TECHNICAL MANUAL

INSTRUMENT CALIBRATION PROCEDURE

AUTOMATIC MODULATION METER

WAYNE KERR
AMM20002Q

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LIST OF EFFECTIVE PAGES

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SECTION 1

INTRODUCTION AND DESCRIPTION

1.1 This procedure describes the calibration of the Wayne Kerr AMM20002Q Automatic Modulation Meter. The instrument being calibrated is referred to herein as the TI (Test Instrument).

1.2 All comments concerning this procedure should be directed to the Measurement Science Department, Corona Division, Naval Surface Warfare Center, P.O. Box 5000, Corona, CA 92878-5000.

1.3 This procedure includes tests of essential performance parameters only. Any malfunction noticed during calibration, whether specifically tested for or not, should be corrected.

Table 1. Calibration Description

TI Characteristics	Performance Specifications	Test Method
Amplitude Modulation (AM)		
AM Modulation	Range: 0 to 99% Tolerance: ±(1% iv + 0.01% AM)[(1)], 1 kHz rate up to 95% depth and carriers from 150 kHz to 500 MHz; ±(2.5% iv + 0.01% AM)[(1)], 30 Hz to 10 kHz rates up to 50% depth and carriers from 150 kHz to 6 MHz; ±(2.5% iv + 0.01% AM)[(1)], 30 Hz to 50 kHz rates up to 50% depth and carriers from 6 MHz to 2.4 GHz	Tested by using a signal generator with internal AM modulation and comparing the TI AM measurements with the AM measurements of a measuring receiver.
AM Distortion	≤0.3%, 1 kHz rate up to 80% depth, 50 Hz to 15 kHz bandwidth, and carriers from 150 kHz to 500 MHz ≤0.6%, 30 Hz to 10 kHz rates up to 95% depth, 10 Hz to 15 kHz bandwidth, and carriers from 150 kHz to 6 MHz; ≤0.6%, 30 Hz to 50 kHz rates up to 95% depth, 10 Hz to 75 kHz bandwidth, and carriers from 6 MHz to 2.4 GHz	Not tested.
Residual AM	≤0.03% rms in CCITT P53A bandwidth, carrier level >-10 dBm	Tested by apply a signal with no modulation from a signal generator and verifying the resulting TI residual AM.
FM Rejection	≤0.75% AM in CCITT P53A bandwidth with 30 kHz FM deviation and carriers from 6 MHz to 500 MHz	Tested by applying a FM modulation signal from a signal generator and verifying the resulting AM measurement performed by the TI.

[(1)]Derated to a tolerance of ±(3% iv + 0.01% AM) due to test equipment accuracy limitations, resulting in a TAR of approximately 3:1.

TI Characteristics	Performance Specifications	Test Method
Frequency Modulation (FM)		
FM Deviation	Range: 0 to ±500 kHz peak, carriers from 6 MHz to 2.4 GHz; 0 to ±50 kHz peak, carriers from 150 kHz to 6 MHz Tolerance: ±(1% iv +1 Hz)[(2)], 1 kHz rate and carriers from 6 MHz to 2.4 GHz; ±(3% iv + 1 Hz), 30 Hz to 200 kHz rates and carriers from 6 MHz to 2.4 GHz Rates: DC/10 Hz to 300 kHz, carriers from 6 MHz to 2.4 GHz; DC/10 Hz to 15 kHz, carriers from 150 kHz to 6 MHz	Tested by using a signal generator with internal FM modulation and comparing the TI FM measurements with the FM measurements of a measuring receiver.
FM Distortion	≤0.1% for deviations up to 100 kHz, rates up to 15 kHz, 50 Hz to 75 kHz bandwidth, and carriers from 6 MHz to 2.4 GHz	Not tested.
Residual FM	≤15 Hz rms in CCITT P53A bandwidth at 1 GHz carrier, increasing 6 dB/octave increase in carrier and reducing 6 dB/octave reduction in carrier, to noise floor <3 Hz rms, carrier level >-10 dBm	Tested by apply a signal with no modulation from a signal generator and verifying the resulting TI residual FM.
AM Rejection	≤40 Hz peak deviation in CCITT P53A bandwidth for 50% AM at 1 kHz rate	Tested by applying an AM modulation signal from a signal generator and verifying the resulting FM measurement performed by the TI.
Phase Modulation (PM)		
PM Deviation	Range: 0 to ±50 radians peak, carriers from 6 MHz to 2.4 GHz Tolerance: ±(1% iv + 0.01 rad)[(3)], 1 kHz rate and carriers from 6 MHz to 2.4 GHz; ±(3% iv + 0.01 rad)[(3)], 300 Hz to 4 kHz rates and carriers from 6 MHz to 2.4 GHz Rates: 50 Hz to 15 kHz, carriers from 6 MHz to 2.4 GHz	Tested by using a signal generator with internal PM modulation and comparing the TI PM measurements with the PM measurements of a measuring receiver.
Residual PM	≤0.02 rad rms in CCITT P53A bandwidth at 1 GHz carrier	Tested by apply a signal with no modulation from a signal generator and verifying the resulting TI residual PM.

[(2)]Derated to a tolerance of ±(3% iv + 1 Hz) due to test equipment accuracy limitations, resulting in a TAR of approximately 3:1.

[(3)]Derated to a tolerance of ±(6% iv + 0.01 rad) due to test equipment accuracy limitations, resulting in a TAR of approximately 2:1.

TI Characteristics	Performance Specifications	Test Method
Carrier Measurements		
Carrier frequency	Range: 150 kHz to 2.4 GHz Tolerance: ±(1 ppm + 0.18 ppm/month + 1 count), standard	Tested by applying signals of known frequency using a signal generator.
	Sensitivity: Automatic Mode: 14 mV rms (-24 dBm), 250 kHz to 1 GHz 44 mV rms (-14 dBm), 1 to 2 GHz 142 mV rms (-4 dBm), 2 to 2.4 GHz Manual Mode: 7 mV rms (-30 dBm), 150 kHz to 1 GHz 22 mV rms (-14 dBm), 1 to 2 GHz 71 mV rms (-4 dBm), 2 to 2.4 GHz	Tested by setting known power levels from a signal generator with a measuring receiver and verifying the TI can measure the signal.
Carrier level measurement	Range: -6 to +30 dBm (uses external 10 dB attenuator, part of TI, for levels between +20 and +30 dBm) Tolerance: ±3 dB, carriers from 150 kHz to 1.8 GHz, carriers levels from +10 to +30 dBm	Tested by applying signals from a signal generator/RF amplifier combination and comparing the TI power level measurements with those made by a measuring receiver.
Audio Frequency (AF) Counter		
AF Measurement	Range: 30 Hz to 300 kHz Tolerance: Standard timebase: ±(1 ppm + 0.18 ppm/month + 1 count)	Tested by applying signals with known frequency using a function generator to the TI and verifying the resulting TI AF frequency indications.
AF Voltmeter		
AF Voltmeter measurement	Range: 10 mV rms to 10 V rms Tolerance: ±1 dB (-10.9%, +12.2%) at 1 kHz rate in 50 Hz to 15 kHz bandwidth; ±3 dB (-29.2%, +41.2%), 50 Hz to 100 kHz rate in 10 Hz to 300 kHz bandwidth	Tested by applying signals with known amplitude using a function generator to the TI and verifying the resulting TI AF voltage indications.
AF Distortion/Filters		
AF Distortion	Frequency range: 100 Hz to 10 kHz Tolerance: ±1 dB iv, 300 Hz to 3 kHz fundamental in 50 Hz to 75 kHz bandwidth	Tested by intentionally distorting the internal modulation signal of a signal generator with a function generator and comparing the TI distortion measurements with that of a measuring receiver.
Attenuator		
10 dB Attenuator (P/N TR5010N)[(4)]	Frequency range: 150 kHz to 2400 MHz Attenuation: 10 dB Tolerance: combined with TI to provide ±3 dB power level measurements from +20 to +30 dBm	Tested by inference during carrier level measurements.

[(4)]The TI 10 dB attenuator must be submitted with the TI for the carrier power level measurements of +20 to +30 dBm to be performed.

SECTION 2

EQUIPMENT REQUIREMENTS

NOTES

Minimum use specifications are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment, which may be used at the discretion of the using laboratory. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

The instruments utilized in this procedure were selected from those known to be available at Navy calibration facilities and the listing by make or model number carries no implication of preference, recommendation, or approval for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in this procedure.

