T.O. 33K3-4-2947-1

TECHNICAL MANUAL

CALIBRATION PROCEDURE

FOR

COMMUNICATION SERVICE MONITOR

FM/AM 1200S, FM/AM 1200 SUPER S

(IFR INC)

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COMMUNICATIONS SERVICE MONITOR

FM/AM 1200S, FM/AM 1200 SUPER S

(IFR INC)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Master Oscillator	Range: 10 MHz Accuracy: (TCXO- through FM/AM-1200S S/N 5411) Aging/year: 1 ppm Temperature: 0.5 ppm (0 to 50 °C) *[1] (TCXO-FM/AM-1200S Option 01 through S/N 5411, FM/AM-1200S S/N 5412 and on, and FM/AM-1200 Super S) Aging/year: 0.5 ppm Temperature: 0.2 ppm (0 to 50 °C) *[1] (OCXO-Option 02, All models) Aging/year: 0.25 ppm Temperature: 0.05 ppm (0 to 50 °C) *[1]	Verified with a Frequency Standard and an Electronic Counter
RF Signal Generator	Range: 250 kHz to 999.9999 MHz	
Frequency	Range: 250 kHz to 999.9999 MHz Accuracy: ±5 Hz + Master Oscillator, FM/AM-1200S (S/N through 4490) and FM/AM-1200 Super S; ±Master Oscillator for FM/AM-1200S (S/N 4491 and on)	Verified with Electronic Counter and Frequency Counter
Output	Range: (10 dB steps with 11 dB range vernier) -127 to -20 dBm Accuracy: ±2.5 dB	Verified with Measuring Receiver, Power Meter and Power Sensor
Spectral Purity	Range: 250 kHz to 999.9999 MHz Accuracy: (Harmonics) FM/AM-1200S: ≤-30 dBc for 2nd, ≤-45 dBc for 3rd harmonic; FM/AM-1200 Super S: <-25 dBc	Verified with a Spectrum Analyzer

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
RF Signal Generator *(Cont.)*	Range: 250 kHz to 999.9999 MHz	
Spectral Purity *(Cont.)*	Range: 250 kHz to 999.9999 MHz Accuracy: (Non-Harmonics, at offset from selected frequency) ≤-30 dBc in band, ±10 kHz to ±1.5 MHz; ≤-55 dBc, ±1.5 MHz to band end	Verified with a Spectrum Analyzer
Residual FM	Range: 250 kHz to 999.9999 MHz, 300 Hz to 3 kHz bandwidth Accuracy: <100 Hz rms	Measured with Measuring Receiver
Frequency Modulation	Range: 250 kHz to 999.9999 MHz	
Distortion	Range: 10 Hz to 20 kHz, Internal; 2 Hz to 20 kHz, External Accuracy: <1% THD at 1 kHz	Verified with Measuring Receiver and Audio Analyzer
Amplitude Modulation	Range: 250 kHz to 999.9999 MHz	
Distortion	Range: 0 to 60% Depth Accuracy: <10% THD at 1 kHz	Measured with Measuring Receiver and Audio Analyzer
Duplex Generator	Range: 250 kHz to 999.9999 MHz	
Frequency	Range: 0 to ±49.99 MHz from receive frequency Accuracy: Same as Master Oscillator	Verified during Master Oscillator calibration
Output Level	Range: Duplex Port, -60 dBm (FM/AM-1200S through S/N 5030 except those listed below *[2]); Duplex High, -15 dBm (FM/AM-1200S S/N 5031 and on and FM/AM-1200 Super S); Duplex Low, -40 dBm *[3] (FM/AM-1200S S/N 5031 and on and FM/AM-1200 Super S); T/R Port, -80 dBm (FM/AM-1200S through 5030) -85 dBm (FM/AM-1200S S/N 5031 and on, including those listed below *[2], and FM/AM-1200 Super S) Accuracy: ±10 dBm, Duplex High, Duplex Port and T/R Port; ±5 dB, Duplex Low	Measured with Measuring Receiver and Sensor Module

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Function Generator, Fixed (Audio Generator #1)	Range: 0 to 2.5 V rms into 150 Ω, 1 kHz	
Frequency	Range: 1 kHz Accuracy: Same as Master Oscillator	Verified during Master Oscillator calibration
Distortion	Range: 1 kHz at 2.5 V rms Accuracy: <0.5% THD	Measured with an Audio Analyzer
Function Generator, Variable (Audio Generator #2)	Range: 0 to 2.5 V rms into 150 Ω	
Frequency	Range: 10 Hz to 30 kHz Accuracy: ±0.01% of indication	Measured with Electronic Counter
Distortion	Range: 10 Hz to 30 kHz at 2.5 V rms Accuracy: <2% THD	Measured with an Audio Analyzer
Receiver Sensitivity	Range: 250 kHz to 999.9999 MHz Accuracy: (1 to 999.9999 MHz FM narrow) 2 µV (-101 dBm) (Typical for the FM/AM 1200 Super S)	Verified with a Synthesized Signal Generator
Frequency Error Meter (RF)	Range: 250 kHz to 999.9999 MHz, ±30 Hz to ±10 kHz FS Meter Ranges Accuracy: ±Master Oscillator +3% FS	Verified with an Electronic Counter
Frequency Error Meter (AF, Audio Counter)	Range: 10 Hz to 12 kHz, ±3 Hz to ±300 Hz FS Meter Ranges Accuracy: ±0.01% of indication ±3% FS	Compared to known input
Modulation Meter	Range: 250 kHz to 999.9999 MHz	
FM Deviation Meter	Range: 0 to 60 kHz FS Accuracy: ±5% of rdg ±3% FS for a 1 kHz tone	Verified with Synthesized Signal Generator and Measuring Receiver

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Modulation Meter *(Cont.)*	Range: 250 kHz to 999.9999 MHz	Verified with Synthesized Signal Generator and Measuring Receiver
AM % Meter	Range: 0 to 200% FS	
	Accuracy: ±5% of rdg ±3% FS for a 1 kHz tone	
Power Meter	Range: 0 to 15 W and 0 to 150 W *[4]; 50 W continuous, >50 to 150 W (1 minute ON, 5 minutes OFF)	Verified with Coupler Set, Power Amplifier and Power Meter
	Accuracy: ±7% of rdg ±3% FS, 1 to 600 MHz; ±20% of rdg ±3% FS, 600 to 1000 MHz	
Distortion Meter	Range: 0 to 20% at 1 kHz	Verified with two known signals applied to the TI
	Accuracy: ±1% at 10% distortion	
SINAD Meter	Range: 3 to 20 dB at 1 kHz	Verified with two known signals applied to the TI
	Accuracy: ±1 dB at 12 dB SINAD	
Spectrum Analyzer Linearity	Range: -30 to -100 dBm, Dynamic	Verified with Synthesized Level Generator
	Accuracy: ±2 dB, -90 to -30 dBm	
Digital Voltmeter (Option 10) (Standard in FM/AM-1200 Super S)	Range: (AC) 0 to 100 V rms, 45 Hz to 10 kHz	Verified with a Meter Calibrator
	Accuracy: ±10% of indication ±2 counts	
	Range: (DC) 0 to ±100 V	
	Accuracy: ±10% of indication ±2 counts	
Oscilloscope Bandwidth	Range: DC to 1 MHz	Verified with Function Generator
	Accuracy: 3 dB	

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Tracking Generator (Option 12) (FM/AM-1200S S/N 5031 and on, including those listed in Appendix A and FM/AM-1200 Super S Premium Option only)	Range: (Output Level) HIGH, -5 dBm; MED, -15 dBm; LOW, -40 dBm Accuracy: HIGH, +3/-5 dBm; MED, ±7 dBm; LOW, +5/-10 dBm	Verified with a Power Meter and a Power Sensor
	Range: (Flatness) 1 to 999.9999 MHz Accuracy: FM/AM-1200S, ±1 dB over displayed area; FM/AM-1200 Super S, ±1 dB over center 80% of display; ±5 dB over remaining display	Verified with a Spectrum Analyzer

*[1] Typical or Operational specification. Not calibrated.

*[2] See Appendix A for a list of applicable serial numbers (S/N).

*[3] Actual level is -25 dB (±5 dB) below Duplex High at the same frequency.

*[4] TI meter is peak or average responding, the indication is W rms.

2 EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1 FREQUENCY STANDARD	Range: 10 MHz Accuracy: ±6.25 X 10^{-8}	Austron 2100F	As Available
2.2 ELECTRONIC COUNTER	Range: 10 Hz to 100 MHz Accuracy: ±6.5 X 10^{-8}	Hewlett-Packard 5345A	
2.3 FREQUENCY COUNTER	Range: 500 to 999.9999 MHz Accuracy: ±6.3947 X 10^{-8}	Hewlett-Packard 5343A	

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.4	MEASURING RECEIVER	Range: (Power Level) 250 kHz to 999.9999 MHz, -20 dBm Accuracy: ±2.0% of indication Range: (Tuned RF Level) 2.5 to 999.9999 MHz, 0 to -127 dBm Accuracy: ±0.625 dB Range: (AM) 0 to 90% depth Accuracy: ±2.0% of indication Range: (FM) 0.1 to 100 kHz deviation Accuracy: ±2.0% of indication 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; >20 kHz Low-Pass Filter, <1% at rates ≤10 kHz	Hewlett-Packard 8902A	
2.5	SENSOR MODULE	Range: 50 to 999.9999 MHz Accuracy: ±3.5% of charted value, 50 to 100 MHz; ±2.75% of charted value, 100 to 999.9999 MHz	Hewlett-Packard 11792A	
2.6	SPECTRUM ANALYZER	Range: 1 to 999.9999 MHz Accuracy: ±1.5 dB, Scale Fidelity; ±0.6 dB Flatness TAR 1.7:1 (Flatness)	Hewlett-Packard 8566B	

