
1	100	0.957 to 1.043
1	10 k	0.957 to 1.043
1	30 k	0.957 to 1.043
1	50 k	0.957 to 1.043
2	1 k	1.917 to 2.083
5	1 k	4.797 to 5.203
10	1 k	9.597 to 10.403
30	1 k	28.797 to 31.203

4.3.1.13 Set Meter Calibrator OPR/STBY switch to STBY.

4.3.1.14 Leave equipment connected.

4.3.2 AUDIO OSCILLOSCOPE VOLTAGE CALIBRATION:

4.3.2.1 On the TI, press AF TEST and set controls as follows:

AC/DC	DC
Scope/Bar	Until Scope is displayed

4.3.2.2 Press TI ►◄ or ◄► buttons, as required, to set for 200 μs/div.

4.3.2.3 Press TI ▲▼ or ▼▲ buttons, as required, to the first value listed in the TI Range column of Table 12.

4.3.2.4 Set Meter Calibrator output for 0.00 VDC.

4.3.2.5 Set Meter Calibrator OPR/STBY switch to OPR.

4.3.2.6 Adjust TI SCOPE knob to place trace 2 div below center horizontal graticule line.

4.3.2.7 Set Meter Calibrator OPR/STBY switch to STBY.

4.3.2.8 Set Meter Calibrator to the first value listed in the Applied column of Table 12.

4.3.2.9 Set Meter Calibrator OPR/STBY switch to OPR.

4.3.2.10 Adjust Meter Calibrator output controls for a deflection 2 div above the center horizontal graticule on the TI.

4.3.2.11 Verify the Meter Calibrator indicates within the corresponding values listed in the Limits column of Table 12.

4.3.2.12 Set Meter Calibrator OPR/STBY switch to STBY.

4.3.2.13 Repeat steps 4.3.2.3 through 4.3.2.12 for the remaining values listed in Table 12.

Table 12.

TI Range (V/div)	Applied (VDC)	Limits (VDC)
10 m	40 m	37 to 43 m
20 m	80 m	74 to 86 m
50 m	200 m	185 to 215 m
100 m	400 m	370 to 430 m
200 m	800 m	740 to 860 m
500 m	2.00	1.85 to 2.15

Table 12. (Cont.)

TI Range (V/div)	Applied (VDC)	Limits (VDC)
1	4.00	3.7 to 4.3
2	8.00	7.4 to 8.6
5	20.00	18.5 to 21.5
10	40.00	37.0 to 43.0
20	80.00	74.0 to 86.0

4.3.2.14 Disconnect test setup.

4.3.3 AUDIO DISTORTION AND SINAD METER CALIBRATION:

4.3.3.1 Connect equipment as shown in Figure 2 with the Power Divider input connected to the Digital Multimeter input.

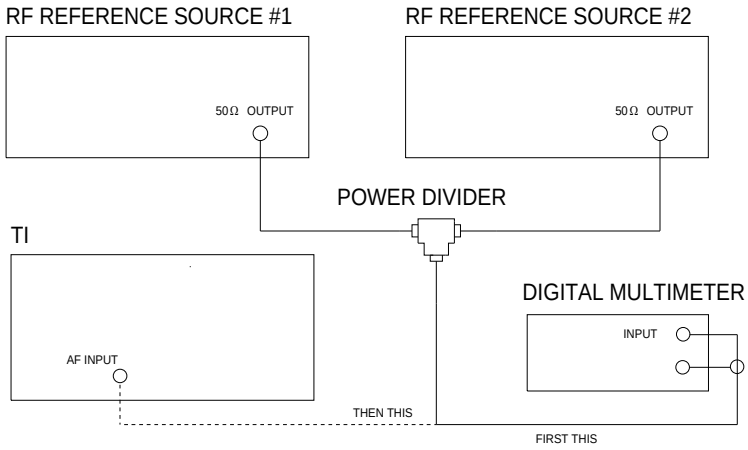


Figure 2.

4.3.3.2 Set Digital Multimeter for ACV measurement.

4.3.3.3 Set RF Reference Source #1 frequency to 1 kHz and output level for 1.000 V rms, as monitored on the Digital Multimeter.

4.3.3.4 Record the RF Reference Source #1 indication. Set RF Reference Source #1 to minimum.

4.3.3.5 Set RF Reference Source #2 frequency to 400 Hz and output level for 20.0 mV rms as monitored on the Digital Multimeter.

