

# Calibration Guide

## Agilent Technologies

### PSG Family Signal Generators

This guide applies to the signal generator models and associated serial number prefixes listed below. Depending on your firmware revision, front panel operation may vary from descriptions in this guide.

E8241A: US4124

E8244A: US4124

E8251A: US4124

E8254A: US4124



**Part Number: E8251-90035**

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# **1 Getting Started**

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## Overview of Getting Started

Agilent's calibration software allows fast and accurate testing of PSG Family signal generators. This chapter describes how to install, configure, and run calibration software so that you can adjust and test your PSG Family signal generator to meet specifications.

### How to Proceed

First, review the rest of this section to learn about installing, configuring, and running calibration software. Next, refer to "Required Equipment" to learn about hardware and software requirements, or become familiar with "Performance Tests" or "Adjustments". If you need assistance, refer to the section on "[Contacting Agilent Technologies](#)" on page 5-2.

To install, configure, and run this software, refer to and perform the steps in the following procedures:

1. "[Confirming Equipment](#)" on page 1-3
2. "[Installing Software](#)" on page 1-4
3. "[Logging Into the Administrative Area](#)" on page 1-5
4. "[Configuring a Test Plan](#)" on page 1-7
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9. "[Running a Test Plan Using the Manual Test Selection Tab](#)" on page 1-20
10. "[Using Equipment Selection](#)" on page 1-22
11. "[Viewing Test Reports](#)" on page 1-24

## Confirming Equipment

- Confirm that you have the proper test equipment. (Refer to the section on “Required Equipment” for a complete listing.) Let all the test equipment and signal generator warm up in accordance with instrument specifications.
- Confirm that your computer has the following hardware, operating system, and software:

**Table 1-1 Computer Requirements**

<b>Hardware</b>	
Test System Controller	IBM PC compatible with a 200 MHz Pentium or greater
Hard Disk Space Required	200 MB or more
RAM Required	64 MB or more
CD-ROM Drive	The CD-ROM drive is used for installation.
GPIB Card	Agilent 82350A GPIB card or National Instruments AT-GPIB/TNT card with VISA Libraries or PCI-GPIB card with VISA Libraries
<b>Operating System</b>	
IBM PC Operating System	Windows 95, Windows 98, Windows 2000, or Windows NT 4.0 computer with Service 5 or above
<b>Software</b>	
Internet Browser for Viewing Help System	Microsoft Internet Explorer 4.0 and above, or Netscape Navigator 4.0 and above.  Either browser must be Java enabled with Java 1.02 or above.

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## Installing Software

To install calibration software, perform the following steps:

1. Close all applications.
2. Insert the CD-ROM that came with your shipment into your computer's CD-ROM drive.
3. Choose **Run** from the Start menu.
4. Type D:\SETUP (where D is the letter for your CD-ROM drive).
5. Follow the instructions on the screen to install calibration software.
6. Restart the computer to re-configure the system.

When the installation is complete, a shortcut is created on the computer's desktop and a program group is added to the Start menu. The shortcut and program group is labeled Agilent Test Management Environment (TME).

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## Logging Into the Administrative Area

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**NOTE** When your system is used in a networked (multi-user) environment, only one person can enter the Administrative Login area at a time. Make sure that no one runs a test when updating equipment in the Administrative Login area that is used by the test, or they will get the warning message:

"Administrator may be updating equipment database. Equipment may be changing and any test performed may have wrong equipment assignment."

This message may also appear if the program was terminated improperly while an Administrator was in the Administrative Login area.

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1. Run the TME software by double-clicking the shortcut icon on the desktop.
2. Select the **Administration** tab. The initial configuration needs to be performed using the Administration tab.

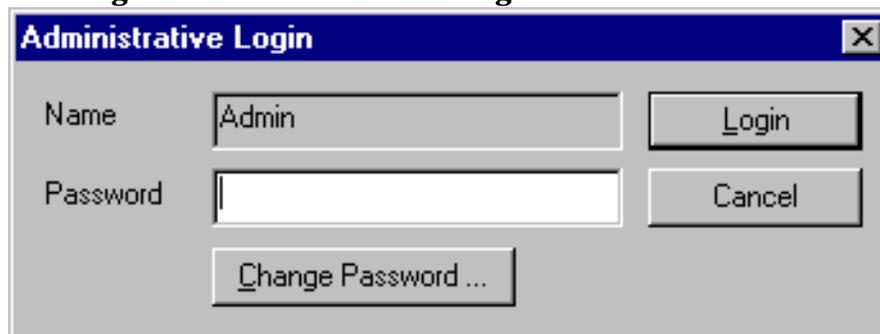
**Figure 1-1 Administration Tab**



3. Select the Login button when the Administrative Login dialog box appears.

There is no password set the first time that the Administrative Login dialog box is being accessed. After the initial login, you have the option to password protect this Administrative Login area or continue bypassing password protection.

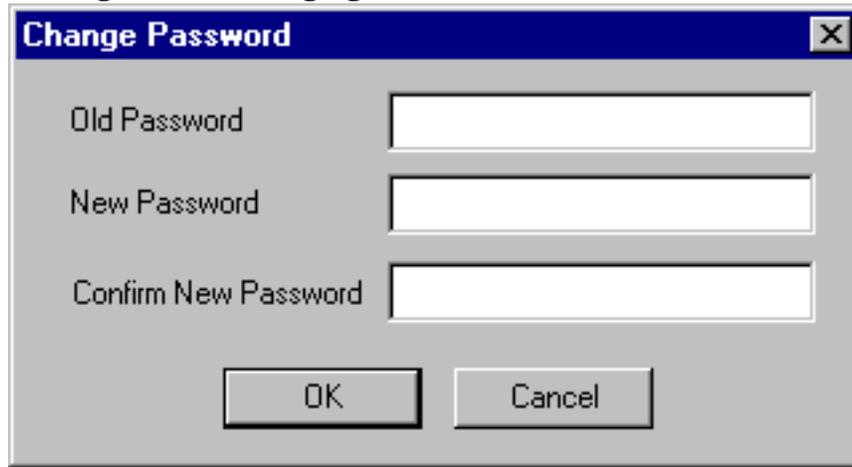
**Figure 1-2 Dialog Box for Administrative Login**



**To enter or change the Administrative Login password**

1. Select the **Change Password** button from the Administrative Login dialog box.

**Figure 1-3** Dialog Box for Changing Passwords



2. Enter the **Old Password** if there was one previously being used or leave the field blank.
3. Enter a **New Password**. The new password can be from 1 to 256 characters in length.
4. Enter the same password again in the **Confirm New Password** field.
5. Select the **OK** button and the new password will take effect.

**To bypass password protection for the Administrative Login dialog box**

1. Leave the password field blank and select the **Login** button from the Administrative Login dialog box.

## Configuring a Test Plan

Configuring a test plan is the process of associating a station name to a set of tests; these tests are used to verify that a unit under test (UUT) meets specifications. A **Station Name** is a name given to a group of test equipment that is used as a measuring standard.

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### NOTES

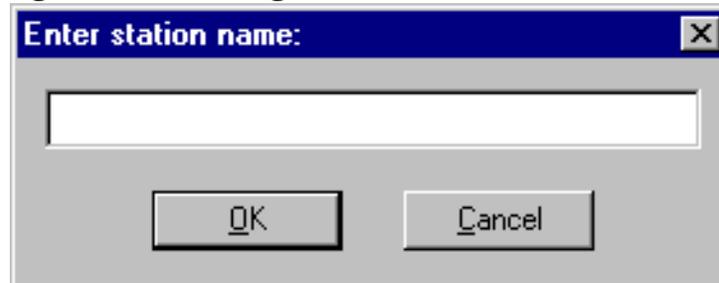
- When a device icon is green, the equipment assigned to the test station is calibrated and ready for use and also indicates that all required parameters have been entered.
  - When a device icon is yellow, the equipment assigned to the test station is calibrated and ready for use, but is due to be re-calibrated within the next 30 days.
  - When an icon is red, the equipment assigned to the test station is either out of calibration or the required parameters have not been entered (for example, serial number).
-



To add/map the equipment you are using to test the UUT

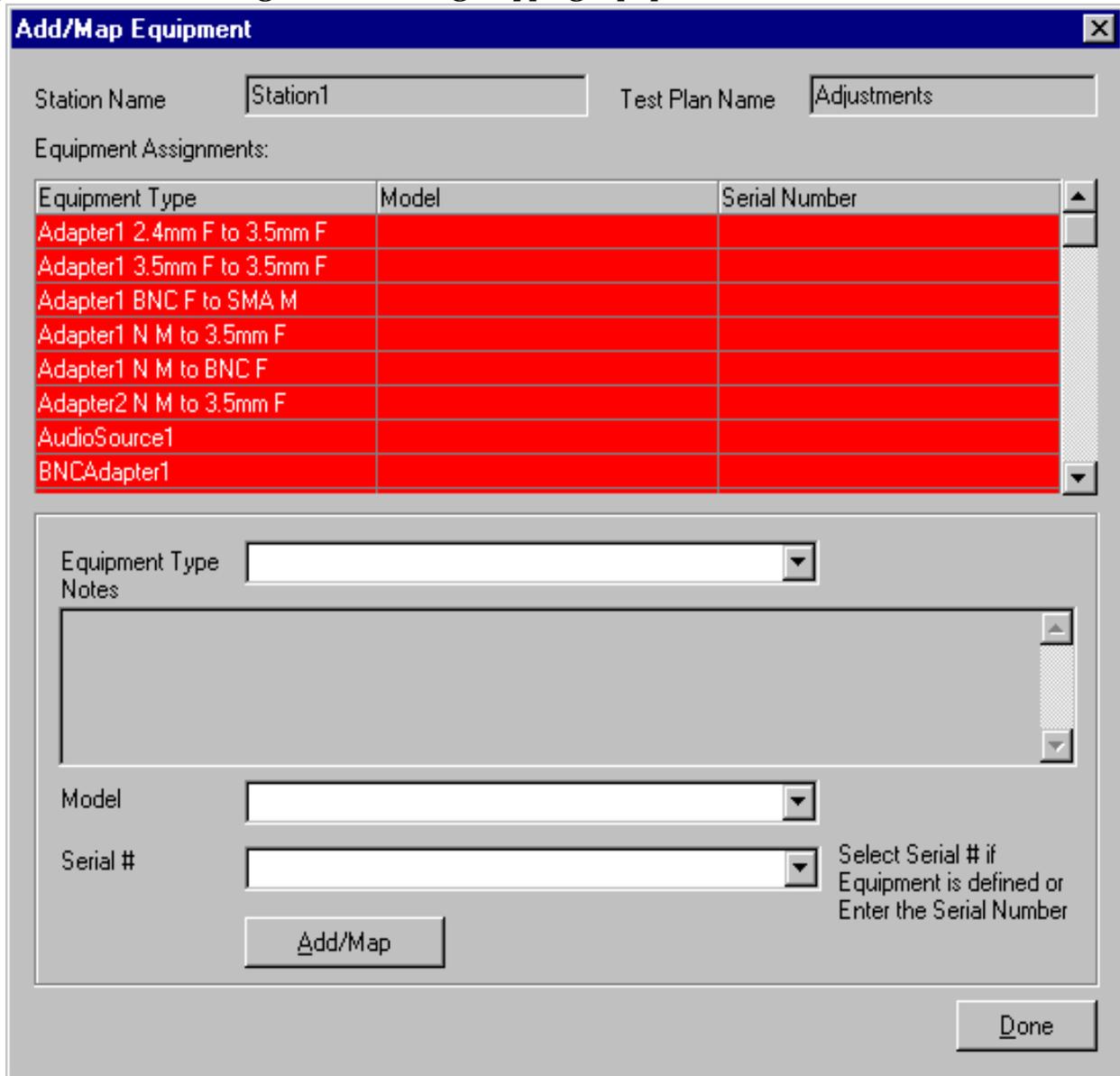
1. Select the **Add Station** button and enter a name (station name) that can be used to identify the group of equipment being added.

**Figure 1-5** Dialog Box for Entering a Station Name



2. Select a **Test Plan Name**. TME software comes pre-configured with a set of test plans that can be configured.
3. Select **Equipment Type** to be **All**. This eliminates the need to change the equipment type each time that a device is added.
4. Select the **Add/Map Equipment** button. A screen is displayed with a list of equipment needed for the Test Plan Name with a red background.

**Figure 1-6** Dialog Box for Adding/Mapping Equipment



5. Select each piece of equipment from the **Equipment Type** drop down menu or double-click each piece of equipment being displayed under the list of **Equipment Assignments**.
6. Select the **Model** from the drop down menu that matches your equipment. Verify that the equipment model and options of your equipment match the required equipment list, otherwise the TME software will not work properly. This may not become apparent until after the testing process has been started on the UUT.
7. Enter the serial number of the equipment. Each device must be assigned a unique combination of model and a serial number. For devices that do not normally have a serial number, such as cables or connectors, a model or part number can be used as a unique identifier representing the serial number.
8. Select the **Add/Map** button. A confirmation screen is displayed. If you agree with it, select the **OK** button. The equipment list item that has been added turns from a red background to a white background.

9. Repeat these steps to add/map the remaining equipment you are using to test the UUT. The goal is to turn the backgrounds of all listed equipment to white.
10. Select **Done** when all the required equipment is added or mapped.

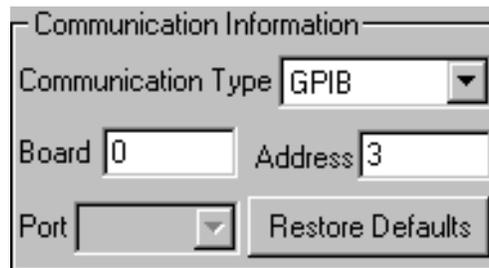
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**NOTE** All equipment available for use can be added at this time. This allows temporary equipment substitution later without entering the Administrative area.

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## Using the Communication Information Area

**Figure 1-7** Communication Information Area of the Administration Screen

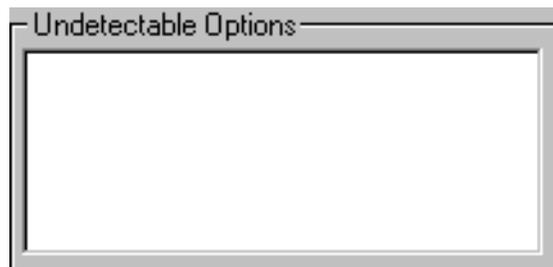
The image shows a dialog box titled "Communication Information". It contains four input fields: "Communication Type" is a dropdown menu with "GPIB" selected; "Board" is a text box containing "0"; "Address" is a text box containing "3"; and "Port" is a dropdown menu. To the right of the "Port" dropdown is a button labeled "Restore Defaults".

- **Communication Type** will display the supported I/O type for the specific device selected. A few examples of this choice include GPIB, Serial, LAN, and None.
- **Board** default value is "0". This represents the default address of the GPIB card. If two GPIB cards are installed and the specific device is connected to the secondary card, this value needs to be changed to "1".
- **Address** is the communication address of the device. For example, 3 is the GPIB address of the device.

## Using the Undetectable Options Area

Some devices may have undetectable options. An undetectable option is one that cannot be detected by way of I/O communication. View your required equipment list and ensure that your test equipment has the necessary undetectable options. If your equipment has the required undetectable options, select the appropriate option from the Undetectable Options list.

**Figure 1-8** Undetectable Options Area of the Administration Screen

The image shows a dialog box titled "Undetectable Options". The main area of the dialog is a large, empty rectangular frame, indicating that no options are currently listed or selected.

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## Entering Calibration Information

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**Figure 1-9** Calibration Information of the Administration Screen

Calibration Information

Last Calibration	01/01/1970	Calibration Interval	12 months
Next Required Cal	01/01/1971	Trace Number	

Below the input fields is a large empty text area with scrollbars.

Calibration Information fields specify the calibration information for the device selected:

- **Last Calibration** date and the **Calibration Interval** can be changed at this time.
- **Next Required Cal** is calculated from the Last Calibration date and the Calibration Interval.
- **Trace Number** is used for reporting purposes only. This information will be displayed in the test reports created by the software.
- An **Edit Cal Data** button is available if a device requires calibration data. For some devices, you may need to enter calibration information.

**To enter calibration information for a device**

---

**NOTES**

- Always use the **Tab** key to move from field to field or select a new field with the mouse; data is stored when a new field is selected.
  - Never press the **Return** key while entering calibration data or the Reference Calibration Factor. This will cause the last row entered to not be accepted.
  - When dealing with data from a power sensor calibration report, Rho represents the Reflection Coefficient magnitude.
- 

1. Select a **Device** icon.
2. Select the **Edit Cal Data** button if it is available.
3. Enter calibration data. Use the **Tab** key to move from field to field.
4. When all the calibration data is entered, select the **OK** button. Depending on the device, you may also need to enter a Reference Calibration Factor.

**To enter a Reference Calibration Factor for a device**

1. Select the **Additional Properties** button.
2. Enter the data. Use the **Tab** key to move from field to field.
3. When you have completed entering this data, select the **OK** button.

---

## Connecting GPIB Test Instruments

The previous sections describe the preparation of the test software. This section describes the preparation of the instruments used by the test software at a given test station. The test software does not check instruments for proper operation on the GPIB bus before attempting to perform tests.

The typical GPIB address configured test station is:

**Table 1-2**            **Typical GPIB Addresses**

Signal Generator	19
Power Meter	13
Frequency Counter	03

It is recommended that the operator follow the steps below to manually check for proper connection of the GPIB devices before performing tests on a newly connected test station.

---

**NOTE**            The GPIB address of each instrument associated with the test station/test plan is defined when configuring a test plan.

---

1. Connect a power cord to each instrument, then connect each instrument to the computer serving as the GPIB controller.
2. Power up all the instruments on the GPIB bus.
3. Check each GPIB instrument for proper communication over the bus and the required “detectable” options. Follow the process described under the section titled: [To check GPIB bus devices](#).

**To check GPIB bus devices**

---

**NOTE** When checking for basic operation of each GPIB device or when checking for detectable options on a given device, you may have to look up the actual command for retrieving the identification string before performing these procedures.

---

The following applies only to Agilent/HP GPIB cards. A different program is used for National Instruments GPIB cards.

1. Start the VISA Assistant:
  - a. Select the “up” box on the right side of the task bar or access it through:  
**Start/Programs/Agilent I\_O Libraries/VISA Assistant.**
2. Check for all expected GPIB devices:
  - a. Verify that all expected GPIB devices are shown in the left window. If a device is missing, correct the problem and restart the VISA Assistant.
3. Check for basic operation of each GPIB device:
  - a. Select a GPIB device to highlight it.
  - b. Select the “Formatted I/O” tab (expand the window if needed).
  - c. Select the SCPI radio button.
  - d. Select on the “\*IDN?” button.
  - e. Check to see that the expected model number is contained in the response text string.
4. Check for detectable options on a given device:
  - a. Select a GPIB device to highlight it.
  - b. Select the “Formatted I/O” tab.
  - c. Select the SCPI radio button.
  - d. Enter “\*OPT?” and select “vaqueros”. A “detectable” option is one that can be detected through the GPIB.

## Preparing the UUT for Test

Before testing the signal generator:

1. Connect a GPIB cable from the computer to the signal generator.
2. Turn on power and wait for signal generator's start up screen to display.
3. Press **Preset** on the signal generator to clear any previous data.

---

**NOTE** Allow sufficient warm-up time for the test equipment and the signal generator. All test equipment requires a 30 minute warm-up period to ensure accurate performance.

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### GPIB Connections

All test equipment controlled by GPIB should be connected to the GPIB connector of the computer. It is recommended that the operator check for proper connection of the GPIB devices before using a newly connected test station.

### ESD Precautions

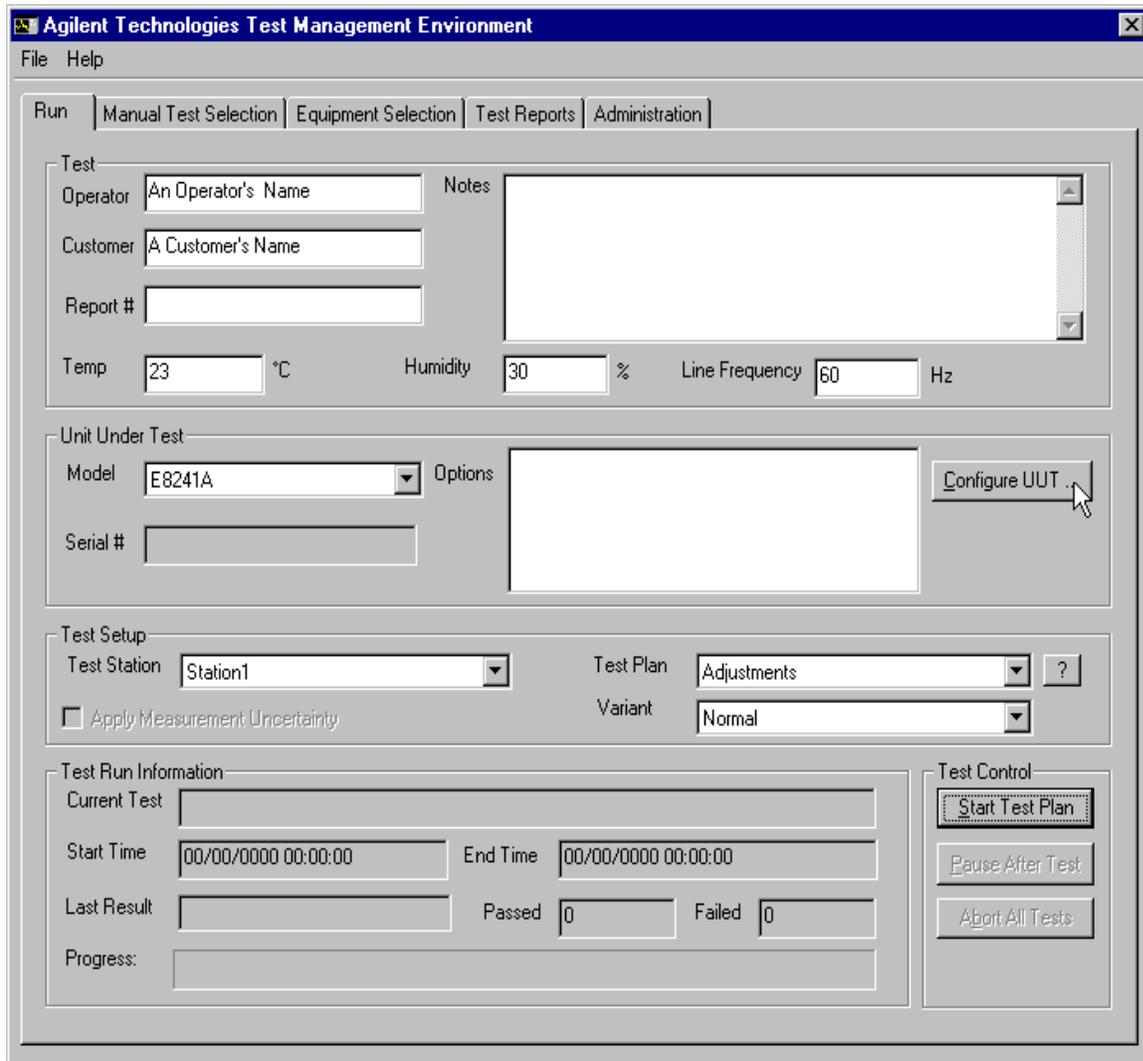
Protection against ESD (electrostatic discharge) is essential while connecting, inspecting, or cleaning connectors attached to a static-sensitive circuit (such as those found in test sets). Static electricity can build up in your body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. Devices such as calibration components and units under test (UUTs), can also carry an electrostatic charge.

