5

Calibration & Testing

5.1 Introduction

This chapter includes procedures for calibration and performance testing the Series 8540C Universal Power Meters.

Refer to Appendix B of this manual for power sensor selection and calibration.

5.2 Calibration Procedure

If any of the instrument performance characteristics cannot be calibrated within specification, refer to the troubleshooting procedure in Chapter 6.

5.2.1 Equipment Required

Table 5-1 lists the equipment required for calibration of the 8540C power meters.

Table 5-1: Equipment Required for Calibration

Description	Representative Model	Key Characteristics
CW Thermistor Power Meter	HP 432A	V_{RF} and V_{COMP} available externally
Thermistor Mount	HP 478A-H75	≤1.07 VSWR @ 50 MHz (30 dB return loss) Accuracy ±0.5% @ 50 MHz
Digital Voltmeter (DVM)	Fluke 8842A	±0.05% accuracy & 1 μV resolution
Directional Coupler, 10 dB	Mini Circuits ZFDC-10-1 10 dB	≤1.15 SWR @ 50 MHz
Step Attenuator, 0 to 90 dB in 10 dB increments	Weinschel Model AC 118A-90-33	≤1.15 SWR @ 50 MHz ±0.1 dB attenuation
RF Source (Signal Generator) (High Power)	Wavetek Model 2405 Option XP	+22 dBm @ 50 MHz
Low Pass Filter	Integrated Microwave Model 904 881	>30 dB attenuation @ 100 MHz
GPIB Controller for IBM PC	National PC2/2A	With driver software

5.2.2 Calibrator Output Power

Perform the Calibrator Output Power Reference Level check (see Section 5.3.2). If the unit fails to meet the power output specification within the 0.981 mW to 1.019 mW minimum and maximum limits, then proceed with the steps below.

To correct the setting of the power output of the calibrator, you must know the password if it has been set, or you must defeat it by setting jumper A2W1 to position B. (This jumper is located and indicated on the Analog PC Board.) If no password has been set, you can proceed with the jumper in position A. Calculate the percent error in power (as described in the Performance Verification Level check) and change the CALFAC by that amount. For example, if the power output is low by 0.5% then increase the CALFAC by that amount. In the following procedure if you make a mistake and wish to start over, press [ESCAPE] and then continue from Step 1.

1. Press [MENU].
2. Scroll to **SERVICE MENU** (using one of the up/down, left/right keys on the front panel) and press [ENTER].
3. Scroll to **CALIBRATOR** and press [ENTER].
4. Select EEPROM and press [ENTER].
5. Press [ENTER] to get past **SNumb** (unit serial number).
6. Enter CALFAC change using the number obtained at the beginning of this test. Press [ENTER].
7. Correct the date and press [ENTER].
8. Correct the time and press [ENTER].
9. Select **WRITE** and press [ENTER].
10. Enter the correct password if needed. If it is not needed, you can either set one or clear it. Press [ENTER].
11. You must verify that the correction has been done by again entering (reads new Cal Fac number):
    a. Scroll to the **SERVICE MENU**.
    b. Scroll to **CALIBRATOR** and press [ENTER].
    c. Select **Power** and press [ENTER].
    d. Select **0 dBm** and press [ENTER].
12. If the calibrator is now within tolerance, perform step 11 again and turn the calibrator **OFF** instead of selecting 0 dBm.

The sensor(s) can now be calibrated by connecting to the calibrator output and pressing ZERO/CAL. If the calibration does not complete satisfactorily, refer to the calibrator voltage and frequency checks starting on page 5-3.

The Linearity test can now be performed as detailed in Section 5.3.3. This is a complete procedure, and must be performed in the exact order given to produce accurate results. If this test fails, try it again with a different sensor. If it still fails, refer to the calibrator voltage and frequency checks starting on page 5-3.

The following tests require that the power meter's housing be removed. To remove the cover, remove the three Binder head screws on the back panel and slip the cover off. This can best be done by carefully resting the unit on the front panel using a cushion or pad to prevent scratching.

