TECHNICAL MANUAL

CALIBRATION PROCEDURE

FOR

RADIO TEST SET

3500

(AEROFLEX)

This publication replaces T.O. 33K3-4-3605-1 dated 30 July 2014.

Published under Authority of the Secretary of the Air Force

30 JUNE 2015

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text and illustrations affected by the changes is indicated by a vertical line in the outer margins of the page.

Date of issue for original and changed pages are:

Original.....0 .....30 June 2015

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 46, CONSISTING OF THE FOLLOWING:

*Zero in this column indicates an original page

RADIO TEST SET

3500

(AEROFLEX)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency		
Time Base *[1]	Range: 10 MHz Accuracy: ±1 X 10^{-6}; *[2] Aging/year: ±1 X 10^{-6}; Temperature: ±5 X 10^{-7} (-20 to 50 °C) *[3]	Compared to a Frequency Standard
RF Signal Generator		
Frequency	Range: 2 MHz to 1 GHz Accuracy: Same as time base	Verified during Time Base Calibration
Output Level	Range: T/R: -120 to -50 dBm; ANT: -90 to -30 dBm; SWR: -65 to -5 dBm Accuracy: ±2 dB	Measured on a Microwave Measurement Receiver
Spectral Purity *[1]		
Harmonics	Range: 2 MHz to 1 GHz Accuracy: ≤-30 dBc	Measured with a Spectrum Analyzer
Non-Harmonics	Range: 2 MHz to 1 GHz Accuracy: (>±20 kHz offset from carrier in band) ≤-40 dBc	

See footnotes at end of Table.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
RF Signal Generator *(Cont.)*		
Phase Noise *[1]	Range: 2 MHz to 1 GHz Accuracy: (20 kHz offset) ≤-80 dBc/Hz	Measured on a Microwave Measurement Receiver
Residual FM	Range: 2 MHz to 1 GHz Accuracy: (300 Hz to 3 kHz BW) <60 Hz rms	
Residual AM	Range: 2 MHz to 1 GHz Accuracy: (300 Hz to 3 kHz BW) <5% AM	
Frequency Modulation *[1]		
Deviation	Range: Off, 500 Hz to 50 kHz Rate: 0 Hz to 20.0 kHz Accuracy: (2 to 50 kHz deviation, 150 Hz to 5 kHz rate) ±10% of setting	
Distortion	Range: 2 MHz to 1 GHz Accuracy: (1 kHz rate, >2 kHz deviation, 300 Hz to 3 kHz BP filter) ≤3% THD	
Amplitude Modulation *[1]		
Depth	Range: Off, 0 to 100%; Rate: 0 Hz to 20.0 kHz Accuracy: (10 to 90% modulation, 150 Hz to 5 kHz rate) ±10% of setting	
Distortion	Range: 2 MHz to 1 GHz Accuracy: (20 to 90% modulation, 1 kHz rate, 300 Hz to 3 kHz BP) ≤3% THD	
Receiver		
Frequency	Range: 2 MHz to 1 GHz Accuracy: Same as time base	Verified during Time Base Calibration

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Receiver *(Cont.)*		
Power Meter	Range: 2 MHz to 1 GHz, *[4] 0 to +43 dBm, external attenuation set to 0 dB; 0 to +53 dBm, external attenuation set to 20 dB; Accuracy: ±1 dB, internal attenuation; ±1.5 dB, external attenuation	Measured on TI with known signal applied
Frequency Error Meter	Range: ±200 kHz Accuracy: ±(Time Base + 2 Hz)	Verified during Time Base Calibration
Frequency Modulation Deviation Meter	Range: 500 Hz to ±100 kHz Accuracy: (150 Hz & 1 kHz rate) ±10% of ind, 500 Hz to 100 kHz deviation; ±5% of ind, 1 to 10 kHz deviation	Measured on TI with known signal applied
Amplitude Modulation Percent Meter	Range: 5 to 100% Accuracy: (1 kHz rate, 30 to 90% modulation, 3 kHz Low Pass Filter) ±5% of ind	
Receive Signal Strength Indication Meter	Range: 2 MHz to 1 GHz, T/R: -50 to +43 dBm; ANT: -90 to -10 dBm, RF amp off; ANT: -110 to -10 dBm, RF amp on Accuracy: ±3 dB, T/R: >-50 dBm; ANT: >-90 dBm, RF amp off; ANT: >-120 dBm, RF amp on	
SINAD Meter	Range: 300 Hz to 10 kHz, 0 to +40 dB Accuracy: (1 kHz Audio Frequency, +8 to +40 dB) ±1.5 dB	

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Receiver *(Cont.)*		
Distortion Meter	Range: 300 Hz to 10 kHz, 0 to 100% FS Resolution: 0.1% Accuracy: (1 kHz Audio Frequency, 1 to 20%) ±10% of ind	Measured on TI with known signal applied
Audio Frequency Generator *[5]		
Amplitude (into 600 Ω)	Range: 0 to 1.57 V rms Accuracy: ±10% of setting	Measured on a Digital Multimeter
Distortion	Range: 30 Hz to 5 kHz Accuracy: (1 kHz rate, sinewave, 300 Hz to 3 kHz) <3% THD	Measured on an Audio Analyzer

*[1] Calibrated at SWR port.

*[2] 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.

*[3] Typical or operational specification. Not calibrated.

*[4] See step 3.8.

*[5] If two sources are selected, they are summed together. AFGEN1 and AFGEN2 may be routed to the external AUD Out connection on the handset. Specifications are for each AFGEN individually.

2 EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1 FREQUENCY STANDARD	Range: 10 MHz Accuracy: <2.5 X 10^{-7}	Arbiter 1083B	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.2 MICROWAVE MEASUREMENT RECEIVER (MMR)	Range: -122 to -3 dBm, 2 MHz to 1 GHz Accuracy: 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)); Range 2, ±0.031 dB; Range 3, ±0.031 dB Range: (AM) 2 MHz to 1 GHz, 1 kHz rate, 18 to 99% AM Accuracy: ±1.4% of rdg Distortion: <0.75% THD Range: (FM) 2 MHz to 1 GHz, 5 to 50 kHz Deviation, 1 kHz rate Accuracy: FM Deviation: ±1.25% of rdg; Distortion: <0.75% THD	Agilent N5530SE50	
2.2.1 POWER METER	Range: -10 to -5 dBm Accuracy: *	Agilent N1911A	
2.2.2 SENSOR MODULE	Frequency Range: 2 MHz to 1 GHz Accuracy: (all % are of charted value) ±2.0%, 2 to 10 MHz; ±2.7%, 10 to 50 MHz; ±2.5%, 50 MHz to 1 GHz	Agilent N5532A-504	

See footnote at end of Equipment Requirements.

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.2.3 SPECTRUM ANALYZER	Range: 2 MHz to 5 GHz, -5 dBm Accuracy: Frequency: ±1 count of LSD; Scale Fidelity: ±1.6 dB Range: (Noise Sidebands) Center Frequency = 1 GHz Accuracy: (20 kHz offset) ≤-86 dBc/Hz	Agilent E4448A	
2.2.4 SYNTHESIZED SIGNAL GENERATOR	Range: (CW) 2 MHz to 1 GHz at -85 to +7 dBm Accuracy: N/A Range: (FM) 500 Hz to 100 kHz deviation at 2 to 1000 MHz (CW) Accuracy: N/A Range: (AM) 30.0 to 90.0% at 2 to 1000 MHz (CW) Accuracy: N/A	Agilent E8257D OPT 550	
2.2.5 ADAPTER	Range: 2.4 mm (f) to Type N (f) Accuracy: N/A	Agilent 11903B	
2.3 POWER METER	Range: -50 to -30 dBm Accuracy: *	Agilent E4418A	
2.4 POWER SENSOR	Range: 10 MHz to 1 GHz Accuracy: (% of charted value) ±4.8%, 10 to 30 MHz; ±2.5%, 30 to 100 MHz; ±3.5%, 100 MHz to 1 GHz	Hewlett-Packard 8481D	
2.5 POWER AMPLIFIER	Range: 2 to 150 W, 100 to 400 MHz Accuracy: N/A	Comtech BHED1758-1000/4006 w/ 82-10-34 Attenuator	

See footnote at end of Equipment Requirements.

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.6	COUPLER SET	Range: 100 to 400 MHz Accuracy: ±3% of charted value	Premier Microwave 1852A	
2.7	POWER SPLITTER	Range: 100 to 400 MHz Accuracy: ≤0.15 dB	Hewlett-Packard 11667A	
2.8	POWER METER	Range: 1 to 10 mW Accuracy: ±(0.2% of rdg + 0.5 μW)	Hewlett-Packard 432B-H05	
2.9	RF REFERENCE SOURCE (2 EA)	Range: 50 mV rms to 1 V rms, 1 to 2 kHz Accuracy: Amplitude ±2.5% of setting	Agilent 9610A/AF	
2.10	POWER DIVIDER	Range: 1 to 2 kHz Accuracy: N/A	Weinschel 1506A	
2.11	DIGITAL MULTIMETER	Range: AC: 50 mV to 1.6 V rms, 1 to 5 kHz Accuracy: ±2.5% of ind	Hewlett-Packard 3458A	
2.12	RESISTOR	Range: 600 Ω Accuracy: ±0.1% of nominal	As Available	
2.13	AUDIO ANALYZER	Range: Distortion, 0 to 100%, 300 Hz to 3 kHz Accuracy: ±1 dB	Hewlett-Packard 8903B OPT 51 or OPT 011	
2.14	MICROPHONE/AUDIO ADAPTER	Range: BNC to Interface Cable Accuracy: N/A	Aeroflex 7005-6240-200 (p/o TI)	

* Power Meter Accuracy included in Sensor Module Accuracy.