Table 2. Equipment Requirements

Item	Minimum Use Specifications	Calibration Equipment
2.1 Signal generator calibrator		Hewlett-Packard 8902AOPTE02
Required Components:		
2.1.1 Measuring receiver	Frequency range: 10 MHz to 1 GHz RF Power range: +25 to -25 dBm (+10 to -25 dBm, using item 2.1.2 sensor module; +10 to +25 dBm, using item 2.6 high-power sensor) Uncertainty: ±0.35 dB AM Depth range: 5% to 95% Uncertainty: ±1% iv FM Deviation range: 2 to 200 kHz Uncertainty: ±1% iv Phase Modulation range: 2 to 15 rads Uncertainty: ±3% iv Distortion range: 10% to 20% (1 kHz fund.) Uncertainty: ±1 dB Filters: 50 and 300 Hz high-pass; 3 kHz, 15 kHz, and >20 kHz low-pass	Hewlett-Packard 8902AOPT002
2.1.2 Sensor module	Frequency range: 10 MHz to 1 GHz RF Power range: +10 to -25 dBm Uncertainty: (see item 2.1.1)	Hewlett-Packard 11722A
2.2 Signal generator	Frequency range: 250 kHz to 2 GHz Uncertainty: ±0.75 ppm Output level: -40 to +15 dBm Uncertainty: NA AM Depth range: 10% to 95% Uncertainty: NA FM Deviation range: 2 to 200 kHz Uncertainty: NA Phase modulation range: 2 to 15 rad Uncertainty: NA Modulation rate range: 400 Hz to 20 kHz Uncertainty: ±0.01%	Hewlett-Packard 8648BOPT1EA, 1E2, 1E5, 1E6,H31

Item	Minimum Use Specifications	Calibration Equipment
2.3 Power divider	Frequency range: 250 kHz to 2 GHz Insertion loss: 6 dB nominal Tracking: within ±0.4 dB Power rating: 1 W min.	Weinschel 1506A
2.4 10 dB attenuator	Frequency range: 10 MHz to 1 GHz Attenuation: 10 dB nominal	Weinschel 2-10
2.5 Function generator	Frequency range: 30 Hz to 300 kHz Uncertainty: ±0.001% Output level range: 50 mV rms to 5 V rms Uncertainty: ±3%	Hewlett-Packard 33120AOPT001
2.6 High-power sensor	Frequency range: 10 to 1000 MHz RF Power range: +10 to +25 dBm Uncertainty: (see item 2.1.1) Compatible with item 2.1.1	Hewlett-Packard 8481B
2.7 RF Amplifier	Frequency range: 1 to 1000 MHz Gain: 20 dB min. Power rating: 1 W min. (+30 dBm min.)	ENI 603LN
2.8 Tee	Type: BNC (f-m-f)	Local supply
2.9 Cables, adapters, etc.	As required	Local supply

SECTION 3

PRELIMINARY OPERATIONS

3.1 Ensure that all power switches are set to off, and set all auxiliary equipment controls as necessary to avoid damage to the equipment and so that dangerous voltages will not be present on output terminals when the power switches are turned on.

3.2 Connect the auxiliary equipment and the TI to the appropriate power source.

3.3 Turn all power switches on and allow sufficient warm-up time for the equipment (the TI requires 30 minutes warm-up time).

3.3.1 During the TI turn on period, ensure that the TI indicates the software version, the self tests passing, the initialization of the TI, self calibration of the TI, and that the TI ends up in a searching mode. If other messages are displayed relating to error conditions, first try cycling the power and if the other messages are still displayed take the appropriate maintenance action.

3.4 Signal Generator Calibrator/Sensor Module Zeroing and Power/AM/FM Reference Calibration

3.4.1 Ensure that the signal generator calibrator system is interconnected, as appropriate.

3.4.2 Activate the measuring receiver INSTR PRESET function (Blue Shift key and Green AUTOMATIC OPERATION key).

3.4.3 Set the measuring receiver for RF POWER measurements.

3.4.4 If the sensor module calibration factor data is not stored in the default Table 1, enable the measuring receiver calibration factor internal Table 2 by entering 27.1 SPCL (activates frequency offset mode, “f OFS” displayed). (See the following note.)

NOTE

Normally, the calibration factor data for the Hewlett-Packard 11722A sensor module is stored in the measuring receiver's internal Table 1. Similarly, the calibration factor data for the Hewlett-Packard 11792A sensor module is usually stored in the measuring receiver's internal Table 2. The calibration factor data stored in the two tables in the measuring receiver must match the sensor module(s) that will be connected to the measuring receiver. If the calibration factor data stored in the measuring receiver tables needs to be checked, refer to the applicable support documentation or manual for the measuring receiver.

3.4.5 Connect the sensor module to the measuring receiver RF POWER - OUTPUT connector.

3.4.6 Press the measuring receiver ZERO key and after the measuring receiver momentarily displays 0.000 W, followed by a small measurement value, press the CALIBRATE key (to turn on the 1 mW reference).

3.4.7 Select the measuring receiver SAVE CAL function (Blue Shift key and CALIBRATE key), and then press the CALIBRATE key (to turn off the 1 mW reference). The sensor module is now zeroed and power reference calibrated.

3.4.8 Disconnect the sensor module from the measuring receiver RF POWER - OUTPUT connector.

3.4.9 Connect the sensor module to the measuring receiver AM/FM - OUTPUT connector.

3.4.10 Set the measuring receiver for AM modulation measurements.

3.4.11 Press the measuring receiver CALIBRATE key (to turn on the AM reference).

3.4.12 After approximately 20 seconds, the measuring receiver will indicate the AM calibration factor (in %), and thereafter every 15 seconds (approximately) the indication will update (noted by momentary flash of display). Wait until at least the third indication to appear, and then select the SAVE CAL function (Blue Shift key and CALIBRATE key).

3.4.13 Set the measuring receiver for FM modulation measurements.

3.4.14 Press the measuring receiver CALIBRATE key (to turn on the FM reference).

3.4.15 If the sensor module is a Hewlett-Packard 11792A series, enter 1.8 SPCL on the measuring receiver.

3.4.16 After approximately 20 seconds, the measuring receiver will indicate the FM calibration factor (in %), and thereafter every 15 seconds (approximately) the indication will update (noted by flash of display momentarily). Wait until at least the third indication to appear, and then select the SAVE CAL function (Blue Shift key and CALIBRATE key).

3.4.17 Press the measuring receiver CALIBRATE key (to turn off the FM reference).

3.4.18 Disconnect the sensor module from the measuring receiver AM/FM - OUTPUT connector.

SECTION 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 MODULATION TESTS

4.1.1 AM Modulation Tests

4.1.1.1 Connect the equipment as shown in Figure 1. (The TI 10 dB attenuator is normally located behind an access panel on the back right of the TI.)

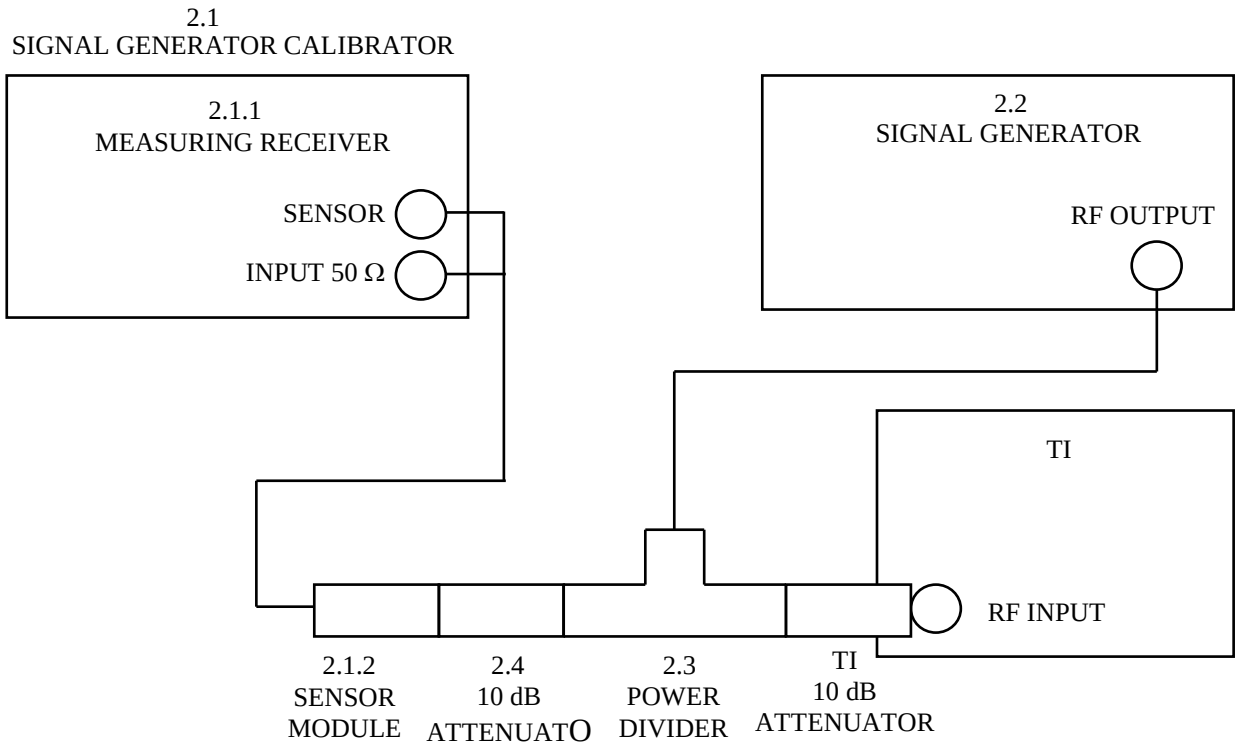

Figure 1. Modulation Test Configuration

4.1.1.2 Preset the signal generator by pressing and holding the ← (backspace) key (in DATA section), and then cycling the signal generator power.