4.3.3.6 Set RF Reference Source #1 to the value recorded in step 4.3.3.4.

4.3.3.7 Disconnect Power Divider Input from the Digital Multimeter.

4.3.3.8 Connect Power Divider Input to the TI AF INPUT.

4.3.3.9 On the TI press AF TEST, Audio Meter, Dist/S-N and then Dist'n 1 kHz.

4.3.3.10 The TI distortion meter must indicate within 1.3 to 2.7%.

4.3.3.11 On the TI, press Dist/S-N and then Sinad 1 kHz.

4.3.3.12 The TI Sinad meter must indicate within 33 to 35 dB.

4.3.3.13 Set all outputs to minimum. Connect equipment as shown in Figure 2 with the Power Divider input connected to the Digital Multimeter input.

4.3.3.14 Set the RF Reference Source #1 frequency to 1 kHz and output level for 1.000 V rms, as monitored on the Digital Multimeter.

4.3.3.15 Record the RF Reference Source #1 indication. Set RF Reference Source #1 to minimum.

4.3.3.16 Set RF Reference Source #2 frequency to 400 Hz and output level for 259.0 mV rms as monitored on the Digital Multimeter.

4.3.3.17 Set RF Reference Source #1 to the value recorded in step 4.3.3.15.

4.3.3.18 Disconnect Power Divider Input from the Digital Multimeter.

4.3.3.19 Connect Power Divider Input to the TI AF INPUT.

4.3.3.20 The TI Sinad meter must indicate within 11 to 13 dB.

4.3.3.21 On the TI, press Dist/S-N and then Dist'n 1 kHz.

4.3.3.22 The TI distortion meter must indicate within 21.8 to 28.2%.

4.3.3.23 Set all output levels to minimum and disconnect test setup.

4.4 RF POWER METER CALIBRATION:

4.4.1 On the TI, set POWER switch to OFF. Set POWER switch to ON and allow 5 minutes for the TI to stabilize. Press Tx TEST.

NOTE

Cycling the TI POWER switch allows the TI to reset to the default settings.

4.4.2 Standardize Power Meter and Power Sensor. Set Power Meter to measure in the dBm mode.

NOTE

Ensure the Power Sensor Calibration Factors have been programmed into the Power Meter memory. Select the appropriate Power Sensor file throughout the Calibration Process.

4.4.3 Connect Synthesized Signal Generator through a low loss cable to the Power Sensor.

4.4.4 Set Synthesized Signal Generator output for 10 MHz at +15.0 dBm as indicated on the Power Meter.

4.4.5 Set Synthesized Signal Generator RF OFF/ON switch to OFF.

4.4.6 Disconnect Power Sensor from the low loss cable.

4.4.7 Connect TI N-type connector to the Synthesized Signal Generator through the same low loss cable as in the above steps.

4.4.8 Set Synthesized Signal Generator RF OFF/ON switch to ON.

4.4.9 The TI broadband power meter must indicate within +14.4 to +15.5 dBm.

4.4.10 Set Synthesized Signal Generator RF OFF/ON switch to OFF.

4.4.11 Repeat steps 4.4.3 through 4.4.10 for the remaining values listed in Table 13.

Table 13.

Signal Generator Level (dBm)	Frequency (MHz)	TI Limits (dBm)
+15.0	10	+14.4 to +15.5
+15.0	100	+14.4 to +15.5
+15.0	250	+14.4 to +15.5
+15.0	500	+14.4 to +15.5
+15.0	750	+14.4 to +15.5
+15.0	1000	+14.4 to +15.5

4.4.12 Set Synthesized Signal Generator output to minimum and disconnect test setup.

4.4.13 Connect equipment as shown in Figure 3.

WARNING

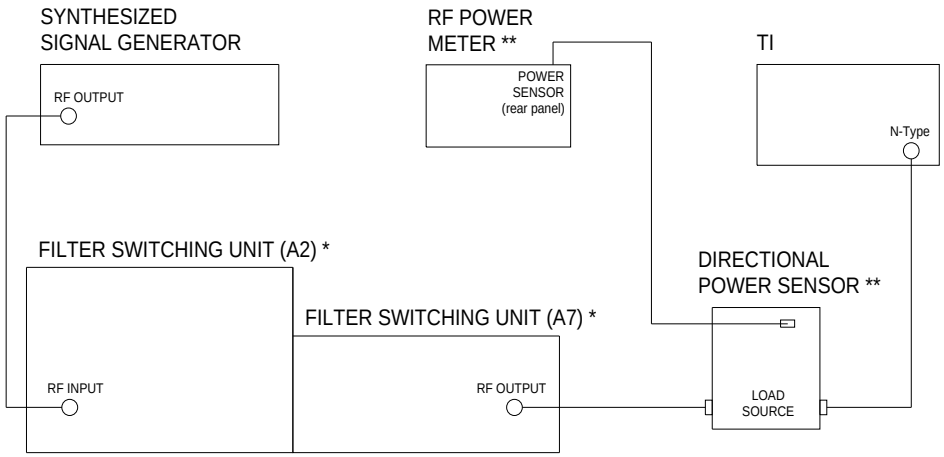
Take care when touching the TI RF Input N Type connector after the application of high levels of continuous power. If 50 W is exceeded for a prolong period, the temperature of the connector can become excessive. If not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