#### To prevent ESD damage to the test set, components, and devices

- Always wear a grounded wrist strap having a 1 million Ohm resistor in series with it when handling components and devices or when making connections to the test set.
- Always use a grounded anti-static mat in front of your test equipment.
- Always wear a heel strap when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.

## Running a Test Plan

Figure 1-10 Example of the Test Plan Screen



**NOTE** The Notes field may display important equipment information and allows you to add information that is included in your test report.

The system is ready to test your first unit. You may run the tests in sequence mode or manual mode.

**To run the tests from the run screen**

1. Enter the appropriate information in the fields provided. The **Operator**, **Customer**, and **Report #** information will be displayed in the test reports.
2. Enter the **Temperature**, **Humidity**, and **Line Frequency**. These fields are required to ensure proper testing and measurement uncertainty calculations.
3. Select the Model Number to be tested. This can be selected from the **Model** field in the **Unit Under Test** section.
4. Select the **Configure UUT** button, ensure that the GPIB details are correct, (the default GPIB Address for the signal generator is 19).

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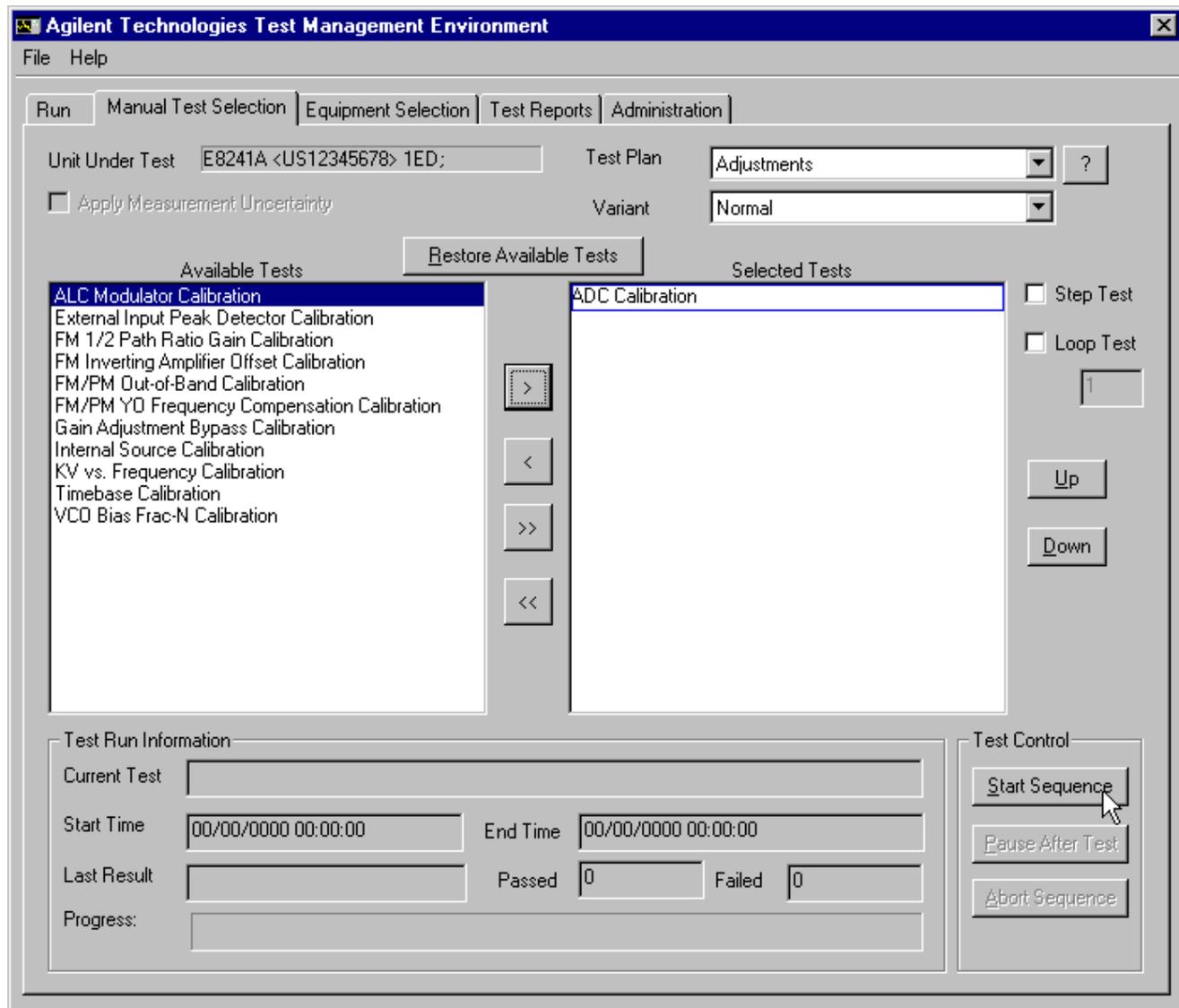
**NOTES**

- If you are asked to input the serial number, type in the correct UUT **Serial #** and select the **OK** button.
- If the serial number is incorrect, it can be changed by selecting the **Change** button.
- Verify the **Communication Properties** and **Factory Calibration Information** and select the **Done** button.

- 
5. Select the **Test Station** that has the necessary equipment to test the selected UUT.
  6. Select the appropriate **Test Plan** for testing. Examples of possible test plans are Performance Verification, Adjustments, or Utilities.
  7. Select the **Variants** of the Test Plan to run. (Normal is the default selection.)
  8. Select the **Apply Measurement Uncertainty** check box if you require the results guard banded by the measurement uncertainty. With this parameter applied, if a measured value falls on or between the specification and the uncertainty limit, an indeterminate flag is displayed.
  9. Select the **Start Test Plan** button in the run screen. This starts execution of the selected Test Plan. Prompts will be displayed to instruct you on how to begin testing of the UUT. Testing performed under the **Run** tab is executed in a predefined order. It automatically sequences through each test until the test process is completed. If an operator requires more control of the testing environment, use the **Manual Test Selection** tab to perform the testing.

## Running a Test Plan Using the Manual Test Selection Tab

Figure 1-11 Example of the Manual Test Selection Screen



The **Manual Test Selection** screen allows more control over running the tests. You can select individual tests, group specific tests, loop a test, or run the tests in your own custom test sequence. Due to the flexibility of selecting tests, you may use this screen to troubleshoot, check repeatability, and other specialized testing. To ensure proper verification of a UUT, the operator should not deviate from the default sequence.

### To run manual tests

Select the manual test order by moving the tests from the **Available Tests** list to the **Selected Tests** list by selecting the test to highlight it and using the arrow keys. (Another method to move the test to the Selected Tests list is to double-click the test in the Available Tests list.)

**Table 1-3 Arrow Keys for Moving Between Available Tests and Selected Tests**

	This control moves highlighted tests from the Available Tests list to the Selected Tests list.
	This control moves highlighted tests from the Selected Tests list to the Available Tests list.
	This control moves all the Available Tests list (the default sequence) to the Selected Tests list. The default sequence is the same test sequence that is executed from the Run tab.
	This control moves all the Selected Tests list to the Available Tests list.

The tests will be performed in the chosen order in the Selected Tests list. You can change the order of the tests by highlighting them and using the Up and Down buttons that are located next to the Selected Tests list.

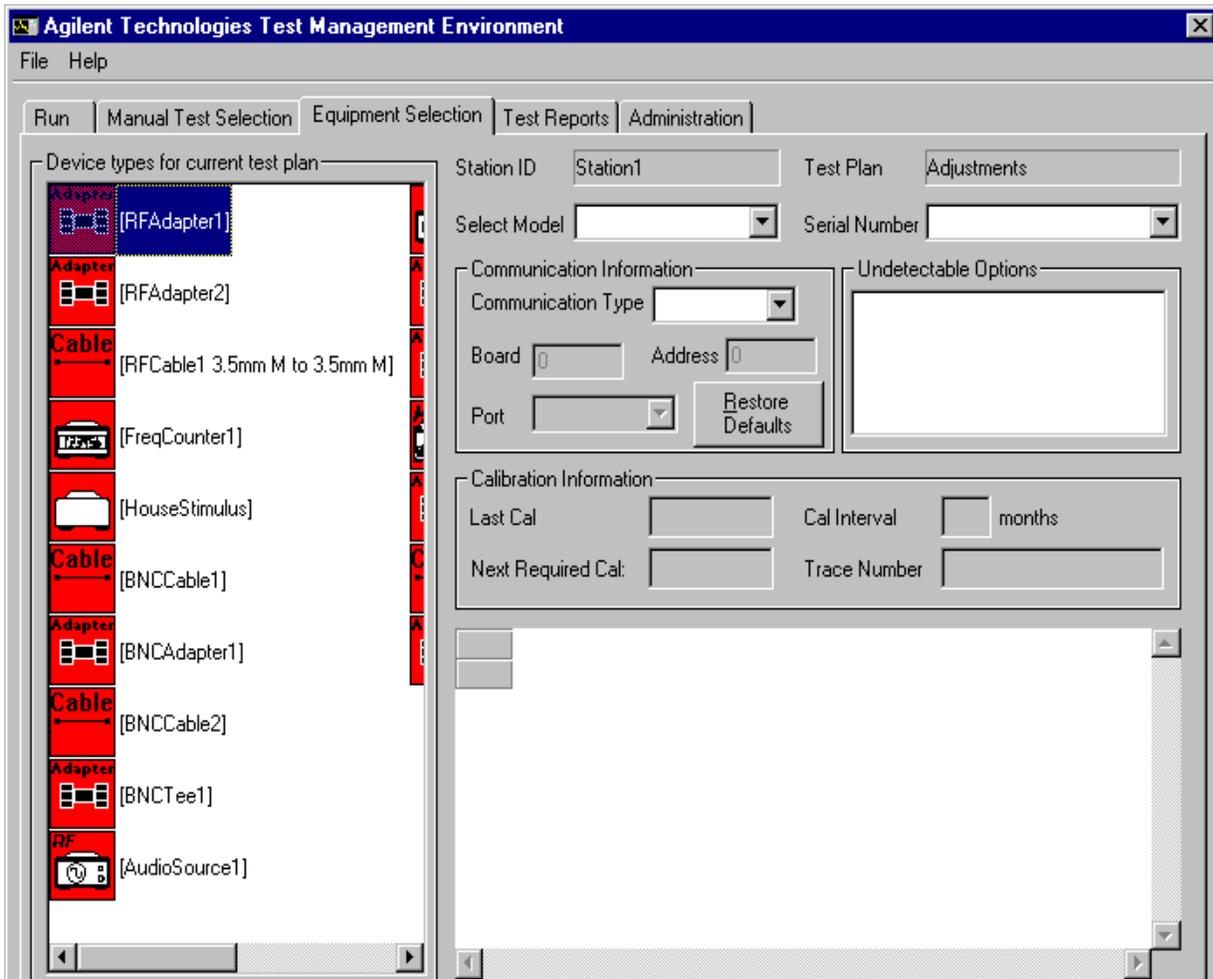
To start a test, select the **Start Sequence** button. Use the other Test Control buttons to pause or abort the test sequence.

On completion of a test, the color used to display the name of the Selected Test changes. If the unit passes, the name is displayed in green. If it fails, the name is displayed in red.

The Progress bar tracks the unit through the tests, changing to reflect what is happening as each test is completed. When the tests are completed, the results are available as a test report.

## Using Equipment Selection

Figure 1-12 Example of the Equipment Selection Screen



### NOTE

- When a device icon is green, the equipment assigned to the test station is calibrated and ready for use and also indicates that all required parameters have been filled in.
- When a device icon is yellow, the equipment assigned to the test station is calibrated and ready for use, but is due to be re-calibrated within the next 30 days.
- When an icon is red, the equipment assigned to the test station is either out of calibration or is not assigned to this test station.

Use the **Equipment Selection** tab to verify that the currently assigned test station equipment can be used to execute a particular test plan or series of tests. The operator can quickly look at the status of any device.

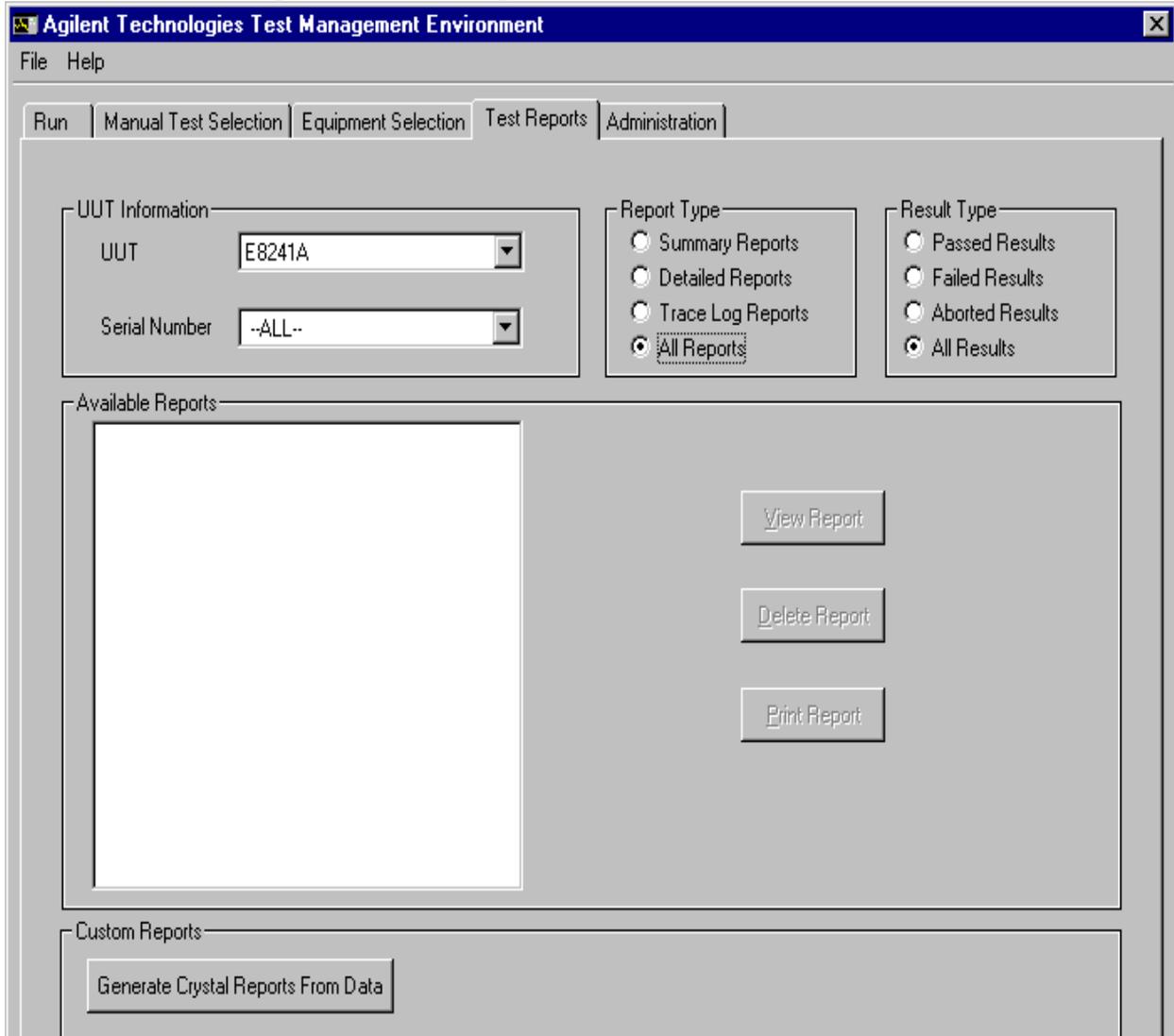
- If a device is not currently configured or no longer in calibration the device icon will be display in red.
- If an available substitute is needed, you can use this tab to temporarily assign that equipment to the station. This substitution can only occur if it was previously defined by the administrator in the Administration tab and made available to the operator.
- The device icons represent the different categories of equipment that are required to execute the test plan. The operator can only change either a selected model or serial number and communication information for a device. The other fields are provided for information purposes only. If changes are required to those fields, they must be performed in the Administration tab.

#### To change information of a device, model, serial or communication information

1. Select the icon that represents the device.
2. If you need to change the **Selected Model** or **Serial Number** of a device, select the parameter to change from the corresponding drop down menus.
3. If you are changing **Communication Information**, select the appropriate communication type from the drop down menu and enter the value for the GPIB board, 0 or 1 (which represents the address of the GPIB I/O card). Then enter the Address field which represents the GPIB address of the device.

## Viewing Test Reports

Figure 1-13 Example of the Test Reports Screen



In the Test Reports screen, you can view or print summary, detailed, trace log, or crystal reports. This calibration software collects data as the tests are run and stores it in a results database.

- **Summary Reports** generates an overview of the testing performed, the name of each test performed, and the results (PASS/FAIL/ABORTED).
- **Detailed Reports** generates a graphical representation of the testing performed. Each test will have the overall test result along with graphs representing the points tested.
- **Trace Log Reports** generates a log of activities that occurred during the testing process. (This is not available for all test plans.)
- **Generate Crystal Reports From Data** accesses the results database to create the desired report. These reports are on an individual test basis only. Along with the overall results of the test and graphical representation of the data, all test points are displayed as well.

#### To access a report

1. In the **UUT Information** area, select the model number from the UUT field.
2. In the **UUT Information** area, select the serial number from the **Serial Number** field.
3. In the **Report Type** area, select the desired report type.
4. In the **Result Type** area, select the desired result type.
5. In the **Available Report** list, select a report to highlight the desired report. The report names correspond to the signal generator's serial number date and time they were tested.
6. Select the buttons to the right of the Available Reports list to view, delete, or print reports.

#### To generate a Crystal Report form

1. Select the **Generate Crystal Reports From Data** button in the Custom Reports area.



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## **2 Required Equipment**

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## Overview of Required Equipment

In this section you will learn about:

**Table 2-1 Required Equipment**

<b>Computer Equipment</b>	This section lists the minimum computer model and its associated interface cards that are required to run calibration software.
<b>Test Equipment</b>	This section lists the test equipment needed to run performance tests and adjustments, any critical specification requirements, and recommended model numbers.

## Computer Equipment

This section lists the minimum computer model and its associated interface cards that are required to run calibration software.

**Table 2-2 Computer Equipment**

<b>Hardware</b>	
Test System Controller	IBM PC compatible with a 200 MHz Pentium or greater
Hard Disk Space Required	200 MB or more
RAM Required	64 MB or more
CD-ROM Drive	The CD-ROM drive is used for installation.
GPIB Card	Agilent 82350A GPIB card or National Instruments AT-GPIB/TNT card with VISA Libraries or PCI-GPIB card with VISA Libraries
<b>Operating System</b>	
IBM PC Operating System	Windows 95, Windows 98, Windows 2000, or Windows NT 4.0 computer with Service 5 or above
<b>Software</b>	
Internet Browser for Viewing Help System	Microsoft Internet Explorer 4.0 and above, or Netscape Navigator 4.0 and above.  Either browser must be Java enabled with Java 1.02 or above.

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## Test Equipment

This section lists the test equipment needed to run performance tests and adjustments, any critical specification requirements, and recommended model numbers. The computer and all test equipment are connected to the unit under test (UUT) using GPIB.

---

**CAUTION** In all test equipment configurations, cables and adapters need to be properly torqued. Exceeding recommended torque values may cause damage to a cable or adapter and may cause inaccurate test results.

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Connector Type	Torque Value
2.4 mm	Use an Agilent 8710-1765 at 8-lb inch when connecting 2.4 mm (m) to 2.4 mm (f).
APC 3.5	Use an Agilent 8710-1765 at 8-lb inch when connecting APC 3.5 (m) to APC 3.5 (f).
SMA	Use an Agilent 8710-1765 at 8-lb inch when connecting APC 3.5 (m) to SMA (f).  Use an Agilent 8710-1582 at 5-lb inch when connecting SMA (m) to APC 3.5 (f).
Type-N	Type-N connectors may be connected finger tight. If a torque wrench is used, Agilent 8710-1766 at 12-lb inch is recommended.
Connector Type	Torque Value

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### NOTES

- All test equipment requires a 30 minute warm-up period to ensure accurate performance.
  - Models for each Test Equipment category are given in order of preference. Alternate or substitute models are listed after the preferred model, but should be considered as a lower priority.
  - It is recommended that all amplifiers be placed in enclosures. This should help reduce the effect of signals radiating into adjacent equipment. It is also recommended that amplifiers are not physically positioned close to equipment that can radiate low-level RF signals.
  - The first two columns of the test equipment table are used to indicate that a piece of test equipment is required during testing for either the E8241A and E8251A (20 GHz models) or the E8244A and E8254A (40 GHz models). Some pieces of test equipment are used for both the 20 GHz and 40 GHz models.
-

**Table 2-3 Test Equipment**

<b>E8241A and E8251A</b>	<b>E8244A and E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>	<b>Critical Specifications</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter	
✓	✓	Power Sensor, Input: Type-N (m)	Agilent E9304A E-Series power sensor	9 kHz to 6 GHz, -70 to +20 dBm
✓	✓	Power Sensor, Input: Type-N (m)	Agilent 8482A power sensor This power sensor can be used in place of the Agilent E9304A E-Series power sensor in some performance tests and some adjustments. It is not an alternate model because some performance tests can not use the Agilent 8482A power sensor.	100 kHz to 4.2 GHz, -30 to +20 dBm
✓		Power Sensor, Input: APC 3.5 (m)	Agilent E4413A E-Series power sensor	50 MHz to 26.5 GHz, -70 to +20 dBm
✓		Power Sensor, Input: APC 3.5 (m)	Agilent 8485A power sensor This power sensor can be used in place of the Agilent 8487A Option H84 power sensor in some adjustments. It is not an alternate model because some performance tests can not use the Agilent 8485A power sensor.	50 MHz to 26.5 GHz, -30 to +20 dBm
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487A Option H84 power sensor Option H84 adds a Standards Lab Calibration.	50 MHz to 50 GHz, -30 to +20 dBm
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487D Option H84 power sensor Option H84 adds a Standards Lab Calibration	50 MHz to 50 GHz, -70 to -20 dBm

**Table 2-3 Test Equipment**

<b>E8241A and E8251A</b>	<b>E8244A and E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>	<b>Critical Specifications</b>
✓		Spectrum Analyzer, Input: Type-N (f)  Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer  Option 001 adds a Second IF Output	9 kHz to 20 GHz
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m)  Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer  Option 001 adds a Second IF Output	9 kHz to 40 GHz  9 kHz to 50 GHz
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator	
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 and Option 050 frequency counter  Option 010 adds a High Stability Timebase, Option 050 adds Channel 3 (5 GHz)	
✓	✓	Frequency Standard, Output: BNC (f)	Use a 10 MHz house standard. (For example, an Agilent 5071A primary frequency standard or equivalent can be used.)	
✓	✓	Vector Signal Analyzer, Input: Type-N (f) Output: BNC (f)	Agilent 89441A vector signal analyzer	
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter  Option 002 adds a High Stability Timebase	