4.1.1.3 Set the signal generator control as follows:

FREQUENCY	10 MHz
AMPLITUDE	0 dBm
FUNCTION - AM	press until “AM xx.x%” is displayed
MODULATION SOURCE - INT 1 kHz	press until “x.xxkHz SIN” is displayed
MODULATION frequency	0.40 kHz
MODULATION SOURCE - MOD ON/OFF	press until “OFF” is not displayed
RF OUTPUT - RF ON/OFF	press until “RF OFF” is not displayed

4.1.1.4 Activate the measuring receiver INSTR PRESET function (Blue Shift key and Green AUTOMATIC OPERATION key).

4.1.1.5 Set the measuring receiver as follows:

MEASUREMENT	AM
DETECTOR	PEAK ±/2 (PEAK+ & PEAK- illuminated)
HP FILTER	50 Hz
LP FILTER	3 kHz

4.1.1.6 Reset the TI by entering #99 (#, 9, and 9 keys).

4.1.1.7 Set the TI for averaging with 32 samples by entering 5 #66 (5, #, 6, and 6 keys).

4.1.1.8 Set the TI controls as follows:

HIGH-PASS FILTER	50 Hz
LOW-PASS FILTER	3 kHz

4.1.1.9 Perform the internal self-alignment of the TI AM demodulator using the internally stored cal factors by entering #07 (#, 0, and 7 keys). (The TI AM/FM/PM self-alignment operation takes approximately 25 seconds.)

NOTE

For the TI AM Depth measurements to be optimized, the TI should be periodically self-aligned to the internal cal factors using the #07 key, sequence.

4.1.1.10 Using the data from the following table, perform the tests of the TI AM depth measurement capability as follows:

4.1.1.10.1 Set the signal generator frequency (RF) to a RF Test Frequency value indicated in the following table. (Use the signal generator FREQUENCY control knob or press the FUNCTION-FREQUENCY key and then enter the value using the DATA keys.)

4.1.1.10.2 Using the DATA entry keys on the measuring receiver, enter the current RF Test Frequency.

4.1.1.10.3 Set the TI and measuring receiver low-pass (LP) and high-pass (HP) filters to each of the values indicated in the following table corresponding to the current RF test frequency.

4.1.1.10.4 Set the signal generator modulation rate to the applicable table setting corresponding to the current RF Test Frequency and Filter settings. (Press the signal generator INT 1 kHz key until “x.xxkHz SIN” is displayed and then use the DATA keys to enter the applicable modulation rate.)

4.1.1.10.5 Press the signal generator AM key (if necessary, to activate the AM data entry mode), and adjust the signal generator AM depth value to obtain the desired AM modulation depth setting on the TI indicated in the following table (within ±0.1% AM).

4.1.1.10.6 Verify that the measuring receiver AM modulation indication is within the AM tolerance limits listed. (Allow several seconds for the TI and measuring receiver indications to settle.)

NOTE

If any AM measurement values are out-of-tolerance, first repeat the TI AM/FM self-alignment using the #07 key sequence and repeat the verification.

4.1.1.10.7 Repeat steps 4.1.1.10.1 through 4.1.1.10.6 for each remaining group of settings listed in the following table.

RF Test Frequency (MHz)	High-Pass Filter Setting (Hz)	Low-Pass Filter Setting (kHz)	Modulation Rate Setting (kHz)	TI AM Modulation Depth Setting (%)	AM Tolerance Limits (% AM)
10.0	50	3	0.40	10.00	within ±0.31
1000.0	”	”	”	10.00	within ±0.31
1000.0	”	”	”	50.00	within ±1.51
10.0	”	”	”	50.00	within ±1.51
10.0	”	”	1.00	50.00	within ±1.51
1000.0	”	”	”	50.00	within ±1.51
1000.0	”	”	”	90.00	within ±2.71
10.0	”	”	”	90.00	within ±2.71
10.0	”	”	”	10.00	within ±0.31
1000.0	”	”	”	10.00	within ±0.31
1000.0	300	75 kHz(1)	10.0	10.00	within ±0.31
10.0	”	”	”	10.00	within ±0.31
10.0	”	”	”	50.00	within ±1.51
1000.0	”	”	”	50.00	within ±1.51

(1)Set the TI LOW-PASS FILTER setting to 75 kHz, and set the measuring receiver LP FILTER to >20 kHz.

4.1.2 FM Rejection Test

4.1.2.1 Set the signal generator controls as follows:

FREQUENCY	100 MHz
AMPLITUDE	10 dBm
FUNCTION - FM	press until “FM x.xxkHz” is displayed
FM	30.0 kHz
MODULATION SOURCE - INT 1 kHz	press until “1kHz” is displayed
MODULATION SOURCE - MOD ON/OFF	press until “OFF” is not displayed

4.1.2.2 Set the TI controls as follows:

HIGH-PASS FILTER	50 Hz
LOW-PASS FILTER	15 kHz

4.1.2.3 Activate the TI CCITT P53A bandpass filter by entering #13 (#, 1, and 3 keys).

4.1.2.4 Press the TI BAND PASS key (illuminated), and ensure that CCITT P53A is momentarily displayed followed by an AM depth measurement value.

4.1.2.5 Verify that the TI AM depth indication is ≤0.75%.

4.1.3 Residual AM Test

4.1.3.1 Set the signal generator controls as follows:

MODULATION SOURCE - MOD ON/OFF	press until “OFF” is displayed

4.1.3.2 Set the TI controls as follows:

LEVEL DETECTOR MODE	RMS
HIGH-PASS FILTER	300 Hz
LOW-PASS FILTER	3 kHz

4.1.3.3 Verify that the TI AM depth indication is ≤0.03%. (Allow several seconds for the TI indication to settle.)

4.1.4 FM Modulation Tests

4.1.4.1 Set the signal generator control as follows:

FREQUENCY	10 MHz
AMPLITUDE	0 dBm
FUNCTION - FM	press until “FM x.xxkHz” is displayed
MODULATION SOURCE - INT 1 kHz	press until “x.xxkHz SIN” is displayed
MODULATION frequency	0.40 kHz
MODULATION SOURCE - MOD ON/OFF	press until “OFF” is not displayed
RF OUTPUT - RF ON/OFF	press until “RF OFF” is not displayed

4.1.4.2 Reset the TI by entering #99 (#, 9, and 9 keys).

4.1.4.3 Set the TI for averaging with 32 samples by entering 5 #66 (5, #, 6, and 6 keys).

4.1.4.4 Ensure that after several seconds the TI display switches from “Searching ….” to indicating the input RF carrier frequency and AM modulation depth.

4.1.4.5 Activate the measuring receiver INSTR PRESET function (Blue Shift key and Green AUTOMATIC OPERATION key).

4.1.4.6 Set the measuring receiver as follows:

MEASUREMENT	FM
DETECTOR	PEAK ±/2 (PEAK+ & PEAK- illuminated)
HP FILTER	50 Hz
LP FILTER	3 kHz

4.1.4.7 Set the TI controls as follows:

LEVEL DISPLAY	FM
HIGH-PASS FILTER	50 Hz
LOW-PASS FILTER	3 kHz

4.1.4.8 Perform the internal self-alignment of the TI FM demodulator using the internally stored cal factors by entering #07 (#, 0, and 7 keys). (The TI AM/FM/PM self-alignment operation takes approximately 25 seconds.)

NOTE

For the TI FM deviation measurements to be optimized, the TI should be periodically self-aligned to the internal cal factors using the #07 key sequence.

4.1.4.9 Using the data from the following table, perform the tests of the TI FM deviation measurement capability as follows:

4.1.4.9.1 Set the signal generator frequency (RF) to a RF Test Frequency value indicated in the following table. (Use the signal generator FREQUENCY control knob or press the FUNCTION-FREQUENCY key and then enter the value using the DATA keys.)

4.1.4.9.2 Using the DATA entry keys on the measuring receiver, enter the current RF Test Frequency.

4.1.4.9.3 Set the TI and measuring receiver low-pass (LP) and high-pass (HP) filters to each of the values indicated in the following table corresponding to the current RF test frequency.