Refer to the Analog PC Board description in Chapter 4 for further help in defining the problem. If the fault cannot be located to the component level, the PC board can be removed and replaced with a different one with no further calibration required except to set the calibrator output power to 0 dBm.

5.2.3 Power Supply Voltage Checks

There are a number of power supplies in the power meter. The rectifiers, filters, and regulators for the ±15 volt and the +5 volt supplies are on the CPU PC Board (A1). All the other supplies are on the Analog PC Board (A2). In case there is a regulated voltage failure, check the corresponding unregulated supply (see Sheet 3 of the A1 Circuit Schematic on page 8-8). The unregulated voltage must be at least 2 volts more than the required regulated output.

To measure the supplies, turn the unit on and let it stabilize for a minute or so. Then proceed as follows:

1. Connect the low side of the DVM to A2TP3 (GND)

2. Connect the high side to the points shown in Table 5-2.

Table 5-2: DC Power Supply Test Points

Test Point	Voltage
A2TP3	GND
TP4	-14.25 to -15.75
TP5	4.8 to 5.2
TP2	14.25 to 15.75
U33-3	11.4 to 12.6
U40-3	-11.4 to -12.6
TP37	4.8 to 5.2
U83-3 (Ch. B)	-4.8 to -5.2
U82-3 (Ch. B)	4.8 to 5.2
U57-3	-4.8 to -5.2
U58-3	4.8 to 5.2
TP27	11.4 to 12.6
TP29 (Ch. B)	11.4 to 12.6
TP30 (Ch. B)	-11.4 to -12.6
TP28	-11.4 to -12.6
U16-1	-9.1 to -10.9

5.2.4 Calibrator Voltages

To measure the calibrator voltages, first make sure that neither side of the DVM is grounded. The following measurements should find most of the problems that can arise in the calibrator circuitry.

1. Connect the DVM across the large resistor, A2R174. Measure 0.4 to 0.9 volts depending on the room temperature and how long the unit has been operating. This voltage is proportional to the current in the thermistor heater transistor which maintains the calibrator thermistor in a 60 °C environment. The voltage measured in the next step is dependent on this being correct.

   The exact ambient temperature and on-time of the instrument mentioned in Step 1 are not specific factors, but do have some effect on the reading taken across A2R174. If there is a problem in the circuit, the measured voltage will usually be outside of the 0.4 to 0.9 Volts specification (for example, 0 Volts or +5 Volts).

2. Connect the low side of the DVM to A2TP3 and the high side to A2TP1. Measure +7 to +8.5 volts. This is the voltage applied to the thermistor bridge that is used to measure the calibrator power. This voltage will vary as the calibrator provides different amounts of RF power. This measurement assumes that the calibrator is OFF. To verify that the calibrator is off, press MENU, scroll to REF POWER ON/OFF, press ENTER select OFF, and press ENTER again.

3. Turn the calibrator ON. Press MENU, scroll to REF POWER ON/OFF, press ENTER, select ON, and press ENTER. Now connect the high side of the DVM to A2U3, pin 7. Measure +3 to +10 volts which should change less than 2 mV per minute. Turn the calibrator off. If the voltage is incorrect or drifts excessively, troubleshoot the sample and hold circuit surrounding A2U3A.

5.2.5 Calibrator Frequency Check

To measure the frequency of the calibrator:

1. Connect a 50 MHz counter to the calibrator output connector.

2. Turn ON the calibrator according to the procedure given in Step 3, above.

3. Measure 49 to 51 MHz.

4. Turn the calibrator OFF.

5.2.6 GPIB Test Functions

If the unit will not calibrate its sensors, there are some test functions available through the GPIB. Using these functions, it is possible to check out the operation of the different parts of the calibrator system.

1. Connect a controller to the GPIB interface connector on the rear panel of the unit, and set the address as required.

   a. Press MENU. Scroll to the Config menu and press ENTER.

   b. Scroll to GPIB and press ENTER.

   c. Select the MODE and ADDRESS as needed and press ENTER. (MODE is either 8541C or 8542C. The default address is 13).