WARNING

A power overload condition is indicated by an audible and visual warning. Do not attempt to stop the warning by disconnecting the TI RF Input N Type connector, as this can damage the transmitter and may cause electric shock or skin burns. If not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

CAUTION

If a power overload condition is indicated, immediately reduce the level of RF power from the transmitter into the TI. Do not stop the warning by switching off the TI, as this will silence the warning but will leave the excessive RF power connected to the internal load. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.



* Part of the HIGH POWER HIGH FREQUENCY RF AMPLIFIER SYSTEM.

** Part of the RF POWER MEASUREMENT SET.

Figure 3.

NOTE

Use the applicable Directional Power Sensor, as required, for the frequency being tested.

4.4.14 Set RF Power Meter, as required, to measure Watts.

4.4.15 On TI, press HELP/SETUP, Setup and RF setup. Toggle the RF level measured in: key until Watts is highlighted. This changes the TI RF power reading to Watts for Table 14. Press Tx TEST.

4.4.16 On the Filter Switching Unit (A2), select the Band, as required, for the Test Frequency being tested.

4.4.17 On the Filter Switching Unit (A2), set RF OUTPUT LEVEL CONTROL fully CCW and press the OPER/STBY key until the OPERATE lamp illuminates.

NOTE

Ensure the RF Power Meter FWD lamp is illuminated. If not, press the RF PWR key.

4.4.18 Set Synthesized Signal Generator, as required, to 0.0 dBm at the first value listed in the Frequency column of Table 14.

4.4.19 Set Filter Switching Unit (A2) RF OUTPUT LEVEL CONTROL for a RF Power Meter indication of the first value listed in the Applied column of Table 14.

NOTE

It may not be possible to set the Filter Switching Unit (A2) RF OUTPUT LEVEL CONTROL for an exact indication of the value listed in the TI WATTS meter indication column of Table 14. If it is not, set the RF OUTPUT LEVEL CONTROL as close as possible and calculate the limits from the TI WATTS meter displayed value.

4.4.20 Verify the TI indicates within the corresponding values listed in the Limits column of Table 14.

4.4.21 Set Filter Switching Unit (A2) RF OUTPUT LEVEL CONTROL fully CCW.

4.4.22 Repeat steps 4.4.16 through 4.4.21 for the remaining corresponding values listed in Table 14. Use the applicable Directional Power Sensor, as required, for the frequency being tested.

Table 14.

Frequency (MHz)	Applied (W) (meter indication)	Limits (W)
10.0000	15	13.2 to 16.9
10.0000	50	44.0 to 56.3
10.0000	100	87.9 to 113
100.0000	15	13.2 to 16.9
100.0000	50	44.0 to 56.3
100.0000	100	87.9 to 113

Table 14. (Cont.)

Frequency (MHz)	Applied (W) (meter indication)	Limits (W)
500.0000	15	13.2 to 16.9
500.0000	50	44.0 to 56.3
500.0000	100	87.9 to 113
1000.0000	15	13.2 to 16.9
1000.0000	50	44.0 to 56.3
1000.0000	100	87.9 to 113

4.4.23 On TI, press HELP/SETUP, Setup and RF setup. Toggle the RF level measured in: key until dBm is highlighted. This changes the TI RF power reading back to dBm.