4.1.4.9.4 Set the signal generator modulation rate to the applicable table setting corresponding to the current RF Test Frequency and Filter settings. (Press the signal generator INT 1 kHz key until “x.xxkHz SIN” is displayed and then use the DATA keys to enter the applicable modulation rate.)

4.1.4.9.5 Press the signal generator FM key (if necessary to activate FM data entry mode), adjust the signal generator FM deviation value to obtain the desired FM deviation setting on the TI display indicated in the following table (within ±10 counts).

4.1.4.9.6 Verify that the measuring receiver FM deviation indication is within the FM tolerance limits listed. (Allow several seconds for the TI and measuring receiver indications to settle.)

NOTE

If any FM measurement values are out-of-tolerance, first re-perform the TI AM/FM self-alignment using the #07 key, sequence and repeat the verification.

4.1.4.9.7 Repeat steps 4.1.4.9.1 through 4.1.4.9.6 for each remaining group of settings listed in the following table.

RF Test Frequency (MHz)	High-Pass Filter Setting (Hz)	Low-Pass Filter Setting (kHz)	Modulation Rate Setting (kHz)	TI FM Deviation Setting (kHz)	AM Tolerance Limits (kHz FM)
10.0	50	3	0.40	2.000	within ±0.061
1000.0	”	”	”	2.000	within ±0.061
1000.0	”	”	”	200.0	within ±6.1
10.0	”	”	”	200.0	within ±6.1
10.0	”	”	1.00	200.0	within ±6.1

RF Test Frequency (MHz)	High-Pass Filter Setting (Hz)	Low-Pass Filter Setting (kHz)	Modulation Rate Setting (kHz)	TI FM Deviation Setting (kHz)	AM Tolerance Limits (kHz FM)
1000.0	50	3	1.00	200.0	within ±6.1
1000.0	”	”	”	20.00	within ±0.61
10.0	”	”	”	20.00	within ±0.61
10.0	”	”	0.40	2.000	within ±0.061
1000.0	”	”	”	2.000	within ±0.061
1000.0	300	75 kHz(1)	10.0	20.00	within ±0.61
10.0	”	”	”	20.00	within ±0.61
10.0	”	”	”	200.0	within ±6.1
1000.0	”	”	”	200.0	within ±6.1

(1)Set the TI LOW-PASS FILTER setting to 75 kHz, and set the measuring receiver LP FILTER to >20 kHz.

4.1.5 AM Rejection Test

4.1.5.1 Set the signal generator controls as follows:

FREQUENCY	100 MHz
AMPLITUDE	10 dBm
FUNCTION - AM	press until “AM xx.x%” is displayed
AM	50%
MODULATION SOURCE - INT 1 kHz	press until “1kHz” is displayed
MODULATION SOURCE - MOD ON/OFF	press until “OFF” is not displayed

4.1.5.2 Set the TI controls as follows:

HIGH-PASS FILTER	50 Hz
LOW-PASS FILTER	15 kHz

4.1.5.3 Activate the TI CCITT P53A bandpass filter by entering #13 (#, 1, and 3 keys).

4.1.5.4 Press the TI BAND PASS key (illuminated), and ensure that CCITT P53A is momentarily displayed followed by a FM deviation measurement value.

4.1.5.5 Verify that the TI FM deviation indication is ≤40 Hz. (Wait several seconds for the TI indication to settle.)

4.1.6 Residual FM Test

4.1.6.1 Set the signal generator controls as follows:

FREQUENCY	1000 MHz
MODULATION SOURCE - MOD ON/OFF	press until “OFF” is displayed

4.1.6.2 Set the TI controls as follows:

LEVEL DETECTOR MODE	RMS
HIGH-PASS FILTER	300 Hz
LOW-PASS FILTER	3 kHz

4.1.6.3 Verify that the TI FM deviation indication is ≤15 Hz.

4.1.7 Phase Modulation Tests

4.1.7.1 Set the signal generator controls as follows:

FREQUENCY	10 MHz
AMPLITUDE	0 dBm
FUNCTION - ϕM	press until “ϕM x.xxrad” is displayed
MODULATION SOURCE - INT 1 kHz	press until “x.xxkHz SIN” is displayed
MODULATION frequency	0.40 kHz
MODULATION SOURCE - MOD ON/OFF	press until “OFF” is not displayed

4.1.7.2 Reset the TI by entering #99 (#, 9, and 9 keys).

4.1.7.3 Set the TI for averaging with 32 samples by entering 5 #66 (5, #, 6, and 6 keys).

4.1.7.4 Ensure that after several seconds the TI display switches from “Searching ….” to indicating the input RF carrier frequency and AM modulation depth.

4.1.7.5 Activate the measuring receiver INSTR PRESET function (Blue Shift key and Green AUTOMATIC OPERATION key).

4.1.7.6 Set the measuring receiver as follows:

MEASUREMENT	ϕM
DETECTOR	PEAK ±/2 (PEAK+ & PEAK- illuminated)
HP FILTER	50 Hz
LP FILTER	3 kHz

4.1.7.7 Set the TI controls as follows:

LEVEL DISPLAY	PM
HIGH-PASS FILTER	50 Hz
LOW-PASS FILTER	3 kHz

4.1.7.8 Perform the internal self-alignment of the TI PM demodulator using the internally stored cal factors by entering #07 (#, 0, and 7 keys). (The TI AM/FM/PM self-alignment operation takes approximately 25 seconds.)

NOTE

For the TI PM rad measurements to be optimized, the TI should be periodically self-aligned to the internal cal factors using the #07 key sequence.

4.1.7.9 Using the data from the following table, perform the tests of the TI PM measurement capability as follows:

4.1.7.9.1 Set the signal generator frequency (RF) to a RF Test Frequency value indicated in the following table. (Use the signal generator FREQUENCY control knob or press the FUNCTION-FREQUENCY key and then enter the value using the DATA keys.)

4.1.7.9.2 Using the DATA entry keys on the measuring receiver, enter the current RF Test Frequency.

4.1.7.9.3 Set the TI and measuring receiver low-pass (LP) and high-pass (HP) filters to each of the values indicated in the following table corresponding to the current RF test frequency.

4.1.7.9.4 Set the signal generator modulation rate to the applicable table setting corresponding to the current RF Test Frequency and Filter settings. (Press the signal generator INT 1 kHz key until "x.xxkHz SIN" is displayed and then use the DATA keys to enter the applicable modulation rate.)

4.1.7.9.5 Press the signal generator ϕM key (if necessary to activate ϕM data entry mode), and adjust the signal generator ϕM value to obtain the desired ϕM setting on the TI display indicated in the following table (within ±10 counts).

4.1.7.9.6 Verify that the measuring receiver ϕM indication is within the ϕM tolerance limits listed. (Wait several seconds for the TI and measuring receiver indications to settle.)

4.1.7.9.7 Repeat steps 4.1.7.9.1 through 4.1.7.9.6 for each remaining group of settings listed in the following table.

RF Test Frequency (MHz)	High-Pass Filter Setting (Hz)	Low-Pass Filter Setting (kHz)	Modulation Rate Setting (kHz)	TI ϕM Setting (rad)	ϕM Tolerance Limits (rad)
10.0	50	3	0.40	2.000	within ±0.121
100.0	”	”	”	2.000	within ±0.121
100.0	”	”	”	10.00	within ±0.61
10.0	”	”	”	10.00	within ±0.61
10.0	”	”	1.00	10.00	within ±0.61
100.0	”	”	”	10.00	within ±0.61
100.0	”	”	”	2.000	within ±0.121
10.0	”	”	”	2.000	within ±0.121
10.0	300	15	3.0	2.000	within ±0.121
100.0	”	”	”	2.000	within ±0.121
100.0	”	”	”	10.00	within ±0.61
10.0	”	”	”	10.00	within ±0.61

4.1.8 Residual PM Test

4.1.8.1 Set the signal generator controls as follows:

FREQUENCY	1000 MHz
AMPLITUDE	10 dBm
MODULATION SOURCE - MOD ON/OFF	press until “OFF” is displayed

4.1.8.2 Set the TI controls as follows:

LEVEL DETECTOR MODE	RMS
HIGH-PASS FILTER	300 Hz
LOW-PASS FILTER	3 kHz

4.1.8.3 Activate the TI CCITT P53A bandpass filter by entering #13 (#, 1, and 3 keys).

4.1.8.4 Press the TI BAND PASS key (illuminated), and ensure that CCITT P53A is momentarily displayed followed by a PM measurement value.

4.1.8.5 Verify that the TI PM indication is ≤0.020 rad.

4.1.9 Audio Distortion Tests

4.1.9.1 Connect the function generator OUTPUT to the signal generator MOD INPUT/OUTPUT connector. Ensure that the equipment is now connected as shown in Figure 2.