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.7	FUNCTION GENERATOR	Range: (Level) -20.0 to +10.0 dBm, 600 Hz to 2 MHz Accuracy: Level: ±0.25 dB; Flatness: ±0.5 dB; Frequency: ±0.0022% of setting	Hewlett-Packard 3325B	
2.8	AUDIO ANALYZER	Range: (Distortion): 20 Hz to 40 kHz Accuracy: ±1 dB of rdg	Hewlett-Packard 8903B	
2.9	SYNTHESIZED SIGNAL GENERATOR	Range: (CW): 250.0 kHz to 999.9999 MHz, at ≤-101 to +10 dBm Accuracy: Level: ±3 dB, Frequency: ±0.75% of rdg Range: (FM): 0 to 60 kHz deviation at 10 to 950 MHz CW Accuracy: N/A Range: (AM): 0 to 90% at 10 to 950 MHz CW Accuracy: N/A	Hewlett-Packard 8663A Opt 002	
2.10	RESISTOR	Range: 150 Ω Accuracy: ±10% of value	Bench Stock	
2.11	POWER AMPLIFIER	Range: 2 to 100 W, 10 to 400 MHz Accuracy: N/A	Microwave Products SSPA0240-22/6140	
2.12	COUPLER SET	Range: 10 to 400 MHz Accuracy: AFPSL Certified	Premier Microwave 1852A	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.13 POWER METER	Range: 1 to 10 mW Accuracy: ±2.5% of rdg	Hewlett-Packard 432B-H05	
2.14 SYNTHESIZED LEVEL GENERATOR	Range: -80.0 to +10.0 dBm at 400 Hz and 10 MHz Accuracy: ±0.25 dB	Hewlett-Packard 3335A Opt 001	
2.15 POWER DIVIDER	Range: 400 Hz to 950 MHz Accuracy: N/A	Weinschel 1506A	
2.16 ATTENUATOR	Range: 20 dB Accuracy: N/A	Hewlett-Packard 8491A-020	
2.17 METER CALIBRATOR	Range: (AC) 0 to 100 V rms at 45 Hz to 10 kHz Accuracy: ±2.5% of rdg Range: (DC) 0 to 100 V Accuracy: ±2.5% of rdg	Fluke 5700A	
2.18 DIGITAL MULTIMETER	Range: 99 to 101 mV at 400 Hz Accuracy: ±0.25% of rdg	Hewlett-Packard 3458A	
2.19 POWER METER	Range: -50 to -2 dBm Accuracy: ±1.2% of indication	Agilent E4418B	
2.20 POWER SENSOR	Range: 10 MHz to 1 GHz Accuracy: (all of Charted Cal Factor) ±2.0%, 10 to ≤30 MHz; ±2.4%, >30 MHz to 1 GHz	Agilent E4412A	
2.21 RF POWER MEASUREMENT SET *	Range: 10 to 400 MHz, 0 to 100 W Accuracy: ±3.0% of rdg TAR: 3.33:1	Bird 4421A300	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.22 HIGH POWER HIGH FREQUENCY RF AMPLIFIER SYSTEM *	Range: 10 to 400 MHz, 0 to 100 W Accuracy: N/A	PST Corp. BHED1719-1000/4006	
2.23 STEP ATTENUATOR	Range: 0 to 50 dB Accuracy: N/A	Hewlett-Packard 8496B	
2.24 FEEDTHROUGH TERMINATION	Range: 50 Ω Accuracy: N/A	Tektronix 011-0049-01	
2.25 ATTENUATOR	Range: 10 dB Accuracy: N/A	Hewlett-Packard 8491A-010	

* Used during Power Meter alternate procedure only.

3 PRELIMINARY OPERATIONS:

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

WARNING

Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) or turned off, where applicable. Ensure that all equipment switches are set to the proper position before making connections or applying power.

3.2 Connect the Sensor Module, as required, to the Measuring Receiver.

3.3 Connect the Power Sensor, as required, to the Power Meter (2.19).

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

3.5 Connect TI to appropriate power source, set PWR/OFF/BATT to PWR and allow 30 minutes warm-up.

3.6 Perform only those functions that are specific to the TI being calibrated. The TI may have any of the following options:

Option 01	For FM/AM-1200S, 0.5 ppm/year aging TCXO oscillator.
Option 02	For FM/AM-1200S and FM/AM-1200 Super S, 0.25 ppm/year aging OCXO oscillator.

Option 10	For FM/AM-1200S, Digital Voltmeter (this option comes standard in the FM/AM-1200 Super S).
Option 12	For FM/AM-1200S, Tracking Generator
Premium	For FM/AM-1200 Super S only, includes Option 02 as well as the Generate Amplifier and Tracking Generator (Option 12).

3.7 During the Calibration Process, when required to enter a specific frequency, use the keyboard to enter the value. Press the RF key, enter the frequency required in MHz and then press ENTER.

3.8 During the Calibration Process, when a display is required on the TI CRT display, set the VERT POS, INT, FOCUS and HORIZ POS controls to view the display as required.

3.9 For any step requiring the TONE GENERATOR, verify the SINE function is selected using the keyboard ↑ or ↓ key to select the waveform after the Tone Frequency is selected.

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 MASTER OSCILLATOR CALIBRATION:

NOTE

Adjustment of the Master Oscillator is normal due to the Aging Rate of the crystal. This is common to all Quartz Oscillators. However, in order to ensure reliability of the TI, the following action will be taken: If TI passes the following applicable steps, NO ADJUSTMENT ACTION should be entered into the Maintenance Data Collection System. If the TI failed, consult the Commercial Data for 10 MHz Frequency Standard adjustment or repair. Perform the applicable steps listed in Commercial Data and enter appropriate ADJUSTMENT ACTION into the Maintenance Data Collection System.

4.1.1 Connect the Frequency Standard 10 MHz REF OUT to the Electronic Counter EXT FREQ STD (1-10 MHz) input (rear panel).

4.1.2 Connect the TI 10 MHz (rear panel) input/output connector on the rear panel to Electronic Counter CHANNEL A input connector. Set the Electronic Counter Impedance switch to 50 Ω.

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.

4.1.3 Adjust the Electronic Counter controls as required for a stable display indication and then push RESET. The Electronic Counter must indicate within the values listed in the Limits column listed in Table 2 for the TI Option and serial number (S/N) being calibrated.

Table 2.

TI Option	Limits (MHz ± count of LSD)
Standard FM/AM-1200S (S/N ≤5411)	9.999 990 to 10.000 010 ±1
FM/AM-1200S (S/N ≥5412), FM/AM-1200S Option 01 (S/N ≤5411) and Standard FM/AM-1200 Super S	9.999 995 to 10.000 005 ±1
All remaining models (including Option 02)	9.999 997 5 to 10.000 002 5 ±1

4.1.4 Disconnect the test setup.

4.1.5 If TI passed step 4.1.3, continue with para 4.2. If TI failed 4.1.3 the TI Frequency Standard will have to be adjusted according to the applicable steps in the Commercial Data.

4.2 RF SIGNAL GENERATOR:

4.2.1 FREQUENCY CALIBRATION:

4.2.1.1 Set TI controls as follows:

VOLUME	FULLY CCW
SQUELCH	FULLY CCW
FREQ ERROR	RF 10K
MODE	GEN
MODULATION	FM WIDE
METER	6 kHz/% X 10
TONE GENERATOR	
1 kHz Level vernier	fully CCW
1 kHz Select	OFF
VAR Level vernier	fully CCW
VAR Select	OFF
GEN LEVEL Attenuator	-20 dBm
GEN LEVEL FINE vernier	fully CCW
GEN	LOCK

4.2.1.2 Connect the TI T/R connector to Electronic Counter CHANNEL A input connector. Set the Electronic Counter Impedance switch to 50 Ω.

4.2.1.3 Using the TI Keyboard, enter the frequencies listed under the Applied column of the appropriate table.

NOTE

For standard FM/AM-1200S with S/N ≤4490, use Table 3. For standard FM/AM-1200S with S/N ≥4491 to ≤5411, use Table 4. For FM/AM-1200S Option 01 with S/N ≤4490 and standard FM/AM-1200 Super S, use Table 5. For FM/AM-1200S Option 01 with S/N ≥4491 and standard FM/AM-1200S with S/N ≥5412, use Table 6. For FM/AM-1200S Option 02 with S/N ≥4491, use Table 7. For all remaining models (including Option 02), use Table 8.

4.2.1.4 Set the Electronic Counter as required for a stable frequency indication at the required resolution. The Electronic Counter must indicate within the values listed in the Limits column of the appropriate table.

4.2.1.5 Repeat steps 4.2.1.3 and 4.2.1.4 for the remaining values listed in the appropriate table.

Table 3.

Applied (MHz)	Limits (Hz)
000.2500	249 994.75 to 250 005.25
001.0000	999 994 to 1 000 006
010.0000	9 999 985 to 10 000 015
050.0000	49 999 945 to 50 000 055
100.0000	99 999 895 to 100 000 105

Table 4.

Applied (MHz)	Limits (Hz)
000.2500	249 999.75 to 250 000.25
001.0000	999 999 to 1 000 001
010.0000	9 999 990 to 10 000 010
050.0000	49 999 950 to 50 000 050
100.0000	99 999 900 to 100 000 100

Table 5.

Applied (MHz)	Limits (Hz)
000.2500	249 994.875 to 250 005.125
001.0000	999 994.5 to 1 000 005.5
010.0000	9 999 990 to 10 000 010
050.0000	49 999 970 to 50 000 030
100.0000	99 999 945 to 100 000 055

Table 6.