2. If the calibrator output power as measured in the Performance Verification Test is within tolerance but the unit will still not complete a sensor calibration, perform the following test to determine if the calibrator is operating correctly:

   a. Send TEST CALIB SOURCE 10 from the controller, followed by TEST CALIB ATTEN 0 (The calibrator output should be +20 dBm ±0.8 dB).

   b. Send TEST CALIB ATTEN 10 (This will insert the 10 dB attenuator into the calibrator output. The power should measure a decrease of 10 dB ±1 dB).

   c. Repeat Step 2b, substituting 20, 30 and 40 successively in the command. The power should be attenuated by the attenuation level specified in the command ±1 dB. This will verify the health of all of the attenuators.

3. The next step is to verify the oscillator power control circuits. This is done by setting the power to higher and lower levels and measuring the results.

   Send the command TEST CALIB ATTEN 0, followed by TEST CALIB SOURCE X where X is -3 to +13. The resulting power output should range between -13 dB from the first reading taken in Step 2.a to at least +21 dBm.

This checks the calibrator control circuits completely. If the unit still will not calibrate a sensor the problem is in the measurement circuits, not the calibrator. Proceed to the next heading.

5.3 Performance Verification Tests

Information in this section is useful for periodic evaluation of the 8540C and its power sensors. These tests can also be used for incoming inspection testing when the instrument is first received, if required.

If the 8540C has not previously been used, review the precautions in Section 1.2 of the manual before the instrument is turned on. Prior to starting the following procedures, the instrument should be allowed to warm up for at least 24 hours to assure maximum stability during testing.

The test for the Calibrator Output Power Reference Level given in this section is valid for an ambient temperature range between +5 °C and +35 °C (+41 °F to +95 °F).

The instrument plus power sensor linearity test is valid when the sensor has been calibrated using the front panel calibrator at a temperature between 0 °C and +50 °C (+32 °F to +122 °F), and if operating within ±5 °C (±9 °F) of that calibration temperature.

It is recommended that the verification be done in the order described since some of the steps use the configuration from a previous step.

5.3.1 Equipment Required

Table 5-3 lists the equipment required for performance testing of the 8540C power meters.

Table 5-3: Equipment Required for Performance Testing

Description	Representative Model	Key Characteristics
CW Thermistor Power Meter	HP 432A	V_{RF} and V_{COMP} available externally
Thermistor Mount	HP 478A-H75	≤1.07 VSWR @ 50 MHz (30 dB return loss) Accuracy ±0.5% @ 50 MHz
Digital Voltmeter (DVM)	Fluke 8842A	±0.05% accuracy and 1 μV resolution
Directional Coupler, 10 dB	Mini Circuits ZFDC-10-1 10 dB	≤1.15 SWR @ 50 MHz
Step Attenuator, 0 to 90 dB in 10 dB increments	Weinschel Model AC 118A-90-33	≤1.15 SWR @ 50 MHz ±0.1 dB attenuation
RF Source (Signal Generator) (High Power)	Wavetek Model 2405 Option XP	+22 dBm @ 50 MHz
Low Pass Filter	Integrated Microwave Model 904 881	>30 dB attenuation @ 100 MHz
GPIB Controller for IBM PC	National PC2/2A	With driver software

Performance Verification Test Data Recording sheets are located on pages 5-12 and 5-13. These sheets can be copied and the copies used for recording test results each time Specification and Performance Verification testing is performed on the specific instrument described by this manual.