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. If not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

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

3.3 Connect TI External DC Power Supply to appropriate power source and attach to DC IN. Press the TI ⏻ switch and allow 3 minute warm-up.

3.4 Throughout the Calibration Procedure, all TI softkeys will be in *Italics* and menu items will be in **Bold**.

3.5 Throughout the Calibration Process, the components of the Microwave Measurement Receiver (MMR) system will be identified by their nomenclature. For example, when instructed to use the MMR Spectrum Analyzer that is p/o the MMR, the procedure will refer to the Spectrum Analyzer as the MMR Spectrum Analyzer.

3.5.1 Throughout this procedure, all MMR hardkeys will be in **BOLD** and all softkeys will be in *Italics*.

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

3.5.3 Press the MMR Spectrum Analyzer **PRESET**, **SYSTEM**, *Alignments*, then *Align All Now*. Configure the MMR Spectrum Analyzer, Power Meter and Sensor Module for a measuring receiver measurement.

3.5.4 Load the MMR Sensor Module Cal Factors into the MMR Spectrum Analyzer and MMR Power Meter.

3.6 Throughout the procedure, all connections made to the MMR are to the MMR Sensor Module unless otherwise noted.

3.7 Throughout the procedure, setting the TI to minimum will be accomplished as follows:

3.7.1 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

3.7.2 Press TI *Edit*, select the lowest amplitude level using the ▲ ▼ ◄ ► keys then press *Done*.

3.7.3 Press TI ◄ ► keys to move the cursor into the **Modulator** window.

3.7.4 Press TI ▲ ▼ keys to move the cursor into the **Gen 1:** field.

3.7.5 Press TI *Edit* to select OFF.

3.7.6 Press TI ▲ ▼ keys to move the cursor into the **Gen 2:** field.

3.7.7 Press TI *Edit* to select OFF.

3.8 Annotate and attach a Limited Certification Label stating the TI Receiver Power Meter is not calibrated >406 MHz.

NOTE

406 MHz is a user requirement that is inherently calibrated at the 400 MHz point.

3.9 If the TI 20 dB External Attenuator does not accompany the TI, annotate and attach a Limited Certification Label stating the TI Power Meter not calibrated >15 W.

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

3.11 Press TI *Return* as required. Press *Util* and then 5 on the keypad. Press arrow keys as required to move the cursor to Restore to Default. Press *Enter* and then *Yes*, to restore default settings. Press *Return*.

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:

NOTE

Throughout para 4.1, ensure the TI operation mode screen is set to the Receiver Test Screen. If not, press *System* and then 2 on the keypad to select the RECEIVER TEST screen.

4.1.1 Connect Frequency Standard 10 MHz REF OUT to the MMR Spectrum Analyzer EXT REF IN (rear panel).

4.1.2 Press MMR Spectrum Analyzer **MODE**, then *Measuring Receive*r. Press **SYSTEM**, *Reference*, then set *Freq Ref Int/Ext* to *Ext*.

4.1.3 Press TI numeric keypad 4, 7 then 7. Press *Enter* then *Yes* to restore default settings.

4.1.4 Press TI *Return* twice then press numeric keypad 1.

4.1.5 Connect TI SWR connector to the MMR Sensor Module.

4.1.6 Press TI ▲ ▼ ◄ ► keys to move the cursor into the **MHz:** field.

4.1.7 Press TI *Edit*, select **500** with the numeric keypad then press *Done*.

4.1.8 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.1.9 Press TI *Edit*, select **SWR** using ▲ ▼ keys then press *Done*.

4.1.10 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.1.11 Press TI *Edit*, select **-5** using the ▲ ▼ ◄ ► keys then press *Done*.

4.1.12 Press TI ◄ ► keys to move the cursor into the **Modulator** window.

4.1.13 Press TI ▲ ▼ keys to move the cursor into the **Gen 1:** field.

4.1.14 Press TI *Edit* to select OFF.

4.1.15 Press TI ▲ ▼ keys to move the cursor into the **Gen 2:** field.

4.1.16 Press TI *Edit* to select OFF.

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.

NOTE

The values in the following steps 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.

4.1.17 Press MMR Spectrum Analyzer **MEASURE**, then *Frequency Counter*.

4.1.18 Verify the MMR Spectrum Analyzer indication is 499 999 500 to 500 000 500 Hz.

4.1.19 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.

4.1.20 Set the TI for minimum and disconnect MMR Sensor Module from the TI.

4.2 RF SIGNAL GENERATOR CALIBRATION:

4.2.1 OUTPUT LEVEL CALIBRATION

NOTE

Throughout para 4.2.1, ensure the TI operation mode screen is set to the Receiver Test Screen. If not, press *System* and then 2 on the keypad to select the RECEIVER TEST screen.

4.2.1.1 Ensure the MMR Spectrum Analyzer, Power Meter and Sensor Module are configured for measuring receiver measurements and all MMR Sensor Modules Cal Factors are loaded.

4.2.1.2 Connect the MMR Sensor Module to the MMR Power Meter REF connector.

4.2.1.3 Standardize MMR for Power Meter measurements.

4.2.1.4 Disconnect the MMR Sensor Module from the MMR Power Meter REF connector. Connect TI SWR connector through adapters, as required, to the MMR Sensor Module.

4.2.1.5 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.2.1.6 Press TI *Return* twice then press numeric keypad 1.

4.2.1.7 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.2.1.8 Press TI *Edit*, select **SWR** using ▲ ▼ keys then press *Done*.

4.2.1.9 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.1.10 Press TI *Edit*, select the first value listed in the Applied Frequency column of Table 2 with the numeric keypad then press *Done*.

4.2.1.11 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.1.12 Press TI *Edit*, select the first value listed in the Applied Level column of Table 2 using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.1.13 Set MMR, as required, to the TI frequency being verified.

4.2.1.14 Set MMR for an RF Power measurement. Allow the MMR Spectrum Analyzer indication to settle.

4.2.1.15 Verify the MMR Spectrum Analyzer indication is within the corresponding values listed in the Limits column of Table 2. Record the MMR indication.

4.2.1.16 Set MMR, as required, for a Tuned RF Level measurement.

4.2.1.17 Press the MMR Spectrum Analyzer *Set Ref*. Allow the MMR Spectrum Analyzer indication to settle.

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.

4.2.1.18 Set MMR Spectrum Analyzer *Ext RF Atten* to the value recorded in step 4.2.1.15 for the frequency being verified.

4.2.1.19 Press TI *Edit*, then set to the next applicable value listed in the Applied Level column of Table 2 using the ▲ ▼ ◄ ► keys for the frequency being verified then press *Done*. Allow the MMR Spectrum Analyzer indication to settle.

4.2.1.20 Verify the MMR Spectrum Analyzer indication is within the corresponding values listed in the Limits column of Table 2.

4.2.1.21 Repeat steps 4.2.1.19 and 4.2.1.20 for the remaining corresponding values listed in the Applied Level column of Table 2 for the frequency being verified.

4.2.1.22 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.1.23 Press TI *Edit*, select the next value listed in the Applied Frequency column of Table 2 with the numeric keypad then press *Done*.

4.2.1.24 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.1.25 Press TI *Edit*, select the first value listed in the Applied Level column of Table 2 using the ▲ ▼ ◄ ► keys for the frequency being verified then press *Done*.

4.2.1.26 Repeat steps 4.2.1.13 through 4.2.1.21.

4.2.1.27 Repeat steps 4.2.1.22 through 4.2.1.26 for the remaining corresponding values listed in Table 2.

Table 2.

Applied Frequency (MHz)	Level (dBm)	Limits (dBm)
2	-5	-7 to -3
	-15	-17 to -13
	-35	-37 to -33
	-55	-57 to -53
	-65	-67 to -63

Table 2. (Cont.)

Frequency (MHz)	Applied Level (dBm)	Limits (dBm)
150	-5	-7 to -3
	-15	-17 to -13
	-35	-37 to -33
	-55	-57 to -53
	-65	-67 to -63
400	-5	-7 to -3
	-15	-17 to -13
	-35	-37 to -33
	-55	-57 to -53
	-65	-67 to -63
1000	-5	-7 to -3
	-15	-17 to -13
	-35	-37 to -33
	-55	-57 to -53
	-65	-67 to -63

4.2.1.28 Set the TI for minimum and disconnect test setup.

4.2.1.29 Standardize the Power Meter (2.3) and Power Sensor. Set the Power Meter (2.3) for a power measurement in the dBm mode.

NOTE

Ensure the Power Sensor Calibration Factors have been programmed into the Power Meter (2.3) memory. Select the appropriate Power Sensor file throughout the Calibration Process.

4.2.1.30 Connect TI ANT connector to the Power Meter (2.3) through the Power Sensor.

4.2.1.31 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.2.1.32 Press TI *Return* twice then press numeric keypad 1.

4.2.1.33 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.2.1.34 Press TI *Edit*, select **ANT** using ▲ ▼ keys then press *Done*.

4.2.1.35 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.1.36 Press TI *Edit*, select the first value listed in the Applied Frequency column of Table 3 with the numeric keypad then press *Done*.

4.2.1.37 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.1.38 Press TI *Edit*, select the first value listed in the Applied Level column of Table 3 using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.1.39 The Power Meter (2.3) must indicate within the corresponding values listed in the Limits column of Table 3. Record the Power Meter (2.3) indication.

4.2.1.40 Disconnect the Power Sensor from the TI ANT connector. Connect TI ANT connector through adapters, as required, to the MMR Sensor Module.

4.2.1.41 Set MMR, as required, to the TI frequency being verified.

4.2.1.42 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.1.43 Press TI *Edit* and set to the first value listed in the Applied Level column of Table 3 for the frequency being verified.