4.4.24 Set Synthesized Signal Generator output to minimum. Disconnect test setup.

4.5 AMPLITUDE MODULATION DEPTH CALIBRATION:

4.5.1 Connect equipment as shown in Figure 4. Press Tx TEST, press SELECT and select the ANTENNA input.

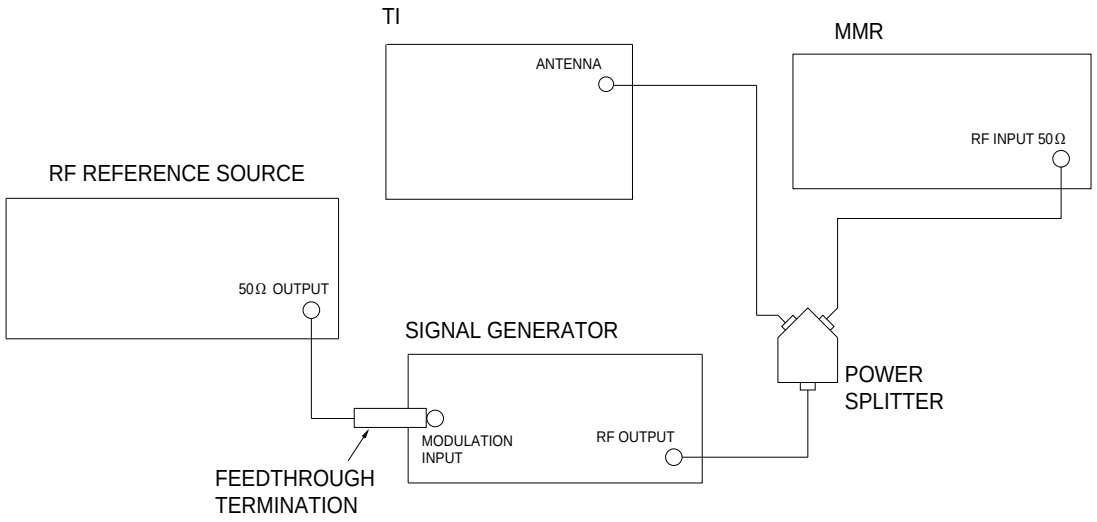


Figure 4.

4.5.2 On the TI press Tx TEST and then press Mod Meter. Press the AM/FM to select AM.

NOTE

From the power up default, the TI should already have an IF filter of 30 kHz and AF filter of 0.3 to 3.4 kHz selected. To verify this is the case press Tx TEST, MOD METER, IF FILTER or AF FILTER then select correct filter if necessary.

NOTE

It may be necessary to change the TI Tx FREQ (or reselect AUTOTUNE) if the displayed Tx FREQ does not agree with the Signal Generator output frequency.

4.5.3 Set Signal Generator to -10 dBm at 10 MHz. Set modulation to AM and EXT DC. Set modulation on.

4.5.4 Set MMR Frequency to the Signal Generator Frequency. Restart MMR.

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

4.5.6 Set RF Reference Source to 0.707 V rms at 1 kHz.

4.5.7 Adjust the Signal Generator AM modulation for the first value listed in the AM Depth column of Table 15 as indicated on the MMR.

4.5.8 The TI must indicate within the corresponding values listed in the Limits column of Table 15.

4.5.9 Set Signal Generator AMPLITUDE to OFF.

4.5.10 Repeat steps 4.5.3 through 4.5.9 for the remaining values listed in Table 15.

Table 15.

Level (dBm)	Signal Generator Frequency (MHz)	AM Depth (%)	Limits (%)
-10	10	30	27 to 33
-10	10	50	46 to 54
-10	10	90	84 to 96
-10	100	50	46 to 54
-10	250	50	46 to 54
-10	500	50	46 to 54
-10	750	50	46 to 54
-10	1000	50	46 to 54

4.5.11 Set MMR controls, as required, to measure AM Depth. Set High Pass Filter to off and Low Pass Filter to 3 kHz and the Detector to Peak + - / 2.

4.5.12 Repeat steps 4.5.3 through 4.5.10 using Table 16, except in step 4.5.6 set RF Reference Source to 0.707 V rms at 100 Hz. Set TI AF filter to 3 kHz LP.

4.5.13 Set MMR controls, as required, to measure AM Depth. Set High Pass Filter to 300 Hz and Low Pass Filter to 15 kHz and the Detector to Peak + - / 2.

4.5.14 Repeat steps 4.5.3 through 4.5.10 using Table 16, except in step 4.5.6 set RF Reference Source to 0.707 V rms at 10 kHz. Set TI AF filter to 15 kHz LP and IF filter to 300 kHz.

Table 16.