5.3.2 Calibrator Output Power Reference Level

The Calibrator Output power reference is factory adjusted to 1 mW ±0.7%. To achieve this accuracy, Giga-tronics uses a precision measurement system with accuracy to ±0.5% (traceable to the NIST - formerly the NBS), and allows for a transfer error of ±0.2% for a total of ±0.7%. If an equivalent measurement system is used for verification, the power reference oscillator output can be verified to 1mW ±1.9% (±1.2% accuracy, ±0.5% verification system error, ±0.2% transfer error, for a maximum error of ±1.9%). To ensure maximum accuracy in verifying the Calibrator Output power reference, the following procedure provides step-by-step instructions for using specified test instruments of known capability. If equivalent test instruments are substituted, refer to the Key Characteristics section in Table 5-3.

The test setup is illustrated in Figure 5-1.

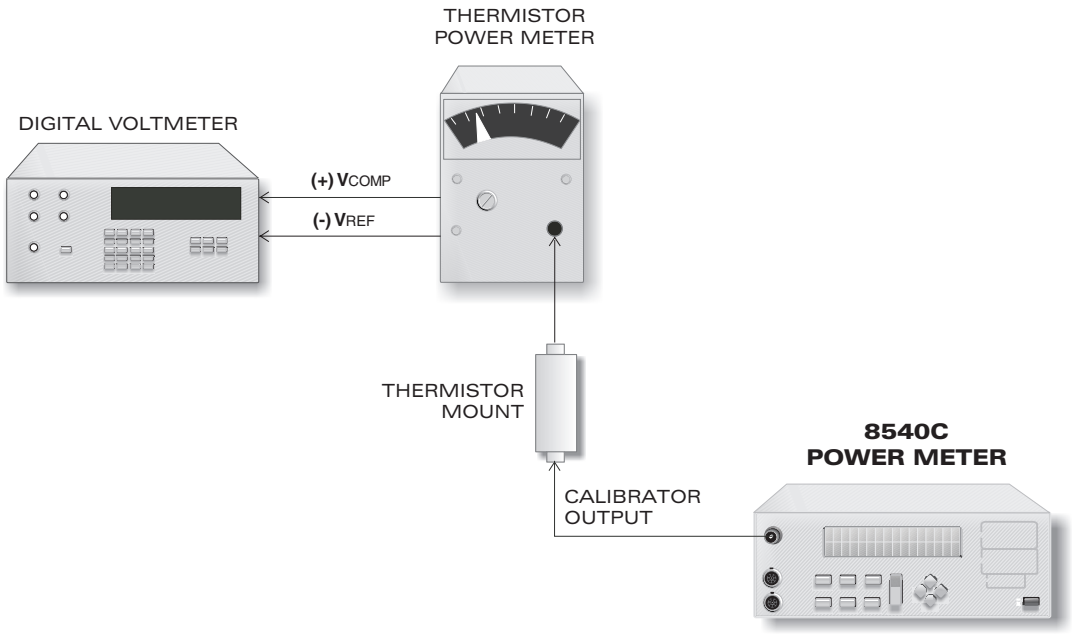

Figure 5-1: Calibrator Output Test Setup

Procedure:

In the following steps, precision power measurements will be made using the 432A Power Meter. For detailed information on using the 432A, please refer to the operating section of the 432A manual.

1. Connect the 432A to the Calibrator Output on the 8540C as shown in Figure 5-1.

2. Turn on all equipment and then wait 30 minutes for the thermistor mount to stabilize before proceeding to the next step.

3. Set the 432A RANGE switch to COARSE ZERO, and adjust the front panel COARSE ZERO control to obtain a zero (±2% F.S.) meter indication.

☛ ***NOTE:*** *Ensure that the DVM input leads are isolated from chassis ground when performing the next step.*

4. Set the DVM to a range that results in a resolution of 1 µV and connect the positive and negative input, respectively, to the V_{COMP} and V_{RF} connectors on the rear panel of the 432A.

5. Fine zero the 432A on the most sensitive range, then set the 432A range switch to 1 mW.

6. Record the DVM indication as V_0.

7. Turn ON the 8540C Calibrator RF power as follows:

   Press MENU, scroll to REF POWER ON/OFF, press ENTER, select ON, press ENTER. Record the reading shown on the DVM as V_1.