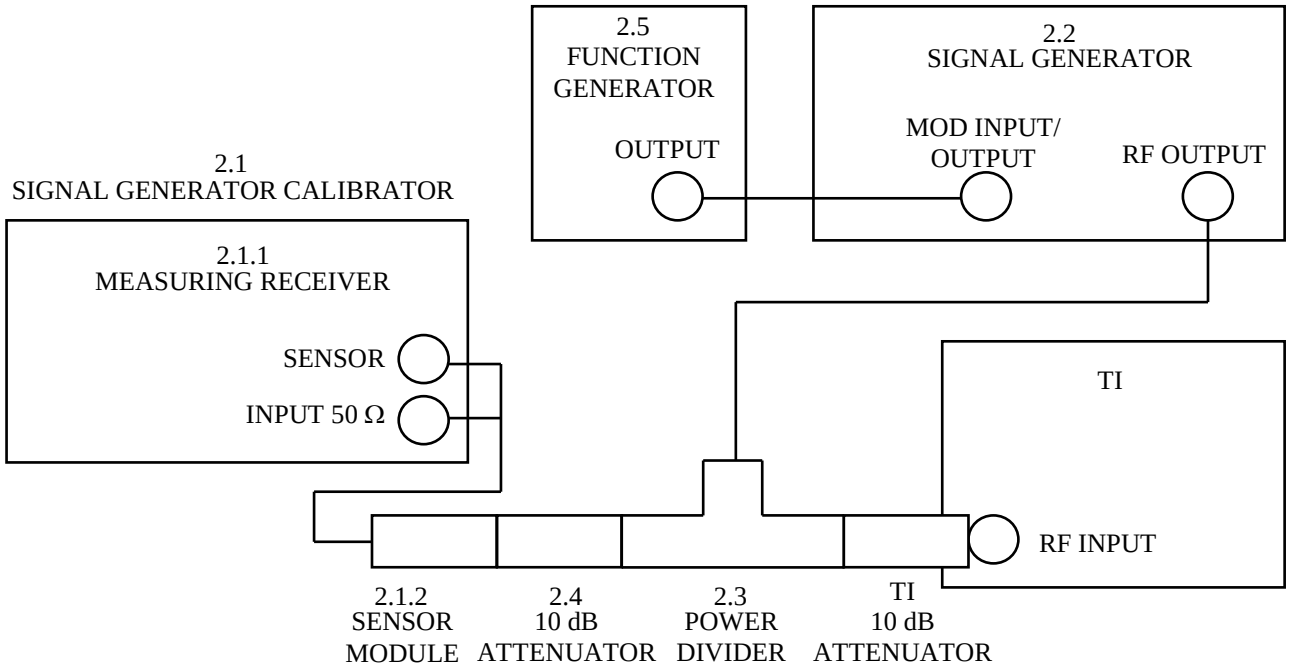

Figure 2. Audio Distortion Test Configuration

4.1.9.2 Cycle the power of the function generator to perform an instrument preset.

4.1.9.3 Set the function generator output to high impedance as follows:

MENU - ON	Blue Shift key, Enter key
D: SYS MENU	use > or < keys to obtain
1: OUT TERM	use ∨ key to obtain
50 OHM	use ∨ key to obtain
HIGH Z	use > or < keys to l lock in high impedance setting press Enter key

4.1.9.4 Set the function generator controls as follows:

FUNCTION	~ (sine)
Freq	3.000 kHz
Ampl	200 mVpp

4.1.9.5 Set the signal generator controls as follows:

FREQUENCY	10 MHz
AMPLITUDE	0 dBm
FUNCTION - AM	press until “AM x.xx%” is displayed
AM	30.0%
MODULATION SOURCE - 1 kHz + EXT DC	press until “1k+DC” is displayed
MODULATION SOURCE - MOD ON/OFF	press until “OFF” is not displayed

4.1.9.6 Activate the measuring receiver INSTR PRESET function (Blue Shift key and Green AUTOMATIC OPERATION key).

4.1.9.7 Set the measuring receiver as follows:

MEASUREMENT	AM
DETECTOR	PEAK ±/2 (PEAK+ & PEAK- illuminated)
HP FILTER	50 Hz
LP FILTER	>20 kHz

4.1.9.8 Ensure that the measuring receiver AM modulation indication is approximately 30.0%. (This is to ensure that the measuring receiver has first properly tuned to the AM modulated signal before proceeding to the distortion measurement mode.)

4.1.9.9 Set the measuring receiver for AUDIO DISTN measurements.

4.1.9.10 Reset the TI by entering #99 (#, 9, and 9 keys).

4.1.9.11 Set the TI for averaging with 32 samples by entering 5 #66 (5, #, 6, and 6 keys).

4.1.9.12 Set the TI controls as follows:

LEVEL DISPLAY	DIST (AM will still be illuminated)
HIGH-PASS FILTER	50 Hz
LOW-PASS FILTER	75 kHz

4.1.9.13 Set the function generator for each of the following frequencies. At each setting, adjust the function generator amplitude level for the approximate TI distortion (Dist) indication desired, and then verify that the TI distortion (Dist) indication is within the tolerance limits listed of the measuring receiver distortion indication. (Wait several seconds for the TI indication to settle.)

Function Generator Frequency (Freq) Setting	TI Distortion (Dist) Nominal Indication (%)	Distortion Tolerance Limits[(1)] % Distortion
3.000 kHz	10	within -1.09%, +1.22
”	20	within -2.17%, +2.44
500 Hz	20	within -2.17%, +2.44
”	10	within -1.09%, +1.22

[(1)]The tolerance limits are provided in terms of distortion %, not actual % of indication; i.e. w/in -1.09%, +1.22% distortions for 10% nominal, implies tolerance range of 8.91% to 11.22% distortion.

4.1.9.14 Disconnect the test equipment from the TI.

4.2 CARRIER MEASUREMENT TESTS

4.2.1 Carrier Frequency Measurement Tests

4.2.1.1 Connect the equipment as shown in Figure 3.

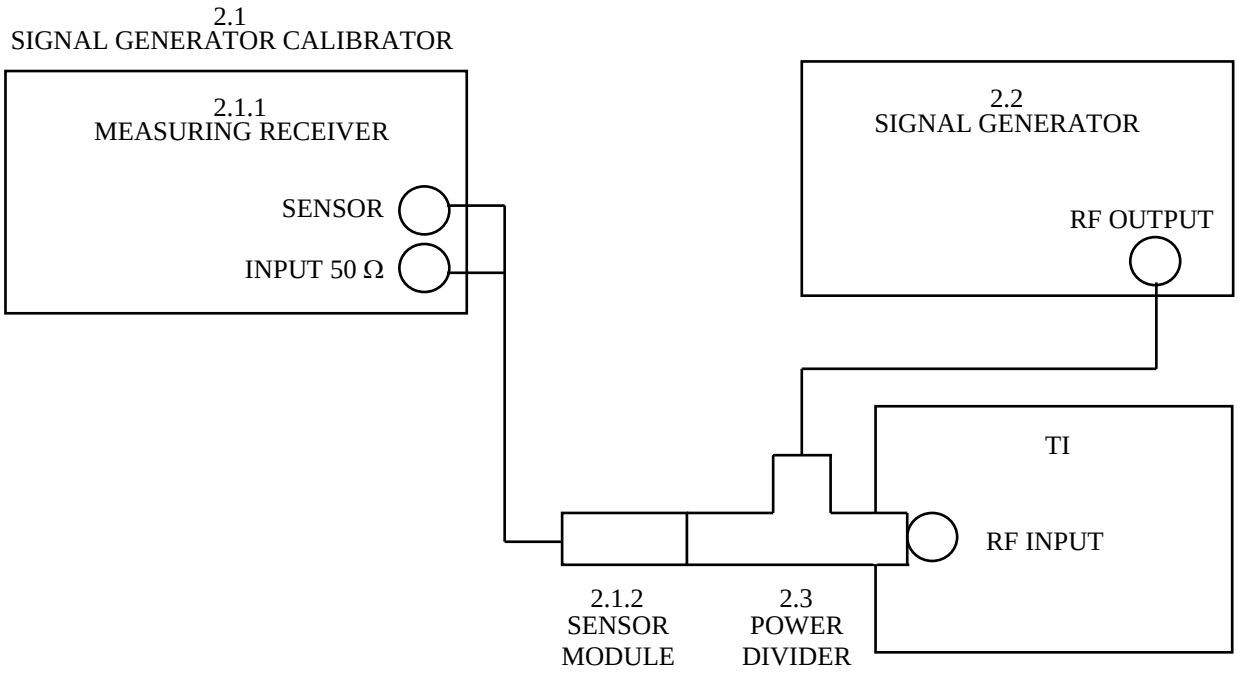

Figure 3. Carrier Frequency/Sensitivity Test Configuration

4.2.1.2 Preset the signal generator by pressing and holding the ← (backspace) key (in DATA section), and then cycling the signal generator power.