**Table 2-3 Test Equipment**

<b>E8241A and E8251A</b>	<b>E8244A and E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>	<b>Critical Specifications</b>
✓	✓	High Frequency Oscilloscope Mainframe	Agilent 54750A high frequency oscilloscope mainframe	
✓	✓	Oscilloscope Plug-In, Chan 1/3 Input: 2.4 mm (m) Trigger Input: APC 3.5 (m)	Agilent 54752A/B oscilloscope plug-in	50 GHz Plug-In
✓		Power Divider, APC 3.5 (f) (f) (f)	Agilent 11636B power divider	dc to 26.5 GHz
✓	✓	Measuring Receiver, Input: Type-N (f)	Agilent 8902A Option 002 measuring receiver  Option 002 adds a High Stability Timebase	
✓	✓	Audio Analyzer, Input: BNC (f)	Agilent 8903B audio analyzer	20 Hz to 100 kHz
✓	✓	Power Supply	Use any generic power supply capable of supplying +15 Vdc @ 300 mA.	+15 Vdc @ 300 mA
✓	✓	Low Frequency LNA, Input: BNC (f) Output: BNC (f)	Advance Control Components W50ATC low frequency low-noise amplifier (LNA)  Advance Control Components 20 Meridian Road Eatontown, NJ 11788  Phone: (732) 460-0212 FAX: (516) 460-0214	Frequency Range: 100 kHz to 500 MHz  (The LNA is only used up to 10 MHz.)  Gain: 50 dB  Noise Figure: 1.85 dB  1 dB compression minimum: +5 dBm
✓ Qty 2	✓ Qty 2	High Frequency LNA, Input: APC 3.5 (f) Output: APC 3.5 (f)	HMITEQ Inc. AFS3-00010300-18-5P-4 high frequency low noise amplifier (LNA)  MITEQ Inc. 100 Davids Drive Hauppauge, NY. 11788 Phone: (516) 436-7400 FAX: (516) 436-7430	Frequency Range: 50 MHz to 3 GHz (Only used up to 2 GHz)  Gain: >56 dB (Total gain with two amplifiers cascaded)  Noise Figure: 1.8 dB  1 dB compression minimum: +10 dBm

**Table 2-3 Test Equipment**

<b>E8241A and E8251A</b>	<b>E8244A and E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>	<b>Critical Specifications</b>
✓	✓	Phase Noise System, Input: APC 3.5 (m)	Agilent E5504B Option 001 phase noise system with Option 401 or Option 402 added	
	✓	External Mixer, SMA (f) (f) (f)	Agilent 11970A external mixer  LO In and IF Out are SMA (f) and connect to APC 3.5 (m) cables.  RF In is an SMA (f) but requires an Agilent R281A R-Band waveguide which has a 2.4 mm (f) output connector; this is used to connect directly to the RF Output of the signal generator.	
	✓	Adapter, Output: 2.4 mm (f)	Agilent R281A R-Band waveguide	26.5 to 40 GHz
✓	✓	Reference Source Output: Type-N (f)	Agilent 8662A high performance RF signal generator or Agilent 8663A high performance RF signal generator	
✓		6 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 006 fixed attenuator	6 dB, dc to 26.5 GHz
✓	✓	10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator	10 dB, dc to 26.5 GHz
✓	✓	20 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 020 fixed attenuator	20 dB, dc to 26.5 GHz
	✓	6 dB Attenuator 2.4 mm (f) to (m)	Agilent 8490D Option 006 fixed attenuator	6 dB, dc to 50 GHz
	✓	10 dB Attenuator 2.4 mm (f) to (m)	Agilent 8490D Option 010 fixed attenuator	10 dB, dc to 50 GHz
✓ Qty 3	✓ Qty2	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable	1 meter cable length
	✓	Cable, 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable	

**Table 2-3 Test Equipment**

<b>E8241A and E8251A</b>	<b>E8244A and E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>	<b>Critical Specifications</b>
✓ Qty 5	✓ Qty 5	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable	48 inch cable length
✓	✓	Cable, Type-N (m) to (m)	Agilent 11500A Type-N (m) to (m) cable	
✓ Qty 2	✓ Qty 2	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter	
✓ Qty 2	✓ Qty 2	Adapter, BNC (f) to BNC (f)	Agilent 1250-0080 BNC (f) to BNC (f) adapter	
✓	✓	Adapter, BNC (f) to Dual Banana	Agilent E9637A BNC (f) to dual banana adapter	
✓		Adapter, BNC (f) to Type-N (m)	Agilent 1250-0780 BNC (f) to Type-N (m) adapter	
✓	✓	Adapter, BNC (f) to SMA (m)	Agilent 1250-1200 BNC (f) to SMA (m) adapter or Agilent E9631A BNC (f) to SMA (m) adapter	
✓ Qty 2	✓ Qty 2	Adapter, BNC (m) to SMA (f)	Agilent 1250-2015 BNC (m) to SMA (f) adapter	
✓ Qty 2	✓ Qty 2	Adapter, BNC (m) to Mini-Grabbers	Agilent 8120-2337 BNC (m) to mini-grabbers adapter	
	✓	Adapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter	
✓ Qty 2	✓	Adapter, 2.4 mm (f) to Type-N (m)	Agilent 11903D 2.4 mm (f) to Type-N (m) adapter	
✓	✓	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter	
	✓	Adapter, 2.4 mm (f) to APC 3.5 (m)	Agilent 11901D 2.4 mm (f) to APC 3.5 (m) adapter	

**Table 2-3 Test Equipment**

<b>E8241A and E8251A</b>	<b>E8244A and E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>	<b>Critical Specifications</b>
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter	
✓	✓	Adapter, APC 3.5 (m) to (m)	Agilent 1250-1748 APC 3.5 (m) to (m) adapter	
✓ Qty 4		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter	
✓		Adapter, APC 3.5 (m) to Type-N (m)	Agilent 1250-1743 APC 3.5 (m) to Type-N (m) adapter	
✓ Qty 3		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter	
✓		Adapter, APC 3.5 (f) to Type-N (f)	Agilent 1250-1745 APC 3.5 (f) to Type-N (f) adapter	

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## **3 Performance Tests**

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## Overview of Performance Test

In this chapter you will learn about all available performance tests for PSG Series signal generators. These performance tests verify that the signal generator meets specifications.

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**CAUTION** In all test equipment configurations, cables and adapters need to be properly torqued. Exceeding recommended torque values may cause damage to a cable or adaptor and may cause inaccurate test results.

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Connector Type	Torque Value
2.4 mm	Use an Agilent 8710-1765 at 8-lb inch when connecting 2.4 mm (m) to 2.4 mm (f).
APC 3.5	Use an Agilent 8710-1765 at 8-lb inch when connecting APC 3.5 (m) to APC 3.5 (f).
SMA	Use an Agilent 8710-1765 at 8-lb inch when connecting APC 3.5 (m) to SMA (f).  Use an Agilent 8710-1582 at 5-lb inch when connecting SMA (m) to APC 3.5 (f).
Type-N	Type-N connectors may be connected finger tight. If a torque wrench is used, Agilent 8710-1766 at 12-lb. inch is recommended.
Connector Type	Torque Value

<b>CW Only PSG-L Series</b>	<b>Analog PSG-A Series</b>	Performance tests are listed in the order that they should be performed to minimize changes in test equipment configurations.  Note that all performance tests are not used with PSG-L Series signal generators.
<b>E8241A E8244A</b>	<b>E8251A E8254A</b>	
✓	✓	Maximum Output Power
✓	✓	Power Level Accuracy
	✓	Internal Pulse Modulation Level Accuracy
	✓	Internal Pulse Modulation Rise/Fall Time
	✓	Internal Pulse Modulation Minimum Pulse Width
	✓	DC FM Carrier Offset
	✓	External AM Frequency Response
	✓	Internal FM Frequency
	✓	External Phase Modulation Frequency Response
	✓	Internal FM Distortion
	✓	Internal Phase Modulation Distortion
	✓	External FM Deviation Accuracy
	✓	Internal Phase Modulation Deviation Accuracy
	✓	External Pulse Modulation On/Off Ratio
✓	✓	Harmonic Spurious
✓	✓	Sub-Harmonic Spurious
✓	✓	Non-Harmonic Spurious
✓	✓	Single-Sideband Phase Noise (Manual Performance Test)

## Maximum Levelled Output Power (Performance Test)

This test verifies that the maximum levelled output power from the signal generator meets specifications.

During this test, the signal generator is initially set to its maximum specified output power (the actual value is dependent on the option being tested) and a measurement is performed using a power meter. If the measured power does not meet the specification, for the option being tested, the signal generator's output power is incremented by 0.1 dB until the maximum specified power is achieved. At each incremented power level, the signal generator is checked for an unlevelled condition. If an unlevelled condition exists prior to achieving the specified maximum output power, the test fails.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter
✓	✓	Power Sensor, Input: Type-N (m)	Agilent E9304A E-Series power sensor or Agilent 8482A power sensor
✓		Power Sensor, Input: APC 3.5 (m)	Agilent E4413A E-Series power sensor
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487A Option H84 power sensor
	✓	Adapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter
	✓	Adapter, 2.4 mm (f) to Type-N (m)	Agilent 11903D 2.4 mm (f) to Type-N (m) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 2.4 mm (f) to (f) adapter
✓		Adapter, 3.5 APC (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter
✓		Adapter, APC 3.5 (f) to Type-N (f)	Agilent 1250-1745 APC 3.5 (f) to Type-N (f) adapter

## Connections and Setup Procedures

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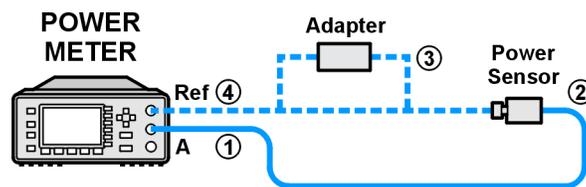
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

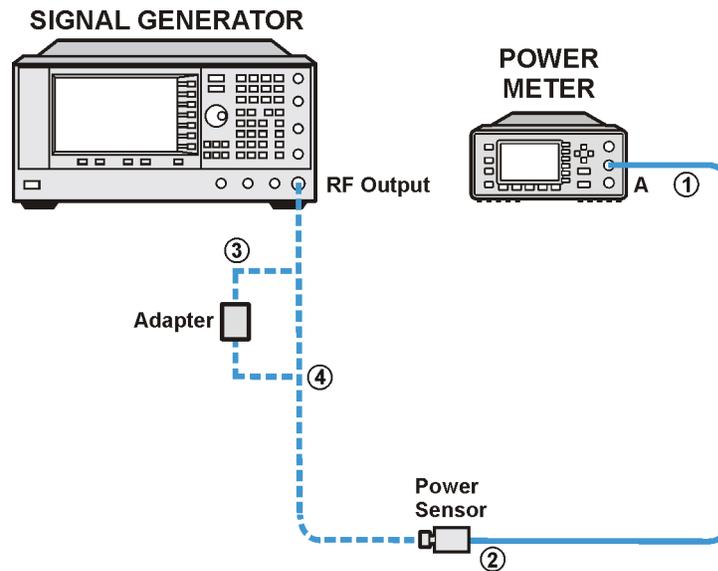
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1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-1 Setup for Power Meter Calibration**



we944a

**Figure 3-2 Setup for Maximum Levelled Output Power Measurement**

we91a

### In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Power Level Accuracy (Performance Test)

This test verifies that output power accuracy, in dBm over the frequency range and power range (down to -110 dBm) of the signal generator, meets specifications.

During the test, the higher power range is measured using a power meter with a calibrated power sensor. The lower power range is measured using a vector signal analyzer. At low power levels, low noise amplifiers (LNAs) are used to raise the signal above the noise floor. At higher frequencies (100 MHz and above), a spectrum analyzer is used to down-convert the signal so that its power may be observed and measured on a vector signal analyzer.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter
✓	✓	Power Sensor, Input: Type-N (m)	Agilent E9304A E-Series power sensor or Agilent 8482A power sensor
✓		Power Sensor, Input: APC 3.5 (m)	Agilent E4413A E-Series power sensor
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487A Option H84 power sensor Option H84 adds Standards Lab Calibration
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487D Option H84 power sensor Option H84 adds Standards Lab Calibration
✓		Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer Option001 adds a Second IF Output
✓	✓	Vector Signal Analyzer, Input: Type-N (f) Output: BNC (f)	Agilent 8944A vector signal analyzer
✓	✓	Power Supply	Use any generic power supply capable of supplying +15 Vdc @ 300 mA.
✓	✓	Low Frequency LNA, Input: BNC (f) Output: BNC (f)	Advanced Control Components W50ATC low frequency low-noise amplifier (LNA)

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓ Qty 2	✓ Qty 2	High Frequency LNA, Input: APC 3.5 (f) Output: APC 3.5 (f)	MITEQ Inc. AFS3-00010300-18-5P-4 high frequency low noise amplifier (LNA)
✓	✓	10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
✓ Qty 3	✓ Qty 2	Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓ Qty 5	✓ Qty 5	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) or Agilent 10503A BNC (m) to (m)
✓ Qty 2	✓ Qty 2	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f)
✓ Qty 2	✓ Qty 2	Adapter, BNC (f) to BNC (f)	Agilent 1250-0080 BNC (f) to BNC (f) adapter
✓ Qty 2	✓ Qty 2	Adapter, BNC to SMA (f)	Agilent 1250-2015 BNC (m) to SMA (f) adapter
✓ Qty 2	✓ Qty 2	Adapter, BNC (m) to mini-grabbers	Agilent 8120-2337 BNC (m) to mini-grabbers
	✓	Adapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter
	✓ Qty 2	Adapter, 2.4 mm (f) to Type-N (m)	Agilent 11903D 2.4 mm (f) to Type-N (m) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓	✓	Adapter, APC 3.5 (m) to (m)	Agilent 1250-1748 APC 3.5 (m) to (m) adapter
✓		Adapter, 3.5 APC (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ Qty 3	✓	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter
✓		Adapter, APC 3.5 (f) to Type-N (f)	Agilent 1250-1745 APC 3.5 (f) to Type-N (f) adapter

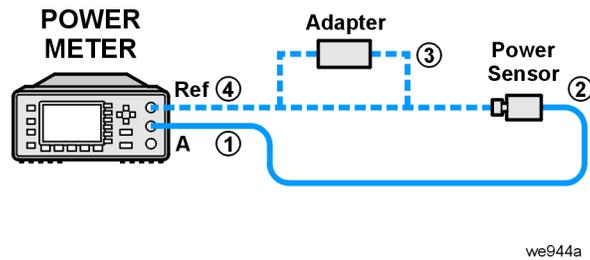
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

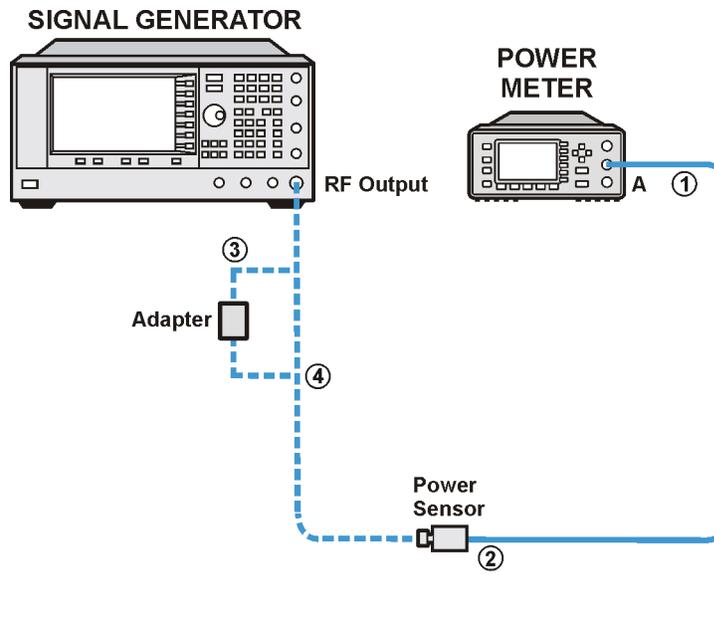
In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-3 Setup for Power Meter Calibration**



**Figure 3-4 Setup for High Power**





## Internal Pulse Modulation Level Accuracy (Performance Test for E8251A and E8254A Models Only)

This test verifies that the power level accuracy of the internal pulse modulator meets specifications.

During the test, the peak-to-peak amplitudes of the CW and PULSE ON signals are measured with a high-frequency, digitizing oscilloscope. The signal generator is placed in CW mode at a certain power level and an oscilloscope is used to measure the peak-to-peak excursion. The signal generator is then pulse modulated by its internal pulse generator and the peak-to-peak measurement is repeated with an oscilloscope.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	High Frequency Oscilloscope Mainframe	Agilent 54750A high frequency oscilloscope mainframe
✓	✓	Oscilloscope Plug-In, Chan 1/3 Input: 2.4 mm (m) Trigger Input; APC 3.5 (m)	Agilent 54752A/B oscilloscope plug-in
✓		10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
✓	✓	20 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 020 fixed attenuator
	✓	10 dB Attenuator 2.4 mm (f) to (m)	Agilent 8493D Option 010 fixed attenuator
✓		Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter BNC (f) to SMA (m)	Agilent 1250-1200 BNC (f) to SMA (m) adapter or Agilent E9631A BNC (f) to SMA (m) adapter
✓		Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm APC 3.5 (f) adapter
	✓	Adapter 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓ Qty 2	✓	Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

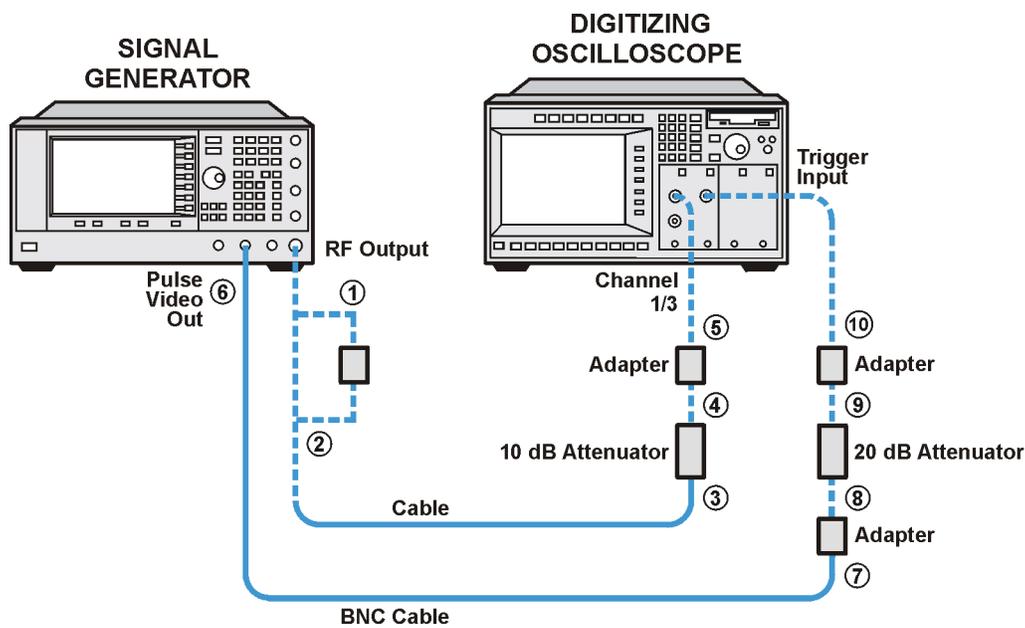
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-6 Setup for Internal Pulse Modulation Level Accuracy**



we915a

### In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies”](#) on page 5-2.

## Internal Pulse Modulation Rise/Fall Time (Performance Test for E8251A and E8254A Models Only)

This test verifies that the internal pulse modulator's rise and fall time meets specifications.

Pulse modulation rise/fall time is defined as the amount of time it takes the pulse envelope to transition from the 10% pulse envelope level to the 90% pulse envelope level on both the rising and falling edges of the pulse.

During the test, the signal generator is placed in an internal pulse modulation mode at a certain power level and the rise and fall time of the pulse envelope is measured with a high-frequency, digitizing oscilloscope.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	High Frequency Oscilloscope Mainframe	Agilent 54750A high frequency oscilloscope mainframe
✓	✓	Oscilloscope Plug-In, Chan 1/3 Input: 2.4 mm (m) Trigger Input; APC 3.5 (m)	Agilent 54752A/B oscilloscope plug-in
✓		10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
✓	✓	20 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 020 fixed attenuator
	✓	10 dB Attenuator 2.4 mm (f) to (m)	Agilent 8493D Option 010 fixed attenuator
✓		Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter BNC (f) to SMA (m)	Agilent 1250-1200 BNC (f) to SMA (m) adapter or Agilent E9631A BNC (f) to SMA (m) adapter
✓		Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm APC 3.5 (f) adapter
	✓	Adapter 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓ Qty 2	✓	Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

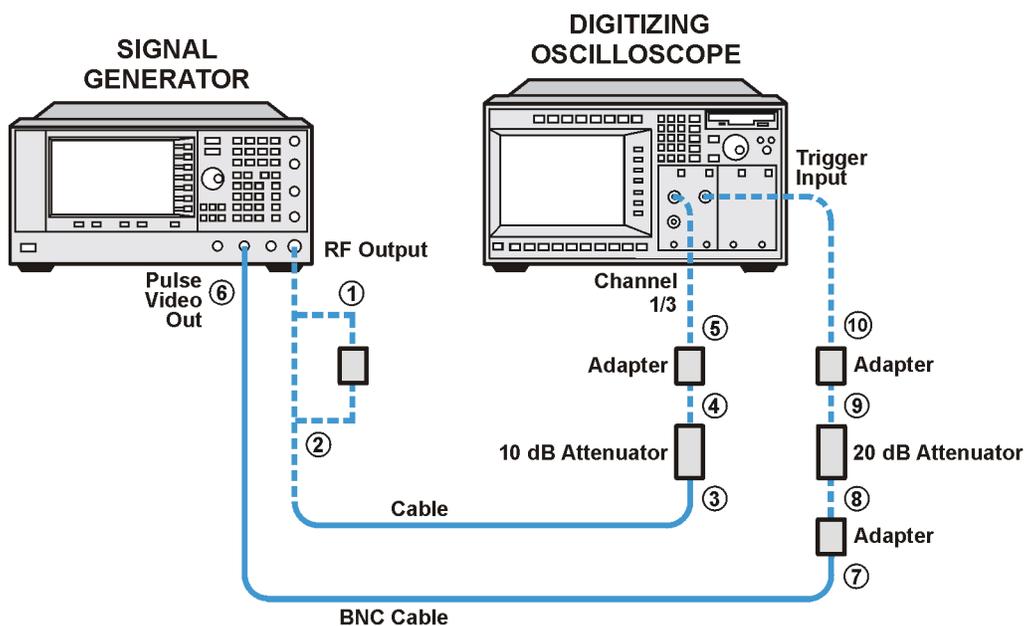
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-7 Setup for Internal Pulse Modulation Rise/Fall Time**



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## In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Internal Pulse Modulation Minimum Pulse Width (Performance Test for E8251A and E8254A Models Only)

This test verifies that the minimum pulse width of the internal pulse modulator meets specifications.