Applied (MHz)	Limits (Hz)
000.2500	249 999.875 to 250 000.125
001.0000	999 999.5 to 1 000 000.5
010.0000	9 999 995 to 10 000 005
050.0000	49 999 975 to 50 000 025
100.0000	99 999 950 to 100 000 050

Table 7.

Applied (MHz)	Limits (Hz)
000.2500	249 999.9375 to 250 000.0625
001.0000	999 999.75 to 1 000 000.25
010.0000	9 999 997.5 to 10 000 002.5
050.0000	49 999 987.5 to 50 000 012.5
100.0000	99 999 975 to 100 000 025

Table 8.

Applied (MHz)	Limits (Hz)
000.2500	249 994.9375 to 250 005.0625
001.0000	999 994.75 to 1 000 005.25
010.0000	9 999 992.5 to 10 000 007.5
050.0000	49 999 982.5 to 50 000 017.5
100.0000	99 999 970 to 100 000 030

4.2.1.6 Set TI GEN LEVEL to minimum and disconnect test setup.

4.2.1.7 Connect the TI T/R connector to the Frequency Counter 500 MHz - 26.5 GHz connector. Set the Frequency Counter input switch to 500 MHz - 26.5 GHz.

4.2.1.8 Set the Frequency Counter resolution to 1 Hz.

4.2.1.9 Set the TI GEN LEVEL to -20 dBm. Using the TI Keyboard, enter the frequencies listed under the Applied column of the appropriate table.

NOTE

For standard FM/AM-1200S with S/N ≤4490, use Table 9. For standard FM/AM-1200S with S/N ≥4491 to ≤5411, use Table 10. For FM/AM-1200S Option 01 with S/N ≤4490 and standard FM/AM-1200 Super S, use Table 11. For FM/AM-1200S Option 01 with S/N ≥4491 and standard FM/AM-1200S with S/N ≥5412, use Table 12. For FM/AM-1200S Option 02 with S/N ≥4491, use Table 13. For all remaining models (including Option 02), use Table 14.

4.2.1.10 Set the Frequency Counter as required for a stable frequency indication at the required resolution. The Frequency Counter must indicate within the values listed in the Limits column of the appropriate table.

4.2.1.11 Repeat steps 4.2.1.9 and 4.2.1.10 for the remaining values listed in the appropriate table.

Table 9.

Applied (MHz)	Limits (Hz)
500.0000	499 999 495 to 500 000 505
950.0000	949 999 045 to 950 000 955

Table 10.

Applied (MHz)	Limits (Hz)
500.0000	499 999 500 to 500 000 500
950.0000	949 999 050 to 950 000 950

Table 11.

Applied (MHz)	Limits (Hz)
500.0000	499 999 745 to 500 000 255
950.0000	949 999 520 to 950 000 480

Table 12.

Applied (MHz)	Limits (Hz)
500.0000	499 999 750 to 500 000 250
950.0000	949 999 525 to 950 000 475

Table 13.

Applied (MHz)	Limits (Hz)
500.0000	499 999 875 to 500 000 125
950.0000	949 999 762 to 950 000 238

Table 14.

Applied (MHz)	Limits (Hz)
500.0000	499 999 870 to 500 000 130
950.0000	949 999 757 to 950 000 243

4.2.1.12 Set TI GEN LEVEL to minimum and disconnect the test setup.

4.2.2 OUTPUT CALIBRATION:

4.2.2.1 Standardize Power Meter (2.19) and Power Sensor. Set the Power Meter (2.19) controls for a dBm measurement. Connect the Power Sensor to the TI T/R connector.

4.2.2.2 Set the TI GEN LEVEL attenuator to -20.0 dBm and adjust the GEN LEVEL FINE vernier CCW until the GEN LEVEL indicates -20.0 dBm.

4.2.2.3 Using the TI Keyboard, enter the first value listed in the Frequency column of Table 15.

4.2.2.4 Set the Power Meter (2.19) CAL FACTOR switch to the appropriate value for the frequency being verified.

4.2.2.5 Verify the Power Meter (2.19) indicates within values listed in the Limits column of Table 15. Record the Power Meter (2.19) indication.

4.2.2.6 Repeat steps 4.2.2.3 through 4.2.2.5 for the remaining corresponding values listed in Table 15.

Table 15.

Applied (MHz)	Limits (dBm)
50.0000	-22.5 to -17.5
500.0000	-22.5 to -17.5
999.9999	-22.5 to -17.5

4.2.2.7 Set the TI RF GEN LEVEL attenuator to minimum and disconnect the Power Meter (2.19) and Power Sensor from the TI RF T/R connector.

4.2.2.8 Connect the TI T/R connector to the Measuring Receiver INPUT 50 Ω.

4.2.2.9 Set the TI GEN LEVEL attenuator to -20.0 dBm and adjust the GEN LEVEL FINE vernier CCW until the GEN LEVEL indicates -20.0 dBm.

4.2.2.10 Using the TI Keyboard, enter 50.0000 MHz.

4.2.2.11 Press the Measuring Receiver INSTR PRESET. Press the Measuring Receiver Gold S key and TUNED RF LEVEL keys. Press the Measuring Receiver Blue Shift and SET REF keys. Verify the Measuring Receiver indicates 0.00 ±0.02 dB.

4.2.2.12 Decrease the TI GEN LEVEL attenuator by 10 dBm and adjust the GEN LEVEL FINE vernier to the first value listed in the Level column of Table 16.

4.2.2.13 Algebraically add the value recorded in step 4.2.2.5 to the Measuring Receiver indication. Verify the results are within the values listed in the Limits column of Table 16.

4.2.2.14 Repeat steps 4.2.2.12 and 4.2.2.13 for the remaining corresponding values listed in Table 16.

Table 16.

Level (dBm)	Limits (dBm)
-30.0	-32.5 to -27.5
-40.0	-42.5 to -37.5
-50.0	-52.5 to -47.5
-60.0	-62.5 to -57.5
-70.0	-72.5 to -67.5
-80.0	-82.5 to -77.5
-90.0	-92.5 to -87.5
-100.0	-102.5 to -97.5
-110.0	-112.5 to -107.5
-120.0	-122.5 to -117.5
-124.0 *	-126.5 to -121.5

* Adjust the TI GEN LEVEL FINE vernier for -124.0 dBm.

4.2.2.15 Repeat steps 4.2.2.9 through 4.2.2.14 for test frequencies of 500.0000 and 999.9999 MHz.

4.2.2.16 Set the TI GEN LEVEL attenuator to -20.0 dBm and GEN LEVEL FINE vernier fully CCW.

4.2.2.17 Using the TI Keyboard, enter 500.0000 MHz.

4.2.2.18 Press the Measuring Receiver INSTR PRESET. Press the Measuring Receiver Gold S key and TUNED RF LEVEL keys. Press the Measuring Receiver Blue Shift and SET REF keys. Verify the Measuring Receiver indicates 0.00 ±0.02 dB.

4.2.2.19 Adjust the TI GEN LEVEL FINE vernier fully CW and verify the Measuring Receiver indicates ≥-11 dB.

4.2.2.20 Set TI GEN LEVEL to minimum and disconnect the test setup.

4.2.3 SPECTRAL PURITY CALIBRATION:

4.2.3.1 Connect the TI T/R connector to the Spectrum Analyzer INPUT 50Ω connector.

4.2.3.2 Set the TI GEN LEVEL attenuator to -20.0 dBm and GEN LEVEL FINE vernier fully CCW.

4.2.3.3 Using the TI Keyboard, enter 0.2500 MHz.

4.2.3.4 Set Spectrum Analyzer as required to display the TI carrier frequency and several harmonics (2nd and 3rd Harmonics only for FM/AM-1200S). Establish a reference level.

4.2.3.5 Verify the harmonics displayed on the Spectrum Analyzer are within the values listed in the Limits column of Table 17.

4.2.3.6 Repeat steps 4.2.3.3 through 4.2.3.5 for the remaining values listed in Table 17.

Table 17.

TI Carrier Applied (MHz)	Signals	Limits (dBc)
0.2500	2nd Harmonic	≤-30 for FM/AM-1200S
	3rd Harmonic	≤-45 for FM/AM-1200S
	All Harmonics	≤-25 for FM/AM-1200 Super S
10.0000	2nd Harmonic	≤-30 for FM/AM-1200S
	3rd Harmonic	≤-45 for FM/AM-1200S
	All Harmonics	≤-25 for FM/AM-1200 Super S
500.0000	2nd Harmonic	≤-30 for FM/AM-1200S
	3rd Harmonic	≤-45 for FM/AM-1200S
	All Harmonics	≤-25 for FM/AM-1200 Super S
999.9999	2nd Harmonic	≤-30 for FM/AM-1200S
	3rd Harmonic	≤-45 for FM/AM-1200S
	All Harmonics	≤-25 for FM/AM-1200 Super S

4.2.3.7 Using the TI keyboard, enter 0.250 MHz.

4.2.3.8 Set Spectrum Analyzer as required to display the TI carrier frequency and all Non-harmonics at ±10 kHz to ±1.5 MHz from the selected TI carrier frequency. Establish a reference level.

4.2.3.9 Verify the Non-harmonics displayed on the Spectrum Analyzer are within the values listed in the Limits column of Table 18.

4.2.3.10 Repeat steps 4.2.3.7 through 4.2.3.9 for the remaining values listed in Table 18.

Table 18.

TI Carrier Applied (MHz)	Signals	Limits (dBc)
0.2500	Non-Harmonics	≤-30
10.0000	Non-Harmonics	≤-30
500.0000	Non-Harmonics	≤-30
999.9999	Non-Harmonics	≤-30

4.2.3.11 Using the TI keyboard, enter 0.250 MHz.

4.2.3.12 Set Spectrum Analyzer as required to display the TI carrier frequency and all Non-harmonics at ±1.5 MHz from the selected TI carrier frequency to band end (0 for negative side and 999.9999 for positive side). Establish a reference level.