   ☛ ***NOTE:*** *The V_1 reading must be taken within 15 seconds after pressing ENTER. Otherwise, turn REF POWER OFF and repeat Steps 6 and 7.*

8. Disconnect the DVM negative lead from the V_{RF} connector on the 432A, and reconnect it to the 432A chassis ground. Record the new indication observed on the DVM as V_{COMP}

9. Repeat Step 7, except select OFF to turn the Calibrator off.

10. Calculate the Calibrator Output level (P_{CAL}) using the following formula:

$$P_{CAL}(Watts) = \frac{2V_{COMP}\ (V_1 - V_0) + V_0^{\,2} - V_1^{\,2}}{4R(\text{Calibration Factor})}$$

    where:

    P_{CAL} = calibrator output power reference level
    V_{COMP}= previously recorded value in Step 8
    V_1= previously recorded value in Step 7
    V_0= previously recorded value in Step 6
    R= 200Ω (assuming HP478A-H75 mount)

    Calibration factor = value for the thermistor mount at 50 MHz (traceable to the NIST)

11. Verify that the P_{CAL} is within the following limits:

    1 mW ±0.019 mW (0.981 to 1.019 mW)

    For record purposes, the measured value of P_{CAL} can be entered on the Test Data Recording Sheet located on page 5-12.

5.3.3 Instrument Plus Power Sensor Linearity

Test Description

Connect the test setup as shown in Figure 5-2. The linearity will be tested over the range +20 dBm to -60 dBm. At low power levels, the linearity measurement will include the uncertainty due to the zero set specification. The procedure should be repeated for each sensor used with the 8540C.

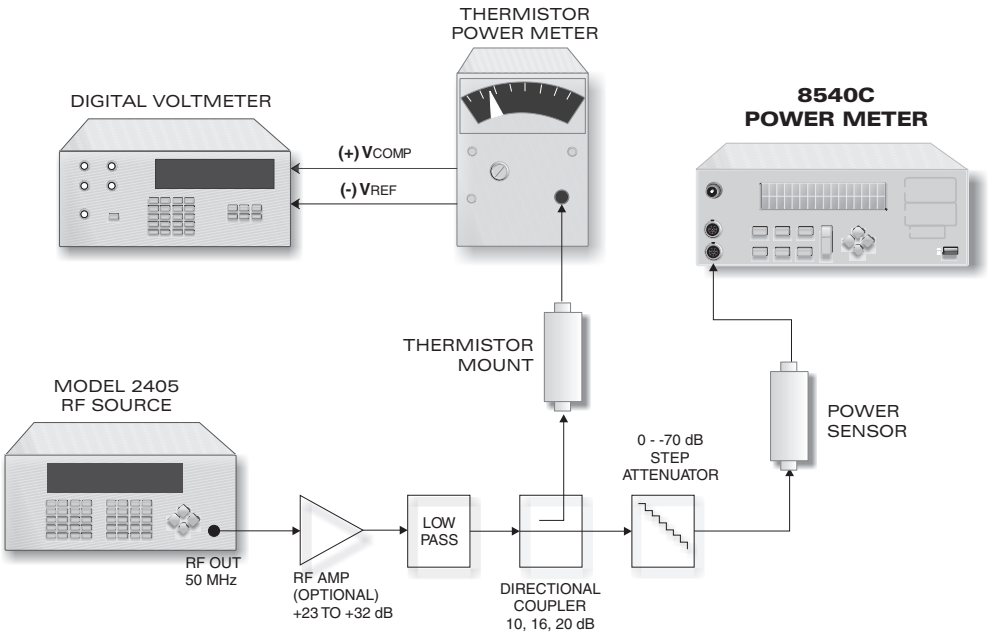

Figure 5-2: Power Linearity Test Setup

When measuring the linearity of a Low VSWR (Series 8031X) or a High Power (Series 8032X) sensor, the power output of the source must be increased by 6 or 10 dB respectively and the directional coupler must be increased from 10 dB to either 16 or 20 dB respectively (see Figure 5-2). The power coefficient of the step attenuator will also have to be considered. The specification of power coefficient for the Weinschel attenuator cited in the Equipment List is: <0.005 dB/dB/W. The latter will affect the linearity of each 10 dB segment, and make it necessary to expand the overall linearity specification by this quantity.