4.2.1.3 Set the signal generator control as follows:

FREQUENCY	250 kHz
AMPLITUDE	10 dBm
RF OUTPUT - RF ON/OFF	press until “RF OFF” is not displayed

4.2.1.4 Reset the TI by entering #99 (#, 9, and 9 keys).

4.2.1.5 Set the TI for averaging with 32 samples by entering 5 #66 (5, #, 6, and 6 keys).

4.2.1.6 Ensure that after several seconds the TI display switches from “Searching ….” to indicating the input RF carrier frequency and AM modulation depth.

4.2.1.7 Set the signal generator FREQUENCY setting to each of the following settings. At each setting, wait a moment for the TI to search for the RF carrier frequency and after the indication is displayed, verify that the TI FREQUENCY indication is within the tolerance limits listed in the following table.

NOTE

Generally, the TI should be able to auto tune to any frequency from 250 kHz to 2.4 GHz. If the TI displays “Searching ...” for a length of time at any signal generator frequency setting, manually tune the TI the test signal by pressing the CARR FREQ key and then enter the test frequency (in MHz). After performing the measurement, return the TI to the auto tune mode by pressing the AUTO key.

Signal Generator Frequency Setting	TI FREQUENCY Indication Tolerance Limits
250.00 kHz	249.98 to 250.02 kHz
10.00000 MHz	9.99995 to 10.00005 MHz
100.00000 MHz	99.99967 to 100.00033 MHz
1000.0000 MHz	999.00674 to 1000.0033 MHz
2000.0000 MHz	1999.0035 to 2000.0065 MHz

4.2.2 Carrier Frequency Sensitivity Tests

4.2.2.1 Activate the measuring receiver INSTR PRESET function (Blue Shift key and Green AUTOMATIC OPERATION key).

4.2.2.2 Set the measuring receiver for RF POWER measurements with log (dBm) display.

4.2.2.3 Set the signal generator frequency to each of the following settings. At each setting, enter the value of the signal generator frequency (in MHz) into the measuring receiver, adjust the signal generator level for each of the following corresponding measuring receiver RF power indications, press the TI AUTO key, and verify that the TI tunes to the signal generator signal.

NOTES

The actual specifications for the TI sensitivity levels are 1 dB lower than those used in the following table due to the necessity to account for the effects of power divider tracking and measuring receiver power measurement accuracy. Without accounting for these effects, testing at the actual TI sensitivity specifications may produce false failure indications.

Entering the current signal generator frequency into the measuring receiver ensures that the measuring receiver uses the proper calibration factor for the sensor module at the current test frequency.

At lower levels, the measuring receiver will take a moment to settle to the current reading. Pressing the measuring receiver CLEAR key will result in the measurement settling directly to the measured value.

Signal Generator Frequency Setting (MHz)	Measuring Receiver RF Power Indication (dBm)
10.0	-23
1000.0	-23
1100.0	-13
2000.0	-13

4.2.2.4 Disconnect the equipment from the TI.

4.2.3 Carrier Power Level Measurements Tests

4.2.3.1 Ensure that the RF amplifier power is turned off before proceeding.

4.2.3.2 High-Power Sensor Setup/Reference Calibration

4.2.3.2.1 Completely disconnect the sensor module from the measuring receiver.

4.2.3.2.2 Connect the high-power sensor to the measuring receiver SENSOR connector (using a power sensor cable).

4.2.3.2.3 Activate the measuring receiver INSTR PRESET function (Blue Shift key and Green AUTOMATIC OPERATION key).

4.2.3.2.4 Set the measuring receiver for RF POWER measurements.

4.2.3.2.5 Connect the high-power sensor (without its attenuator) to the measuring receiver RF POWER connector.

4.2.3.2.6 Press the measuring receiver ZERO key and after the measuring receiver momentarily displays 0.000 W, followed by a small measurement value, press the CALIBRATE key (to turn on the 1 mW reference).

4.2.3.2.7 Using the measuring receiver DATA entry keys, enter the reference calibration factor of the high-power sensor (xy.z % CAL FACTOR; or x, y, . (period), z, Blue Shift, and MHz keys).

4.2.3.2.8 Select the measuring receiver SAVE CAL function (Blue Shift key and CALIBRATE key), and then press the CALIBRATE key (to turn off the 1 mW reference). The sensor module is now zeroed and power reference calibrated.

4.2.3.2.9 Disconnect the high-power sensor from the measuring receiver RF POWER - OUTPUT connector.

4.2.3.2.10 Reconnect the high-power sensor to its attenuator.

4.2.3.2.11 Set the measuring receiver for log (dBm) display.

4.2.3.3 Preset the signal generator by pressing and holding the ← (backspace) key (in DATA section), and then cycling the signal generator power.

4.2.3.4 Connect the equipment as shown in Figure 4.

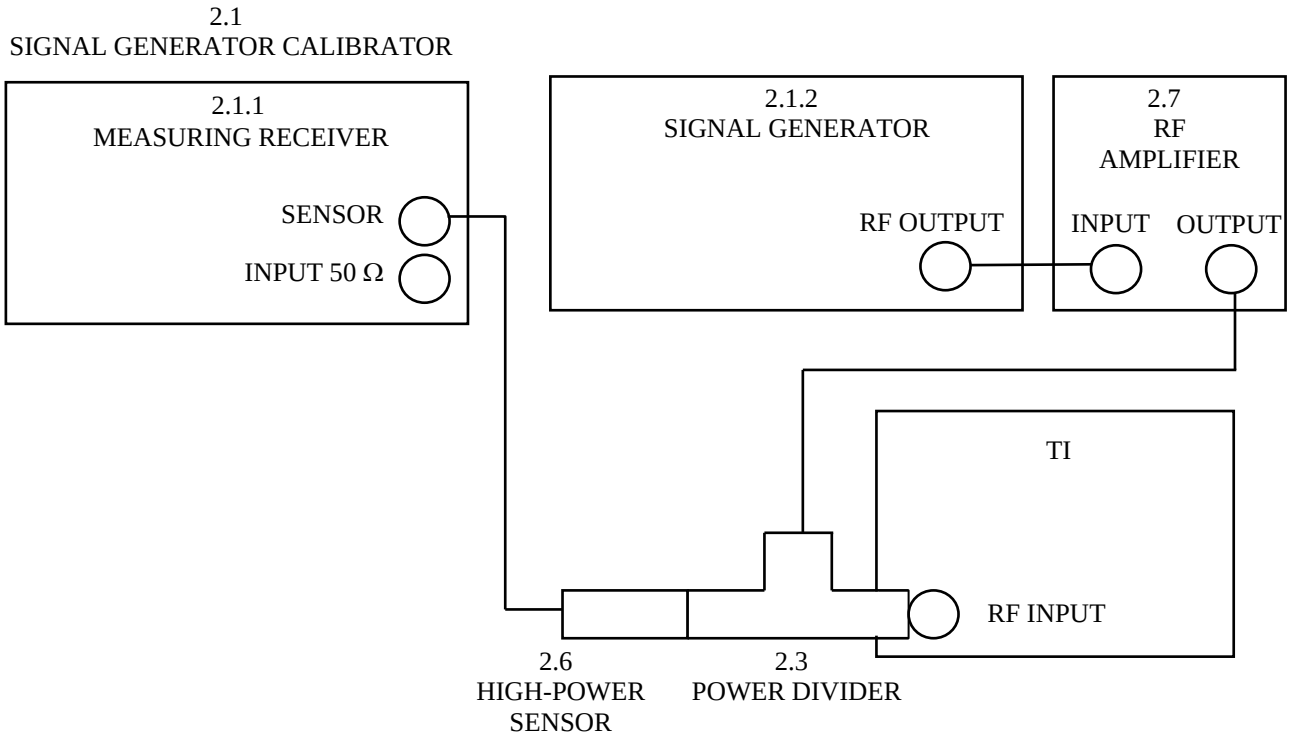

Figure 4. Carrier Level Measurement Test Configuration

4.2.3.5 Set the signal generator control as follows:

FREQUENCY	10 MHz
AMPLITUDE	-40 dBm
RF OUTPUT - RF ON/OFF	press until “RF OFF” is not displayed

4.2.3.6 Turn the RF amplifier power to on.

4.2.3.7 Slowly increase the signal generator AMPLITUDE (using the control or DATA entry keys) to obtain an approximate +5 dBm indication on the measuring receiver.

4.2.3.8 Reset the TI by entering #99 (#, 9, and 9 keys).

4.2.3.9 Set the TI for averaging with 32 samples by entering 5 #66 (5, #, 6, and 6 keys).

4.2.3.10 Set the TI controls as follows:

LEVEL DISPLAY	RF POWER

4.2.3.11 Using the data from the following table, perform the tests of the TI RF POWER measurement capability as follows:

4.2.3.11.1 Set the signal generator frequency (RF) to a RF Test Frequency value indicated in the following table. (Use the signal generator FREQUENCY control knob or press the FUNCTION-FREQUENCY key and then enter the value using the DATA keys.)