4.2.1.44 Set MMR, as required, for a Tuned RF Level measurement.

4.2.1.45 Press the MMR Spectrum Analyzer *Set Ref*. Allow the MMR Spectrum Analyzer indication to settle.

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.

4.2.1.46 Set MMR Spectrum Analyzer *Ext RF Atten* to the value recorded in step 4.2.1.39 for the frequency being verified.

4.2.1.47 Press TI *Edit*, then set to the next applicable value listed in the Applied Level column of Table 3 using the ▲ ▼ ◄ ► keys for the frequency being verified then press *Done*. Allow the MMR Spectrum Analyzer indication to settle.

4.2.1.48 Verify the MMR Spectrum Analyzer indication is within the corresponding values listed in the Limits column of Table 3.

4.2.1.49 Repeat steps 4.2.1.47 and 4.2.1.48 for the remaining corresponding values listed in the Applied Level column of Table 3 for the frequency being verified.

4.2.1.50 Disconnect test setup.

4.2.1.51 Connect TI ANT connector to the Power Meter (2.3) through the Power Sensor.

4.2.1.52 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.1.53 Press TI *Edit*, select the next value listed in the Applied Frequency column of Table 3 with the numeric keypad then press *Done*.

4.2.1.54 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.1.55 Press TI *Edit*, select the first value listed in the Applied Level column of Table 3 using the ▲ ▼ ◄ ► keys for the frequency being verified then press *Done*.

4.2.1.56 Repeat steps 4.2.1.39 through 4.2.1.49.

4.2.1.57 Repeat steps 4.2.1.50 through 4.2.1.56 for the remaining corresponding values listed in Table 3.

Table 3.

Applied Frequency (MHz)	Level (dBm)	Limits (dBm)
10	-30	-32 to -28
	-40	-42 to -38
	-50	-52 to -48
	-60	-62 to -58
	-70	-72 to -68
	-80	-82 to -78
	-90	-92 to -88
70	-30	-32 to -28
	-40	-42 to -38
	-50	-52 to -48
	-60	-62 to -58
	-70	-72 to -68
	-80	-82 to -78
	-90	-92 to -88

Table 3. (Cont.)

Frequency (MHz)	Applied Level (dBm)	Limits (dBm)
200	-30	-32 to -28
	-40	-42 to -38
	-50	-52 to -48
	-60	-62 to -58
	-70	-72 to -68
	-80	-82 to -78
	-90	-92 to -88
400	-30	-32 to -28
	-40	-42 to -38
	-50	-52 to -48
	-60	-62 to -58
	-70	-72 to -68
	-80	-82 to -78
	-90	-92 to -88
600	-30	-32 to -28
	-40	-42 to -38
	-50	-52 to -48
	-60	-62 to -58
	-70	-72 to -68
	-80	-82 to -78
	-90	-92 to -88

Table 3. (Cont.)

Applied Frequency (MHz)	Level (dBm)	Limits (dBm)
800	-30	-32 to -28
	-40	-42 to -38
	-50	-52 to -48
	-60	-62 to -58
	-70	-72 to -68
	-80	-82 to -78
	-90	-92 to -88
1000	-30	-32 to -28
	-40	-42 to -38
	-50	-52 to -48
	-60	-62 to -58
	-70	-72 to -68
	-80	-82 to -78
	-90	-92 to -88

4.2.1.58 Set the TI for minimum and disconnect test setup.

4.2.1.59 Connect TI T/R connector to the Power Meter (2.3) through the Power Sensor.

4.2.1.60 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.2.1.61 Press TI *Return* twice then press numeric keypad 1.

4.2.1.62 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.2.1.63 Press TI *Edit*, select **T/R** using ▲ ▼ keys then press *Done*.

4.2.1.64 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.1.65 Press TI *Edit*, select the first value listed in the Applied Frequency column of Table 4 with the numeric keypad then press *Done*.

4.2.1.66 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.1.67 Press TI *Edit*, select the first value listed in the Applied Level column of Table 4 using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.1.68 The Power Meter (2.3) must indicate within the corresponding values listed in the Limits column of Table 4. Record the Power Meter (2.3) indication.

4.2.1.69 Disconnect the Power Sensor from the TI T/R connector. Connect TI T/R connector through adapters, as required, to the MMR Sensor Module.

4.2.1.70 Set MMR, as required, to the TI frequency being verified.

4.2.1.71 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.1.72 Press TI *Edit* and set to the first value listed in the Applied Level column of Table 4 for the frequency being verified.

4.2.1.73 Set MMR, as required, for a Tuned RF Level measurement.

4.2.1.74 Press the MMR Spectrum Analyzer *Set Ref*. Allow the MMR Spectrum Analyzer indication to settle.

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.

4.2.1.75 Set MMR Spectrum Analyzer *Ext RF Atten* to the value recorded in step 4.2.1.68 for the frequency being verified.

4.2.1.76 Press TI *Edit*, then set to the next applicable value listed in the Applied Level column of Table 4 using the ▲ ▼ ◄ ► keys for the frequency being verified then press *Done*. Allow the MMR Spectrum Analyzer indication to settle.

4.2.1.77 Verify the MMR Spectrum Analyzer indicates within the corresponding values listed in the Limits column of Table 4.

4.2.1.78 Repeat steps 4.2.1.76 and 4.2.1.77 for the remaining corresponding values listed in the Applied Level column of Table 4 for the frequency being verified.

4.2.1.79 Disconnect test setup.

4.2.1.80 Connect TI T/R connector to the Power Meter (2.3) through the Power Sensor.

4.2.1.81 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.1.82 Press TI *Edit*, select the next value listed in the Applied Frequency column of Table 4 with the numeric keypad then press *Done*.

4.2.1.83 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.1.84 Press TI *Edit*, select the first applicable value listed in the Applied Level column of Table 4 using the ▲ ▼ ◄ ► keys for the frequency being verified then press *Done*.

4.2.1.85 Repeat steps 4.2.1.68 through 4.2.1.78.

4.2.1.86 Repeat steps 4.2.1.79 through 4.2.1.85 for the remaining corresponding values listed in Table 4.

Table 4.

Frequency (MHz)	Applied Level (dBm)	Limits (dBm)
10	-50	-52 to -48
	-70	-72 to -68
	-90	-92 to -88
	-100	-102 to -98
	-120	-122 to -118
70	-50	-52 to -48
	-70	-72 to -68
	-90	-92 to -88
	-100	-102 to -98
	-120	-122 to -118
200	-50	-52 to -48
	-70	-72 to -68
	-90	-92 to -88
	-100	-102 to -98
	-120	-122 to -118
400	-50	-52 to -48
	-70	-72 to -68
	-90	-92 to -88
	-100	-102 to -98
	-120	-122 to -118

Table 4. (Cont.)

Frequency (MHz)	Applied Level (dBm)	Limits (dBm)
600	-50	-52 to -48
	-70	-72 to -68
	-90	-92 to -88
	-100	-102 to -98
	-120	-122 to -118
800	-50	-52 to -48
	-70	-72 to -68
	-90	-92 to -88
	-100	-102 to -98
	-120	-122 to -118
1000	-50	-52 to -48
	-70	-72 to -68
	-90	-92 to -88
	-100	-102 to -98
	-120	-122 to -118

4.2.1.87 Set the TI for minimum and disconnect test setup.

4.2.2 SPECTRAL PURITY CALIBRATION:

NOTE

Throughout para 4.2.2, ensure the TI operation mode screen is set to the Receiver Test Screen. If not, press *System* and then 2 on the keypad to select the RECEIVER TEST screen.

NOTE

The following will not utilize the MMR Power Meter and Sensor Module. The TI will be connected directly to the MMR Spectrum Analyzer INPUT 50 Ω.

4.2.2.1 Connect the TI SWR connector through the Adapter to the MMR Spectrum Analyzer RF INPUT 50 Ω.

4.2.2.2 Press MMR Spectrum Analyzer **PRESET**.

4.2.2.3 Press MMR Spectrum Analyzer **MODE**, then *Spectrum Analysis*. Press **AMPLITUDE Y SCALE**, set *Attenuation Auto/Man* to *Man*, then set to 30 dB. Press **SWEEP**, set *Auto Sweep Time Norm/Accy* to *Accy*.

4.2.2.4 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.2.2.5 Press TI *Return* twice then press numeric keypad 1.

4.2.2.6 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.2.2.7 Press TI *Edit*, select **SWR** using ▲ ▼ keys then press *Done*.

4.2.2.8 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.2.9 Press TI *Edit*, select the first value listed in the Applied column of Table 5 using the numeric keypad then press *Done*.

4.2.2.10 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.2.11 Press TI *Edit*, select **-5** using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.2.12 Press MMR Spectrum Analyzer **FREQUENCY/CHANNEL** and set to the first value listed in the Applied column of Table 5.

4.2.2.13 Press MMR Spectrum Analyzer **SPAN X SCALE** and set to 1 kHz. Press **MEASURE**, *More 1 of 2*, then *Harmonic Distortion*. Press **MEAS SETUP**, *Harmonics*, then set to 5. Press **SINGLE**, then **RESTART**.

4.2.2.14 Allow the MMR Spectrum Analyzer indication to settle. Verify the amplitude of the first four Harmonic signals, as displayed on the MMR Spectrum Analyzer, are within the corresponding value listed in the Harmonics Limits column of Table 5.

4.2.2.15 Press MMR Spectrum Analyzer **MEASURE**, then *Meas Off*. Press **SWEEP**, then set *Sweep Single/Cont* to *Cont*.

4.2.2.16 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.2.17 Press TI *Edit*, select the next value listed in the Applied column of Table 5 with the numeric keypad then press *Done*.