In assembling the test setup shown in Figure 5-2, keep in mind that if testing is to be conducted with Low VSWR or High Power sensors, the optional RF Amplifier must have frequency and bandwidth parameters to match the sensor's characteristics (see the Sensor Selection Guide in Chapter 1, if unsure of characteristics), and the Directional Coupler must be increased as stated above for the particular series of sensors. All Standard (Series 8030X) and True RMS (Series 8033X) sensors are tested with a 10 dB Directional Coupler and without the optional RF amplifier.

Refer to the Linearity Data recording section of the Performance Verification Data recording sheets located on pages 5-12 and 5-13. The tolerance is already entered for the various steps, and includes an allowance for specified zero set errors at low power levels.

☛ ***NOTE:*** *To ensure accurate and repeatable measurements, the 432A power meter should be zeroed just before taking each reading that will be used to calculate P1 in the Power Meter column of the Performance Verification Test Data Sheets on pages 5-12 and 5-13.*

Setup Parameters

The following setup parameters should be accomplished prior to performing the Power Linearity test:

1. The 8540C and sensor should be calibrated (see Section 2.6.3. Refer also to the complete instructions on how to calibrate the sensor in Appendix B of this manual).

2. The Averaging is set to AUTO by entering the key sequence

   [MENU] [Meas Setup] [Average] [Avg A] or [Avg B] [Auto]

Test Procedure

Extreme care is required in the following procedure since the accuracy requirements are critical to ensure the most accurate test results.

Power readings are determined using the thermistor power meter in the same general way as given in the Power Reference Level test. That is, P1 and P2 in the Power Meter reading column of the Performance Verification Test Data Sheet tables are calculated each time for the respective values of V_{COMP}, V_0, and V_1 read on the DVM.

1. Set the step attenuator to 70 dB. Turn the source power output off, and then zero the 8540C.

   (The 8540C is zeroed by pressing [ZERO/CAL] and then following the softkey label instructions.)

2. Set the step attenuator to 0 dB after the 8540C has zeroed.

3. Set the power output of the RF source so that the thermistor power meter indicates 1.00 mW ±0.025 mV.

4. Record the calculated power meter reading and the displayed 8540C reading in the correct columns of the Linearity Data recording sheet on page 5-12.

5. Set the power output of the RF source so that the thermistor power meter indicates 3.98 mW ±0.10 mW.

6. Record the new calculated power meter reading and the new displayed 8540C reading as in Step 4 above.

7. Set the power output of the RF Source so that the thermistor power meter indicates 3.98 mW ±0.10 mW.

8. Record the calculated power meter reading and the displayed 8540C reading as in Step 4, above.

9. Set the power output of the RF Source so that the thermistor power meter indicates 5.01 mW ±0.13 mW.

10. Record the new calculated power meter reading and the new displayed 8540C reading as in Step 4, above.

11. Repeat using the power meter indications in the Data Recording sheet on page 5-13. Note that the Step Attenuator is used to generate the remaining 70 dB range of 10 dB steps for a total range of 80 dB. Repeat Step 1, above, between each 10 dB step shown on the Linearity Data Recording sheet.

12. Make the calculations indicated on the Linearity Data sheet, and enter the values in the appropriate blank spaces.

5.3.4 GPIB Port Check

The following steps are used to confirm that the GPIB port is functional.

1. Set the 8540C to the desired address (the default is 13; see Table 2-1 for address setting instructions if necessary).

2. Connect the GPIB controller to the GPIB Port on the rear of the 8540C.

3. Send the command (if emulating an HP 438):

   *IDN? or ?ID

   (*IDN? is the IEEE 488.2 Common ID query. When addressed to talk after receiving the command, the 8540C will output a string that identifies itself as Model 8541C or 8542C.)