Level (dBm)	Signal Generator Frequency (MHz)	AM Depth (%)	Limits (%)
-10	10	30	26 to 34
-10	10	50	45 to 55
-10	10	90	81 to 99
-10	100	50	45 to 55
-10	250	50	45 to 55
-10	500	50	45 to 55
-10	750	50	45 to 55
-10	1000	50	45 to 55

4.5.15 Set Signal Generator output to minimum.

4.6 <u>FREQUENCY MODULATION DEVIATION CALIBRATION:</u>

4.6.1 Set MMR to Measuring Receiver mode.

4.6.2 On the TI, press Tx TEST and then Mod Meter. Set controls as follows:

AM/FM	FM
Return	
Tx FREQ	First value listed in the Signal Generator Frequency column of Table 17

NOTE

From the power up default, the TI should already have an IF filter of 30 kHz and AF filter of 0.3 to 3.4 kHz selected. Verify this is the case and select if necessary.

NOTE

It may be necessary to change the TI Tx FREQ (or reselect AUTOTUNE) if the displayed Tx FREQ does not agree with the Signal Generator output frequency.

4.6.3 Set Signal Generator to 0.0 dBm and to the first frequency listed in the Signal Generator Frequency column of Table 17. Set Modulation to FM and EXT DC. Set AMPLITUDE to ON. Set modulation to on.

4.6.4 Set MMR Frequency to the TI carrier frequency. Restart the MMR.

4.6.5 Set MMR controls, as required, to measure FM Deviation. Set Detector to Peak +.

4.6.6 Set MMR High Pass Filter to 300 Hz and Low Pass Filter to 3 kHz.

4.6.7 Set RF Reference Source to 0.707 V rms at 1 kHz.

4.6.8 Adjust the Signal Generator FM modulation controls for the first value listed in the FM Deviation column of Table 17, as indicated on the MMR.

4.6.9 The TI must indicate within the corresponding values listed in the Limits column of Table 17.

4.6.10 Set Signal Generator AMPLITUDE to OFF.

4.6.11 Repeat steps 4.6.2 through 4.6.10 for the remaining values listed in Table 17.

Table 17.

Level (dBm)	Signal Generator Frequency (MHz)	FM Deviation (kHz)	TI Limits (kHz)
0.0	100	20	18.8 to 21.2
0.0	500	20	18.8 to 21.2
0.0	1000	20	18.8 to 21.2
0.0	100	50	47.0 to 53.0
0.0	100	75	70.5 to 79.5
0.0	100	1.00	0.94 to 1.06

4.6.12 Repeat steps 4.6.2 through 4.6.11 using Table 18, except in step 4.6.7, set RF Reference Source to 0.707 V rms at 100 Hz and in step 4.6.6, set MMR High Pass Filter to off and Low Pass Filter to 3 kHz. Set TI AF filter to 3 kHz LP and IF filter to 300 kHz.

4.6.13 Repeat steps 4.6.2 through 4.6.11 using Table 18, except in step 4.6.7, set RF Reference Source to 0.707 V rms at 10 kHz and in step 4.6.6, set MMR High Pass Filter to 300 Hz and Low Pass Filter to 15 kHz. Set TI AF filter to 15 kHz LP and IF filter to 300 kHz.

Table 18.

Level (dBm)	Signal Generator Frequency (MHz)	FM Deviation (kHz)	TI Limits (kHz)
0.0	100	20	18.3 to 21.7
0.0	500	20	18.3 to 21.7
0.0	1000	20	18.3 to 21.7
0.0	100	50	45.7 to 54.3
0.0	100	60	54.9 to 65.1
0.0	100	1.00	0.91 to 1.09

4.6.14 Set all output levels to minimum and disconnect test setup.

4.7 RF SPECTRUM ANALYZER LEVEL FLATNESS CALIBRATION:

4.7.1 Connect TI BNC antenna connector to the RF Reference Source 50 Ω OUTPUT. Press the TI RF IN/OUT SELECT to select the BNC antenna input.

4.7.2 Set RF Reference Source to 0.0 dBm at 10.05 MHz.

4.7.3 Set TI to SPEC ANA. Set TI Center Freq to 10.05 MHz. Set Vert Scale to 10 dB/div and SPAN to 20 kHz. Set Ref Level (if necessary) to place the signal to the top graticule line on the TI display.

4.7.4 Adjust the RF Reference Source level slightly, as necessary, to place the signal on the TI display exactly on the top graticule.

4.7.5 Record the exact level of the RF Reference Source.

4.7.6 Adjust the RF Reference Source level until the TI display moves to the next graticule line below the reference line. Record the level of the RF Reference Source.

4.7.7 Algebraically subtract the reading recorded in step 4.7.5 from the RF Reference Source level in step 4.7.6. The result must indicate within the corresponding values listed in the Limits column of Table 19.