During the test, the signal generator's internal pulse modulator is used to modulate a CW signal. The internal pulse generator is set up for the minimum pulse width with the ALC on and off. An oscilloscope is used to perform a maximum function on the pulse envelope and the minimum pulse width is measured.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	High Frequency Oscilloscope Mainframe	Agilent 54750 A high frequency oscilloscope mainframe
✓	✓	Oscilloscope Plug-In, Chan 1/3 Input: 2.4 mm (m) Trigger Input; APC 3.5 (m)	Agilent 54752A/B oscilloscope plug-in
✓		10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
✓	✓	20 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 020 fixed attenuator
	✓	10 dB Attenuator 2.4 mm (f) to (m)	Agilent 8493D Option 010 fixed attenuator
✓		Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter BNC (f) to SMA (m)	Agilent 1250-1200 BNC (f) to SMA (m) adapter or Agilent E9631A BNC (f) to SMA (m) adapter
✓		Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm APC 3.5 (f) adapter
	✓	Adapter 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓ Qty 2	✓	Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

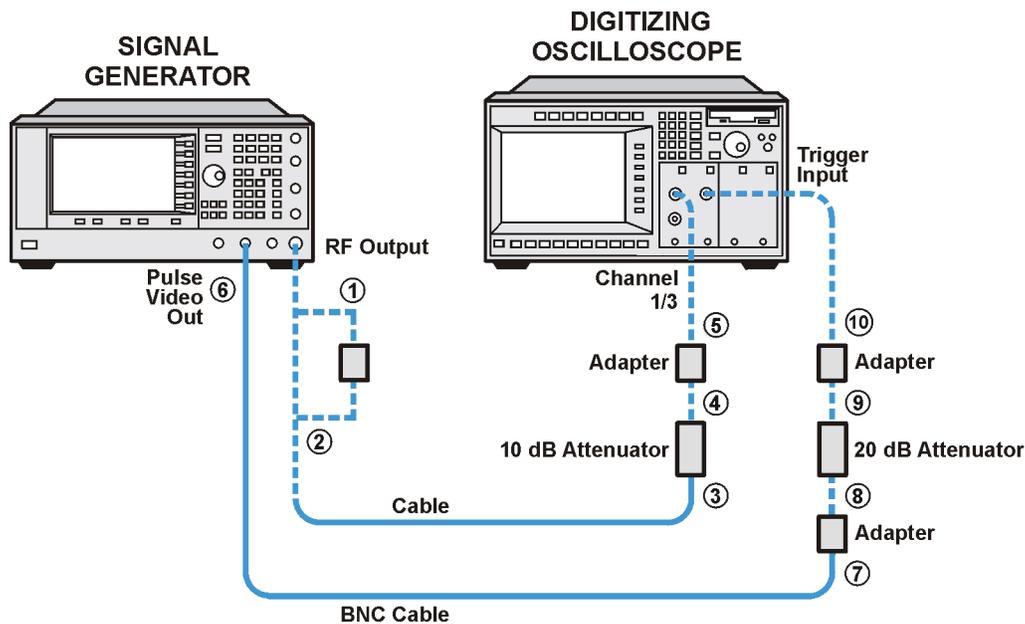
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-8 Setup for Internal Pulse Modulation Minimum Pulse Width**



we915a

### In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## DC FM Carrier Offset (Performance Test for E8251 A and E8254A Models Only)

This test verifies that the amount of carrier frequency shift with FM turned on and then off meets specifications.

The carrier frequency shift is due to residual dc voltage in the EXT 1 dc-coupled path.

During the test, the signal generator is set to a selected carrier frequency, the EXT 1 input is selected and left open, a particular value of FM deviation is selected, FM is enabled, and a DC FM calibration is performed.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 Option 050 frequency counter
✓		Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓		Cable Type-N (m) to (m)	Agilent 11500A Type-N (m) to (m) cable
	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ Qty 2	✓	Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

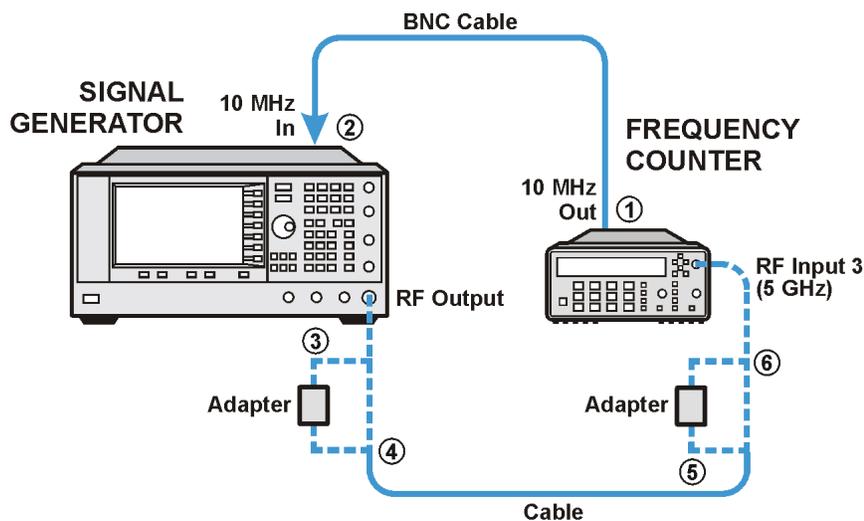
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-9 Setup for DC FM Carrier Offset**



we916a

## In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Internal FM Frequency Response (Performance Test for E8251A and E8254A Models Only)

This test verifies that the internal FM frequency response meets specifications.

FM Frequency Response verifies that a selected FM deviation remains constant within  $\pm 1$  dB as the FM rate is varied from 20 Hz to 100 kHz and the signal generator CW frequency is varied from 500 MHz to 1.0 GHz. If the signal generator meets the frequency response specification in this CW frequency range, frequency response in all other frequency ranges is assured; this assurance is based upon the internal design of the signal generator.

During this test, FM deviation is set to 100 kHz at an FM rate of 1 kHz. The actual deviation is measured with a measuring receiver and stored as the reference deviation. While the deviation setting remains at 100 kHz, actual deviation is measured for FM rates between 20 Hz and 100 kHz. If the measured deviation at any test rate is more than 1 dB different from the reference deviation at 1 kHz, the test fails.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Measuring Receiver, Input: Type-N (f)	Agilent 8902A Option 002 measuring receiver  Option 002 adds a High Stability Timebase
✓	✓	Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Cable Type-N (m) to (m)	Agilent 11500A Type-N (m) to (m) cable
	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓	✓	Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

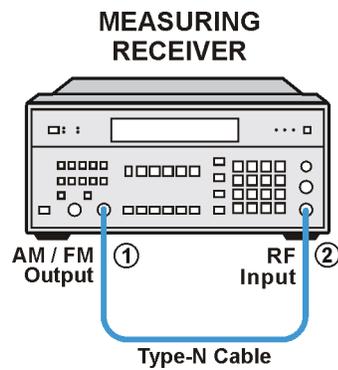
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

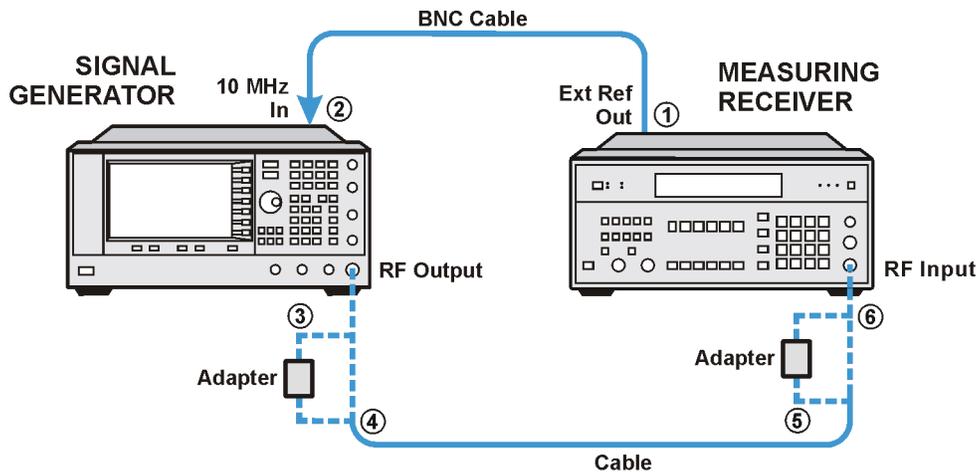
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-10 Setup for Measuring Receiver Calibration**



we945a

**Figure 3-11 Setup for Internal FM Frequency Response**



we918a

**In Case of Difficulty**

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## External Phase Modulation Frequency Response (Performance Test for E8251A and E8254A Models Only)

This test verifies that the external phase modulation frequency response (deviation flatness), while varying the modulation rate from 50 Hz to 100 kHz, meets specifications.

During this test, a reference value is taken with a 1 kHz modulation rate. The modulation rate is then varied with delta-measurements being made. The delta has to be within  $\pm 3$  dB.

A measuring receiver is used to measure the FM deviation. The FM deviation is then divided by the modulation rate to achieve the phase modulation deviation.

External phase modulation deviation accuracy is checked for CW frequencies from 500 kHz to 1.0 GHz. If the signal generator meets the frequency response specification in this frequency range, accuracy in all other frequency ranges is assured; this assurance is based upon the internal design of the signal generator.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter Option 002 adds a High Stability Timebase
✓	✓	Measuring Receiver, Input: Type-N (f)	Agilent 8902A Option 002 measuring receiver Option 002 adds a High Stability Timebase
✓	✓	Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓ Qty 4	✓ Qty 4	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Cable Type-N (m) to (m)	Agilent 11500A Type-N (m) to (m) cable
✓ Qty 2	✓ Qty 2	Adapter BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f)
✓	✓	Adapter Dual Banana to BNC (f)	Agilent E9637A dual banana to BNC (f) adapter
	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓	✓	Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

## Connections and Setup Procedures

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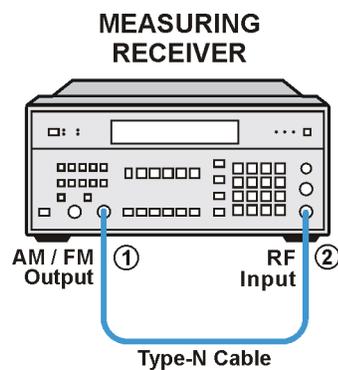
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

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1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

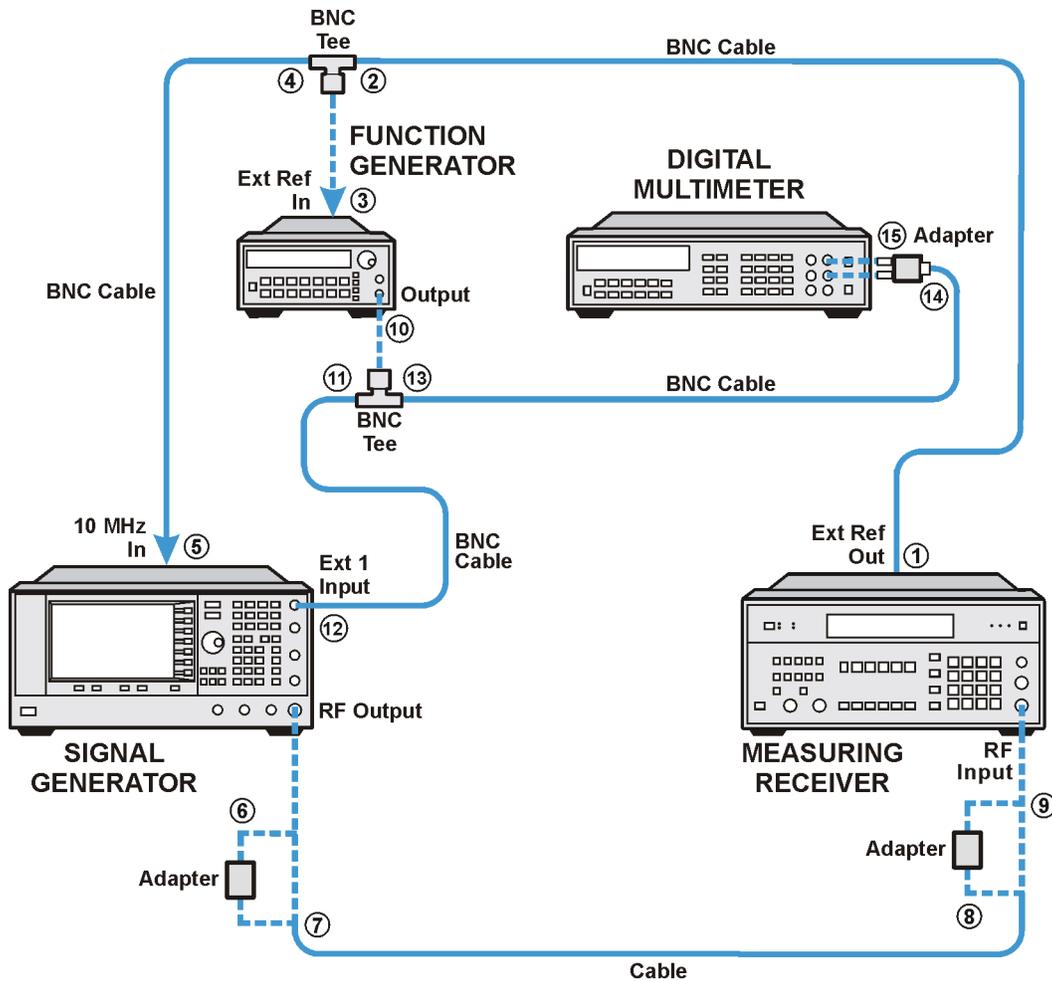
**Figure 3-12 Setup for Measuring Receiver Calibration**



we945a

## External Phase Modulation Frequency Response (Performance Test for E8251A and E8254A Models Only)

Figure 3-13 Setup for External Phase Modulating Frequency Response



we950a

## In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to "Getting Started" in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to ["Contacting Agilent Technologies" on page 5-2](#).

## Internal FM Distortion (Performance Test for E8251A and E8254A Models Only)

This test verifies that internal FM distortion meets specifications.

FM distortion is expressed as the square root of a ratio. The ratio is made up of the power contained in the harmonics of the demodulated FM waveform over the power of the fundamental of the demodulated waveform. This test is essentially a Total Harmonic Distortion (THD) measurement and is made using an audio analyzer. THD is the amount of unwanted frequency components added to a signal due to the non-linearities of an amplifier or mixer when a signal passes through.

During this test, the signal generator is internally FM modulated at a 1 kHz modulation rate. The resulting THD is measured with an audio analyzer. The THD indicated by the audio analyzer includes the distortion added by the measuring receiver.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Measuring Receiver, Input: Type-N (f)	Agilent 8902A Option 002 measuring receiver  Option 002 adds a High Stability Timebase
✓	✓	Audio Analyzer, Input: BNC (f)	Agilent 8903B audio analyzer
✓	✓	Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓ Qty 2	✓ Qty 2	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Cable Type-N (m) to (m)	Agilent 11500A Type-N (m) to (m) cable
	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓	✓	Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

## Connections and Setup Procedures

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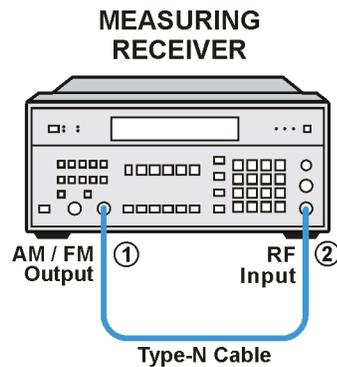
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

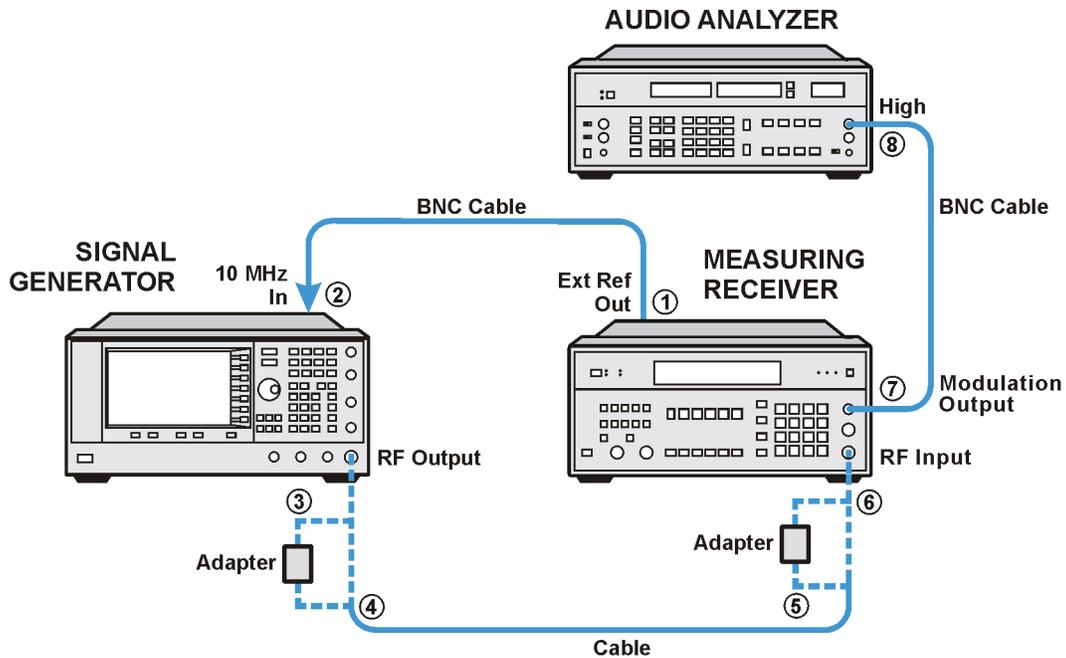
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1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-14** Setup for Measuring Receiver Calibration



we945a

**Figure 3-15 Setup for Internal FM Distortion**

we913a

### In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Internal Phase Modulation Distortion (Performance Test for E8251A and E8254A Models Only)

This test verifies that internal phase modulation distortion meets specifications.

Phase modulation distortion is expressed as the square root of a ratio. The ratio is made up of the power contained in the harmonics of the demodulated phase-modulated waveform over the power of the fundamental of the demodulated waveform. This test is essentially a Total Harmonic Distortion (THD) measurement and is made using an audio analyzer. THD is the amount of unwanted frequency components added to a signal due to the non-linearities of an amplifier or mixer when a signal passes through.

During this test, the signal generator is internally phase modulated at a 1 kHz modulation rate. The resulting THD is measured with an audio analyzer. The THD indicated by the audio analyzer includes the distortion added by the measuring receiver.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Measuring Receiver, Input: Type-N (f)	Agilent 8902A Option 002 measuring receiver  Option 002 adds a High Stability Timebase
✓	✓	Audio Analyzer, Input: BNC (f)	Agilent 8903B audio analyzer
✓	✓	Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓ Qty 2	✓ Qty 2	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Cable Type-N (m) to (m)	Agilent 11500A Type-N (m) to (m) cable
	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓	✓	Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

## Connections and Setup Procedures

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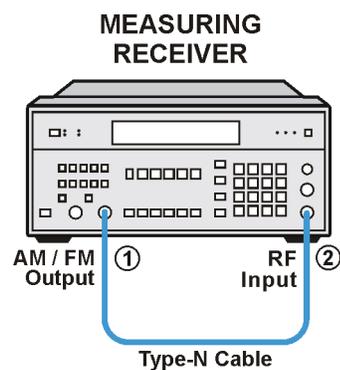
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

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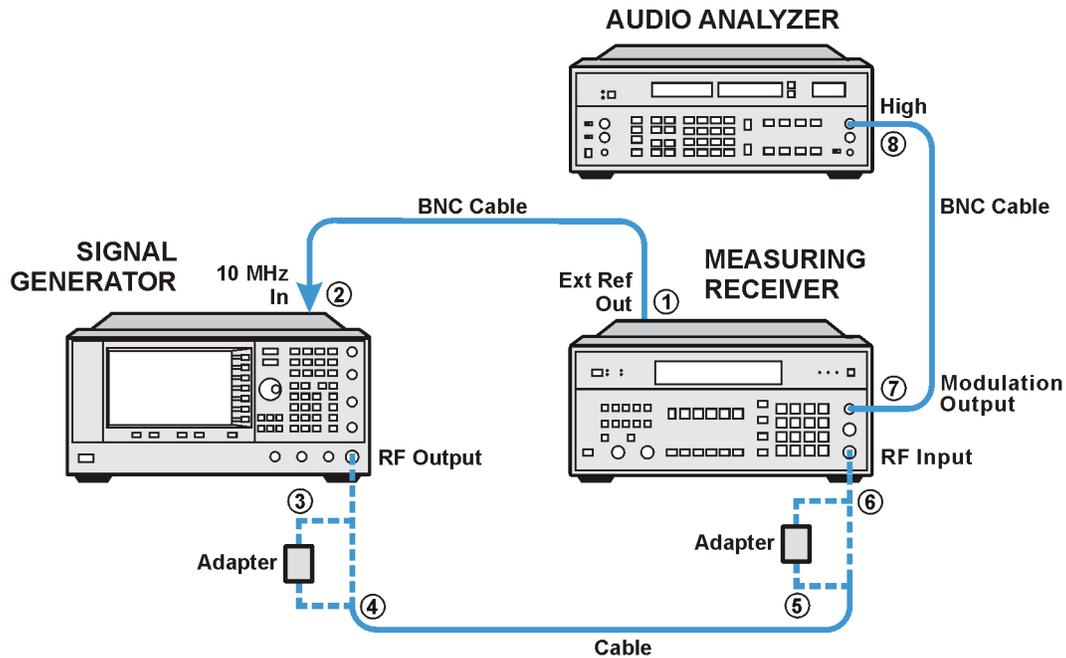
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-16** Setup for Measuring Receiver Calibration



we945a

## Internal Phase Modulation Distortion (Performance Test for E8251A and E8254A Models Only)

**Figure 3-17 Setup for Internal Phase Modulation Distortion**

we913a

**In Case of Difficulty**

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies”](#) on page 5-2.

## External FM Deviation Accuracy (Performance Test for E8251A and E8254A Models Only)

This test verifies that external FM deviation accuracy meets specifications by comparing the selected FM deviation to the measured FM deviation.

During this test, a measuring receiver is used to demodulate an FM signal and indicate the recovered deviation frequency.