4. Display the response on the controller.

This completes the Specification and Performance Verification Tests for the 8540C Series Digital Power Meter and its sensors. If the instrument has performed as described in this chapter, it is correctly calibrated and within specifications.

Giga-tronics Series 8540C
Performance Verification Test Data Sheet

Date:	
Operator:	
Test Number:	(if required)
Series 8540C S/N:	
Power Sensor S/N:	

Calibrator Output Power Reference		
Minimum	**Actual Reading**	**Maximum**
0.981 mW		1.019 mW

Linearity Data - (+16 dBm to +20 dBm)

Step Attenuator Value	Power Set Point	Power Meter Reading (P)	8450C (DUT) Reading (R)	Reference Power Ratio	8540C (DUT) Reading Ratio	Linearity Error (%)[1]	
						Linearity Specification	Accumulated Linearity Error[2]
0 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	3.98 mW ±0.10 mW	P2 =	R2 =			±1%	Same as Lin. error above
0 dB	3.98 mW ±0.10 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	5.01 mW ±0.13 mW	P2 =	R2 =			+1% -1.6%	
0 dB	5.01 mW ±0.13 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	6.31 mW ±0.16 mW	P2 =	R2 =			+1% -2.7%	
0 dB	6.31 mW ±0.16 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	7.94 mW ±0.2 mW	P2 =	R2 =			+1% -3.8%	
0 dB	7.94 mW ±0.2 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10 mW ±0.25 mW	P2 =	R2 =			+1% -4.9%	

(continued)

-60 dBm to +16 dBm Linearity Data are on the next page.

Notes:

1. Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] x 100
2. Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

Linearity Data - (-60 dBm to +16 dBm)							
Step Attenuator Value	Power Set Point	Power Meter Reading (P)	8540C (DUT) Reading (R)	Reference Power Ratio	8540C (DUT) Reading Ratio	Linearity Error (%)[1]	
						Linearity Specification	Accumulated Linearity Error[2]
0 dB						See Note 3	
						±1%	Same as Lin. error above
10 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
20 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
30 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
40 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
50 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
60 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1.5%	
70 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±6%	

Notes:

1. Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] x 100
2. Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.
3. Use the first CW Linearity error value entered in the +16 dBm to +20 dBm Linearity Data on page 5-12.

6

Maintenance

6.1 Periodic Maintenance

This chapter describes maintenance practices and troubleshooting guidelines for the 8540C.

6.1.1 Testing & Calibration

The 8540C should be periodically tested (and calibrated, if it will not pass all performance tests), using the test and calibration procedures described in Chapter 5 of the manual.

Testing (and, if necessary, calibration) should be performed at one year intervals, unless the 8540C is operated in an extremely dirty or chemically contaminated environment, or is subject to severe abuse (such as being dropped). In such cases, more frequent maintenance (immediate, if the unit is dropped or severely abused in some way) is required.

6.1.2 Cleaning

The front panel and housing of the unit can be cleaned using a cloth dampened in a mild detergent. Do not use abrasive cleaners, scouring powders, or any harsh chemicals. Wipe the soap residue off with a clean, damp cloth, then dry with a clean dry cloth.

6.1.3 Lithium Battery

The power meter contains a 3.6V lithium battery, which preserves configuration and calibration data while line power is off.

If the 8540C is to be placed in long term storage (2 years or more), the battery should be removed.

To check the battery, connect a voltmeter between TP13 (ground) and TP16 (+) on the CPU PC Board (A1). If the voltage is less than 3.1V, the battery should be replaced.

Replacement

Battery life depends on the usage of the 8540C. With normal daily use, the battery is expected to last at least three years. To avoid unintentional loss of data in the volatile memory of the 8540C, it is recommended that the lithium battery be replaced every three years. This can be done without losing the data stored in RAM if the old battery is removed and the new battery installed in less than 10 seconds with main power off, or if power is left on while changing the batteries.