4.2.2.18 Press MMR Spectrum Analyzer **FREQUENCY/CHANNEL** and set to next value listed in the Applied column of Table 5. Press **RESTART**.

4.2.2.19 Repeat steps 4.2.2.13 through 4.2.2.18, as required, for the remaining corresponding values for Harmonic signals listed in Table 5.

Table 5.

Applied (MHz)	Limits (dBc) Harmonics	Nonharmonics
2	≤-30	≤-40
70	≤-30	≤-40
200	≤-30	≤-40
400	≤-30	≤-40
600	≤-30	≤-40
800	≤-30	≤-40
1000	≤-30	≤-40

4.2.2.20 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.2.21 Press TI *Edit*, select the first value listed in the Applied column of Table 5 using the numeric keypad then press *Done*.

4.2.2.22 Press the MMR Spectrum Analyzer **FREQUENCY/CHANNEL** and set to the first value listed in the Applied column of Table 5.

4.2.2.23 Set the MMR Spectrum Analyzer controls to place the peak of the carrier at a convenient reference level.

4.2.2.24 Set the MMR Spectrum Analyzer controls as required to measure any Nonharmonic Signal level >±20 kHz offset from carrier in band.

4.2.2.25 Verify the amplitude of any Nonharmonic Signal is within the corresponding value listed in the Nonharmonic Limits column of Table 5.

4.2.2.26 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.2.27 Press TI *Edit*, select the next value listed in the Applied column of Table 5 with the numeric keypad then press *Done*.

4.2.2.28 Press the MMR Spectrum Analyzer **FREQUENCY/CHANNEL** and set to the next corresponding value listed in the Applied column of Table 5.

4.2.2.29 Repeat steps 4.2.2.23 through 4.2.2.28, as required, for the remaining corresponding values for Nonharmonic Signals listed in Table 5.

4.2.2.30 Set the TI for minimum and disconnect test setup.

4.2.3 PHASE NOISE AND RESIDUAL FM CALIBRATION:

NOTE

Throughout para 4.2.3, ensure the TI operation mode screen is set to the Receiver Test Screen. If not, press *System* and then 2 on the keypad to select the RECEIVER TEST screen.

4.2.3.1 Connect equipment as shown in Figure 1.

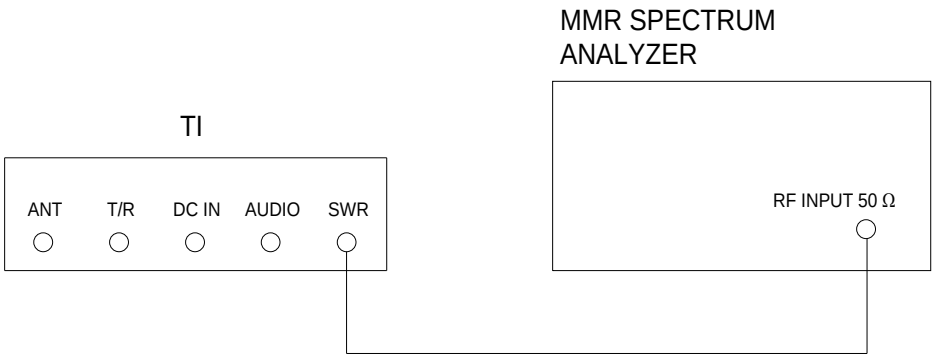

Figure 1.

4.2.3.2 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore default settings.

4.2.3.3 Press TI *Return* twice then press numeric keypad 1.

4.2.3.4 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.2.3.5 Press TI *Edit*, select **SWR** using ▲ ▼ keys then press *Done*.

4.2.3.6 Press TI ▲ ▼ keys to move the cursor into the **Mod:** field.

4.2.3.7 Press TI *Edit*, select **OFF** using ▲ ▼ keys then press *Done*.

4.2.3.8 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.3.9 Press TI *Edit*, select 1000 with the numeric keypad then press *Done*.

4.2.3.10 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.3.11 Press TI *Edit*, select **-5** using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.3.12 Set the MMR to Measuring Receiver mode.

4.2.3.13 Set the MMR Frequency to the TI frequency. Set the MMR controls, as required, to measure FM Deviation. Set the High Pass Filter to 300 Hz, Low Pass Filter to 3 kHz and Detector to RMS.

4.2.3.14 Verify the MMR FM Deviation indication is <60 Hz rms.

4.2.3.15 Set the MMR to Spectrum Analysis Mode. Set the MMR Center Frequency to the TI frequency, Span to 50 kHz and RBW to 300 Hz. Set the reference level as required to set the peak at a convenient level.

4.2.3.16 Set the MMR Spectrum Analyzer for a marker peak search, set the Marker Delta to 20 kHz and set the Marker Noise to On.

NOTE

The MMR Spectrum Analyzer will display the indication in dB/Hz vs dBc/Hz.

4.2.3.17 Verify the MMR Spectrum Analyzer ΔMkr Noise Level is ≤-80 dBc/Hz.

4.2.3.18 Set the TI for minimum and disconnect test setup.

4.2.4 RESIDUAL AM CALIBRATION:

NOTE

Throughout para 4.2.4, ensure the TI operation mode screen is set to the Receiver Test Screen. If not, press *System* and then 2 on the keypad to select the RECEIVER TEST screen.

NOTE

The following will not utilize the MMR Power Meter and Sensor Module. The TI will be connected directly to the MMR Spectrum Analyzer INPUT 50 Ω.

4.2.4.1 Connect the Adapter to the MMR Spectrum Analyzer RF INPUT 50 Ω.

4.2.4.2 Press MMR Spectrum Analyzer **PRESET** key, then set controls as follows:

MODE	*Measuring Receiver*
MEASURE	*More 1 of 3*
	Modulation Distortion
AMPLITUDE Y SCALE	*Display Unit*
	dB
FREQUENCY/Channel	*1 GHz*

4.2.4.3 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore default settings.

4.2.4.4 Press TI *Return* twice then press numeric keypad 1.

4.2.4.5 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.2.4.6 Press TI *Edit*, select **SWR** using ▲ ▼ keys then press *Done*.

4.2.4.7 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.2.4.8 Press TI *Edit*, select **1000** with the numeric keypad then press *Done*.

4.2.4.9 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.4.10 Press TI *Edit*, select **-5** using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.4.11 Connect the TI SWR connector through the Adapter to the MMR Spectrum Analyzer RF INPUT 50 Ω.

4.2.4.12 Press the MMR Spectrum Analyzer **DET/DEMOD**, *High Pass Filter* and set to *300 Hz*. Press *Low Pass Filter* and set to *3 kHz*. Press *Detector*, then *Peak +-/2*.

4.2.4.13 Press the MMR Spectrum Analyzer **MEASURE**, then *AM Depth*.

4.2.4.14 Verify the MMR Spectrum Analyzer AM Depth indication is <5.0%.

4.2.4.15 Leave test setup connected.

4.2.5 FREQUENCY MODULATION CALIBRATION:

NOTE

Throughout para 4.2.5, ensure the TI operation mode screen is set to the Receiver Test Screen. If not, press *System* and then 2 on the keypad to select the RECEIVER TEST screen.

4.2.5.1 Press MMR Spectrum Analyzer **PRESET** key, then set controls as follows:

MODE	*Measuring Receiver*
	FM Deviation
AMPLITUDE Y SCALE	*Display Unit*
	kHz
FREQUENCY/Channel	first value listed in the Applied Frequency column of Table 6

4.2.5.2 Press TI ▲ ▼ keys to move the cursor into the **Mod:** field.

4.2.5.3 Press TI *Edit*, select FM using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.5.4 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.5.5 Press TI *Edit*, select **-5** using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.5.6 Press TI ◄ ► keys to move the cursor into the **Gen 1:** field.

4.2.5.7 Press TI *Edit* to select ON.

4.2.5.8 Press TI ▲ ▼ ◄ ► keys to move the cursor into the **MHz:** field.

4.2.5.9 Press TI *Edit*, using the ▲ ▼ ◄ ► keys adjust to the first value listed in the Applied Frequency column of Table 6 then press *Done*, as required.

4.2.5.10 Press TI ▲ ▼ ◄ ► keys to move the cursor into the Freq column of **Gen 1:**.

4.2.5.11 Press TI *Edit*, using the ▲ ▼ ◄ ► keys adjust to the first value listed in the Applied Rate column of Table 6 then press *Done*.

4.2.5.12 Press TI ▲ ▼ keys to move the cursor into the FM column of **Gen 1:**.

4.2.5.13 Press TI *Edit*, using the ▲ ▼ ◄ ► keys adjust to the first value listed in the Applied Deviation column of Table 6.

4.2.5.14 Press the MMR Spectrum Analyzer **DET/DEMOD**, *High Pass Filter* and set to *300 Hz*. Press *Low Pass Filter* and set to *3 kHz*. Press *Detector*, then *Peak +*.

4.2.5.15 Press the MMR Spectrum Analyzer **MEASURE**, then *FM Deviation*.

4.2.5.16 Allow the MMR Spectrum Analyzer indication to settle. Verify the MMR Spectrum Analyzer FM Deviation indication is within the corresponding values listed in the Limits column of Table 6.

4.2.5.17 Press the MMR Spectrum Analyzer **MEASURE**, *More 1 of 3* and *Modulation Distortion*. Press **DET/DEMOD**, then set the *High Pass Filter* and *Low Pass Filter* to *None*.

4.2.5.18 Verify the MMR Spectrum Analyzer Distortion indication is ≤3.000%.

4.2.5.19 Repeat steps 4.2.5.13 through 4.2.5.18, as required, for the remaining corresponding values in Table 6.

Table 6.