FM deviation accuracy is checked for CW frequencies from 500 MHz to 1.0 GHz. If the signal generator meets the FM deviation accuracy specification in this frequency range, FM deviation accuracy in all other frequency ranges is assured; this assurance is based upon the internal design of the signal generator.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter  Option 002 adds a High Stability Timebase
✓	✓	Measuring Receiver, Input: Type-N (f)	Agilent 8902A Option 002 measuring receiver  Option 002 adds a High Stability Timebase
✓	✓	Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓ Qty 4	✓ Qty 4	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Cable Type-N (m) to (m)	Agilent 11500A Type-N (m) to (m) cable
✓ Qty 2	✓ Qty 2	Adapter BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f)
✓	✓	Adapter Dual Banana to BNC (f)	Agilent E9637A dual banana to BNC (f) adapter
	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓	✓	Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

## Connections and Setup Procedures

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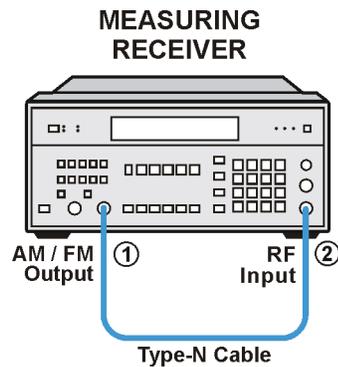
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

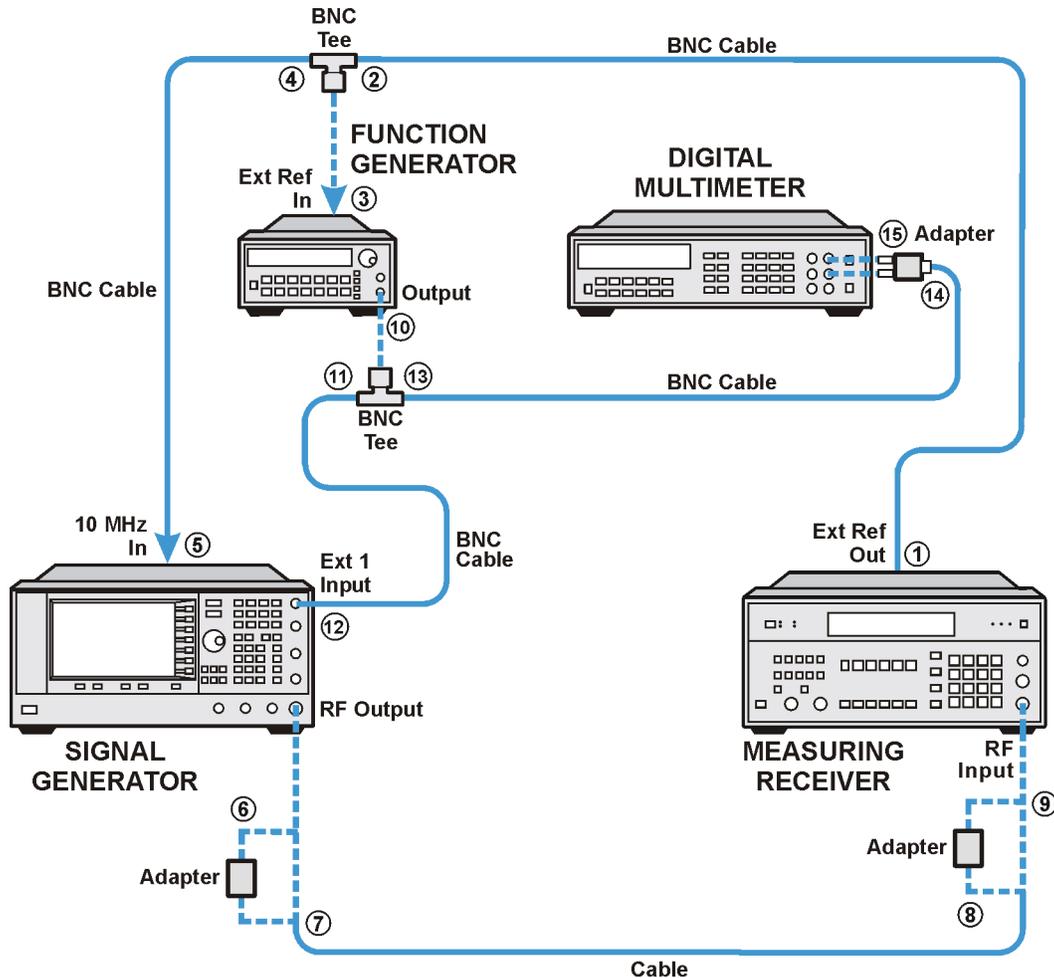
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1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-18** Setup for Measuring Receiver Calibration



we945a

**Figure 3-19 Setup for External FM Deviation Accuracy**

we950a

### In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies”](#) on page 5-2.

## Internal Phase Modulation Deviation Accuracy (Performance Test for E8251A and E8254A Models Only)

This test verifies that internal phase modulation deviation accuracy meets specifications.

During this test, a measuring receiver is used to demodulate the phase-modulated signal and indicate the recovered phase deviation.

Phase modulation deviation accuracy is checked, by comparing the selected phase modulation deviation to the measured phase modulation deviation, for CW frequencies from 500 MHz to 1.0 GHz. If the signal generator meets the accuracy specification in this frequency range, accuracy in all other frequency ranges is assured; this assurance is based upon the internal design of the signal generator.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Measuring Receiver, Input: Type-N (f)	Agilent 8902A Option 002 measuring receiver  Option 002 adds a High Stability Timebase
✓	✓	Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Cable Type-N (m) to (m)	Agilent 11500A Type-N (m) to (m) cable
	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓	✓	Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

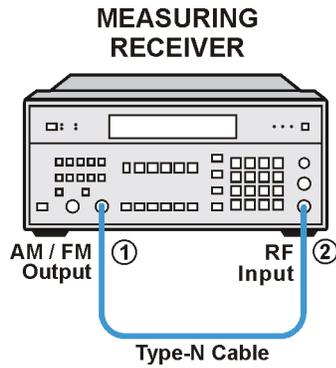
### Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

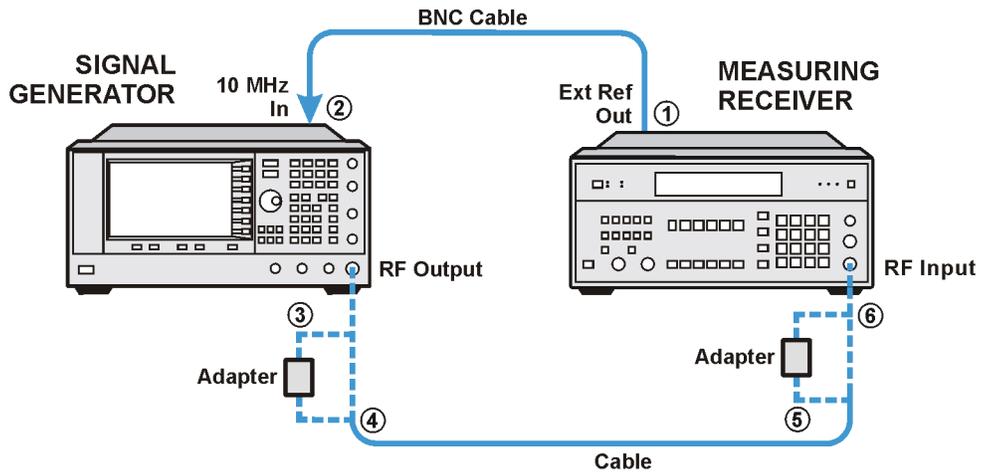
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-20** Setup for Internal Phase Modulation Deviation Accuracy



we945a

**Figure 3-21** Setup for Internal Phase Modulation Deviation Accuracy



we918a

## In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## External Pulse Modulation On/Off Ratio (Performance Test for E8251A and E8254A Models Only)

This test verifies that the external pulse modulation on/off ratio meets specifications.

During this test, a dc voltage, supplied from a function generator, is used to switch the signal generator's pulse modulation on and off. A spectrum analyzer is used to measure the power of the fundamental (CW) frequency from the signal generator with the pulse on and off. The difference in these power levels is the external pulse modulation on/off ratio, in dB.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓		Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 1820-6164 2.4 mm (m) to (f) cable
✓ Qty 2	✓ Qty 2	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓		Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ Qty 2		Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

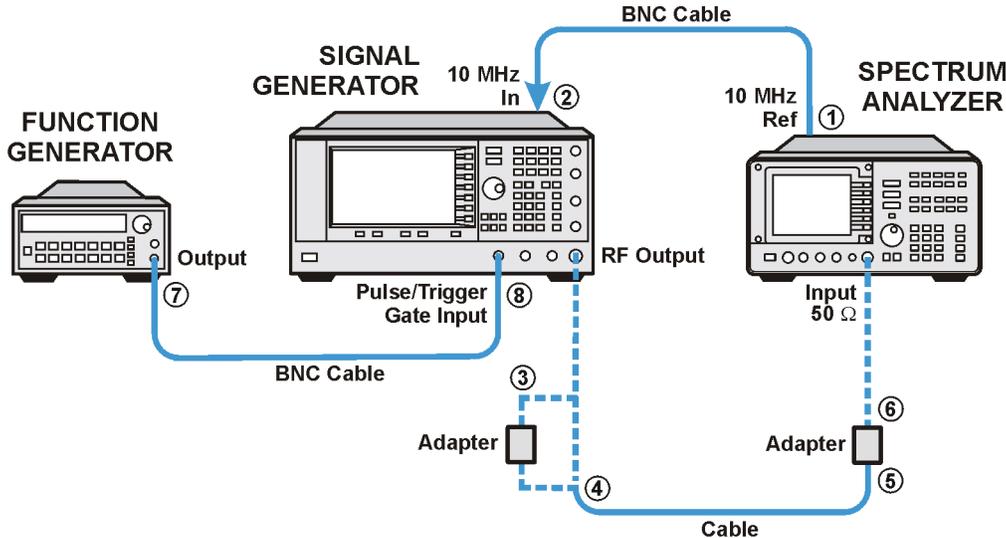
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-22 Setup for External Pulse Modulation On/Off Ratio**



we914a

## In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies”](#) on page 5-2.

## Harmonic Spurious (Performance Test)

This test verifies that harmonic spurious signals meet specifications.

Harmonic spurious signals are signal impurities that occur at integer multiples of a generated signal's fundamental frequency.

During this test, a spectrum analyzer is used to measure the relative power between the fundamental frequency's power and the power of a harmonic frequency. This is done for all 2nd and 3rd harmonics of the fundamental that are below 20 GHz for the E8241A and E8251A and below 40 GHz for the E8244A and E8254A.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓		Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓		10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
	✓	10 dB Attenuator 2.4 mm (f) to (m)	Agilent 8493D Option 010 fixed attenuator
✓		Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 1820-6164 2.4 mm (m) to (f) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ Qty 2		Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

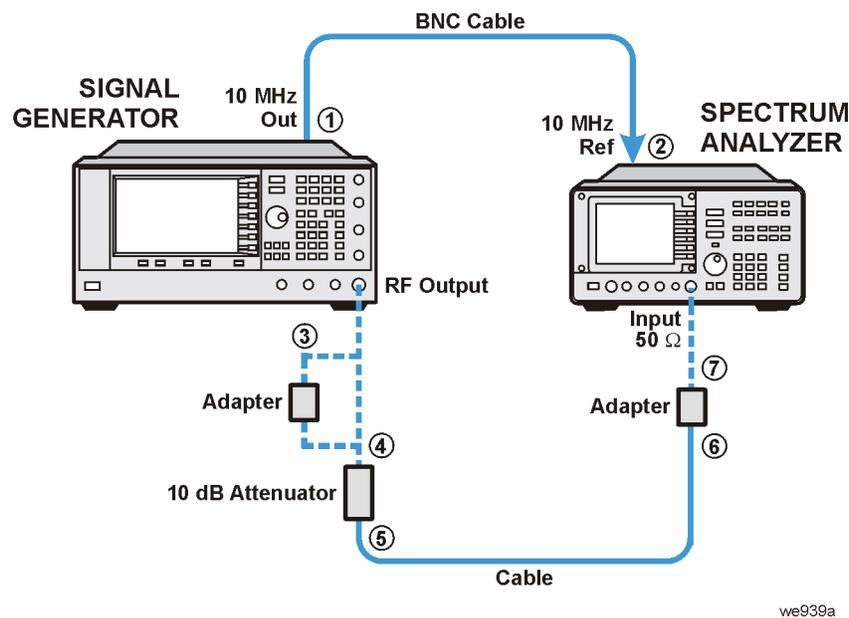
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-23 Setup for Harmonic Spurious**



we939a

### In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Sub-Harmonic Spurious (Performance Test)

This test verifies that the relative power, between the fundamental frequency's power and the power of the sub-harmonic frequency, meets specifications.

Sub-harmonic spurious signals are signal impurities that occur at 0.25, 0.5, 0.75, 1.25, and 1.5 multiples of a generated signal's fundamental frequency.

During this test, a spectrum analyzer measures the amplitude of sub-harmonic spurious signals. This is done for the sub-harmonics of the fundamental that are below 20 GHz for the E8241A and E8251A and below 40 GHz for the E8244A and E8254A.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓		Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓		10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
	✓	10 dB Attenuator 2.4 mm (f) to (m)	Agilent 8493D Option 010 fixed attenuator
✓		Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 1820-6164 2.4 mm (m) to (f) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ Qty 2		Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

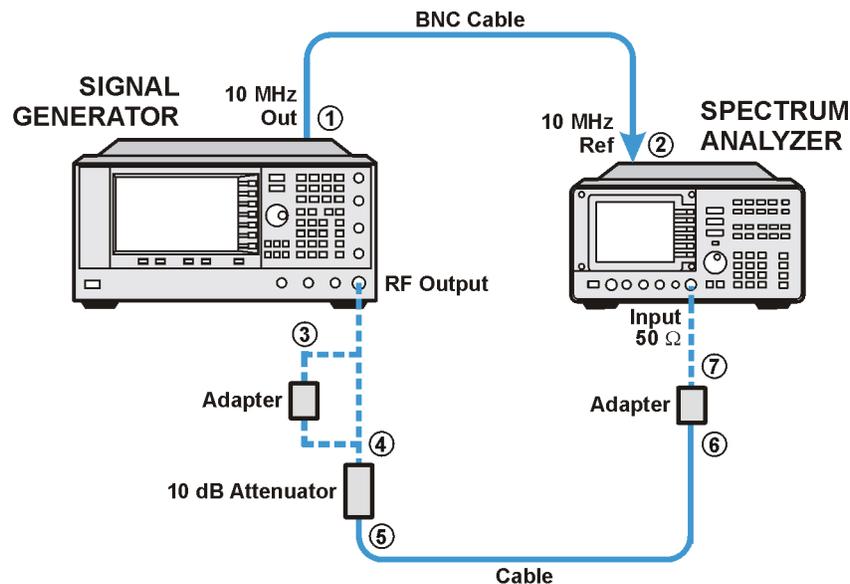
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-24 Setup for Sub-Harmonic Spurious**



we939a

## In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Non-Harmonic Spurious (Performance Test)

This test verifies that the amplitude of non-harmonic spurious signals, relative to a fundamental frequency, meets specifications.

Non-harmonic spurious signals are unwanted signals which are produced by the signal generator's internal frequency synthesis.

During this test, a spectrum analyzer measures the amplitude of non-harmonic spurious signals. This is done for the non-harmonic spurious signals of the fundamental that are below 20 GHz for the E8241A and E8251A and below 40 GHz for the E8244A and E8254A

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓		Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓		10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
	✓	10 dB Attenuator 2.4 mm (f) to (m)	Agilent 8493D Option 010 fixed attenuator
✓		Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 1820-6164 2.4 mm (m) to (f) cable
✓	✓	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓	✓	Adapter 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ Qty 2		Adapter APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

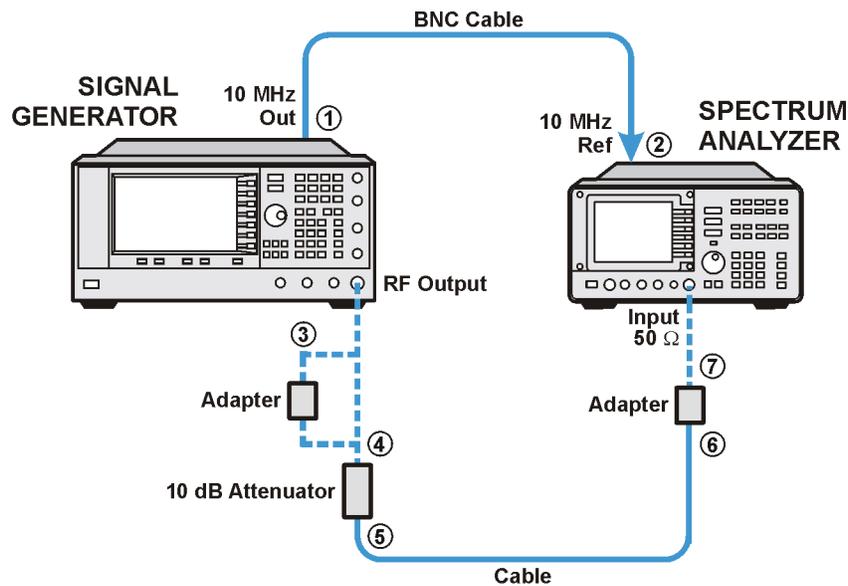
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 3-25 Setup for Non-Harmonic Spurious**



we939a

### In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

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## Single-Sideband Phase Noise (Manual Performance Test)

This manual test verifies that the signal generator's single-sideband phase noise meets specifications.

During this test, a phase noise system is used to measure the single-sideband phase noise of the signal generator. There are four different test setups depending on the carrier frequency being tested:

- 255 MHz
- 600 MHz
- 1.8 GHz, 3.0 GHz, 9.6 GHz, or 19.8 GHz
- 39.8 GHz (E8244A and E8254A Models Only)

An Agilent 8662A/8663A high performance RF signal generator (reference source) is used to produce carrier frequencies for 255 MHz, 1.8 GHz, 3.0 GHz, 9.6 GHz, 19.8 GHz, and 39.8 GHz (E8244A and E8254A models only). The Agilent 70427A downconverter is used to produce a carrier frequency for 600 MHz; this signal is used as the reference source when testing standard models and models equipped with Option UNJ at 100 Hz, 1 kHz, 10 kHz, and 100 kHz offsets.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓		Phase Noise System, Input: APC 3.5 (m)	Agilent E5504B Option 001 phase noise system with Option 401 or Option 402 added
✓	✓	External Mixer, SMA (f) (f) (f)	Agilent 11970A external mixer  LO In and IF Out are SMA (f) and connect to APC 3.5 (m) cables.  RF In is an SMA (f) but requires an Agilent R281A R-Band waveguide which has a 2.4 mm (f) output connector; this is used to connect directly to the RF Output of the signal generator.
	✓	Adapter, Output: 2.4 mm (f)	Agilent R281A R-Band waveguide
✓	✓	Reference Source Output: Type-N (f)	Agilent 8662A high performance RF signal generator or Agilent 8663A high performance RF signal generator
✓ Qty 2	✓ Qty 2	Cable APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable 2.4 mm (m) to (f)	Agilent 1820-6164 2.4 mm (m) to (f) cable
✓ Qty 5	✓ Qty 5	Cable BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
	✓	Adapter 2.4 mm (f) to APC 3.5 (m)	Agilent 11901D 2.4 mm (f) to APC 3.5 (m) adapter
✓ Qty 4		Adapter APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter

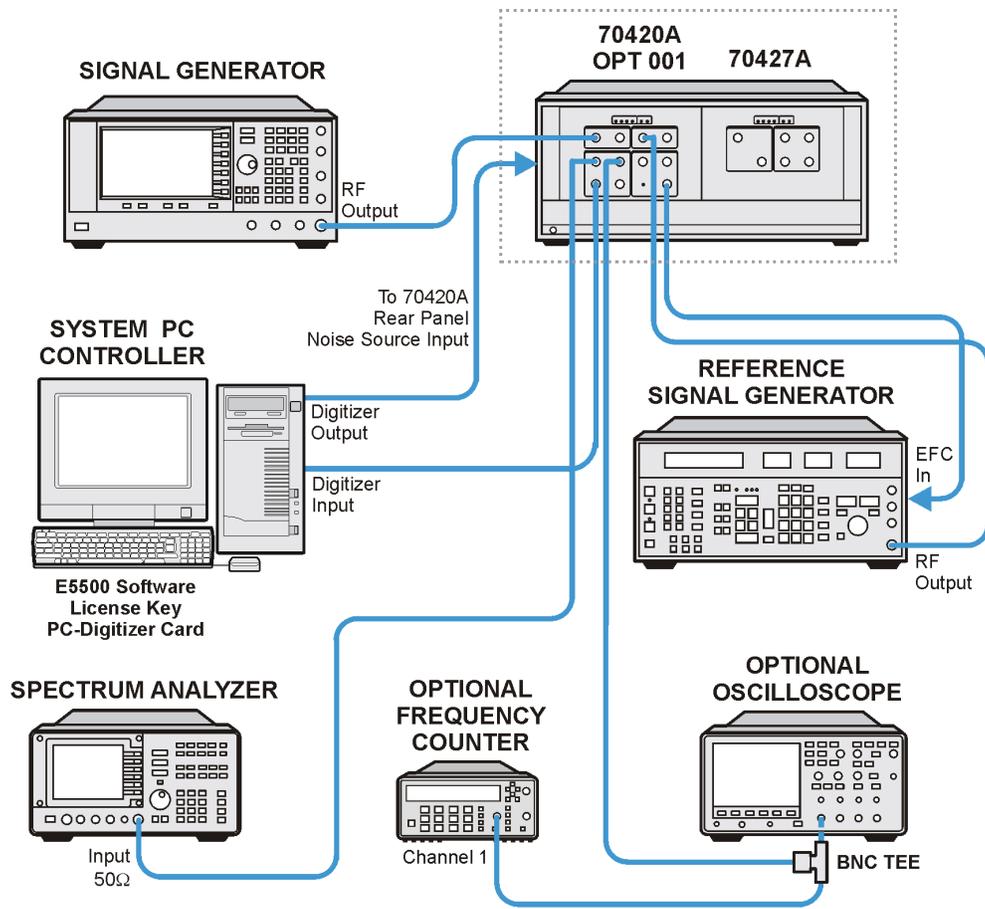
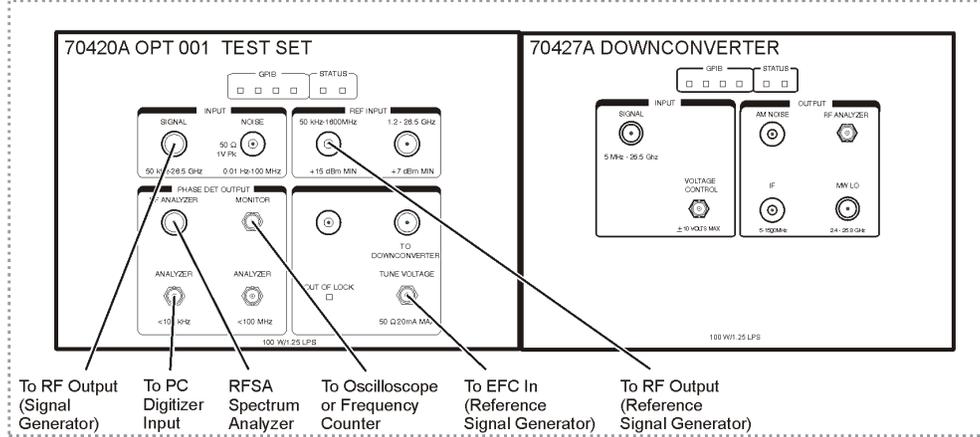
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**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

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# Connections and Setup Procedures for a 255 MHz Single-Sideband Phase Noise Measurement

**Figure 3-26 Setup with a Carrier Frequency of 255 MHz from the 8662A/8663A Reference Source**



we921a

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. Preset all test equipment and the signal generator.
4. Connect the 8662A/8663A RF Output to the 70420A Reference Input.
5. Connect the 70420A Tune Voltage Output to the 8662A/8663A EFC rear panel connector.
6. In the Agilent E5504B Option 001 Phase Noise System user interface, change the following parameters:
  - a. Select the “View” pull down menu.
  - b. Select “Display Preferences” and un-check the “Spurs” box.
  - c. Select “OK” to close Display Preferences.
  - d. Select the “System” pull down menu and select “Server Hardware Connections”.
  - e. Select or ensure that the FFT Analyzer has the “11 PCI20428W-1” selected.
  - f. Connect the signal generator's RF OUTPUT to the 70420A Signal Input.
  - g. Select the “Define” pull down menu, select “Measurement”, and select the following settings:

Parameter	Setting
<b>Type and Range Tab</b>	
Measurement Type	Absolute phase noise
Start Offset Frequency	1 Hz
Stop Offset Frequency	4
FFT Averages	Normal
FFT Quality	Normal
Swept Quality	
<b>Sources Tab</b>	
Carrier Source Connected	Test Set
Carrier Source Frequency	255 MHz
Carrier Source Power	7 dBm
Detector Input Frequency	255 MHz
Reference Source Power	15 dBm
VCO Tune Constant	1.275 Hz/Volt
VCO Tune Range	10 Volts
VCO Input Resistance	1E+6 ohms