WARNING

Battery replacement requires removing the cover from the instrument and then restoring power before removing the battery. This procedure should be performed only by qualified personnel.

This replacement procedure is intended for users knowledgeable in the use and care of equipment using non-rechargeable lithium batteries. The recommended replacement battery is a Tadiran Type TL-5242, Giga-tronics Part# 21212.

Lithium batteries can supply substantial current and, depending on factors such as the state of charge, can overheat when shorted.

1. Turn OFF the 8540C.

2. Remove the cover.

3. Turn ON the 8540C (to maintain memory power while replacing the battery).

4. Note the orientation of the battery which is located on the left side of the top (CPU) PC board, half way back in the unit. The battery is held in place with a plastic clamp and a "hook and loop" fastener. Cut the plastic clamp and peel the battery free of the PC board.

5. Disconnect the battery wires. The connector is polarized so it can only be inserted one way, with the red wire toward the rear of the instrument.

6. Install the new battery, replace the plastic clamp, and connect the wires.

7. Turn OFF the 8540C and measure the battery voltage between TP13 (com) and TP17 (bat). It must be at least 3.5V.

8. Replace the cover and secure.

9. If desired, a label can be attached indicating when the next battery replacement is due.

To test for satisfactory operation of the new battery, turn the 8540C ON, calibrate a sensor, turn the 8540C OFF, wait ten seconds, and turn the 8540C instrument back ON. The sensor calibration should still be valid, as indicated by the displayed power level.

6.2 Troubleshooting

If the 8540C seems to be malfunctioning, the first step is to determine whether or not the problem is actually being caused by the 8540C. Investigate any auxiliary equipment to which the 8540C is connected, and check all connections between devices in the test setup. Make sure that the 8540C has not been configured incorrectly (either by way of the front panel configuration menus or over the GPIB).

Before investigating the 8540C's circuits, review the circuit descriptions in Chapter 4.

NOTE: *If you are returning an instrument to Giga-tronics for service, first contact Giga-tronics customer service at 800.444.2878 or Fax 925.328.4702, so that a return authorization number can be assigned.*

6.2.1 General Failure

If the front panel displays are erratic, blank, or unresponsive to the front panel controls, this suggests a general breakdown of the control system, probably resulting from a problem in the power supply or the CPU circuit.

1. If nothing will light up on the front panel at all (not even the backlighting of the display window), check the fuse. If the fuse has failed, check the line voltage setting, correct it if it is wrong, and replace the fuse (see Section 1.2). The display window may not show a readable message if the contrast setting on the rear panel is not adjusted properly.

2. Investigate the power supply circuit (see Sheet 3 of the A1 Circuit Schematic, drawing #21694 in Chapter 8); check all regulated voltage outputs.

3. Check the connections between the CPU PC board (A1), the LCD display PC board (A4) and the Front Panel PC board (A3).

6.2.2 Channel-Specific Failure in the 8542C

If the instrument is a Model 8542C and only one of the two sensors will calibrate, troubleshoot the circuits associated with the channel that fails. The separate channels are shown on Sheet 1 (Ch A) and Sheet 2 (Ch B) of the A2 Analog Circuit Schematic, drawing #21697 in Chapter 8. For example, if the unit will calibrate sensor A but not sensor B, proceed as follows:

1. Try reversing the two sensors to determine if one of them is bad.

2. If the unit fails to display the **B UNCALIBRATED** message, or fails to display any sensor B data when the sensor is connected, the problem probably lies in the temperature sensing thermistor circuit which connects to U39, pin 3. Measure the voltage at U39, pin 1. It should be about 2 or 3 volts. If it is above 7 or below 0.5 volts, the thermistor circuit is faulty.

6.2.3 Functional Failures

If the power supplies and the CPU seem to be working normally, yet the 8540C will not perform its calibration or measurement functions, it is necessary to perform more detailed testing to find the source of the problem. A number of instrument self-test functions are available. On the Service menu, select TEST FUNCTIONS for an extensive menu of tests.