Applied Frequency (MHz)	Applied Rate (kHz)	Applied Deviation (kHz)	Limits (kHz)
1000	1	5	4.5 to 5.5
		25	22.5 to 27.5
		50	45 to 55

4.2.5.20 Set the TI for minimum. Leave test setup connected.

4.2.6 AMPLITUDE MODULATION CALIBRATION:

NOTE

Throughout para 4.2.6, ensure the TI operation mode screen is set to the Receiver Test Screen. If not, press *System* and then 2 on the keypad to select the RECEIVER TEST screen.

4.2.6.1 Press MMR Spectrum Analyzer **PRESET** key, then set controls as follows:

MODE	*Measuring Receiver*
MEASURE	*More 1 of 3*
	Modulation Distortion
AMPLITUDE Y SCALE	*Display Unit*
	%
FREQUENCY/Channel	first value listed in the Applied Frequency column of Table 7

4.2.6.2 Press TI ▲ ▼ keys to move the cursor into the **Mod:** field.

4.2.6.3 Press TI *Edit*, select **AM** using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.6.4 Press TI ▲ ▼ keys to move the cursor into the **Lvl:** field.

4.2.6.5 Press TI *Edit*, select **-5** using the ▲ ▼ ◄ ► keys then press *Done*.

4.2.6.6 Press TI ▲ ▼ ◄ ► keys to move the cursor into the **MHz:** field.

4.2.6.7 Press TI *Edit*, using the ▲ ▼ ◄ ► keys adjust to the first value listed in the Applied Frequency column of Table 7 then press *Done*, as required.

4.2.6.8 Press TI ▲ ▼ keys to move the cursor into the AM column of **Gen 1:**.

4.2.6.9 Press TI *Edit*, using the ▲ ▼ ◄ ► keys adjust to the first value listed in the Applied Depth column of Table 7.

4.2.6.10 Press the MMR Spectrum Analyzer **DET/DEMOD**, *High Pass Filter* and set to *300 Hz*. Press *Low Pass Filter* and set to *3 kHz*. Press *Detector*, then *Peak +-/2*.

4.2.6.11 Press the MMR Spectrum Analyzer **MEASURE**, then *AM Depth*.

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

4.2.6.13 Press the MMR Spectrum Analyzer **MEASURE**, *More 1 of 3* and *Modulation Distortion*. Press **DET/DEMOD**, then set the *High Pass Filter* and *Low Pass Filter* to *None*.

4.2.6.14 Verify the MMR Spectrum Analyzer Distortion indication is ≤3.000%.

4.2.6.15 Repeat steps 4.2.6.9 through 4.2.6.14, as required, for the remaining corresponding values in Table 7.

Table 7.

Applied Frequency (MHz)	Depth (%)	Limits (%)
1000	20	18 to 22
	55	49.5 to 60.5
	90	81 to 99

4.2.6.16 Set the TI for minimum and disconnect test setup.

4.3 RECEIVER RF CALIBRATION:

4.3.1 POWER METER CALIBRATION:

CAUTION

Damage to the TI may occur if >20 W continuous is applied. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

4.3.1.1 Connect equipment as shown in Figure 2.

CAUTION

The 10 dB Attenuator (p/o Power Amplifier) must be used when using the Power Amplifier to avoid damage to the TI. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

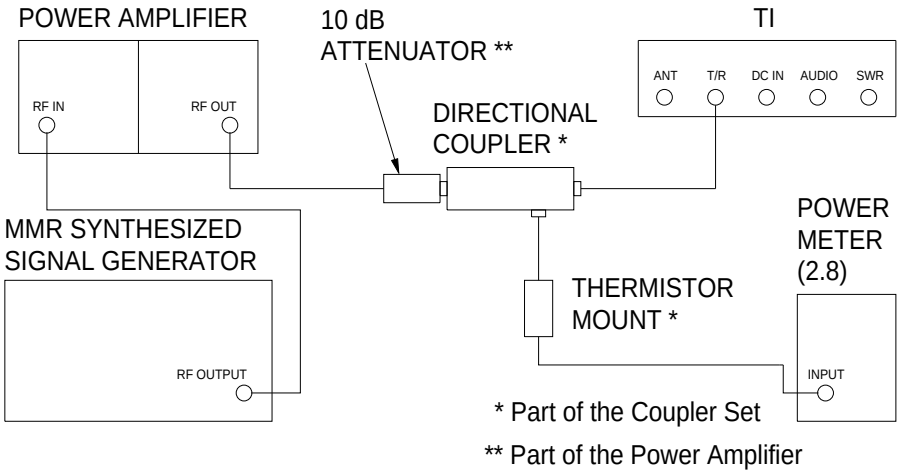

Figure 2.

NOTE

Throughout para 4.3.1, ensure the TI operation mode screen is set to the Transmitter Test Screen. If not, press *System* and then 3 on the keypad to select the TRANSMITTER TEST screen.

4.3.1.2 On the Power Meter set switch to 40 dB Coupler and CAL FACTOR/Vernier controls to the appropriate value for the frequency being generated.

4.3.1.3 Adjust Power Amplifier RF OUPUT LEVEL CONTROL fully CCW.

4.3.1.4 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.3.1.5 Press TI *Return* twice then press numeric keypad 2.

4.3.1.6 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.3.1.7 Press TI *Edit*, select **T/R** using ▲ ▼ keys then press *Done*.

4.3.1.7.1 If TI **RF-POWER** field is not displayed, perform the following:

4.3.1.7.2 Press TI *Setup*, select **RF POWER METER** using ▲ ▼ keys.

4.3.1.7.3 Press TI *Edit* key to highlight the field. Press a number corresponding to an open meter position.

4.3.1.7.4 Press TI *Done* to store the setting. Press *Return*.

4.3.1.8 Press TI ◄ ► keys to move the cursor into the **RF-POWER** field and press *Zoom*.

4.3.1.9 Set the MMR Synthesized Signal Generator as required for 0.0 dBm output at 100.0 MHz.

4.3.1.10 On the Power Amplifier press the appropriate BAND, as required, for 100 MHz. Adjust RF OUPUT LEVEL CONTROL to the first value listed in the Applied column of Table 8 as indicated on the Power Meter (2.8).

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

4.3.1.12 On the Power Amplifier adjust RF OUTPUT LEVEL CONTROL fully CCW.

4.3.1.13 Repeat steps 4.3.1.10 through 4.3.1.12 for the remaining corresponding values listed in Table 8.

Table 8.

Applied (W)	Limits (W)
10	7.9 to 12.6
15	11.9 to 18.9
141 *	99.8 to 199.2

* Insert the TI supplied 20 dB External Attenuator. N/A if 20 dB External Attenuator is not provided. Remove after measurement.

4.3.1.14 Repeat steps 4.3.1.9 through 4.3.1.13 for a test frequency of 400 MHz.

4.3.1.15 Set the MMR Synthesized Signal Generator RF ON/OFF switch to OFF and disconnect test setup.

4.3.2 FREQUENCY MODULATION DEVIATION METER CALIBRATION:

NOTE

Throughout para 4.3.2, ensure the TI operation mode screen is set to the Duplex Test Screen. If not, press *System* and then 1 on the keypad to select the DUPLEX TEST screen.

4.3.2.1 Connect equipment as shown in Figure 3.

4.3.2.2 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.3.2.3 Press TI *Return* twice then press numeric keypad 3.

4.3.2.4 Press TI ◄ ► keys to move the cursor into the **Receiver** window.

4.3.2.5 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.3.2.6 Press TI *Edit* to toggle the selection to **ANT**.

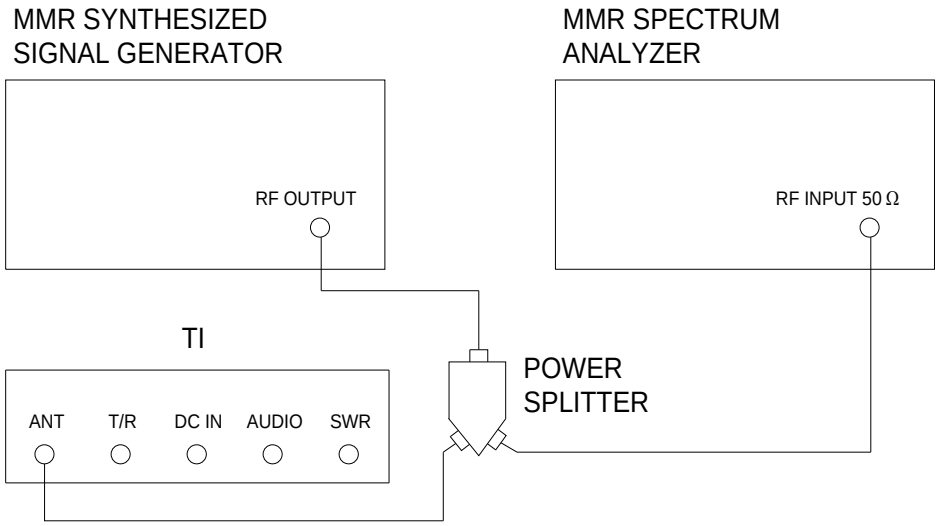

Figure 3.

4.3.2.7 Press TI ▲ ▼ keys to move the cursor into the **Mod:** field.

4.3.2.8 Press TI *Edit* to toggle the selection to **FM**.

4.3.2.9 Press TI ▲ ▼ keys to move the cursor into the **AFBW:** field.

4.3.2.10 Press TI *Edit*, select **0.3-3k BP** (if TI does not have **0.3-3k BP**, use **0.3-5k BP**) using the ▲ ▼ keys then press *Done*.