Parameter	Setting
<b>Cal Tab</b>	
Measure Phase Detector Constant	Checkmark
Measure VCO Tune Constant	Checkmark
Verify calculated phase lock loop suppression	Blank
Phase Lock Loop Suppression	Use Theoretical Value
<b>Block Diagram Tab</b>	
Carrier Source	Manual
Down Converter	None
Reference Source	8662A/8663A
Phase Detector Mode	Automatic
Test Set Tune Voltage Destination	Reference Source
VCO Tune Mode	EFC
<b>Test Set Tab</b>	
Input Attenuation	0 dB
LNA Low Pass Filter	Auto
LNA Gain	Auto
PLL Integrator Attenuation	0 dB
<b>Downconverter Tab</b>	
Input Attenuation	Auto
IF Gain	Auto
Microwave/Millimeter Band	Microwave (0 - 26.5 GHz)
<b>Graph Tab</b>	
Title	User specific
Graph Type	Single-sideband phase noise (dBc/Hz)
X Scale minimum	1 Hz
X Scale maximum	100E+6

Parameter	Setting
Y Scale maximum	0
Y Scale minimum	-170
Normalize Trace Data	1 Hz bandwidth

### Making the Measurement with a Carrier Frequency of 255 MHz

1. Set the signal generator frequency to 255 MHz and the power to 7 dBm.
2. Set the RF Output to on.
3. Perform a phase noise measurement.
4. Select the Measure pull down menu and select New Measurement.
5. Place markers at the specified offsets.
6. Compare the marker amplitude value to the following specifications:

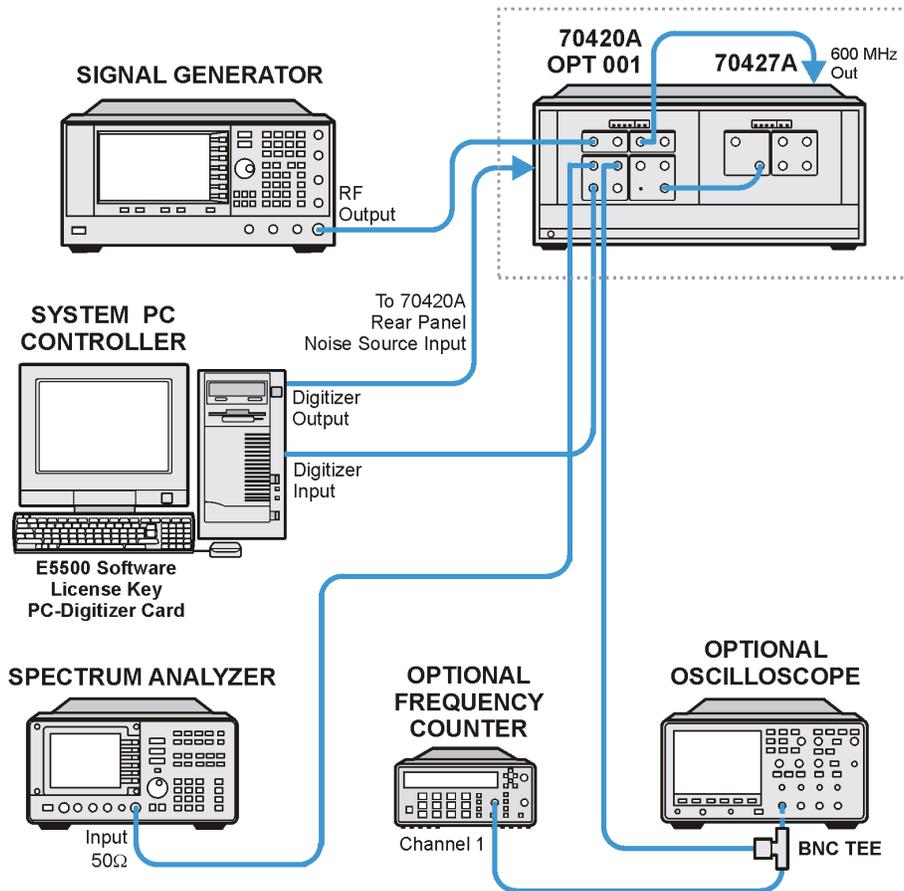
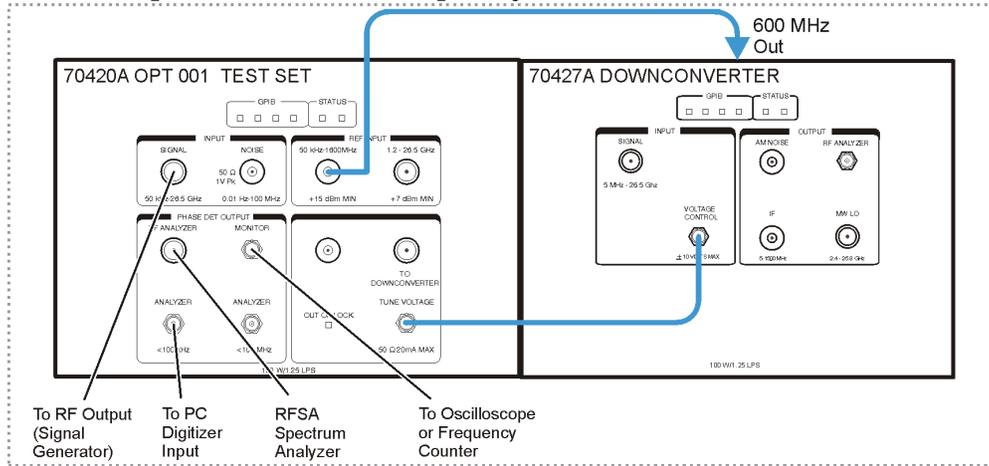
If Option UNJ fails at a carrier frequency of 255 MHz and an offset of 1 kHz, it may not be due to the signal generator. Under these test conditions, the signal generator specifications are better than the 8662A/8663A specifications. If a failure occurs, a three-source measurement should be performed at this carrier frequency and this offset to identify a true failure. (For information on performing a three-source measurement, refer to the Agilent #5504B Option 001 phase noise system user documentation.)

Offset from Carrier (dBc/Hz)					
Carrier Frequency	Standard	Option UNJ			
	20 kHz	100 Hz	1 kHz	10 kHz	100 kHz
255 MHz	-136	-100	-127	-134	-134

7. Print out a phase plot.
8. Continue to the next setup and perform the measurement.

# Connections and Setup Procedures for a 600 MHz Single-Sideband Phase Noise Measurement

Figure 3-27 Setup with a Carrier Frequency of 600 MHz from the 70427A Reference Source



we922a

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB test equipment.
3. Connect the 70427A rear panel 600 MHz output to the 70427A low frequency Reference Input.
4. Connect the 70427A Tune Voltage Output to the 70427A Voltage Control Input.
5. Set the signal generator frequency to 600 MHz and the power to 7 dBm.
6. In the Agilent E5504B Option 001 phase noise system user interface, change the following parameters.

Parameter	Setting
<b>Type and Range Tab</b>	
Carrier Source Frequency	600MHz
Detector Input Frequency	600MHz
Reference Source Power	20 dBm
VCO Tune Constant	30 Hz/Volt
VCO Tune Range	8 Volts
VCO Input Resistance	600 ohms
<b>Block Diagram Tab</b>	
Down Converter	System Control
Reference Source	Manual
Test Set Tune Voltage Destination	Down Converter
VCO Tune Mode	DCFM
<b>Downconverter Tab</b>	
Input Frequency	600E+6
Reference Chain Reference	10 MHz
External Tune Enable	Checkmark
<b>Graph Tab</b>	
Title	User Specific

**Making the Measurement with a Carrier Frequency of 600 MHz**

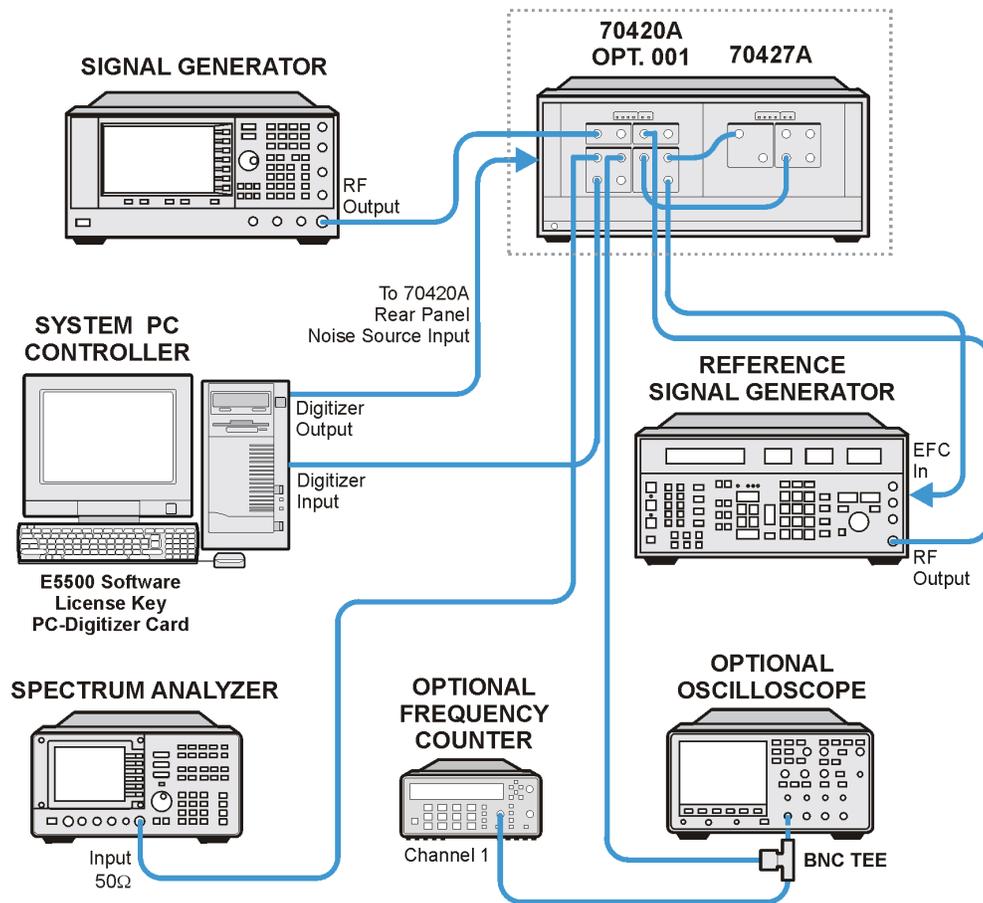
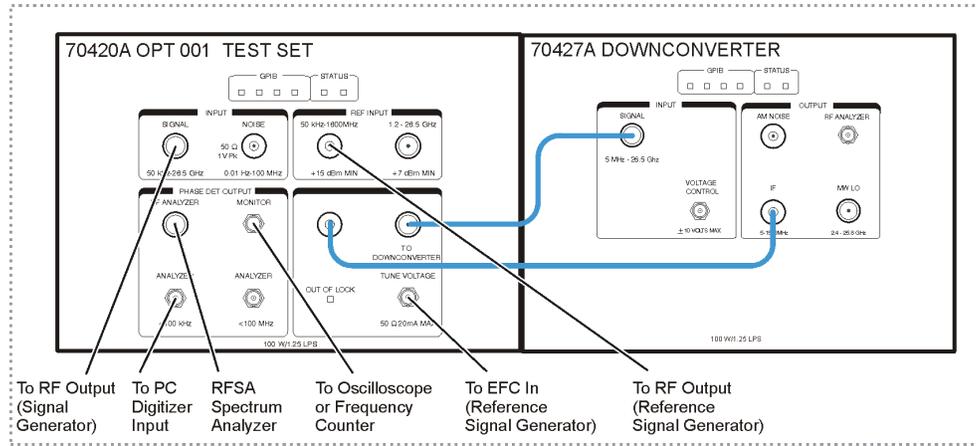
1. The 70427A 10 MHz is manually tuned to change the beat note frequency.
2. Observe the frequency counter and increase/decrease the Tuning Voltage Center value until the beat note frequency is less than the software specified value.
3. Click the left-mouse button and select the “Continue” key.
4. Place markers at the specified offsets.
5. Compare the marker amplitude value to the following specifications:

<b>Offset from Carrier (dBc/Hz)</b>					
<b>Carrier Frequency</b>	<b>Standard</b>	<b>Option UNJ</b>			
	<b>20 kHz</b>	<b>100 Hz</b>	<b>1 kHz</b>	<b>10 kHz</b>	<b>100 kHz</b>
600 MHz	-130	-94	-121	-130	-130

6. Print out a phase plot.
7. Continue to the next carrier setup and perform the measurement.

# Connections and Setup Procedures for a 1.8, 3.0, 9.6, or 19.8 GHz Single-Sideband Phase Noise Measurement

**Figure 3-28 Setup with a Carrier Frequency of 1.8, 3.0, 9.6, or 19.8 GHz from the 8662A/8663A Reference Source**



we935a

## Single-Sideband Phase Noise (Manual Performance Test)

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. Connect the 8662A/8663A RF Output to the 70420A Reference Input.
4. Connect the 70420A Tune Voltage Output to the 8662A/8663A EFC rear panel connector.
5. Repeat the following steps for frequencies of 1.8, 3.0, 9.6, or 19.8 GHz and proceed to “Making the Measurement”.
  - a. Set the signal generator frequency to either 1.8, 3.0, 9.6, or 19.8 GHz and the power to 7 dBm.
  - b. In the Agilent E5504B Option 001 phase noise system user interface, change the following parameters:

Parameter	Setting
<b>Sources Tab</b>	
Carrier Source Frequency	1.8, 3.0, 9.6, or 19.8 GHz
Carrier Source Output Connected	Downconverter
Detector Input Frequency	1.8, 3.0, 9.6, or 19.8 GHz
Reference Source Power	15 dBm
VCO Tune Contrast	(5E-9) Carrier Source Frequency
VCO Tune Range	10 Volts
VCO Input Resistance	1E+6 ohms
<b>Block Diagram Tab</b>	
Down Converter	System Control
Reference Source	8662A/8663A
Test Set Tune Voltage Destination	Reference Source
VCO Tune Mode	EFC
<b>Downconverter Tab</b>	
Input Frequency	1.8, 3.0, 9.6, or 19.8 GHz
External Tune Enable	
<b>Graph Tab</b>	
Title	User Specific

**Making the Measurement with a Carrier Frequency of 1.8, 3.0, 9.6, or 19.8 GHz**

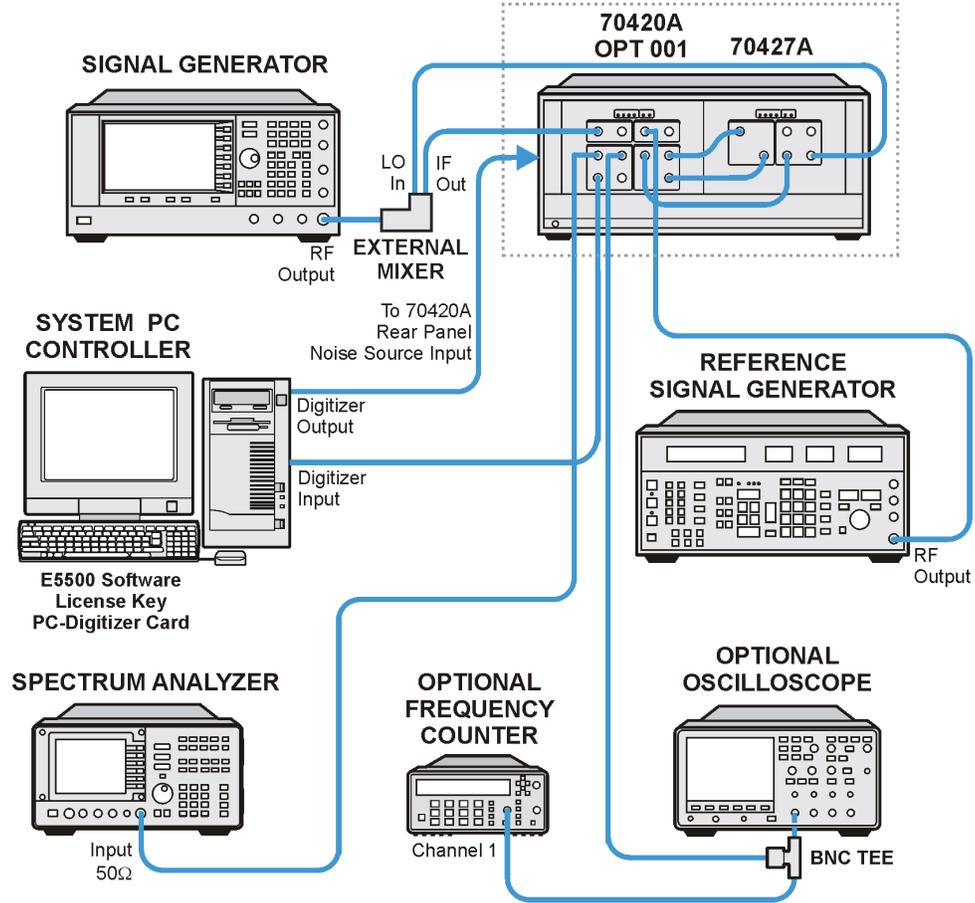
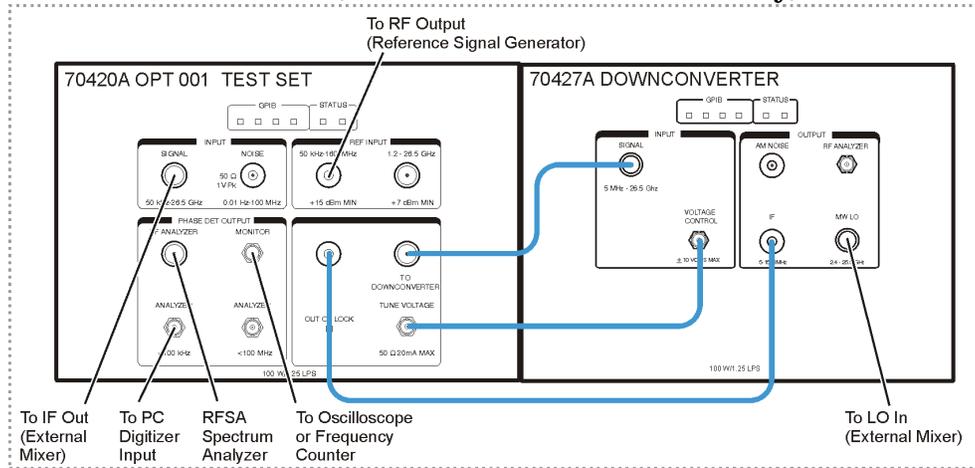
1. From the Instrument Connections panel, click on “Optimize Downconverter”.
2. Perform a phase noise measurement.
3. Place markers at the specified offsets.
4. Compare the marker amplitude value to the following specifications:

<b>Offset from Carrier (dBc/Hz)</b>					
<b>Carrier Frequency</b>	<b>Standard</b>	<b>Option UNJ</b>			
		<b>100 Hz</b>	<b>1 kHz</b>	<b>10 kHz</b>	<b>100 kHz</b>
1.8 GHz	-124	-88	-115	-123	-124
3.0 GHz	-120	-80	-107	-118	-118
9.6 GHz	-110	-74	-101	-110	-110
19.8 GHz	-104	-68	-95	-104	-104

5. Print out the phase plot.
6. Continue to the next setup and perform the measurement.

# Connections and Setup Procedures for a 39.8 GHz Single-Sideband Phase Noise Measurement (E8244A and E8254A Models Only)

**Figure 3-29 Setup with a Carrier Frequency of 39.8 GHz from the 8662A/8663A Reference Source (E8244A and E8254A Models Only)**



we923a

1. Connect the signal generator's RF output to the 11970A RF input.
2. Connect the 70427A uW LO to the 11970A LO input.
3. Connect the 11970A IF output to the 70420A Signal input.
4. Connect the 8662A/8663A RF Output to the 70420A Reference Input.
5. Connect the 70420A Tune Voltage Output to the 70427A Voltage Control Input.
6. Set the signal generator frequency to 39.8 GHz and the power to 7 dBm.
7. In the Agilent E5504B Option 001 phase noise system user interface, change the following parameters:

Parameter	Setting
<b>Downconverter Tab</b>	
Input Frequency	39.8 GHz (E8244A and E8254A models only)
LO Power	10 dBm
Microwave/Millimeter Band	A (26.5 - 40 GHz)
Millimeter Band Mixer Bias Enabled	Checkmark
Reference	100 MHz
External Tune Enable	Checkmark
<b>Sources Tab</b>	
Carrier Source Frequency	39.8 GHz (E8244A and E8254A models only)
Carrier Source Power	7 dBm
Carrier Source Output Connected	Downconverter
Detector Input Frequency	39.8 GHz (E8244A and E8254A models only)
Reference Source Power	15 dBm
VCO Tune Constant	Same value as under the <b>Downconverter Tab</b> , Tuning Sensitivity
VCO Tune Range	10 Volts
VCO Input Resistance	1E+6 ohms
<b>Block Diagram Tab</b>	
Down Converter	System Control
Reference Source	8662A/8663A
Test Set Tune Voltage Destination	Down Converter
VCO Tune Mode	EFC

Parameter	Setting
<b>Test Set Tab</b>	
PPL Integrator Attenuation	12 dB
<b>Graph Tab</b>	
Title	User specific

### Making the Measurement with a Carrier Frequency of 39.8 GHz

1. Perform a phase noise measurement.
2. Place markers at the specified offsets.
3. Compare the marker amplitude value to the following specification.

Offset from Carrier (dBc/Hz)					
Carrier Frequency	Standard	Option UNJ			
	20 kHz	100 Hz	1 kHz	10 kHz	100 kHz
39.8 GHz	-98	-62	-89	-98	-98

4. Print out the phase plot.

### In Case of Difficulty

If this performance test fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to "Getting Started" in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to ["Contacting Agilent Technologies" on page 5-2](#).

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## **4 Adjustments**

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## Overview of Adjustments

In this section you will learn about all available adjustments for the PSG Series signal generators. These adjustments are performed so that the signal generator is properly calibrated.

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**CAUTION** In all test equipment configurations, cables and adapters need to be properly torqued. Exceeding recommended torque values may cause damage to a cable or adaptor and may cause inaccurate test results.

---

Connector Type	Torque Value
2.4 mm	Use an Agilent 8710-1765 at 8-lb inch when connecting 2.4 mm (m) to 2.4 mm (f).
APC 3.5	Use an Agilent 8710-1765 at 8-lb inch when connecting APC 3.5 (m) to APC 3.5 (f).
SMA	Use an Agilent 8710-1765 at 8-lb inch when connecting APC 3.5 (m) to SMA (f).  Use an Agilent 8710-1582 at 5-lb inch when connecting SMA (m) to APC 3.5 (f).
Type-N	Type-N connectors may be connected finger tight. If a torque wrench is used, Agilent 8710-1766 at 12-lb. inch is recommended.
Connector Type	Torque Value

<b>CW Only PSG-L Series</b>	<b>Analog PSG-A Series</b>	Adjustments are listed in the order that they should be performed for proper calibration.
<b>E8241A E8244A</b>	<b>E8251A E8254A</b>	Note that all adjustments are not used with PSG-L Series signal generators.
✓	✓	ADC Calibration
✓	✓	YIG-Driver Pre-Tune Calibration
✓	✓	VCO Bias Frac-N Calibration
	✓	Internal Source Calibration
	✓	AM Audio Path Offset Calibration
✓	✓	KV vs. Frequency Calibration
✓	✓	Timebase Calibration
	✓	FM Scale Offset Calibration
	✓	FM Path Offset Calibration
	✓	FM In-Band Offset Calibration
	✓	FM Inverting Amplifier Offset Calibration
	✓	FM 1/2 Path Ratio Gain Calibration
	✓	Mod Source Relative Gain Calibration
	✓	FM/PM Out-of-Band Calibration
	✓	FM/PM YO Frequency Compensation Calibration
	✓	DC FM Calibration
	✓	Low Frequency Output Calibration
	✓	External Input Peak Detector Calibration
✓	✓	ALC Dynamic Calibration
✓	✓	Power Flatness Calibration
✓	✓	Attenuator Calibration - Low Band and High Power
✓	✓	Attenuator Calibration - High Band and High Power
✓	✓	Attenuator Calibration - Low Band and Low Power
✓	✓	Attenuator Calibration - High Band and Low Power
✓	✓	ALC Modulator Calibration
	✓	AM Gain Calibration
✓	✓	Gain Adjustment Bypass Calibration (Frequencies $\leq$ 3.2 GHz)
	✓	Pulse Width Calibration

---

## ADC Calibration

This adjustment calibrates the CPU board's ADC gain. The ADC gain is adjusted so that the ABUS reads the same voltage as the digital multimeter when reading the +10 V reference.