4.7.8 Repeat steps 4.7.6 and 4.7.7 for the remaining values listed in Table 19.

Table 19.

Division below 0 dB Reference	Limits (dB)
1st	-12.5 to -7.5
2nd	-22.5 to -17.5
3rd	-32.5 to -27.5
4th	-42.5 to -37.5
5th	-52.5 to -47.5

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

4.8 AUDIO GENERATOR CALIBRATION:

4.8.1 LEVEL CALIBRATION:

4.8.1.1 Connect TI AF GEN OUT connector to the Digital Multimeter Input.

4.8.1.2 Set Digital Multimeter to measure ACV.

4.8.1.3 On the TI, press AF TEST and then Audio Gen and set controls as follows:

Gen 1/Gen 2	Gen 1
Freq	50 Hz
Level	1 V

NOTE

Verify that TI Gen 2 is not activated.

4.8.1.4 The Digital Multimeter must indicate within 0.949 to 1.051 VAC.

4.8.1.5 Repeat steps 4.8.1.3 and 4.8.1.4 for the remaining values listed in Table 20.

Table 20.

TI Audio Level (VAC)	TI Audio Frequency (Hz)	Limits (VAC)
1	50	0.949 to 1.051
1	500	0.949 to 1.051
1	5 k	0.949 to 1.051
1	10 k	0.949 to 1.051
1	15 k	0.949 to 1.051
2	50	1.899 to 2.101
2	15 k	1.899 to 2.101
4	50	3.799 to 4.201
4	15 k	3.799 to 4.201
20 m	50	18.9 to 21.1 m
20 m	15 k	18.9 to 21.1 m
400 m	50	379.9 to 420.1 m
400 m	15 k	379.9 to 420.1 m

4.8.1.6 Set TI Audio Gen, Gen 1 Level to minimum and disconnect test setup.

4.8.2 LEVEL DISTORTION CALIBRATION:

4.8.2.1 Connect TI AF GEN OUT connector to the Audio Analyzer HIGH input.

4.8.2.2 On the TI, press AF TEST and then Audio Gen and set controls as follows:

Gen 1/Gen 2	Gen 1
Freq	1 kHz
Level	1 V

NOTE

Verify that TI Gen 2 is not activated.

4.8.2.3 Set Audio Analyzer as required to measure distortion at 1 kHz.

4.8.2.4 The Audio Analyzer must indicate within the corresponding value listed in the Limits column of Table 21.

4.8.2.5 Repeat steps 4.8.2.2 through 4.8.2.4 for the remaining values listed in Table 21.

Table 21.

TI Audio Level (VAC)	TI Audio Frequency (Hz)	Limits (%)
1	1 k	<0.5
1	50	<1.0
1	5 k	<1.0
1	10 k	<1.0
1	15 k	<1.0

4.8.2.6 Set TI AF Audio Test Gen 1 Level to minimum and disconnect test setup.

4.8.2.7 Set all POWER switches to OFF. Disconnect and secure all equipment.

4.8.2.8 Annotate and attach a Limited Certification Label per step 3.7 as applicable.

CALIBRATION PERFORMANCE TABLE

Not Required

APPENDIX A

A.1 TIME BASE ADJUSTMENT:

A.1.1 Connect Frequency Standard 10 MHz REF OUT to the Signal Generator EXT FREQ STD INPUT.

A.1.2 Connect Signal Generator output to TI N-type connector. On the TI, press RF IN/OUT SELECT to select the N-type input.

A.1.3 On the TI, press HELP/SETUP, Setup, then Calibrate.

NOTE

Key in code 2, 9, 4, 5 to unlock the TI calibration and diagnostics menus, then press Calibrate.

A.1.4 On the TI, press Freq Std.

A.1.5 Set Signal Generator to 1000 MHz at 0.0 dBm.

A.1.6 The offset reading at the bottom of the TI display now indicates the TI reading error at 1000 MHz.

A.1.7 Using the front panel variable control, adjust the calibration value displayed until the offset is as close to 0 Hz as possible.

NOTE

The ↑ and ↓ keys switch between coarse and fine adjustment for the calibration value.

A.1.8 When the offset indication is as close as practical to 0 Hz, press Return and then press Store Cal.

A.1.9 Press Return until the TI display is at the main menu.

A.1.10 Set Signal Generator output to minimum. Disconnect test setup. Cycle TI Power OFF, then back ON to relock TI calibration and diagnostics menus.

A.1.11 Return to the Calibration Process.