4.3.2.11 Press TI ▲ ▼ keys to move the cursor into the **IFBW:** field.

4.3.2.12 Press TI *Edit*, select **300k** using the ▲ ▼ keys then press *Done*.

4.3.2.13 Press TI ◄ ► keys to move the cursor into the **MOD-FMDEV** window and press *Zoom*.

4.3.2.14 Press TI ▲ ▼ keys to move the cursor into the Measure Type field.

4.3.2.15 Press TI *Edit*, select PK-PK/2 using the ▲ ▼ keys then press *Done*.

4.3.2.16 Press TI ▲ ▼ keys to move the cursor into the Peak Hold field.

4.3.2.17 Press TI *Edit* to toggle the selection to Off.

4.3.2.18 Press TI ▲ ▼ keys to move the cursor into the Avg Reading field.

4.3.2.19 Press TI *Edit*, select 1 using the ▲ ▼ keys then press *Esc*.

4.3.2.20 Press the MMR Spectrum Analyzer **MEASURE**, then *FM Deviation*.

4.3.2.21 Press the MMR Spectrum Analyzer **DET/DEMOD**, *High Pass Filter* and set to *300 Hz*. Press *Low Pass Filter* and set to *3 kHz*. Press *Detector*, then *Peak+* keys.

4.3.2.22 Press TI ◄ ► keys to move the cursor into the **Receiver** window.

4.3.2.23 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.3.2.24 Press TI *Edit*, set to the value listed in the Applied Frequency column of Table 10 using the ▲ ▼ ◄ ► keys, as required, then press *Done*.

4.3.2.25 Set MMR Synthesized Signal Generator, as required, to the value listed in the Applied Frequency column of Table 10 at a level of -10.0 dBm.

4.3.2.26 Set MMR Synthesized Signal Generator internal modulation, as required, to the first value listed in the Applied Rate column of Table 10.

4.3.2.27 On the MMR Synthesized Signal Generator, set FM ON/OFF to ON and set the deviation, as required, for the first value listed in the Applied Deviation column of Table 10 as indicated on the MMR Spectrum Analyzer, for the Rate being verified.

4.3.2.28 Allow the MMR Spectrum Analyzer indication to settle.

NOTE

The MMR Spectrum Analyzer **RESTART** must be pressed after changing the MMR Synthesized Signal Generator FM deviation.

4.3.2.29 Verify the TI indicates within the corresponding values listed in the Limits column of Table 10.

4.3.2.30 Repeat steps 4.3.2.27 through 4.3.2.29 for the remaining corresponding values listed in Table 10 for the Rate being verified.

4.3.2.31 Set MMR Synthesized Signal Generator internal modulation, as required, to the next value listed in the Applied Rate column of Table 10.

4.3.2.32 Repeat steps 4.3.2.27 through 4.3.2.30 for the remaining corresponding values listed in Table 10.

Table 10.

Frequency (MHz)	Applied Rate (Hz)	Deviation (kHz)	TI Limits (kHz)
100	1k	0.5	0.45 to 0.55
		1.0	0.95 to 1.05
		10.0	9.5 to 10.5
		50.0	45 to 55
		100.0	90 to 110
	150 *	0.5	0.45 to 0.55
		1.0	0.95 to 1.05
		10.0	9.5 to 10.5
		50.0	45 to 55
		100.0	90 to 110

* Set TI **AFBW** to **0.3k LP**. Set MMR Spectrum Analyzer *High Pass Filter* to *50 Hz* and *Low Pass Filter* to *3 kHz*.

4.3.2.33 Set the MMR Synthesized Signal Generator RF ON/OFF switch to OFF. Leave test setup connected.

4.3.3 AMPLITUDE MODULATION PERCENT METER CALIBRATION:

NOTE

Throughout para 4.3.3, ensure the TI operation mode screen is set to the Duplex Test Screen. If not, press *System* and then 1 on the keypad to select the DUPLEX TEST screen.

4.3.3.1 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.3.3.2 Press TI *Return* twice then press numeric keypad 3.

4.3.3.3 Press TI ◄ ► keys to move the cursor into the **Receiver** window.

4.3.3.4 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.3.3.5 Press TI *Edit* to toggle the selection to **ANT**.

4.3.3.6 Press TI ▲ ▼ keys to move the cursor into the **Mod:** field.

4.3.3.7 Press TI *Edit* to toggle the selection to **AM**.

4.3.3.8 Press TI ▲ ▼ keys to move the cursor into the **AFBW:** field.

4.3.3.9 Press TI *Edit*, select **3k LP** using the ▲ ▼ keys then press *Done*.

4.3.3.10 Press TI ◄ ► keys to move the cursor into the **MOD-AMMOD** window and press *Zoom*.

4.3.3.11 Press TI ▲ ▼ keys to move the cursor into the Measure Type field.

4.3.3.12 Press TI *Edit*, select PK-PK/2 using the ▲ ▼ keys then press *Done*.

4.3.3.13 Press TI ▲ ▼ keys to move the cursor into the Peak Hold field.

4.3.3.14 Press TI *Edit* to toggle the selection to Off.

4.3.3.15 Press TI ▲ ▼ keys to move the cursor into the Avg Reading field.

4.3.3.16 Press TI *Edit*, select 1 using the ▲ ▼ keys then press *Esc*.

4.3.3.17 Press the MMR Spectrum Analyzer **MEASURE**, then *AM Depth*.

4.3.3.18 Press the MMR Spectrum Analyzer **DET/DEMOD**, *High Pass Filter* and set to *300 Hz*. Press *Low Pass Filter* and set to *3 kHz*. Press *Detector*, then *Peak +-/2*.

4.3.3.19 Set MMR Synthesized Signal Generator internal modulation to a 1 kHz rate.

4.3.3.20 Press TI ◄ ► keys to move the cursor into the **Receiver** window.

4.3.3.21 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.3.3.22 Press TI *Edit*, set to the value listed in the Applied Frequency column of Table 11 using the ▲ ▼ ◄ ►keys, as required, then press *Done*.

4.3.3.23 Set MMR Synthesized Signal Generator, as required, to the value listed in the Applied Frequency column of Table 11 at a level of-10.0 dBm.

4.3.3.24 On the MMR Synthesized Signal Generator, set AM ON/OFF to ON and set the depth, as required, for the first value listed in the Applied Depth column of Table 11 as indicated on the MMR Spectrum Analyzer.

4.3.3.25 Allow the MMR Spectrum Analyzer indication to settle.

4.3.3.26 Verify the TI indicates within the corresponding values listed in the Limits column of Table 11.

4.3.3.27 Repeat steps 4.3.3.24 through 4.3.3.26 for the remaining corresponding values listed in Table 11.

Table 11.

Applied Frequency (MHz)	Depth (%)	TI Limits (%)
1000	30	28 to 32
	50	47 to 53
	90	85 to 95

4.3.3.28 Set MMR Synthesized Signal Generator RF ON/OFF switch to OFF. Disconnect the test setup.

4.3.4 RECEIVE SIGNAL STRENGTH INDICATION METER CALIBRATION:

NOTE

Throughout para 4.3.4, ensure the TI operation mode screen is set to the Duplex Test Screen. If not, press *System* and then 1 on the keypad to select the DUPLEX TEST screen.

4.3.4.1 Ensure the MMR Spectrum Analyzer, Power Meter and Sensor Module are configured for a measuring receiver measurement and all MMR Sensor Module Cal Factors are loaded.

4.3.4.2 Connect the MMR Sensor Module to the MMR Power Meter REF connector. Press the MMR Spectrum Analyzer **PRESET** and set controls as follows:

MODE	*Measuring Receiver*
SYSTEM	*More 1 of 3*
	More 2 of 3
Power Meter	
Zero & Cal Power Meter	

4.3.4.3 Connect equipment as shown in Figure 4.

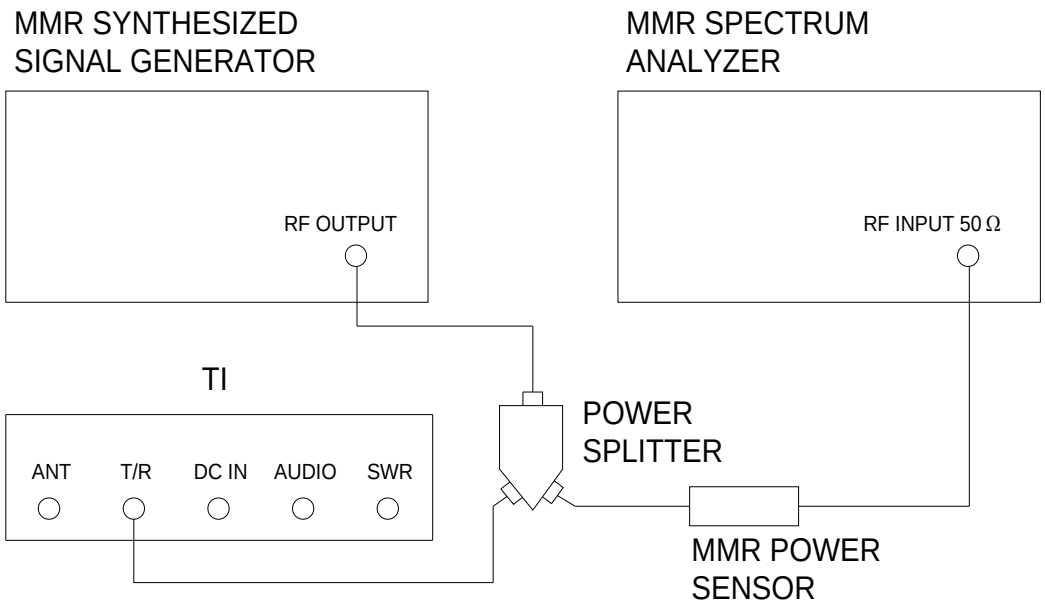

Figure 4.