4.2.3.11.2 Using the DATA entry keys on the measuring receiver, enter the applicable calibration factor for the high-power sensor at the RF Test Frequency. (Example: 91.5% cal factor; enter 9, 1, . (period), 5, Blue Shift, and MHz keys.)

4.2.3.11.3 Slowly adjust the signal generator AMPLITUDE (using the control or DATA entry keys) to obtain the appropriate indication on the measuring receiver from the following table corresponding to the current RF Test Frequency. (The indication to be established on the measuring receiver does not need to be exact.)

4.2.3.11.4 Verify that the current TI LEVEL indication is within ±3 dB of the measuring receiver indication.

4.2.3.11.5 Repeat steps 4.2.3.11.1 through 4.2.3.11.4 for each remaining group of settings listed in the following table.

RF Test Frequency (MHz)	Measuring Receiver Indication (dBm)
1000.0	+10.0
”	+17.0
10.0	+17.0
”	+10.0

4.2.3.12 Set the signal generator output to off by pressing the RF ON/OFF key until “RF OFF” is displayed.

4.2.3.13 Turn the RF amplifier power to off.

4.2.3.14 Insert the TI 10 dB attenuator into the test configuration directly at the TI RF INPUT connector. (If not already available, the TI 10 dB attenuator is normally located behind an access panel on the back right of the TI.)

4.2.3.15 Set the signal generator control as follows:

RF OUTPUT - RF ON/OFF press until “RF OFF” is not displayed

4.2.3.16 Turn the RF amplifier power to on.

4.2.3.17 Using the data from the following table, perform the tests of the TI RF POWER measurement capability as follows:

4.2.3.17.1 Set the signal generator frequency (RF) to a RF Test Frequency value indicated in the following table. (Use the signal generator FREQUENCY control knob or press the FUNCTION-FREQUENCY key and then enter the value using the DATA keys.)

4.2.3.17.2 Using the DATA entry keys on the measuring receiver, enter the applicable calibration factor for the high-power sensor at the RF Test Frequency. (Example: 91.5% cal factor; enter 9, 1, . (period), 5, Blue Shift, and MHz keys.)

4.2.3.17.3 Slowly adjust the signal generator AMPLITUDE (using the control or DATA entry keys) to obtain the appropriate indication on the measuring receiver from the following table corresponding to the current RF Test Frequency. (The indication to be established on the measuring receiver does not need to be exact.)

4.2.3.17.4 Verify that the current TI LEVEL indication plus 10 dB is within ±3 dB of the measuring receiver indication. (Note: the addition of 10 dB to the current TI LEVEL indication is to account for the 10 dB attenuator.)

4.2.3.17.5 Repeat steps 4.2.3.17.1 through 4.2.3.17.4 for each remaining group of settings listed in the following table.

RF Test Frequency (MHz)	Measuring Receiver Indication (dBm)
10.0	+24.0(1)
1000.0	+24.0(1)

(1)The RF amplifier is specified to be able to provide 1 W (+30 dBm), which after accounting for the nominal power divider loss of 6 dB, should still be able to provide an approximate minimum of +24 dBm to the TI (through the 10 dB attenuator) and the high-power sensor. If the measuring receiver indication of +24 dBm cannot be obtained due to limitations on the output power of the RF amplifier, use the highest power level that can be obtained (not to exceed the desired +24 dBm level).

4.2.3.18 Set the signal generator output to off by pressing the RF ON/OFF key until “RF OFF” is displayed.

4.2.3.19 Turn the RF amplifier power to off.

4.2.3.20 Disconnect the test equipment from the TI.

4.2.3.21 Disconnect the high-power sensor from the measuring receiver. Reconnect the sensor module to the measuring receiver.

4.2.3.22 Return the TI 10 dB attenuator back to the access panel on the back right of the TI.

4.3 AUDIO FREQUENCY/VOLTAGE TESTS

4.3.1 Connect the equipment as shown in Figure 5.

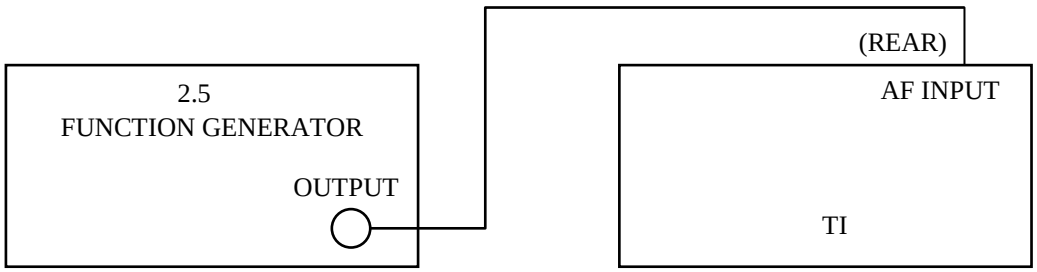

Figure 5. AF Frequency/Voltmeter Test Configuration

4.3.2 Cycle the power of the function generator to perform an instrument preset.

4.3.3 Set the function generator output to high impedance as follows:

MENU - ON	Blue Shift key, Enter key
D: SYS MENU	use > or < keys to obtain
1: OUT TERM	use ∨ key to obtain
50 OHM	use ∨ key to obtain
HIGH Z	use > or < keys to lock in high impedance setting press Enter key

4.3.4 Set the function generator controls as follows:

FUNCTION	~ (sine)
Freq	30 Hz
Ampl	5.000 Vrms

4.3.5 Reset the TI by entering #99 (#, 9, and 9 keys).

4.3.6 Set the TI for averaging with 32 samples by entering 5 #66 (5, #, 6, and 6 keys).

4.3.7 Set the TI controls as follows:

LEVEL DISPLAY	AF VOLTS
LEVEL DETECTOR MODE	RMS
HIGH-PASS FILTER	10 Hz
LOW-PASS FILTER	300 kHz

4.3.8 Set the function generator for each of the following frequency/amplitude combinations. At each setting, verify that the TI AF FREQUENCY and AF VOLTS indications are within the tolerance limits listed in the following table, if applicable. (Wait a moment for the TI indication to settle.)

Function Generator Frequency (Freq) Setting (kHz)	Function Generator Amplitude (Ampl) Setting	TI AF FREQUENCY Indication Tolerance Limits	TI AF VOLTS Indication Tolerance Limits
30 Hz	5 V rms	0.02 to 0.04 kHz	- - -
50 Hz	5 V rms	0.04 to 0.06 kHz	3.540 to 7.063 V
”	2 V rms	- - -	1.416 to 2.825 V
”	200 mV rms	- - -	142 to 283 mV
1 kHz	200 mV rms	- - -	142 to 283 mV
”	2 V rms	- - -	1.416 to 2.825 V
”	5 V rms	0.99 to 1.01 kHz	3.540 to 7.063 V
10 kHz	5 V rms	9.99 to 10.01 kHz	3.540 to 7.063 V
”	2 V rms	- - -	1.416 to 2.825 V
”	200 mV rms	- - -	142 to 283 mV
100 kHz	200 mV rms	- - -	142 to 283 mV
”	2 V rms	- - -	1.416 to 2.825 V
”	5 V rms	99.99 to 100.01 kHz	3.540 to 7.063 V
300 kHz	5 V rms	299.99 to 300.01 kHz	- - -

4.3.9 Set the TI controls as follows:

HIGH-PASS FILTER	50 Hz
LOW-PASS FILTER	15 kHz

4.3.10 Set the function generator controls as follows:

Freq	1.000 kHz
Ampl	5.000 V rms

4.3.11 Set the function generator for each of the following amplitudes. At each setting, verify that the TI AF VOLTS indication is within the tolerance limits listed in the following table. (Wait a moment for the TI indication to settle.)

Function Generator Amplitude (Ampl) Setting	TI AF VOLTS Indication Tolerance Limits
5 V r ms	4.456 to 5.610 V
2 V rms	1.783 to 2.244 V
200 mV rms	178 to 224 mV

4.3.12 Disconnect the test equipment from the TI.

4.3.13 Unless other measurements are to be performed, turn all power switches to off or standby and disconnect the equipment from the TI.

4.3.14 Affix a SPECIAL CALIBRATION label to the TI stating that “AM Measurement tested to ±(3% iv + 0.01% AM)”, “FM Measurement accuracy tested to ±(3% iv + 1 Hz)”, and “PM Deviation accuracy tested to ±(6% iv + 0.01 rad).”