4.2.3.13 Verify the Non-harmonics displayed on the Spectrum Analyzer are within the values listed in the Limits column of Table 19.

4.2.3.14 Repeat steps 4.2.3.11 through 4.2.3.13 for the remaining values listed in Table 19.

Table 19.

TI Carrier Applied (MHz)	Signals	Limits (dBc)
0.2500	Non-Harmonics	≤-55
10.0000	Non-Harmonics	≤-55
500.0000	Non-Harmonics	≤-55
999.9999	Non-Harmonics	≤-55

4.2.3.15 Set TI GEN LEVEL to minimum and disconnect the test setup.

4.2.4 RESIDUAL FM CALIBRATION:

4.2.4.1 Connect the TI T/R connector to the Measuring Receiver INPUT 50 Ω connector.

4.2.4.2 Set the TI GEN LEVEL to -20.0 dBm and the FINE vernier fully CCW.

4.2.4.3 On the TI, enter a frequency of 10.0000 MHz.

4.2.4.4 On the Measuring Receiver, press FM key, 300 Hz HP FILTER, 3 kHz LP FILTER, Blue (Shift) key and then RMS (AVG) key.

4.2.4.5 The Measuring Receiver must indicate within the values listed in the Limits column of Table 20.

4.2.4.6 Repeat steps 4.2.4.3 and 4.2.4.5 for the remaining values listed in Table 20. The Measuring Receiver must indicate within the values listed in the Limits column of Table 20.

Table 20.

TI Frequency (MHz)	Limits (Hz)
10.0000	<100
100.0000	<100
500.0000	<100
999.9999	<100

4.2.4.7 Set the TI GEN LEVEL to minimum and disconnect the test setup.

4.2.5 FREQUENCY MODULATION DISTORTION CALIBRATION:

4.2.5.1 Connect Sensor Module input to the TI T/R connector. Connect the Measuring Receiver MODULATION OUTPUT/AUDIO INPUT to the Audio Analyzer INPUT HIGH connector.

4.2.5.2 Set TI controls as follows:

MODE	GEN
MODULATION	FM WIDE
METER	20 kHz/% X 10
TONE GENERATOR	
1 kHz Level vernier	fully CCW
1 kHz Select	INTL
VAR Level vernier	fully CCW
VAR Select	OFF
GEN LEVEL Attenuator	-20 dBm
GEN LEVEL FINE vernier	fully CCW
GEN	LOCK

4.2.5.3 Set the TI frequency to 10.0000 MHz.

4.2.5.4 Set the Measuring Receiver as required to measure FM on the 10 MHz carrier signal. Set 3 kHz LP FILTER to on.

4.2.5.5 Adjust the TI 1 kHz Level vernier for an indication of 10 kHz deviation on the Measuring Receiver.

4.2.5.6 Set the Audio Analyzer as required to measure distortion.

4.2.5.7 The Audio Analyzer must indicate within the values listed in the Limits column of Table 21.

4.2.5.8 Repeat steps 4.2.5.3 through 4.2.5.7 for the remaining frequencies listed in Table 21.

Table 21.

Frequency (MHz)	Limits (%)
10.0000	<1.0
100.0000	<1.0
500.0000	<1.0
950.0000	<1.0

4.2.5.9 Set TI GEN LEVEL to minimum. Do not disconnect the test setup.

4.2.6 AMPLITUDE MODULATION DISTORTION CALIBRATION:

4.2.6.1 Set TI controls as follows:

MODULATION	AM NORM
METER	60 kHz/% X 10
TONE GENERATOR	
1 kHz Level vernier	fully CCW
1 kHz Select	INTL
VAR Level vernier	fully CCW
VAR Select	OFF
GEN LEVEL Attenuator	-20 dBm
GEN LEVEL FINE vernier	fully CCW
GEN	LOCK

4.2.6.2 Set the TI frequency to 10.0000 MHz.

4.2.6.3 Set the Measuring Receiver as required to measure AM on the 10 MHz carrier signal.

4.2.6.4 Adjust the TI 1 kHz Level vernier for an indication of 50% depth on the Measuring Receiver.

4.2.6.5 Set the Audio Analyzer as required to measure distortion.

4.2.6.6 The Audio Analyzer must indicate within the values listed in the Limits column of Table 22.

4.2.6.7 Repeat steps 4.2.6.2 through 4.2.6.6 for the remaining frequencies listed in Table 22.

Table 22.

Frequency (MHz)	Limits (%)
10.0000	<10.0
100.0000	<10.0
500.0000	<10.0
950.0000	<10.0

4.2.6.8 Set TI GEN LEVEL to minimum and disconnect the test setup.

4.3 DUPLEX GENERATOR OUTPUT LEVEL CALIBRATION:

4.3.1 Connect the Synthesized Signal Generator 10 MHz OUTPUT (rear panel) to the TI 10 MHz connector (rear panel).

4.3.2 Connect the Sensor Module to the Synthesized Signal Generator RF OUTPUT.

4.3.3 Set the Synthesized Signal Generator output to 0.0 dBm at 100 MHz.

4.3.4 Set the Measuring Receiver as required to measure RF Power and enter the calibration factor for the Synthesized Signal Generator test frequency.

4.3.5 Set Measuring Receiver for Tuned RF Level by pressing the Gold S key followed by the TUNED RF LEVEL (RF POWER) key.

NOTE

When the Measuring Receiver RECAL light illuminates press the CALIBRATE key and wait for a new reading.

4.3.6 Decrease the Synthesized Signal Generator in 10 dB steps to -100 dBm.

4.3.7 Disconnect the Sensor Module from the Synthesized Signal Generator.

4.3.8 Connect the Sensor Module input to the TI T/R connector.

4.3.9 Set the TI MODE to DUP. Set the TI TONE GENERATOR 1 kHz Select to OFF. Set TI frequency to 100 MHz. Set the TI OFFSET to 0.00 MHz.

4.3.10 The Measuring Receiver must indicate within the limits, for the model being tested, listed in the appropriate Limits column of Table 23. For all models other than FM/AM-1200S through S/N 5030 (except those listed in Appendix A), skip to step 4.3.13.

4.3.11 Disconnect the Sensor Module input from the T/R connector and reconnect it to the TI DUPLEX connector.

4.3.12 The Measuring Receiver must indicate within the limits, for the model being tested, listed in the appropriate Limits column of Table 23.

4.3.13 Disconnect the Sensor Module from the TI.

4.3.14 Repeat steps 4.3.3 through 4.3.13 for the remaining frequencies listed in Table 23.

Table 23.

TI Models	Frequency (MHz)	Limits (dBm) T/R connector	Limits (dBm) DUPLEX connector
FM/AM-1200S *	100.0000	-90.0 to -70.0	-70.0 to -50.0
FM/AM-1200S ** and FM/AM-1200 Super S	100.0000	-95.0 to -75.0	N/A
FM/AM-1200S *	500.0000	-90.0 to -70.0	-70.0 to -50.0
FM/AM-1200S ** and FM/AM-1200 Super S	500.0000	-95.0 to -75.0	N/A
FM/AM-1200S *	950.0000	-90.0 to -70.0	-70.0 to -50.0
FM/AM-1200S ** and FM/AM-1200 Super S	950.0000	-95.0 to -75.0	N/A

* Through S/N 5030, except those listed in Appendix A.

** S/N 5031 and on, including those listed in Appendix A.

4.3.15 For FM/AM-1200S through S/N 5030, except those listed in Appendix A, skip to step 4.3.31.

4.3.16 Connect the Sensor Module input to the Synthesized Signal Generator RF OUTPUT.

4.3.17 Set the Synthesized Signal Generator output to 0.0 dBm at 100 MHz.

4.3.18 Set the Measuring Receiver as required to RF Power and then enter the calibration factor for the Synthesized Signal Generator test frequency.

4.3.19 Set Measuring Receiver for Tuned RF Level by pressing the Gold S key followed by the TUNED RF LEVEL (RF POWER) key.

NOTE

When the Measuring Receiver RECAL light illuminates press the CALIBRATE key and wait for a new reading.

4.3.20 Decrease the Synthesized Signal Generator in 10 dB steps down to -60 dBm.

4.3.21 Disconnect the Sensor Module from the Synthesized Signal Generator.

4.3.22 Connect the Sensor Module input to the TI DUPLEX connector.

4.3.23 Set the TI MODE to DUP. Set TI frequency to 100 MHz.

4.3.24 On the TI, press the 2ND FUNCT key and press 5 (OPT for FM/AM-1200S or TRACK for FM/AM-1200 Super S). Use the ↑ or ↓ key to select HIGH DUPLEX and press ENTER.

4.3.25 The Measuring Receiver must indicate within the values listed in the Limits column of Table 24.

4.3.26 Record the reading on the Measuring Receiver.

4.3.27 Using the ↑ or ↓ key, select the LOW DUPLEX output and press ENTER.

4.3.28 The Measuring Receiver must indicate 20 to 30 dB lower than the value recorded in step 4.3.26.

4.3.29 Disconnect the Sensor Module from the TI DUPLEX connector.

4.3.30 Repeat steps 4.3.16 through 4.3.29 for the remaining frequencies listed in Table 24.

Table 24.

TI DUPLEX	Frequency (MHz)	Limits (dBm)
HIGH	100.0000	-5.0 to -25.0
LOW	100.0000	20 to 30 dB lower
HIGH	500.0000	-5.0 to -25.0
LOW	500.0000	20 to 30 dB lower
HIGH	950.0000	-5.0 to -25.0
LOW	950.0000	20 to 30 dB lower

4.3.31 Disconnect the test setup.

4.4 FUNCTION GENERATOR, FIXED, DISTORTION CALIBRATION:

4.4.1 Connect the Audio Analyzer INPUT HIGH, across 150 Ω Resistor, to the TI TONE OUT connector.

4.4.2 Set the Audio Analyzer as required to measure AC Level.

4.4.3 Set the TI TONE GENERATOR 1 kHz Select to INTL and adjust the 1 kHz Level vernier until the Audio Analyzer indicates about 2.5 V rms.