During this adjustment, an internal ABUS calibration routine is executed. The ABUS\_node is connected to the +10 V reference and measured. The +10 V reference is switched to the Sweep Out connection on the rear-panel interface and the +10 V reference is read by the digital multimeter. The absolute value of the ABUS\_node minus the digital multimeter value is stored as the cal factor.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter Option 002 adds a High Stability Timebase
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable, or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, Dual Banana to BNC (f)	Agilent E9637A dual banana to BNC (f) adapter

## Connections and Setup Procedures

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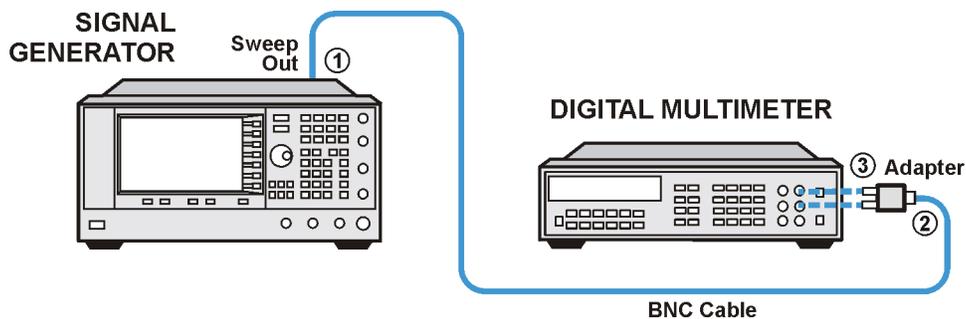
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

---

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-1 Setup for ADC Calibration**



we924a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## YIG-Driver Pre-Tune Calibration

This adjustment calibrates the A5 Sampler YO drive to minimize phase-lock-voltage error and to improve linearity above 7 GHz.

During this adjustment, a function generator is connected to a house standard and serves as an external 10 MHz reference. A spectrum analyzer is used to measure the output frequency and to ensure phase lock. Voltage measurements are made using the YO\_PHSCLK ABUS.

The routine starts by setting the YO to 3250 MHz (FL), using the Pretune\_DAC on the A9 YIG Driver, and checking to ensure that the YO is locked to the correct harmonic. A fine-lock routine is run that changes the Pretune\_DAC value until the YO error voltage falls outside the lock range. Once the error voltage is outside the lock range, the DAC limit is saved as either a high or low DAC limit. The YO is set to 8500 MHz (FH) and the routine is run again. The calculated Pretune\_DAC value for each frequency (DL & DH) is determined by adding the high and low DAC limits and dividing by two. The Pretune\_DAC is set to the new value for each frequency and the error voltages are measured.

To improve YO linearity, a second routine is run. This routine sets three different frequencies and measures the DAC values and error voltages. The routine uses these DAC values along with the YO Offset and YO Slope values to determine new Pretune\_DAC values which are stored as a third term and used above 7 GHz.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓		Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer Option 001 adds a Second IF Output
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓		Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable, 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
	✓ (Qty 2)	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓ (Qty 2)		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter

E8241A E8251A	E8244A E8254A	Test Equipment	Preferred Model or Alternate Model
✓		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

## Connections and Setup Procedures

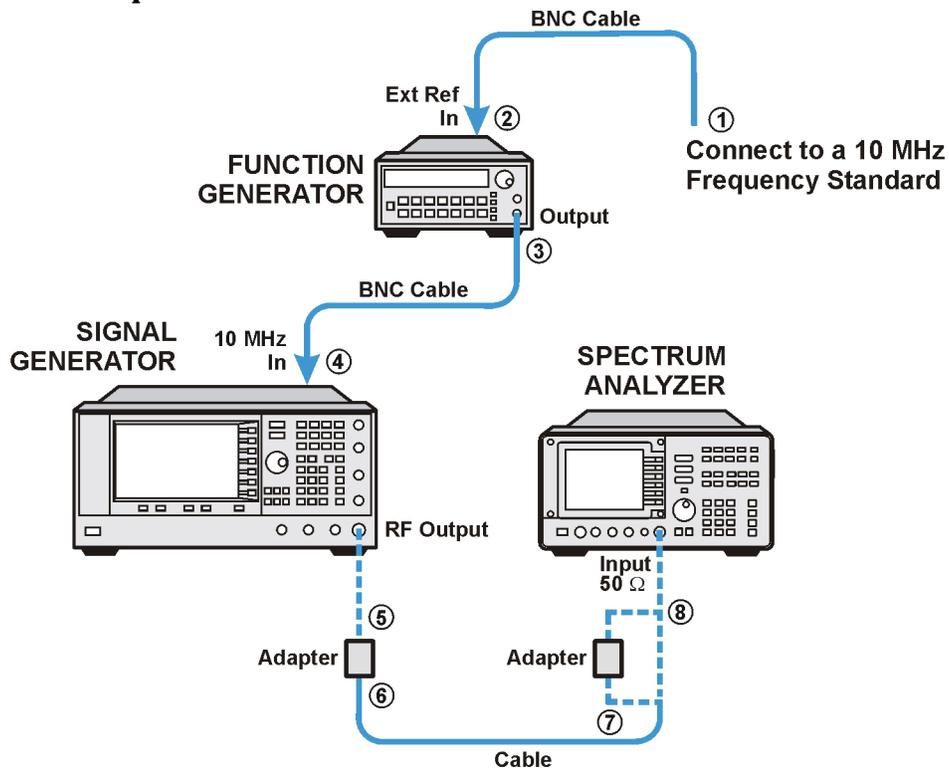
**NOTE**

All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-2 Setup for YIG-Driver Pre-Tune Calibration**



we937a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## VCO Bias Frac-N Calibration

This adjustment calibrates the A6 Frac-N for a stable VCO output at all frequencies and temperatures.

During this adjustment, the VCO frequency of A6 Frac-N is set to approximately 750 MHz. EE\_Pot is adjusted until an oscillation (side bands) appears at 15 MHz offset from the carrier. A baseline measurement of the side bands is made using a spectrum analyzer. EE\_Pot output is increased, which increases the level of the side bands, until a significant side band is present to ensure the side band level is distinguishable from the noise floor. EE\_Pot output is decreased until the baseline is reached. The voltage on F\_2\_ABUS is measured.

The VCO output needs to be reduced by approximately 2 dB to ensure stability. A high and low voltage limit is calculated using the F\_2\_ABUS voltage that will result in a 2 dB drop in VCO output power. The calculated voltages are used as the high and low voltage limits of a target range. EE\_Pot is adjusted until the voltage on F\_2\_ABUS falls within the calculated range.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓		Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable, 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
	✓ (Qty 2)	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓ (Qty 2)		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

## Connections and Setup Procedures

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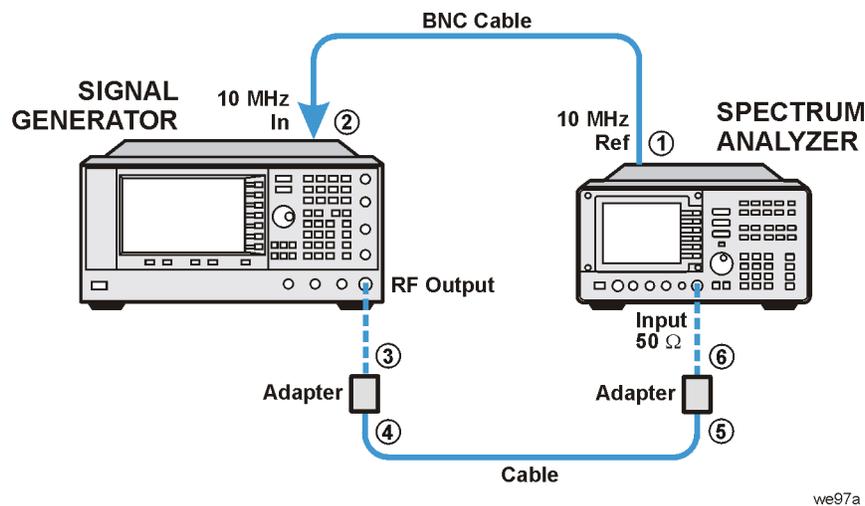
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

---

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-3 Setup for VCO Bias Frac-N Calibration**



### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Internal Source Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the Log AM Offset, DC Offset, and DC Gain on the A11 Pulse/Analog Modulation Generator.

During this adjustment, ABUS voltages are measured through the rear panel Sweep Out connector.

### Log AM Offset Calibration

The FGEN Offset DAC is set to zero, the LF Output voltage is measured, and the results are stored as Offset\_a. The FGEN Offset DAC is set to 3000, the LF Output voltage is measured, and the results are stored as Offset\_b. The Sensitivity =  $(\text{Offset}_b - \text{Offset}_a)/3000$  and the result is stored.

### DC Offset Calibration

The FGEN Offset DAC is set to zero, the LF Output voltage is measured, and the results are stored as Offset\_a. The FGEN Offset DAC is set to 1000, the LF Output voltage is measured, and the results are stored as Offset\_b. The Sensitivity =  $((\text{Offset}_b - \text{Offset}_a)/1000) * \text{Offset}_a$  and the result is rounded and stored.

### DC Gain Calibration

The FGEN Offset DAC is set to a default value and the LF Output voltage is measured. The results of dividing two by the measured value (cal factor =  $2/\text{measured value}$ ) is stored.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter Option 002 adds a High Stability Timebase
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, Dual Banana to BNC (f)	Agilent E9637A dual banana to BNC (f) adapter

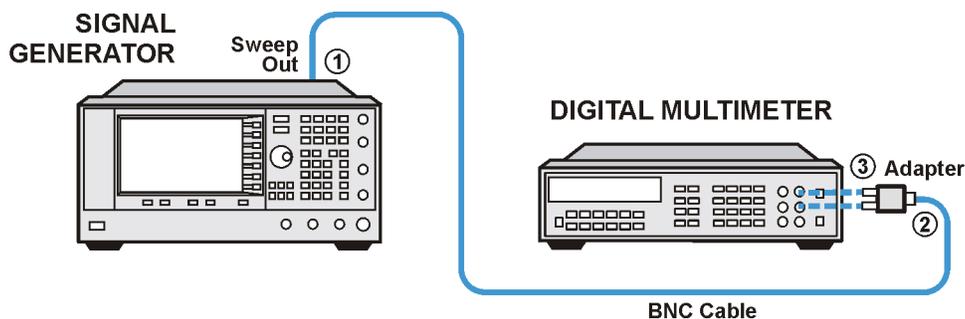
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-4 Setup for Internal Source Calibration**



we924a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to "Getting Started" in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to ["Contacting Agilent Technologies" on page 5-2](#).

## AM Audio Path Offset Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the amplitude modulation (AM) path to remove any offset when AM mode is enabled.

During this adjustment, the AM offsets are separated from the ALC offsets in both linear and exponential mode. A path is selected, the ABUS is zeroed, the ALC LVL\_DAC value is recorded using a multimeter connected to Sweep Out, and a power measurement is performed using a power meter connected to the RF output. AM is turned on, the AM\_OFFSET\_DAC set to 0, and the AM\_ABUS value is read and recorded. The AM\_OFFSET\_DAC is set to 500 and the AM\_ABUS read. Using the results of the AM\_ABUS reading with the AM\_OFFSET\_DAC at 0 and 500, a value is calculated and stored so that the AM\_ABUS equals 0 V.

Then another power reading is made with AM on. The AM on and off power levels are used to calculate a value for the LVL\_DAC so there is < 0.002 dBm difference between AM on and off.

Next, the AM offsets associated with the A11 Pulse/Analog Modulation Generator are eliminated. The routine is performed six times, once for each of the AM modes (INT1, INT2, EXT1 AC, EXT1 DC, EXT2 AC, and EXT2 DC). The instrument is placed in linear mode. With AM off, a power measurement is made, and AM is turned on. The AM\_OFFSET\_DAC is set to 0 and the AM\_ABUS read. The AM\_OFFSET\_DAC is set to 500 and the AM\_ABUS read. The ABUS readings are used to calculate a SCALE\_DAC value that is used with the AM\_OFFSET\_DAC which is used to eliminate AM path offsets. The SCALE\_DAC value is stored and the power level difference between AM on and off is checked for < 0.01 dB difference.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Power Meter	Agilent E4418B E-Series power meter or Agilent E4419A/B E-Series power meter
✓		Power Sensor, Input: Type-N (m)	Agilent E9304A E-Series power sensor
✓		Power Sensor, Input: APC 3.5 (m)	Agilent E4413A E-Series power sensor
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487A Option H84 power sensor Option H84 adds a Standards Lab Calibration
	✓	Adapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

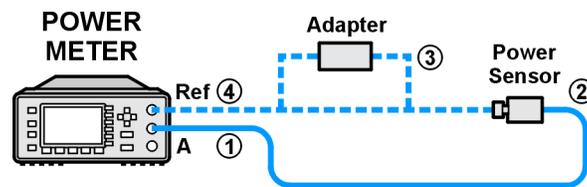
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

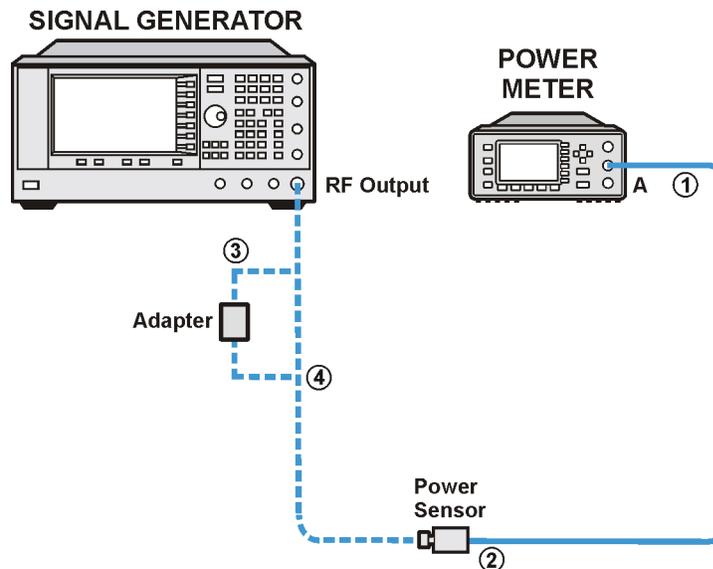
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-5 Setup for Power Meter Calibration**



we944a

**Figure 4-6 Setup for AM Audio Path Offset Calibration**



we91a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## KV vs. Frequency Calibration

This adjustment calibrates the sensitivity of the VCO on the A6 Frac-N.

During this adjustment, the VCO is set to a frequency and the tune voltage is measured and saved. The VCO is then set to a second frequency and the tune voltage measured and saved. The sensitivity is calculated by dividing the frequency delta by the difference between the tune voltages. The VCO sensitivity is determined for frequencies between 500.0000001 MHz and 1000 MHz.

The first VCO frequency is 500.0000001 MHz. The VCO tuning voltage at TUNE\_ABUS node is switched to the "Sweep Out BNC" and measured using a multimeter. The voltage is stored as Tune\_voltage1. The second frequency is determined by adding the delta frequency to the VCO frequency. The tune voltage is measured and stored as Tune\_voltage2. Sensitivity is equal to "delta frequency/(Tune\_voltage2 - Tune\_voltage1)". At VCO frequencies of 600 MHz and greater, the second VCO frequency is determined by subtracting the delta frequency from the VCO frequency. The sensitivity formula changes and is equal to "delta frequency/(Tune\_voltage1 - Tune\_voltage2)". The change in the formulas is so the VCO is calibrated between 500.0000001 MHz and 1000 MHz.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter  Option 002 adds a High Stability Timebase
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, Dual Banana to BNC (f)	Agilent E9637A dual banana to BNC (f) adapter

## Connections and Setup Procedures

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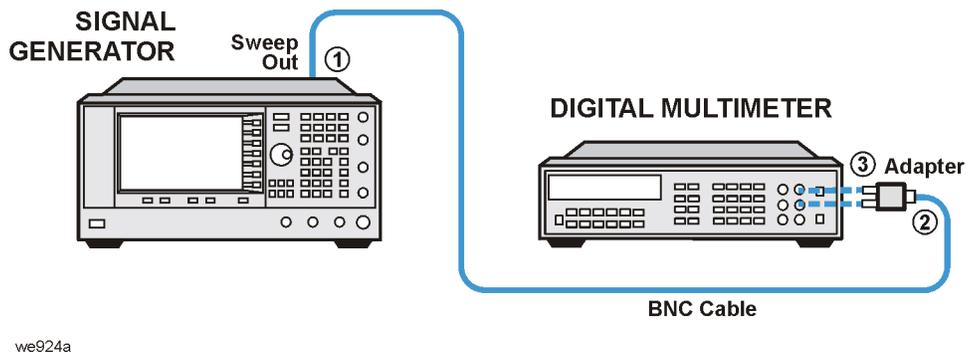
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

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1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-7 Setup for KV vs. Frequency Calibration**



### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2.](#)

## Timebase Calibration

This adjustment calibrates the absolute instrument frequency by adjusting the reference oscillator's frequency.

During this adjustment, the instrument is set to a given frequency and two DACs are adjusted until the output frequency equals the set frequency.

First the program checks to see that the instrument has warmed up for a minimum of 60 minutes. If the warm up period is less than 60 minutes, the routine will abort. Next, the instrument is set for an output frequency of 10 MHz. The fine tune DAC (Fine\_dac) is set to mid-range and the coarse tune DAC (Coarse\_dac) is adjusted so that the RF output frequency is as close to 10 MHz as possible. Finally, the fine tune DAC is adjusted so that the output frequency is 10 MHz. The internal reference oscillator can be adjusted to the resolution of the frequency counter being used.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 and Option 050 frequency counter  Option 010 adds a High Stability Timebase, Option 050 adds Channel 3 (5 GHz)
✓	✓	Frequency Standard, Output: BNC (f)	Use a 10 MHz house standard. (For example, an Agilent 5071A primary frequency standard or equivalent can be used.)
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, BNC (f) to Type-N (m)	Agilent 1250-0780 BNC (f) to Type-N (m) adapter
	✓	XAdapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter
✓		Adapter, APC 3.5 (f) to Type-N (f)	Agilent 1250-1745 APC 3.5 (f) to Type-N (f) adapter

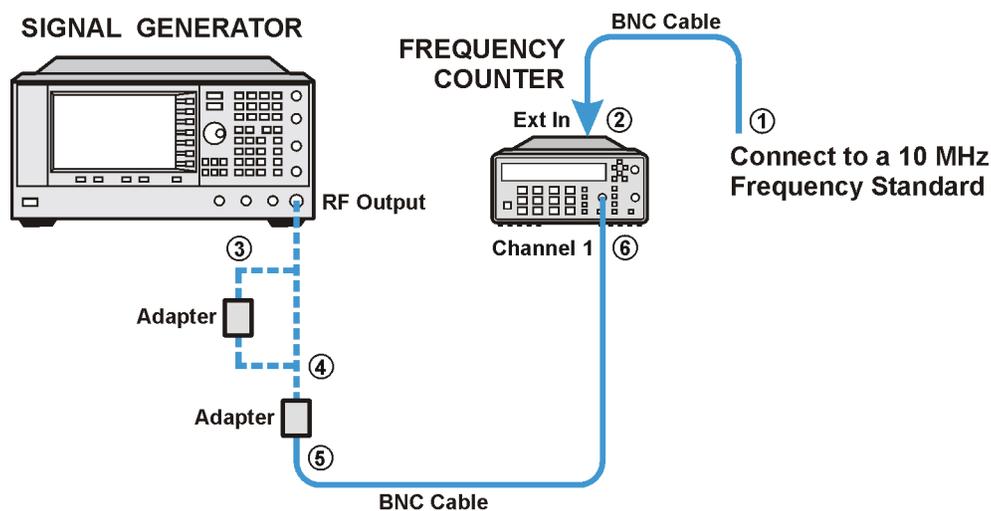
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-8 Setup for Timebase Calibration**



we926a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2.](#)

## FM Scale Offset Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the FM Scale DAC on the A11 Pulse/Analog Modulation Generator so that there is no change in output frequency when the FM Offset DAC is switched.

During this adjustment, the effects associated with changes in the FM Scaling circuit due to changes in noise gain caused by changes in the FM Offset circuit, are calibrated out. The adjustment is made by setting the FM\_SCALE\_DAC to a low and high gain level while setting the FM2\_OFFSET\_DAC to minimum and then maximum conditions. At each DAC condition, the frequency is measured and the results are used to determine a value that is stored.

E8241A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 and Option 050 frequency counter  Option 010 adds a High Stability Timebase, Option 050 adds Channel 3 (5 GHz)
✓	✓	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)	✓	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

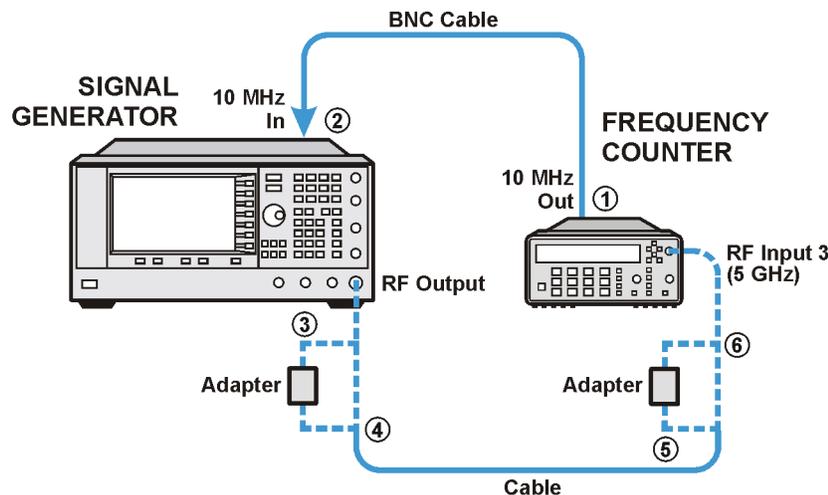
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-9 Setup for FM Scale Offset Calibration**



we916a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## FM Path Offset Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment generates a DAC value to null the voltage offsets on the A6 Frac-N and A11 Pulse/Analog Modulation Generator.

During this adjustment, when FM is enabled the A6 Frac-N and A11 Pulse/Analog Modulation Generator may generate unwanted voltage offsets. These voltage offsets tune the Frac-N VCO from the desired frequency.

There are two FM Offset DACs, which generate a correction value for the external inputs, internal FM, and FM internally grounded. The two external inputs can either be ac or dc-coupled. With all these different combinations, a total of 13 correction values are generated and stored in FlashROM.