CALIBRATION CHECKLIST

TEST INST (S) Wayne Kerr AMM20002Q Automatic Modulation Meter

PROC. NO. NA 17-20GQ-109		MFR	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.1	Modulation Tests					
4.1.1	AM Modulation Tests					
	(Rate) (AM Dep.)					(% AM)
4.1.1.10.6	10 MHz, 400 Hz, 10%	–	ck( )			within ±0.31
4.1.1.10.7	1000 MHz, 400 Hz, 10%	–	ck( )			within ±0.31
”	1000 MHz, 400 Hz , 50%	–	ck( )			within ±1.51
”	10 MHz, 400 Hz , 50%	–	ck( )			within ±1.51
”	10 MHz, 1 kHz , 50%	–	ck( )			within ±1.51
”	1000 MHz, 1 kHz , 50%	–	ck( )			within ±1.51
”	1000 MHz, 1 kHz , 90%	–	ck( )			within ±2.71
”	10 MHz, 1 kHz , 90%	–	ck( )			within ±2.71
”	10 MHz, 1 kHz , 10%	–	ck( )			within ±0.31
”	1000 MHz, 1 kHz , 10%	–	ck( )			within ±0.31
”	1000 MHz, 10 kHz , 10%	–	ck( )			within ±0.31
”	10 MHz, 10 kHz , 10%	–	ck( )			within ±0.31
”	10 MHz, 10 kHz, 50%	–	ck( )			within ±1.51
”	1000 MHz, 10 kHz, 50%	–	ck( )			within ±1.51
4.1.2	FM Rejection Test					
4.1.2.5	100 MHz @30 kHz FM	–	ck( )			≤0.75% AM
4.1.3	Residual AM Test					
4.1.3.3	100 MHz (no modulation)	–	ck( )			≤0.03% AM
4.1.4	FM Modulation Tests					
	(Rate) (FM Dev.)					(kHz FM)
4.1.4.9.6	10 MHz, 400 Hz, 2 kHz	–	ck( )			within ±0.061
4.1.4.9.7	1000 MHz, 400 Hz, 2 kHz	–	ck( )			within ±0.061
”	1000 MHz, 400 Hz, 200 kHz	–	ck( )			within ±6.1
”	10 MHz, 400 Hz, 200 kHz	–	ck( )			within ±6.1
”	10 MHz, 1 kHz, 200 kHz	–	ck( )			within ±6.1
”	1000 MHz, 1 kHz, 200 kHz	–	ck( )			within ±6.1
”	1000 MHz, 1 kHz, 20 kHz	–	ck( )			within ±0.61
”	10 MHz, 1 kHz, 20 kHz	–	ck( )			within ±0.61

CALIBRATION CHECKLIST

TEST INST (S) Wayne Kerr AMM20002Q Automatic Modulation Meter

PROC. NO. NA 17-20GQ-109		MFR	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
	(Rate) (FM Dev.)					(kHz FM)
4.1.4.9.7	10 MHz, 1 kHz, 2 kHz	–	ck( )			within ±0.061
”	1000 MHz, 1 kHz, 2 kHz	–	ck( )			within ±0.061
”	1000 MHz, 10 kHz, 20 kHz	–	ck( )			within ±0.61
”	10 MHz, 10 kHz, 20 kHz	–	ck( )			within ±0.61
”	10 MHz, 10 kHz, 200 kHz	–	ck( )			within ±6.1
”	1000 MHz, 10 kHz, 200 kHz	–	ck( )			within ±6.1
4.1.5	AM Rejection Test					
4.1.5.5	100 MHz @50% AM	–	ck( )			≤40 Hz FM deviation
4.1.6	Residual FM Test					
4.1.6.3	1000 MHz (no modulation)	–	ck( )			≤15 Hz FM deviation
4.1.7	Phase Modulation Tests					
	(Rate) (PM)					(rad)
4.1.7.9.6	10 MHz, 400 Hz, 2	–	ck( )			within ±0.121
4.1.7.9.7	100 MHz, 400 Hz, 2	–	ck( )			within ±0.121
”	100 MHz, 400 Hz, 10	–	ck( )			within ±0.61
”	10 MHz, 400 Hz, 10	–	ck( )			within ±0.61
”	10 MHz, 1 kHz, 10	–	ck( )			within ±0.61
”	100 MHz, 1 kHz, 10	–	ck( )			within ±0.61
”	100 MHz, 1 kHz, 2	–	ck( )			within ±0.121
”	10 MHz, 1 kHz, 2	–	ck( )			within ±0.121
”	10 MHz, 3 kHz, 2	–	ck( )			within ±0.121
”	100 MHz, 3 kHz, 2	–	ck( )			within ±0.121
”	100 MHz, 3 kHz, 10	–	ck( )			within ±0.61
”	10 MHz, 3 kHz, 10	–	ck( )			within ±0.61
4.1.8	Residual PM Test					
4.1.8.5	1000 MHz (no modulation)	–	ck( )			≤0.020 rad
4.1.9	Audio Distortion Tests					(Distortion)
4.1.9.13	Fund. 3 kHz Dist. 10%	–	ck( )			within -1.09%, +1.22%
”	Fund. 3 kHz Dist. 20%	–	ck( )			within -2.17%, +2.44%
”	Fund. 500 Hz Dist. 20%	–	ck( )			within -2.17%, +2.44%
”	Fund. 500 Hz Dist. 10%	–	ck( )			within -1.09%, +1.22%

CALIBRATION CHECKLIST

TEST INST (S) Wayne Kerr AMM20002Q Automatic Modulation Meter

PROC. NO. NA 17-20GQ-109		MFR	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.2	Carrier Measurement Tests					
4.2.1	Carrier Frequency Measurement Tests					
		(kHz)				(kHz)
4.2.1.7	250 kHz	250.00				249.98 to 250.02
		(MHz)				(MHz)
”	10 MHz	10.00000				9.99995 to 10.00005
”	100 MHz	100.00000				99.99967 to 100.00033
”	1000 MHz	1000.0000				999.00674 to 1000.0033
”	2000 MHz	2000.0000				1999.0035 to 2000.0065
4.2.2	Carrier Frequency Sensitivity Tests					
4.2.2.3	10 MHz: -23 dBm	–	ck( )			Tunes to signal
”	1000 MHz: -23 dBm	–	ck( )			”
”	1100 MHz: -13 dBm	–	ck( )			”
”	2000 MHz: -13 dBm	–	ck( )			”
4.2.3	Carrier Power Level Measurement Tests					
4.2.3.11.4	1000 MHz +10 dBm	–	ck( )			within ±3 dB
4.2.3.11.5	1000 MHz +17 dBm	–	ck( )			within ±3 dB
”	10 MHz +17 dBm	–	ck( )			within ±3 dB
”	10 MHz +10 dBm	–	ck( )			within ±3 dB
4.2.3.17.4	10 MHz +24 dBm(1)	–	ck( )			within ±3 dB
4.2.3.17.5	1000 MHz +24 dBm(1)	–	ck( )			within ±3 dB
4.3	Audio Frequency/Voltage Tests					
4.3.8	30 Hz, 5 V rms	0.03 kHz				0.02 to 0.04 kHz
”	50 Hz, 5 V rms	0.05 kHz				0.04 to 0.06 kHz
”	50 Hz, 5 V rms	5.000 V				3.540 to 7.063 V
”	50 Hz, 2 V rms	2.000 V				1.416 to 2.825 V
”	50 Hz, 200 mV rms	200 mV				142 to 283 mV
”	1 kHz, 200 mV rms	200 mV				142 to 283 mV
”	1 kHz, 2 V rms	2.000 V				1.416 to 2.825 V
”	1 kHz, 5 V rms	1.00 kHz				0.99 to 1.01 kHz

(1)Or use highest power level obtainable (not to exceed +24 dBm measuring receiver indications).

CALIBRATION CHECKLIST

TEST INST (S) Wayne Kerr AMM20002Q Automatic Modulation Meter

PROC. NO. NA 17-20GQ-109		MFR	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.3.8	1 kHz, 5 V rms	5.000 V				3.540 to 7.063 V
”	10 kHz, 5 V rms	10.00 kHz				9.99 to 10.01 kHz
”	10 kHz, 5 V rms	5.000 V				3.540 to 7.063 V
”	10 kHz, 2 V rms	2.000 V				1.416 to 2.825 V
”	10 kHz, 200 mV rms	200 mV				142 to 283 mV
”	100 kHz, 200 mV rms	200 mV				142 to 283 mV
”	100 kHz, 2 V rms	2.000 V				1.416 to 2.825 V
”	100 kHz, 5 V rms	100.00 kHz				99.99 to 100.01 kHz
”	100 kHz, 5 V rms	5.000 V				3.540 to 7.063 V
”	300 kHz, 5 V rms	300.00 kHz				299.99 to 300.01 kHz
4.3.11	1 kHz, 5 V rms	5.000 V				4.456 to 5.610 V
”	1 kHz, 2 V rms	2.000 V				1.783 to 2.244 V
”	1 kHz, 200 mV rms	200 mV				178 to 224 mV
4.3.14	Affix SPECIAL CAL label					Affix label