4.4.4 Set the Audio Analyzer as required to measure distortion.

4.4.5 The Audio Analyzer must indicate <0.5%.

4.4.6 Set TI 1 kHz Level vernier to minimum and disconnect the test setup.

4.5 FUNCTION GENERATOR, VARIABLE CALIBRATION:

4.5.1 FREQUENCY CALIBRATION:

4.5.1.1 Connect the Electronic Counter CHANNEL A to the TI TONE OUT connector.

4.5.1.2 Set the TI TONE GENERATOR 1 kHz Select to OFF and TONE GENERATOR VAR Select to INTL.

4.5.1.3 On the TI, press the keyboard TONE key, enter the first frequency listed in Table 25, in Hz, and press ENTER.

4.5.1.4 Set the TI TONE GENERATOR VAR Level vernier fully CW.

4.5.1.5 Set the Electronic Counter as required to measure frequency at the required resolution.

4.5.1.6 The Electronic Counter must indicate within the values listed in the Limits column of Table 25.

4.5.1.7 Repeat steps 4.5.1.3 through 4.5.1.6 for the remaining frequencies listed in Table 25.

Table 25.

Frequency (Hz)	Limits (Hz)
10	9.999 to 10.001
100	99.99 to 100.01
1000	999.9 to 1000.1
30000	29997 to 30003

4.5.1.8 Set TI TONE GENERATOR VAR Level vernier fully CCW and disconnect the test setup.

4.5.2 DISTORTION CALIBRATION:

4.5.2.1 Connect the Audio Analyzer INPUT HIGH, across the 150 Ω Resistor, to the TI TONE OUT connector.

4.5.2.2 On the TI, press the keyboard TONE key, enter the first frequency listed in Table 26, in Hz, and press ENTER.

4.5.2.3 Set the Audio Analyzer as required to measure AC Level.

4.5.2.4 Set the TI TONE GENERATOR VAR Level vernier until the Audio Analyzer indicates about 2.5 V rms.

4.5.2.5 Set the Audio Analyzer as required to measure distortion.

4.5.2.6 The Audio Analyzer must indicate within the values listed in the Limits column of Table 26.

4.5.2.7 Repeat steps 4.5.2.2 through 4.5.2.6 for the remaining frequencies listed in Table 26.

Table 26.

Frequency (Hz)	Limits (%)
20	<2.0
100	<2.0
1000	<2.0
30000	<2.0

4.5.2.8 Set TI TONE GENERATOR VAR Level vernier fully CCW and disconnect the test setup.

4.6 RECEIVER SENSITIVITY CALIBRATION:

NOTE

The Receiver Sensitivity specification is Typically 2 µV (-101 dBm) for the FM/AM 1200 Super S Model. A limitation statement is not required if the TI Sensitivity is worse than -101 dBm, however, significant degradation usually points to a repair of the IF block.

4.6.1 On the TI, set MODULATION to FM NAR.

4.6.2 On the TI, set the SQUELCH until the TI is just silenced.

4.6.3 Connect the Synthesized Signal Generator RF OUTPUT to the TI ANT connector.

4.6.4 Set the TI and the Synthesized Signal Generator frequency controls, as required, to the first value listed in the Frequency column of Table 27.

4.6.5 Set the Synthesized Signal Generator output until the TI breaks squelch.

4.6.6 The Synthesized Signal Generator must indicate within the values listed in the Limits column of Table 27.

4.6.7 Set the Synthesized Signal Generator output to minimum.

4.6.8 Repeat steps 4.6.4 through 4.6.7 for the remaining values listed in Table 27.

Table 27.

Frequency (MHz)	Limits (dBm)
1.0000	≤-101
500.0000	≤-101
999.9999	≤-101

4.6.9 Disconnect the Synthesized Signal Generator RF OUTPUT from the TI ANT connector.

4.7 FREQUENCY ERROR METER (RF) CALIBRATION:

4.7.1 Connect the Synthesized Signal Generator 10 MHz OUTPUT (rear panel) to the TI 10 MHz connector (rear panel).

4.7.2 Set the TI MODE to REC.

4.7.3 Connect the Synthesized Signal Generator RF OUTPUT to the TI ANT connector.

4.7.4 Set the Synthesized Signal Generator output to -50.0 dBm at 1.000 MHz.

4.7.5 Set the TI FREQ ERROR to RF 30.

4.7.6 Set the TI frequency to 1.0000 MHz.

4.7.7 On the Synthesized Signal Generator, adjust the frequency slowly until the TI FREQ ERROR meter indicates exactly +3.0.

4.7.8 The Synthesized Signal Generator frequency must indicate within the values listed in the Limits column of Table 28.

4.7.9 Repeat steps 4.7.4 through 4.7.8 for the remaining values listed in Table 28.

Table 28.

TI FREQ ERROR	FREQ ERROR Meter Indication	Limits (MHz)
RF 30	+3.0	1.0000291 to 1.0000309
RF 30	-3.0	0.9999691 to 0.9999709
RF 100	+1.0	1.000097 to 1.000103
RF 100	-1.0	0.999897 to 0.999903
RF 300	+3.0	1.000291 to 1.000309
RF 300	-3.0	0.999691 to 0.999709
RF 1 K	+1.0	1.000970 to 1.001030
RF 1 K	-1.0	0.998970 to 0.999030
RF 3 K	+3.0	1.002910 to 1.003090
RF 3 K	-3.0	0.996910 to 0.997090
RF 10 K	+1.0	1.009700 to 1.010300
RF 10 K	-1.0	0.989700 to 0.990300

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

4.8 <u>FREQUENCY ERROR METER (AF, AUDIO COUNTER) CALIBRATION:</u>

4.8.1 Connect equipment as shown in Figure 1.

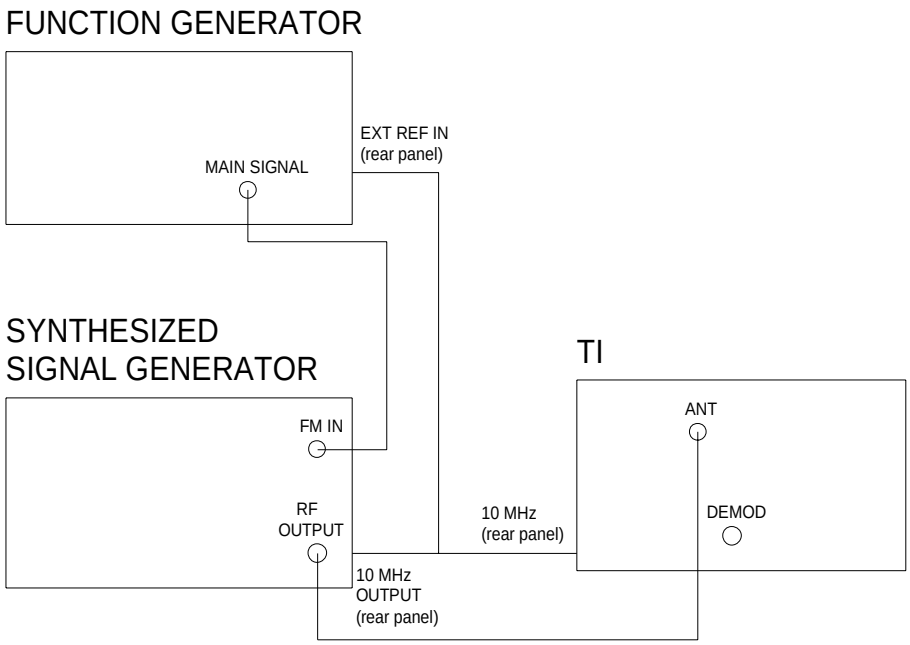

Figure 1.

4.8.2 Set TI controls as follows:

MODULATION	FM WIDE
METER	6 kHz/% X 10
FREQ ERROR	AUDIO 3
MODE	REC
TONE GENERATOR	
1 kHz Level vernier	fully CCW
1 kHz Select	OFF
VAR Level vernier	fully CCW
VAR Select	OFF
GEN LEVEL Attenuator	-20 dBm

GEN LEVEL FINE vernier	fully CCW
GEN	LOCK

4.8.3 Set the Synthesized Signal Generator output to -50.0 dBm at a 10.0000 MHz test frequency. Set the modulation controls as required for external frequency modulation.

4.8.4 Set the TI to 10.0000 MHz. Enter 1 kHz for the TI TONE frequency.

4.8.5 Set the Function Generator output to 1.0000 kHz and adjust the Level as required for a reading of 5 kHz deviation as indicated on the TI MODULATION meter.

4.8.6 Adjust the Function Generator frequency until the TI FREQ ERROR meter indicates exactly +3.0.

4.8.7 The Function Generator must indicate within the values listed in the Limits column of Table 29.

4.8.8 Repeat steps 4.8.3 through 4.8.7 for the remaining values listed in Table 29.

Table 29.

FREQ ERROR	FREQ ERROR meter indication	Limits (kHz)
AUDIO 3	+3.0	1.00291 to 1.00309
AUDIO 3	-3.0	0.99691 to 0.99709
AUDIO 30	+3.0	1.02910 to 1.03090
AUDIO 30	-3.0	0.96910 to 0.97090
AUDIO 300	+3.0	1.29100 to 1.30900
AUDIO 300	-3.0	0.69100 to 0.70900

4.8.9 Set all outputs to minimum and disconnect the test setup.

4.9 MODULATION METER CALIBRATION:

4.9.1 FM DEVIATION METER CALIBRATION:

4.9.1.1 Connect equipment as shown in Figure 2.

4.9.1.2 On the TI, set MODULATION to the first value listed in the Mode column of Table 30 and METER to 2 kHz/% X 10.

4.9.1.3 Set the Synthesized Signal Generator as required for -10.0 dBm at the test frequency of 10.0000 MHz. Set the Synthesized Signal Generator modulation controls as required for an external 1 kHz modulated signal. Set the Step Attenuator to 20 dB.