4.3.4.4 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.3.4.5 Press TI *Return* twice then press numeric keypad 3.

4.3.4.6 Press TI ◄ ► keys to move the cursor into the **Receiver** window.

4.3.4.7 Press TI ▲ ▼ keys to move the cursor into the **Port:** field.

4.3.4.8 Press TI *Edit* to toggle the selection to **T/R**.

4.3.4.9 Press TI ▲ ▼ keys to move the cursor into the **Mod:** field.

4.3.4.10 Press TI *Edit* to toggle the selection to FM.

4.3.4.11 Press TI ▲ ▼ keys to move the cursor into the IF BW field, to the right of **Mod:** field.

4.3.4.12 Press TI *Edit*, select 25k using the ▲ ▼ keys then press *Esc*.

4.3.4.13 Set MMR Synthesized Signal Generator, as required, to the first value listed in the Frequency column of Table 12 at a level of -3 dBm.

4.3.4.14 Press TI ▲ ▼ keys to move the cursor into the **MHz:** field.

4.3.4.15 Press TI *Edit*, select the first value listed in the Frequency column of Table 12 with the numeric keypad then press *Done*.

4.3.4.16 Press MMR Spectrum Analyzer **MEASURE**, *RF Power* then *Frequency Counter*. Press **MEAS SETUP**, then set *Tuning Auto/Man* to *Man* and set to the first value listed in the Frequency column of Table 12. Press **MEASURE**, then *RF Power* and allow reading to settle.

4.3.4.17 Adjust the MMR Synthesized Signal Generator, as required, for a -10 dBm indication on the MMR Spectrum Analyzer. Allow the MMR Spectrum Analyzer indication to settle.

4.3.4.18 Verify the TI indication is within the corresponding values listed in the Limits column of Table 12 for the level being calibrated.

4.3.4.19 Press TI *Edit*, select the next value listed in the Frequency column of Table 12 with the numeric keypad then press *Done*.

4.3.4.20 Set MMR Synthesized Signal Generator, as required, to the next value listed in the Frequency column of Table 12.

4.3.4.21 Press MMR Spectrum Analyzer *Frequency Counter*. Press **MEAS SETUP**, then set *Tuning Auto/Man* to *Man* and set to the next applicable value listed in the Frequency column of Table 12. Press **MEASURE**, then *RF Power* and allow reading to settle.

4.3.4.22 Repeat steps 4.3.4.17 and 4.3.4.18.

4.3.4.23 Repeat steps 4.3.4.19 through 4.3.4.22 for the remaining corresponding values listed in Table 12.

Table 12.

	Limits (dBm)	
Frequency (MHz)	**-10 dBm**	**-20 dBm**
2	-13 to-7	-23 to -17
70	-13 to -7	-23 to -17
200	-13 to -7	-23 to -17
400	-13 to -7	-23 to -17
600	-13 to -7	-23 to -17
800	-13 to -7	-23 to -17
1000	-13 to -7	-23 to -17

4.3.4.24 Set MMR Synthesized Signal Generator RF ON/OFF switch to OFF. Disconnect the test setup.

4.3.4.25 Repeat steps 4.3.4.1 through 4.3.4.24 for the TI ANT port using the MMR Synthesized Signal Generator level of -20 dBm.

4.3.5 SINAD METER AND DISTORTION METER CALIBRATION:

NOTE

Throughout para 4.3.5, ensure the TI operation mode screen is set to the Audio Test Screen. If not, press *System* and then 5 on the keypad to select the AUDIO screen.

4.3.5.1 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.3.5.2 Press TI *Return* twice, 5 then 1 with the numeric keypad.

4.3.5.3 Connect equipment as shown in Figure 5 with the Power Divider input connected to the Digital Multimeter input.

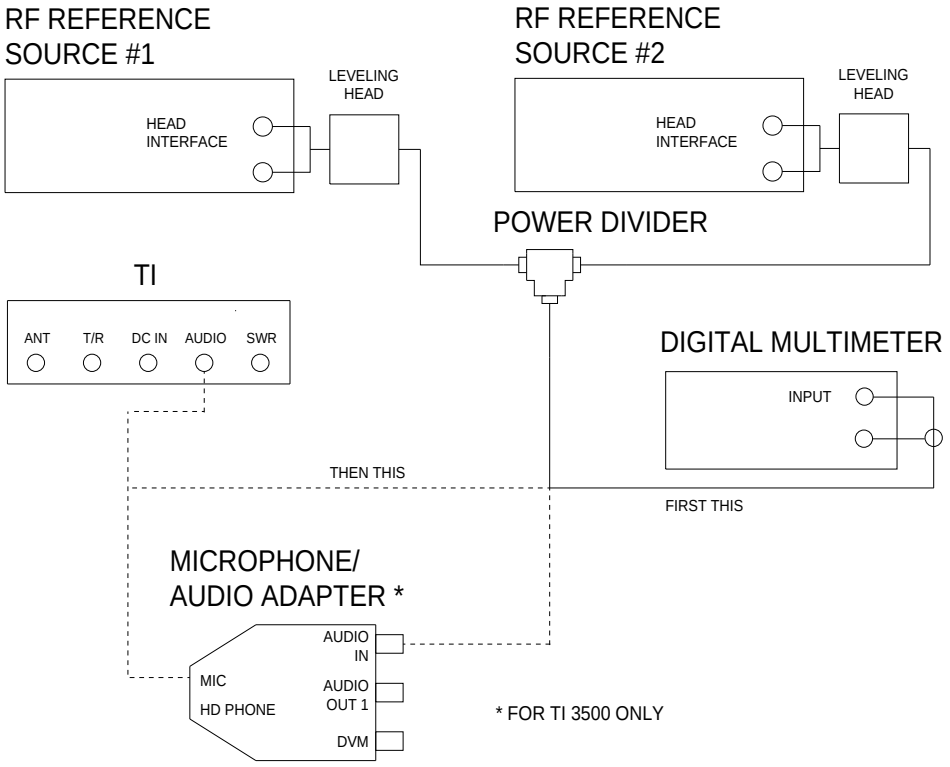

Figure 5.

4.3.5.4 Set the Digital Multimeter for ACV measurement.

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

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

4.3.5.7 Set the RF Reference Source #2 frequency to 2 kHz and output level for 260.0 mV rms as monitored on the Digital Multimeter.

4.3.5.8 Set the RF Reference Source #1 to the value recorded in step 4.3.5.6.

4.3.5.9 Disconnect the Power Divider Input from the Digital Multimeter.

4.3.5.10 Connect the Power Divider Input to the Microphone/Audio Adapter AUDIO IN.

4.3.5.11 Press the TI Microphone/Audio Adapter key.

4.3.5.12 Verify the TI SINAD meter indicates within 10.5 to 13.5 dB.

4.3.5.13 Set all outputs to minimum. Connect equipment as shown in Figure 5 with the Power Divider input connected to the Digital Multimeter input.

4.3.5.14 Set the RF Reference Source #2 frequency to 2 kHz and output level for 50.0 mV rms as monitored on the Digital Multimeter.

4.3.5.15 Set the RF Reference Source #1 to the value recorded in step 4.3.5.6.

4.3.5.16 Disconnect the Power Divider Input from the Digital Multimeter.

4.3.5.17 Connect the Power Divider Input to the Microphone/Audio Adapter AUDIO IN.

4.3.5.18 Press TI *Return* then 2 with the numeric keypad.

4.3.5.19 Verify the TI DISTORTION meter indicates within 4.5 to 5.5%.

4.3.5.20 Set all outputs to minimum and disconnect test setup.

4.4 AUDIO FREQUENCY GENERATOR CALIBRATION:

4.4.1 AMPLITUDE CALIBRATION:

NOTE

Throughout para 4.4.1, ensure the TI operation mode screen is set to the Audio Test Screen. If not, press *System* and then 5 on the keypad to select the AUDIO screen.

4.4.1.1 Connect equipment as shown in Figure 6.

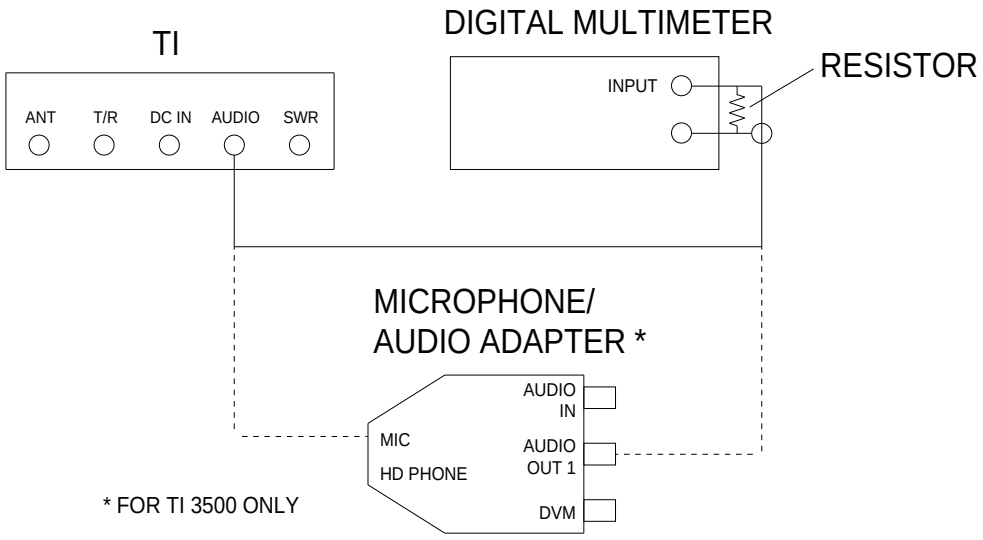

Figure 6.