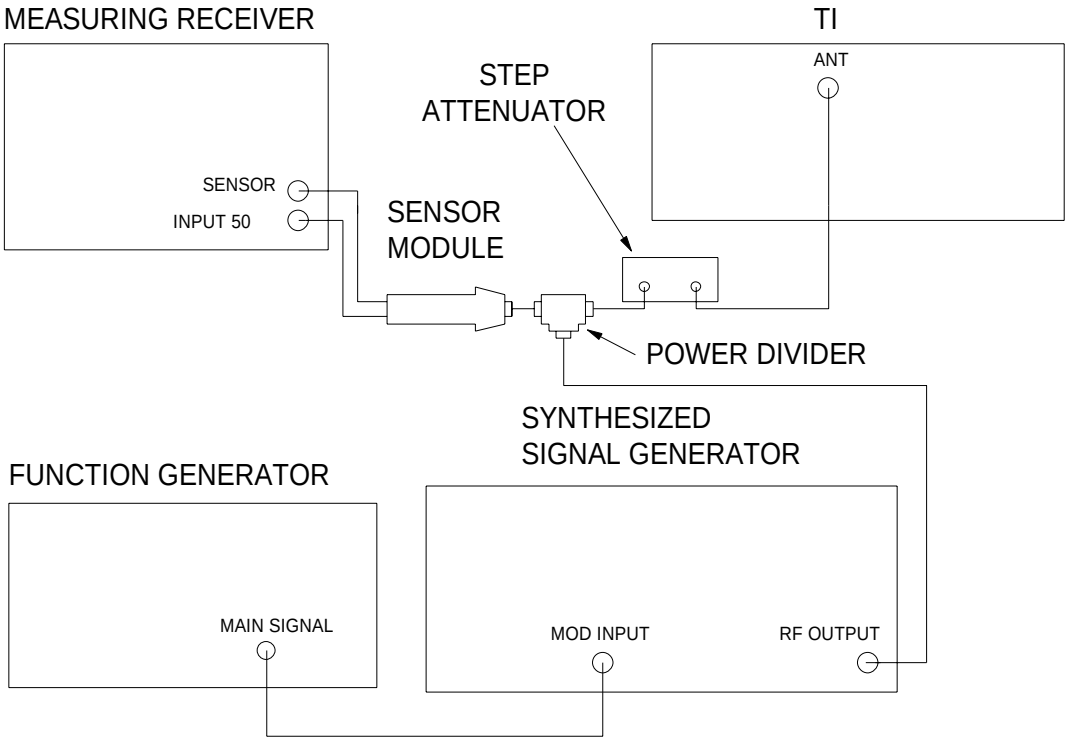

Figure 2.

4.9.1.4 Set the TI frequency to the test frequency.

4.9.1.5 Set the Measuring Receiver as required to measure FM at the test frequency.

4.9.1.6 Set the Function Generator output to 1.0000 kHz and adjust the Level as required for an exact indication of 20 on the TI MODULATION meter.

4.9.1.7 The Measuring Receiver must indicate within the values listed in the Limits column of Table 30.

4.9.1.8 Repeat steps 4.9.1.2 through 4.9.1.7 for the remaining values listed in Table 30.

NOTE

Set the Measuring Receiver HP and LP FILTERS as required.

Table 30.

Test Frequency (MHz)	**Mode**	**TI METER (kHz/% X 10)**	**TI MODULATION meter indication**	**Limits (kHz)**
10.0000	FM NAR	2	20	1.840 to 2.160
10.0000	FM NAR	6	6	5.520 to 6.480

Table 30. (Cont.)

Test Frequency (MHz)	Mode	TI METER (kHz/% X 10)	TI MODULATION meter indication	Limits (kHz)
10.0000	FM NAR	20	5	4.15 to 5.85
10.0000	FM MID	20	10	8.90 to 11.10
10.0000	FM MID	20	15	13.65 to 16.35
10.0000	FM MID	20	20	18.40 to 21.60
10.0000	FM MID	60	60	55.20 to 64.80
500.0000	FM NAR	2	20	1.840 to 2.160
500.0000	FM NAR	6	6	5.520 to 6.480
500.0000	FM MID	20	20	18.40 to 21.60
500.0000	FM MID	60	60	55.20 to 64.80
950.0000	FM NAR	2	20	1.840 to 2.160
950.0000	FM NAR	6	6	5.520 to 6.480
950.0000	FM MID	20	20	18.40 to 21.60
950.0000	FM MID	60	60	55.20 to 64.80

4.9.1.9 Set all outputs to minimum.

4.9.2 AM % METER CALIBRATION:

4.9.2.1 On the TI, set MODULATION to AM NAR and METER to 6 kHz/% X 10.

4.9.2.2 Set the Synthesized Signal Generator as required for 0.0 dBm at the test frequency of 10.0000 MHz. Set the Step Attenuator to 50 dB. Set the Synthesized Signal Generator modulation controls as required for an internal 1 kHz modulated signal.

4.9.2.3 Set the TI frequency to the test frequency listed in the Test Frequency column of Table 31.

4.9.2.4 Set the Measuring Receiver as required to measure AM at the test frequency.

4.9.2.5 Adjust the Synthesized Signal Generator AM depth as required for an exact indication of 1 on the TI MODULATION meter.

4.9.2.6 The Measuring Receiver must indicate within the values listed in the Limits column of Table 31.

4.9.2.7 Repeat steps 4.9.2.1 through 4.9.2.6 for the remaining values listed in Table 31.

Table 31.

Test Frequency (MHz)	TI METER (kHz/% X 10)	TI MODULATION meter indication	Limits (%)
10.0000	6	1	7.70 to 12.30
10.0000	6	2	17.20 to 22.80
10.0000	6	3	26.70 to 33.30
10.0000	6	4	36.20 to 43.80
10.0000	6	5	45.70 to 54.30
10.0000	6	6	55.20 to 64.80
10.0000	20	5	41.50 to 58.50
500.0000	6	6	55.20 to 64.80
500.0000	20	5	41.50 to 58.50
950.0000	6	6	55.20 to 64.80
950.0000	20	5	41.50 to 58.50

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

4.10 POWER METER CALIBRATION:

4.10.1 Connect equipment as shown in Figure 3.

4.10.2 On the TI, set METER to WATTS - AVG 15.

4.10.3 On the Power Meter (2.13), set to 40 dB Coupler and CAL FACTOR/Vernier controls to the appropriate value.

4.10.4 On the RF Power Amplifier, set the Filter Switching Unit BAND SELECT-MHz to 250-400 and POWER ADJUST controls fully CCW.

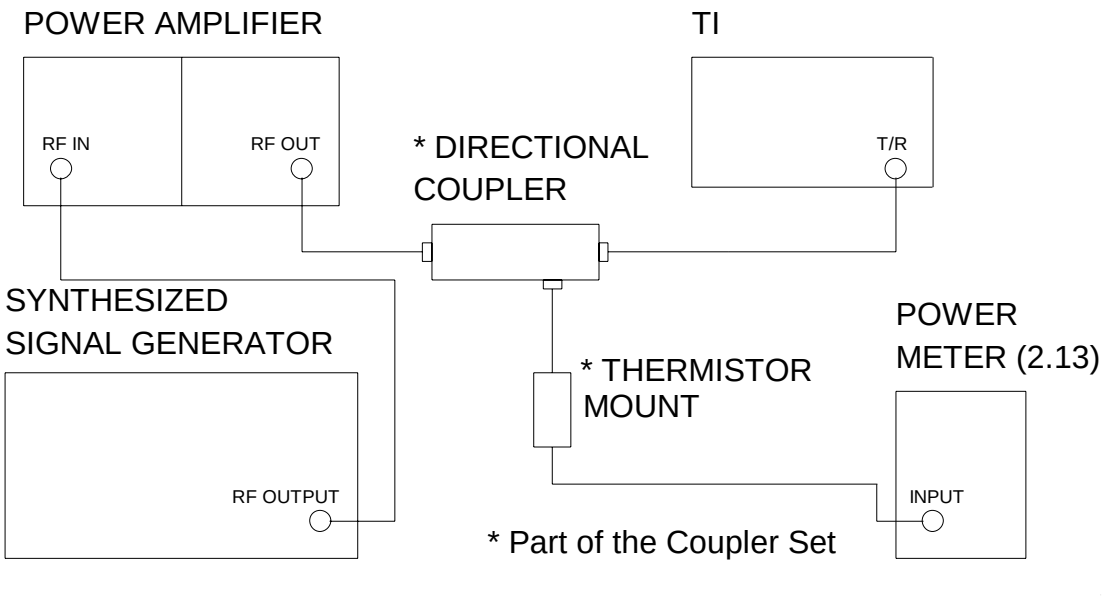

Figure 3.

4.10.5 Set Synthesized Signal Generator for a 0 dBm output at 400 MHz.

4.10.6 On the RF Power Amplifier, set the Filter Switching Unit 100-400 MHz POWER ADJUST controls for an exact indication of 15 on the TI WATTS meter.

4.10.7 The Power Meter (2.13) must indicate within the limits listed in the Limits column of Table 32.

4.10.8 Repeat steps 4.10.2 through 4.10.7 for the remaining values listed in Table 32.

CAUTION

Do not apply >50 W continuous to TI. For testing levels >50 W, apply power for 1 minute and allow 5 minutes between readings. Damage to the TI may occur if >50 W continuous is applied.

NOTE

Set the Filter Switching Unit BAND SELECT-MHz to the appropriate band for the frequency being tested.

Table 32.

TI METER	Test Frequency (MHz)	TI WATTS meter indication	Limits (W)
WATTS - AVG 15	400.0000	15	13.5 to 16.5
WATTS - PK 15	400.0000	15	13.5 to 16.5

Table 32. (Cont.)

TI METER	Test Frequency (MHz)	TI WATTS meter indication	Limits (W)
WATTS - AVG 150	400.0000	50	42.0 to 58.0
WATTS - PK 150	400.0000	50	42.0 to 58.0
WATTS - AVG 150	400.0000	100	88.5 to 111.5
WATTS - AVG 15	100.0000	15	13.5 to 16.5
WATTS - AVG 150	100.0000	100	88.5 to 111.5
WATTS - AVG 15	10.0000	15	13.5 to 16.5
WATTS - AVG 150	10.0000	100	88.5 to 111.5

4.10.9 Set all outputs to minimum and disconnect the test setup.

4.10A <u>POWER METER CALIBRATION:</u> (Alternate Method)

4.10A.1 Connect equipment as shown in Figure 1A.

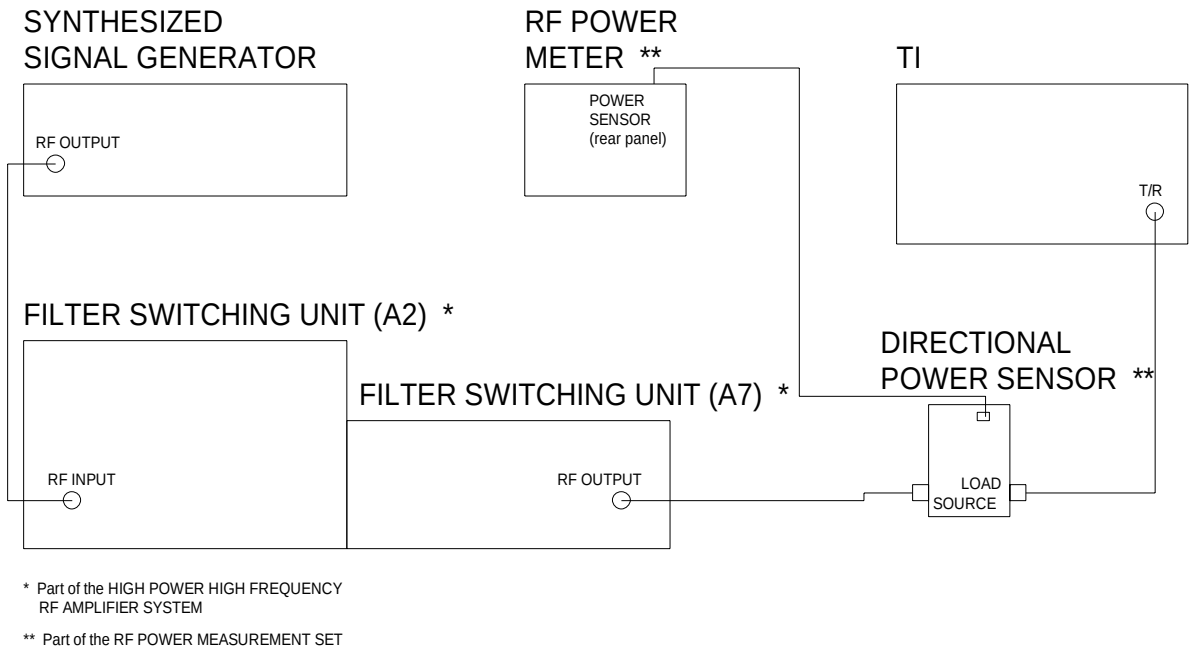

Figure 1A.

NOTE

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

4.10A.2 Set the RF Power Meter, as required, to measure Watts.

4.10A.3 On the Filter Switching Unit (A2), select the Band, as required, for the Test Frequency being tested.

4.10A.4 On the Filter Switching Unit (A2), set the 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.

4.10A.5 On the TI, set METER to WATTS - AVG 15.

4.10A.6 Set the Synthesized Signal Generator, as required, to 0.0 dBm at the first frequency listed in the Frequency column of Table 2A.

4.10A.7 Set the Filter Switching Unit (A2) RF OUTPUT LEVEL CONTROL for a TI WATTS meter indication of the first value listed in the TI WATTS meter indication column of Table 2A.

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 2A. 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.

4.10A.8 The RF Power Meter must indicate within the values listed in the Limits column of Table 2A.

4.10A.9 Set the Filter Switching Unit (A2) RF OUTPUT LEVEL CONTROL fully CCW.

4.10A.10 Repeat steps 4.10A.3 through 4.10A.9 for the remaining values listed in Table 2A. Use the applicable Directional Power Sensor, as required, for the frequency being tested.

Table 2A.

TI METER	Test Frequency (MHz)	TI WATTS meter indication	Limits (W)
WATTS - AVG 15	400.0000	15	13.5 to 16.5
WATTS - PK 15	400.0000	15	13.5 to 16.5
WATTS - AVG 150	400.0000	50	42.0 to 58.0

Table 2A. (Cont.)

TI METER	Test Frequency (MHz)	TI WATTS meter indication	Limits (W)
WATTS - PK 150	400.0000	50	42.0 to 58.0
WATTS - AVG 150	400.0000	100	88.5 to 111.5
WATTS - AVG 15	100.0000	15	13.5 to 16.5
WATTS - AVG 150	100.0000	100	88.5 to 111.5
WATTS - AVG 15	10.0000	15	13.5 to 16.5
WATTS - AVG 150	10.0000	100	88.5 to 111.5

4.10A.11 Set all outputs to minimum or STBY. Disconnect the test setup.

4.11 DISTORTION METER AND SINAD METER CALIBRATION:

4.11.1 Connect equipment as shown in Figure 4.

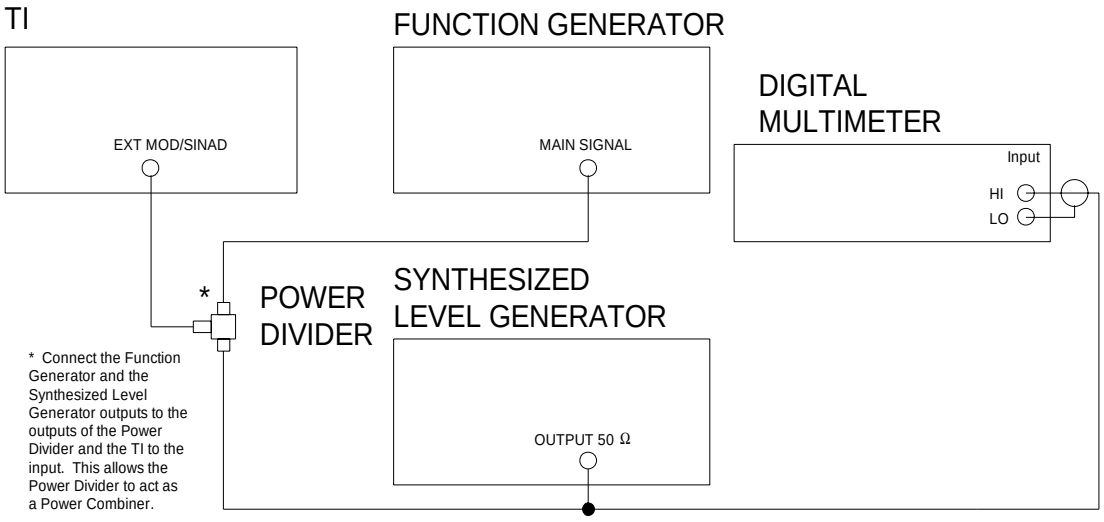

Figure 4.

4.11.2 On the TI, set METER to DIST.

4.11.3 Set the Digital Multimeter as required to measure AC voltage.

4.11.4 With the Synthesized Level Generator temporarily disconnected from the test setup, set the Function Generator to 1 kHz and the output level for a 2 V rms indication on the Digital Multimeter.

4.11.5 With the Function Generator temporarily disconnected from the test setup, set the Synthesized Level Generator to 400 Hz and the output level for a 0.2 V rms indication on the Digital Multimeter.

4.11.6 The TI indication must be within the appropriate limits listed in the Limits column of Table 33.

NOTE

It may be necessary to phase lock the Function Generator and the Synthesized Level Generator. Use the required test equipment as necessary.

4.11.7 On the TI, set METER to SINAD.

4.11.8 With the Function Generator temporarily disconnected from the test setup, set the Synthesized Level Generator for a 0.519 V rms indication on the Digital Multimeter.

4.11.9 The TI must indicate within the appropriate limits listed in the Limits column of Table 33.

Table 33.

TI METER	TI meter indication	Limits
DIST	10	9.0 to 11.0 %
SINAD	12	-13.0 to -11.0 dB

4.11.10 Set all outputs to minimum and disconnect the test setup.

4.12 SPECTRUM ANALYZER LINEARITY CALIBRATION:

4.12.1 Set the TI controls as follows:

FREQ ERROR	RF 10K
MODE	REC
MODULATION	FM WIDE
METER	SIG
TONE GENERATOR	
1 kHz Level vernier	fully CCW
1 kHz Select	OFF
VAR Level vernier	fully CCW
VAR Select	OFF
GEN LEVEL Attenuator	-20 dBm
GEN LEVEL FINE vernier	fully CCW
GEN	LOCK
VERTICAL	RESID/IF

HORIZONTAL	1 kHz/DIV
IF-RESID (AC-GND-DC)	IF (AC)

4.12.2 Adjust the TI VERTICAL position for a reference at the bottom graticule line (-110 dBm) on the CRT display.

4.12.3 Connect the Synthesized Level Generator OUTPUT 50 Ω through Attenuators (2.16 and 2.25) to the TI ANT IN connector.