4.4.1.2 Press TI *Return*, numeric keypad 7 then 7. Press *Enter* then *Yes* to restore to restore default settings.

4.4.1.3 Press TI *Return* twice, then press numeric keypad 6.

4.4.1.4 Press TI ▲ ▼ keys to move the cursor into the **# 1:** field.

4.4.1.5 Press TI *Edit* to toggle the selection to **ON**.

4.4.1.6 Press TI ▲ ▼ keys to move the cursor into the **Freq** field.

4.4.1.7 Press TI *Edit*, select the first value listed in the Frequency column of Table 13 using the ▲ ▼ ◄ ► keys then press *Done*.

4.4.1.8 Press TI ▲ ▼ keys to move the cursor into the **Level** field.

4.4.1.9 Press TI *Edit*, select the first value listed in the Applied column of Table 13 using the ▲ ▼ ◄ ► keys then press *Done*.

4.4.1.10 Set the Digital Multimeter to measure V rms and verify the indication is within the corresponding values listed in the Limits column of Table 13.

4.4.1.11 Press TI *Edit*, select the next value listed in the Applied column of Table 13 using the ▲ ▼ ◄ ► keys for the frequency being verified then press *Done*.

4.4.1.12 Verify the Digital Multimeter indication is within the values listed in the Limits column of Table 13.

4.4.1.13 Repeat steps 4.4.1.11 and 4.4.1.12 for the remaining corresponding values listed in the Applied column of Table 13 for the frequency being verified.

4.4.1.14 Press TI ▲ ▼ keys to move the cursor into the **Freq** field.

4.4.1.15 Press TI *Edit*, select the next value listed in the Frequency column of Table 13 using the ▲ ▼ ◄ ► keys then press *Done*.

4.4.1.16 Press TI ▲ ▼ keys to move the cursor into the **Level** field.

4.4.1.17 Press TI *Edit*, select the first value listed in the Applied column of Table 13 using the ▲ ▼ ◄ ► keys for the frequency being verified then press *Done*.

4.4.1.18 Repeat steps 4.4.1.10 through 4.4.1.13.

4.4.1.19 Repeat steps 4.4.1.14 through 4.4.1.18, as required, for the remaining corresponding values listed in Table 13.

Table 13.

Frequency (kHz)	Applied (V rms)	Limits (V rms)
0.03	1.57	1.413 to 1.727
	1	0.9 to 1.1
	0.75	0.675 to 0.825
	0.5	0.45 to 0.55
	0.25	0.225 to 0.275
2.5	1.57	1.413 to 1.727
	1	0.9 to 1.1
	0.75	0.675 to 0.825
	0.5	0.45 to 0.55
	0.25	0.225 to 0.275
5	1.57	1.413 to 1.727
	1	0.9 to 1.1
	0.75	0.675 to 0.825
	0.5	0.45 to 0.55
	0.25	0.225 to 0.275

4.4.1.20 Press TI ▲ ▼ keys to move the cursor into the **# 1:** field.

4.4.1.21 Press TI *Edit* to toggle the selection to **OFF**.

4.4.1.22 Press TI ▲ ▼ keys to move the cursor into the **# 2:** field.

4.4.1.23 Press TI *Edit* to toggle the selection to ON.

4.4.1.24 Repeat steps 4.4.1.6 through 4.4.1.19 for **# 2:** field.

4.4.1.25 Press TI ▲ ▼ keys to move the cursor into the **# 2:** field.

4.4.1.26 Press TI *Edit* to toggle the selection to **OFF** and disconnect test setup.

4.4.2 DISTORTION CALIBRATION:

NOTE

Throughout para 4.4.2, ensure the TI operation mode screen is set to the Audio Test Screen. If not, press *System* and then 5 on the keypad to select the AUDIO screen.

4.4.2.1 Connect equipment as shown in Figure 7.

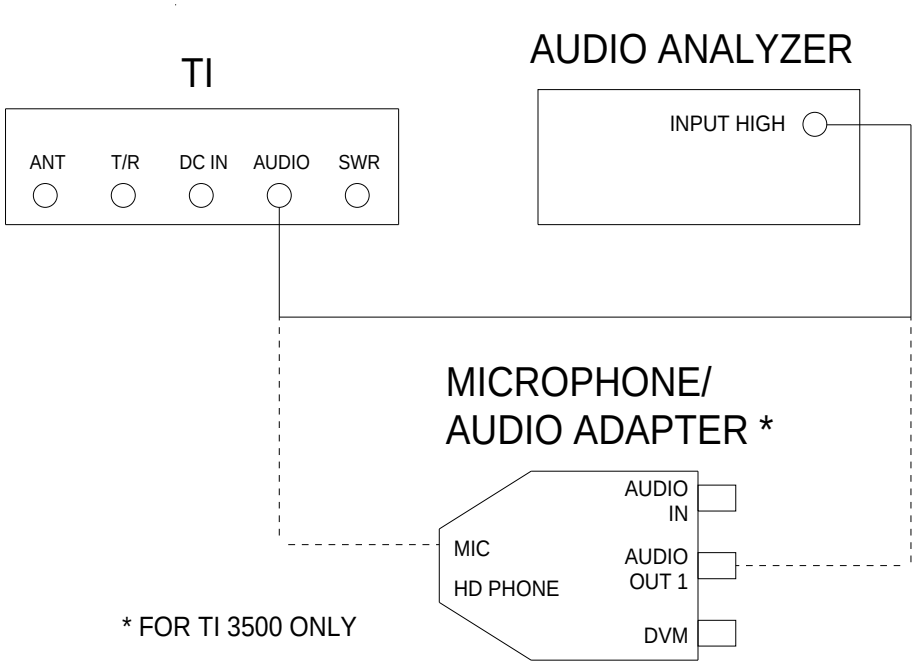

Figure 7.

4.4.2.2 Press TI ▲ ▼ keys to move the cursor into the **# 1:** field.

4.4.2.3 Press TI *Edit* to toggle the selection to **ON**.

4.4.2.4 Press TI ▲ ▼ keys to move the cursor into the **Level** field.

4.4.2.5 Press TI *Edit*, select 1.57 using the ▲ ▼ ◄ ► keys then press *Done*.

4.4.2.6 Set the Audio Analyzer MEASUREMENT to DISTN.

4.4.2.7 Press TI ▲ ▼ keys to move the cursor into the **Freq** field.

4.4.2.8 Press TI *Edit*, select the first value listed in the Frequency column of Table 14 using the ▲ ▼ ◄ ► keys then press *Done*.

4.4.2.9 Verify the Audio Analyzer indication is within the corresponding value listed in the Limits column of Table 14.

4.4.2.10 Repeat steps 4.4.2.8 and 4.4.2.9 for the remaining corresponding values listed in Table 14.

Table 14.

Frequency (Hz)	Limits (THD)
300	<3.0%
600	<3.0%
900	<3.0%
1 k	<3.0%
3 k	<3.0%

4.4.2.11 Press TI ▲ ▼ keys to move the cursor into the **# 1:** field.

4.4.2.12 Press TI *Edit* to toggle the selection to **OFF**.

4.4.2.13 Press TI ▲ ▼ keys to move the cursor into the **# 2:** field.

4.4.2.14 Press TI *Edit* to toggle the selection to **ON**.

4.4.2.15 Repeat steps 4.4.2.4 through 4.4.1.10 for **# 2:** field.

4.4.2.16 Press TI ▲ ▼ keys to move the cursor into the **# 2:** field.

4.4.2.17 Press TI *Edit* to toggle the selection to **OFF** and disconnect test setup.

4.4.2.18 As appropriate, annotate and attach a Limited Certification Label per steps 3.8 and/or 3.9.

CALIBRATION PERFORMANCE TABLE

Not Required

APPENDIX A

A-1 TIME BASE ADJUSTMENT:

A-1.1 Connect Frequency Standard 10 MHz REF OUT to the MMR Spectrum Analyzer EXT REF IN (rear panel).

A-1.2 Press MMR Spectrum Analyzer **MODE**, then *Measuring Receiver*. Press **SYSTEM**, *Reference*, then set *Freq Ref Int/Ext* to *Ext*. Press MMR Spectrum Analyzer **MEASURE**, then *Frequency Counter*.

A-1.3 Press TI numeric keypad 4, 7 then 7. Press *Enter* then *Yes* to restore default settings.

A-1.4 Press TI *Return* then press numeric keypad 6- **CALIBRATION**.

A-1.5 Connect TI SWR PORT to the MMR Sensor Module.

A-1.6 Press TI *Edit*, then TI numeric keypad 30203. Press *Done*.

A-1.7 Press TI numeric keypad 6 for **TCXO CAL ADJUSTMENT**. Use the ▲ ▼ ◄ ► softkeys to go to **TCXO**.

A-1.8 Press TI *Edit*, adjust **TXCO Value** using ▲ ▼ ◄ ► and NUMBER softkeys to adjust the **TXCO Value** so the reading on the MMR Spectrum Analyzer is as close to 500 MHz as possible.

A-1.9 Press TI *Done*, then *Save*.

A-1.10 Press TI *Return*, then *System*.

A-1.11 Press TI numeric keypad 4, 7 then 2.

A-1.12 Press TI numeric keypad as required to set the: **UUT IP Address**: 1.

A-1.13 Press TI *Config*, then **SYSTEM**.

A-1.14 Press the TI ⏻ switch to turn Off. Press the TI ⏻ switch to turn TI On and allow 3 minute warm-up.

A-1.15 Disconnect the test setup and continue with para 4.2.