4.12.4 Set Synthesized Level Generator controls as follows:

FREQUENCY	10 MHz
AMPLITUDE	+10 dBm
FUNCTION	MOD OFF

4.12.5 Adjust the Synthesized Level Generator output until the displayed signal on the TI CRT is on the -30 dB graticule line.

4.12.6 Decrease the Synthesized Level Generator output by -10.00, -20.00, -30.00, -40.00, -50.00 and -60.00 dB.

4.12.7 Ensure signal is displayed on TI CRT at the -40, -50, -60, -70, -80 and -90 dB graticule lines respectively within ±2 dB.

4.12.8 Set the Synthesized Level Generator output to minimum and disconnect the test setup.

4.13 DIGITAL VOLTMETER CALIBRATION:

4.13.1 Connect the Meter Calibrator OUTPUT HI and OUTPUT LO to the TI SCOPE/DVM connector.

4.13.2 On the TI keyboard, press 2ND FUNCT and then press DVM. Using the ↑ or ↓ key, select the DIGITAL VOLTMETER and press ENTER. Use the ± key to toggle to the AC scale.

4.13.3 Set the Meter Calibrator output as required for 10.00 V rms at 45 Hz and set OPR/STBY to OPR.

4.13.4 The TI Digital Voltmeter display must indicate within the values listed in the Limits column of Table 34.

4.13.5 Set the Meter Calibrator OPR/STBY to STBY.

4.13.6 Repeat steps 4.13.3 through 4.13.5 for the remaining values listed in Table 34.

Table 34.

Meter Calibrator Level (V rms)	Frequency (Hz)	Limits (V rms)
10.00	45	8.98 to 11.02
50.00	45	44.8 to 55.2
100.00	45	89.8 to 110.2
10.00	1 k	8.98 to 11.02
50.00	1 k	44.8 to 55.2
100.00	1 k	89.8 to 110.2
10.00	10 k	8.98 to 11.02
50.00	10 k	44.8 to 55.2
100.00	10 k	89.8 to 110.2

4.13.7 On the TI keyboard, use ± to toggle to the DC scale.

4.13.8 Set the Meter Calibrator output to +10.00 V DC and set OPR/STBY to OPR.

4.13.9 The TI Digital Voltmeter display must indicate within the values listed in the Limits column of Table 35.

4.13.10 Set the Meter Calibrator OPR/STBY to STBY.

4.13.11 Repeat steps 4.13.8 through 4.13.10 for the remaining values listed in Table 35.

Table 35.

Meter Calibrator Level (V DC)	Limits (VDC)
+10.00	8.98 to 11.02
-10.00	-11.02 to -8.98
+50.00	44.8 to 55.2
-50.00	-55.2 to -44.8
+100.00	89.8 to 110.2
-100.00	-110.2 to -89.8

4.13.12 Disconnect the test setup.

4.14 OSCILLOSCOPE BANDWIDTH CALIBRATION:

4.14.1 Connect the Function Generator through the Feedthrough Termination to the TI SCOPE/DVM connector.

4.14.2 Set the TI controls as follows:

FREQ ERROR	RF 10K
MODE	REC
MODULATION	FM WIDE
METER	SIG
TONE GENERATOR	
1 kHz Level vernier	fully CCW
1 kHz Select	OFF
VAR Level vernier	fully CCW
VAR Select	OFF
GEN LEVEL Attenuator	-20 dBm
GEN LEVEL FINE vernier	fully CCW
GEN	LOCK
VERTICAL	1 V/DIV
HORIZONTAL	As Required
AC - GND - DC (IF - RESID)	AC (IF)

4.14.3 Set the Function Generator output frequency to 10 kHz. Adjust the output level for six divisions of vertical deflection on the TI CRT display.

NOTE

Set the TI HORIZONTAL control as required to best view the six divisions of vertical deflection.

4.14.4 On the Function Generator, increase the frequency until the TI CRT display indicates 4.2 divisions of vertical deflection.

4.14.5 The Function Generator frequency must indicate ≥1 MHz.

4.14.6 Set the Function Generator output to minimum and disconnect the test setup.

4.15 TRACKING GENERATOR CALIBRATION:

4.15.1 OUTPUT LEVEL CALIBRATION:

4.15.1.1 Set TI MODE to DUP.

4.15.1.2 On the TI, press 2ND FUNCT, then 5 (OPT for FM/AM-1200S, TRACK for FM/AM-1200 Super S). Using the ↑ or ↓ key, select the TRACK HIGH function, select ON and press ENTER. Set TI Span/Div to 1 kHz.

4.15.1.3 Connect the TI DUPLEX connector to the Spectrum Analyzer input.

4.15.1.4 Set the Spectrum Analyzer controls as required to view the first frequency value listed in the Frequency column of Table 36. Set the Spectrum Analyzer controls to place the fundamental signal at a convenient reference. Note the graticule line established as the reference.

4.15.1.5 Disconnect the TI DUPLEX from the Spectrum Analyzer.

4.15.1.6 Using the same cable as in step 4.15.1.3, connect the Synthesized Signal Generator to the Spectrum Analyzer input.

4.15.1.7 Set the Synthesized Signal Generator frequency to the first value listed in the Frequency column of Table 36. Set the Synthesized Signal Generator amplitude to the graticule line noted in step 4.15.1.4.

4.15.1.8 Disconnect the Synthesized Signal Generator from the Spectrum Analyzer.

4.15.1.9 Standardize Power Meter (2.19) and Power Sensor. Set the Power Meter (2.19) controls for a dBm measurement. Connect the Power Sensor directly to the Synthesized Signal Generator output.

4.15.1.10 Set the Power Meter (2.19) CAL FACTOR switch to the appropriate value for the frequency being verified.

4.15.1.11 The Power Meter must indicate within the values listed in the Limits column of Table 36.

4.15.1.12 Disconnect the Power Sensor from the Synthesized Signal Generator output.

4.15.1.13 Repeat steps 4.15.1.3 through 4.15.1.12 for the remaining corresponding values listed in Table 36 for TI TRACK HIGH function.

4.15.1.14 On the TI, press 2ND FUNCT, then 5 (OPT for FM/AM-1200S, TRACK for FM/AM-1200 Super S). Using the ↑ or ↓ key, select the TRACK MED function, select OFF and press ENTER. Set TI SPAN to 1 kHz.

4.15.1.15 Repeat steps 4.15.1.3 through 4.15.1.12 for the remaining corresponding values listed in Table 36 for TI TRACK MED function.

4.15.1.16 On the TI, press 2ND FUNCT, then 5 (OPT for FM/AM-1200S, TRACK for FM/AM-1200 Super S). Using the ↑ or ↓ key, select the TRACK LOW function, select OFF and press ENTER. Set TI SPAN to 1 kHz.

4.15.1.17 Repeat steps 4.15.1.3 through 4.15.1.12 for the remaining corresponding values listed in Table 36 for TI TRACK LOW function.

Table 36.

TI Function	Frequency (MHz)	Limits (dBm)
TRACK HIGH	10.0000	-10 to -2
TRACK HIGH	100.0000	-10 to -2
TRACK HIGH	500.0000	-10 to -2
TRACK HIGH	999.9999	-10 to -2
TRACK MED	10.0000	-22 to -8
TRACK MED	100.0000	-22 to -8
TRACK MED	500.0000	-22 to -8
TRACK MED	999.9999	-22 to -8
TRACK LOW	10.0000	-50 to -35
TRACK LOW	100.0000	-50 to -35
TRACK LOW	500.0000	-50 to -35
TRACK LOW	999.9999	-50 to -35

4.15.1.18 Set all outputs to minimum and disconnect the test setup.

4.15.2 FLATNESS CALIBRATION:

4.15.2.1 Connect the TI DUPLEX connector through the Attenuator to the Spectrum Analyzer.

4.15.2.2 On the TI, press 2ND FUNCT, then 5 (OPT for FM/AM-1200S, TRACK for FM/AM-1200 Super S). Using the ↑ or ↓ key, select the TRACK HIGH function, select ON and press ENTER. Set TI Span/Div to 1 MHz.

4.15.2.3 Set the Spectrum Analyzer controls as required to view the swept output from the TI.

4.15.2.4 Using the Spectrum Analyzer, measure the difference between the minimum and maximum output from the TI. Set the Spectrum Analyzer controls as required to 1 dB per division.

4.15.2.5 The difference between the minimum and maximum output levels observed on the Spectrum Analyzer must be ≤2 dB.

NOTE

Because of the TI CRT degradation, when the TIs own Spectrum Analyzer is utilized with the Tracking Generator, the specification of ±1 dB Flatness is valid for the center 80% of the display only. The remaining 20% is specified at ±5 dB Flatness.

4.15.2.6 On the TI, press 2ND FUNCT, then 5 (OPT for FM/AM-1200S, TRACK for FM/AM-1200 Super S). Using the ↑ or ↓ key, select the TRACK HIGH function, select OFF and press ENTER.

4.15.2.7 Set all POWER switches to OFF or STANDBY. Disconnect and secure all test equipment.

CALIBRATION PERFORMANCE TABLE

Not Required

APPENDIX A

Installation of the Tracking Generator (Option 12) is applicable to FM/AM-1200S with serial numbers (S/N) 5031 and higher and for those with the following S/N:

4761	4765	4766	4768	4772	4774	4778	4781	4782	4798	4800	4827
4842	4850	4854	4896	4897	4898	4899	4900	4902	4903	4908	4911
4912	4913	4921	4922	4926	4936	4937	4941	4943	4944	4959	4960
4971	4997	4998	5005	5006	5014	5018	5019	5028			