The adjustment algorithm uses a frequency counter to determine the Frac-N nominal frequency. The frequency counter is used to calculate the FM Offset DAC sensitivity (DAC counts/Hz). The correction DAC value is then calculated and stored in FlashROM.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 and Option 050 frequency counter  Option 010 adds a High Stability Timebase, Option 050 adds Channel 3 (5 GHz)
✓	✓	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)	✓	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

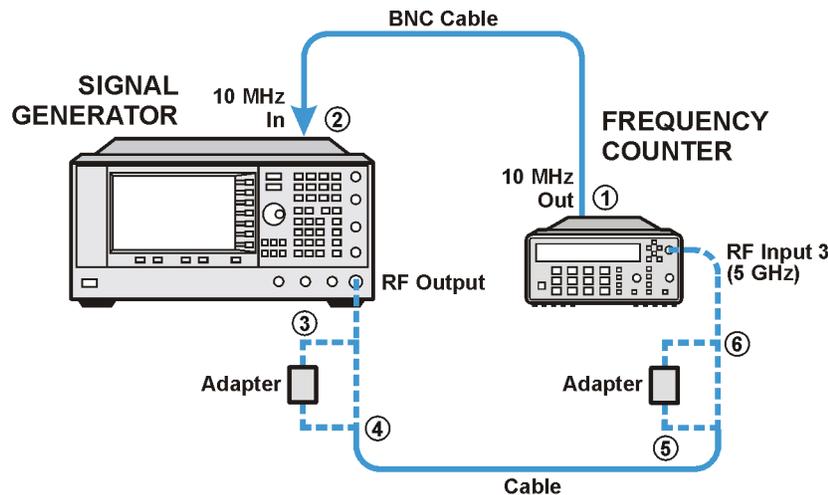
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-10 Setup for FM Path Offset Calibration**



we916a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies”](#) on page 5-2.

## FM In-Band Offset Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the offsets associated with changes to the FM\_IN\_BAND\_DAC on the A6 Frac-N. Changes in the FM\_IN\_BAND\_DAC causes non-linear changes in the noise gain on the FM\_IN\_BAND\_DAC operation amplifier. These changes in noise gain appear as changes in the RF output frequency.

During this adjustment, the instrument is set up so the FM1, Ext1, and DCFM paths are selected. The FM\_IN\_BAND\_DAC and FM\_IN\_BAND\_OFFSET\_DACs are set to 0 and the RF output frequency is measured. The FM\_IN\_BAND\_OFFSET\_DAC is set to 4095 and the RF output frequency is measured again. These two measured values are used to determine the slope and offset associated with an FM\_IN\_BAND\_DAC value of 0.

Then, the FM\_IN\_BAND\_DAC is set to 299 and the FM\_IN\_BAND\_OFFSET\_DAC set to 0 and the RF output frequency is measured. The FM\_IN\_BAND\_OFFSET\_DAC set to 4095 and the RF output frequency measured again. These two measurements are used to determine the slope and offset associated with an FM\_IN\_BAND\_DAC value of 299.

The slope and offset values for 0 and 299 FM\_IN\_BAND\_DAC settings are used to determine the FM\_IN\_BAND\_OFFSET\_DAC.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 and Option 050 frequency counter  Option 010 adds a High Stability Timebase, Option 050 adds Channel 3 (5 GHz)
✓	✓	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)	✓	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

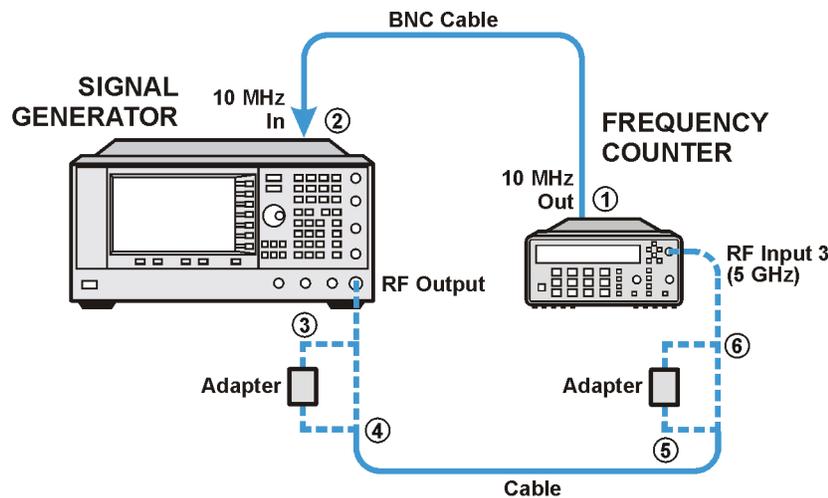
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-11 Setup for FM In-Band Offset Calibration**



we916a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies”](#) on page 5-2.

## FM Inverting Amplifier Offset Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment is similar to the FM Path Offset Calibration, but this adjustment generates a DAC value to null the voltage offset on the differential inverting amplifier on the A6 Frac-N.

During this adjustment, when FM is enabled, the A6 Frac-N and A11 Pulse/Analog Modulation Generator may generate unwanted voltage offsets. These voltage offsets tune the Frac-N VCO from the desired frequency.

The signal generator frequency is set for 525 MHz at 0 dBm. The EXT1 input is dc-coupled and left open for this calibration. FM is enabled with an FM deviation of 100 kHz. The calibration loads the FM\_OFFSET\_DACs with the values calculated in the FM Path Offset Calibration. The two FM multiplexers, on the A11 Pulse/Analog Modulation Generator, have their ground inputs selected. The FM\_SCALE\_DAC is set to 0 and an internal voltage measurement is made on the analog bus through the FM\_ABUS node. The FM1\_OFFSET\_DAC is set for 255 and another voltage measurement is made. From these two measurements, an Offset DAC value is calculated. If the difference between the Offset DAC value and the original FM\_OFFSET\_DAC values are greater than 20 DAC values, the calibration fails. Otherwise, the difference DAC value, which takes into account the FM Path Offset and the FM Inverting Amp Offset, is stored.

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## FM 1/2 Path Ratio Gain Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the A11 Pulse/Analog Modulation Generator FM 1 and FM 2 paths for equal gains.

During this adjustment, a function generator and a digital voltmeter are connected to the EXT 1 input of the signal generator and a frequency counter is connected to RF output. The signal generator is set to 525 MHz and 0 dBm output. The function generator is set for a 1 V dc output. The FM 1 path is set to EXT 1 and dc-coupled, while the RF output frequency is measured and used as the target value for the FM 2 adjustment. Next, the FM 2 path is set to EXT 1 and dc-coupled. The FM 2 path sensitivity is determined by measuring the RF output frequency with the FM\_SCALE\_DAC set to two different values. The FM\_SCALE\_DAC correction value is then determined using the RF output frequencies and DAC values. The new FM\_SCALE\_DAC value is verified and stored.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 and Option 050 frequency counter  Option 010 adds a High Stability Timebase, Option 050 adds Channel 3 (5 GHz)
✓	✓	XXDigital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter  Option 002 adds a High Stability Timebase
✓	✓	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓ (Qty 2)	✓ (Qty 2)	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
✓	✓	Adapter, BNC (f) to Dual Banana	Agilent E9637A BNC (f) to dual banana adapter
	✓	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)	✓ (Qty 2)	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

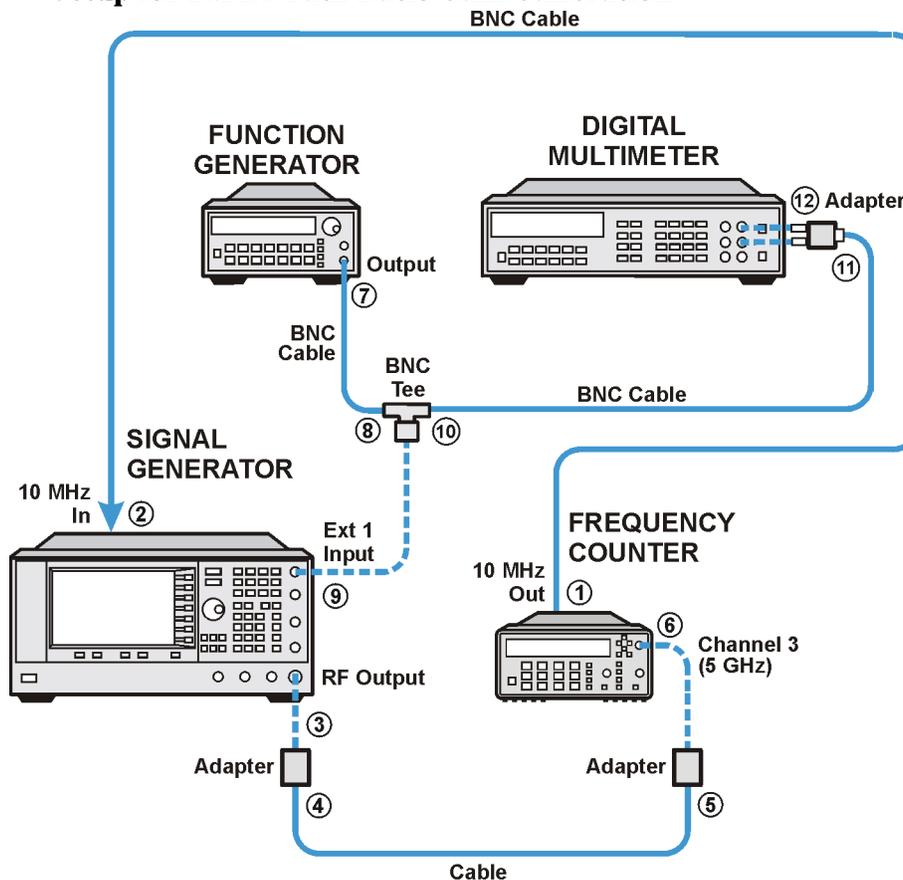
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-12 Setup for FM 1/2 Path Ratio Gain Calibration**



we928a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Mod Source Relative Gain Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment corrects for the differences in the FM source signal paths on the A11 Analog/Pulse Modulation Generator.

During this adjustment, scaling factors are determined for each FM source signal path for a given modulation signal level. The FM deviation is the same and independent of the signal source or signal path. Scaling factors are applied to the FM\_SCALE\_DAC on the A11 Analog/Pulse Modulation Generator.

The adjustment starts by setting the signal generator to 1 GHz with an FM deviation of 117.1875 kHz. The INT1 path is selected and the modulation level is set to 0 V. The output frequency is measured using a frequency counter and stored. The modulation level is then changed to -2 V and the output frequency is measured. The difference between the two frequencies is compared to a target deviation and use to determine a scaling factor. The routine is repeated for the INT2 path. The process for calibrating EXT1 and EXT2 paths and determining the scaling factors is the same except that a function generator is used to provide a modulation level of 1 V and a digital multimeter is used to set the modulation level.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 and Option 050 frequency counter  Option 010 adds a High Stability Timebase, Option 050 adds Channel 3 (5 GHz)
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter  Option 002 adds a High Stability Timebase
✓	✓	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓ (Qty 3)	✓ (Qty 3)	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
✓	✓	Adapter, BNC (f) to Dual Banana	Agilent E9637A BNC (f) to dual banana adapter
	✓	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)	✓ (Qty 2)	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

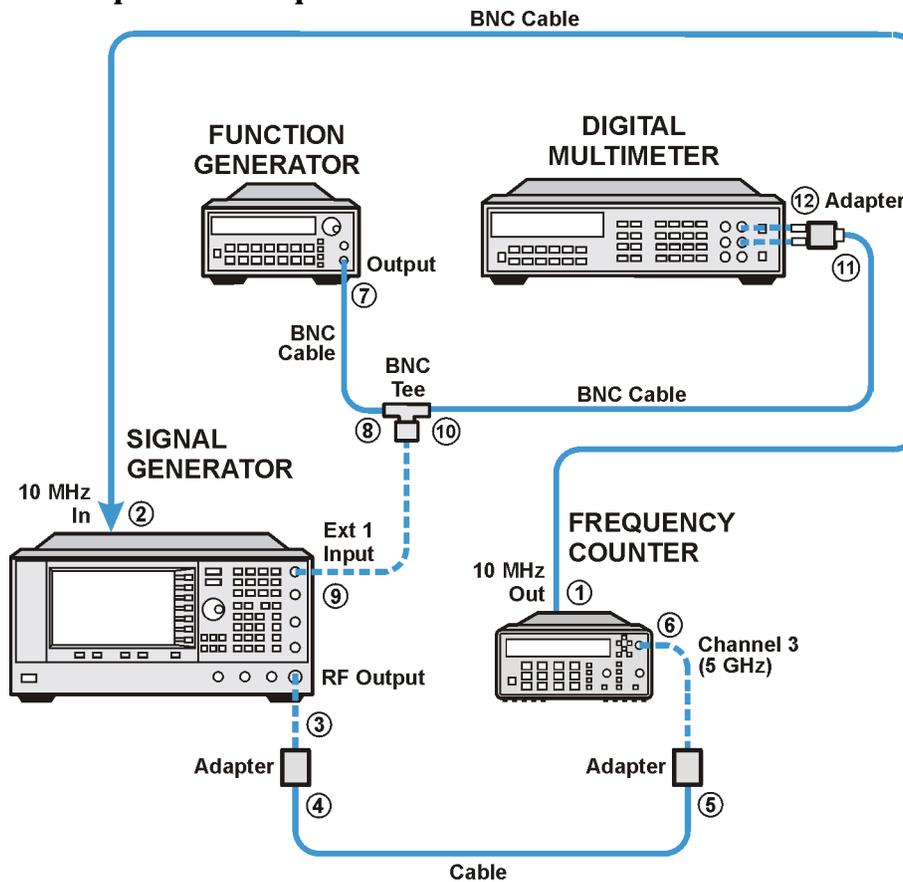
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

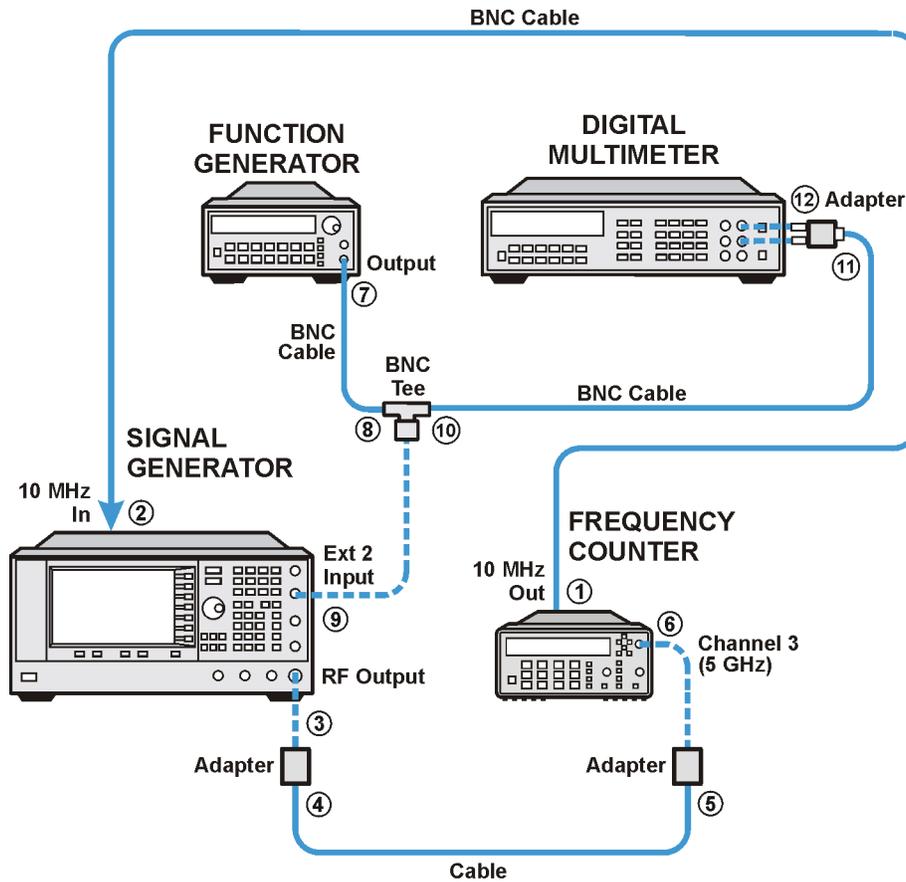
In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-13 Setup for Ext 1 Input**



we928a

**Figure 4-14 Setup for Ext2 Input**

we932a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## FM/PM Out-of-Band Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the FM Gain DAC on the YO Driver and the FM Out-of-Band DAC on the A6 Frac-N.

These adjustments calibrate FM and PM deviation at rates above the A6 Frac-N and YO loop bandwidths (out-of-band).

During this adjustment, a function generator and a digital multimeter are connected to a BNC tee on the EXT 1 input. The function generator is set to a desired rate and the amplitude is set to a desired level using the digital multimeter. Once the amplitude adjustment is complete, the digital multimeter connection is moved to the "Sweep Out" BNC.

The YO Driver and Frac-N integrator outputs are switched to the Sweep Out through the ABUS. With the function generator set to a rate equal to an out-of-band condition, the integrator levels are measured with the digital multimeter and compared to the calibrated in-band path integrator levels. The FM Gain DAC and FM Out-of-Band DAC are adjusted to minimize the voltage difference between in-band and out-of band integrator levels.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter Option 002 adds a High Stability Timebase
✓ (Qty 3)	✓ (Qty 3)	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
✓	✓	Adapter, BNC (f) to Dual Banana	Agilent E9637A BNC (f) to dual banana adapter

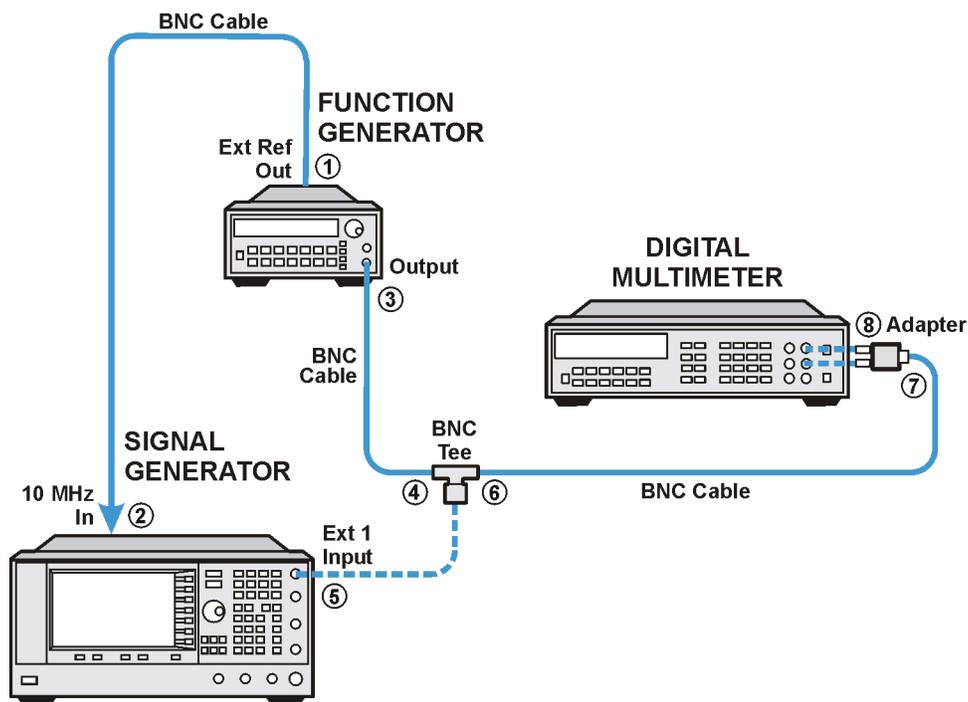
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

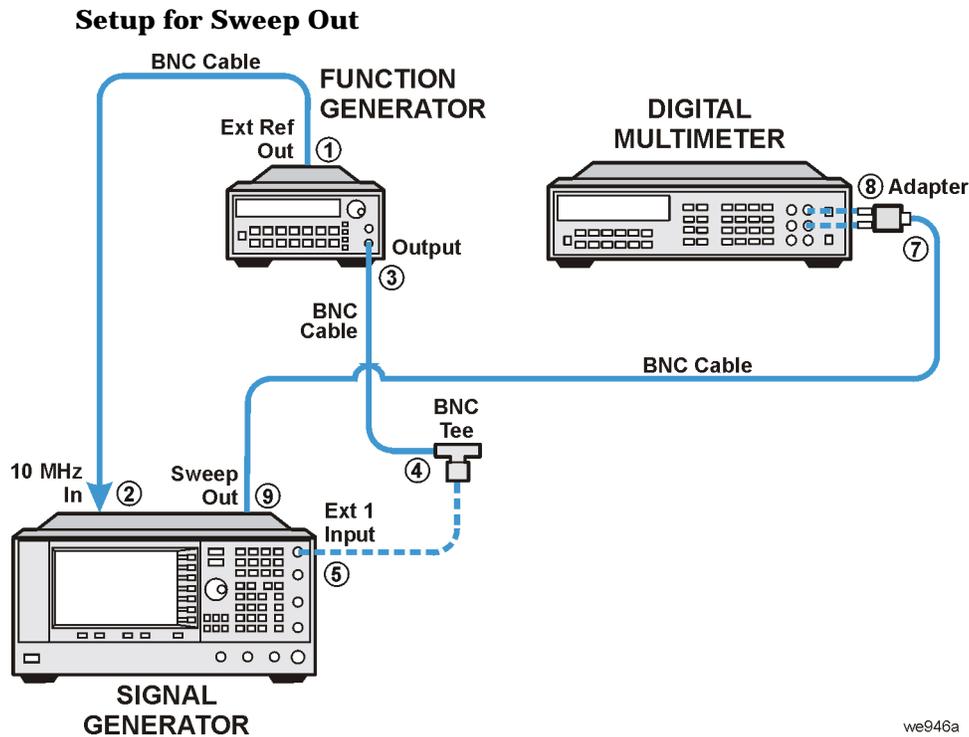
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-15** Setup for Ext 1 Input



we930a

Figure 4-16



## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies”](#) on page 5-2.

## FM/PM YO Frequency Compensation Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment generates an FM flatness correction for the YIG Oscillator (YO) when the YO Phase Lock Loop (PLL) is open. Two correction values are generated and stored in a Programmable Gate Array (PGA) on the YO Driver. One correction value is generated at an FM deviation of 250 kHz with a rate of 500 kHz. The second value is generated at an FM deviation of 1000 kHz with a rate of 2000 kHz.

During this adjustment, a function generator is used to provide the baseband FM modulation. A digital multimeter ensures that the function generator amplitude is accurate. The signal generator is set up for 0 dBm at a carrier of 1 GHz. The EXT 1 input with ac-coupling is used by the signal generator. With FM turned on, a spectrum analyzer measures the modulation sidebands. A reference measurement for the flatness is first made at a deviation of 50 kHz with a rate of 100 kHz. The spectrum analyzer is tuned to the carrier frequency with a span capable of displaying the sidebands. The spectrum analyzer performs a marker-delta measurement between the amplitude of the carrier and the upper and lower sidebands. An average is calculated between the dBc values of the two measured sidebands.

The test equipment is then set for the test deviation and rate. The spectrum analyzer measurement is repeated. The calibration switches in different RC networks to change the shape of a low pass filter on the YO Driver. This is repeated until the differences between the amplitude of the test sidebands and the reference sidebands are at a minimum. If the differences in sidebands are greater than 1 dB, the adjustment fails.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer Option 001 adds a Second IF Output
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter Option 002 adds a High Stability Timebase
✓		Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable, 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓ (Qty 3)	✓ (Qty 3)	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
✓	✓	Adapter, Dual Banana to BNC (f)	Agilent E9637A Dual banana to BNC (f) adapter
	✓	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter

## FM/PM YO Frequency Compensation Calibration (Adjustment for E8251A and E8254A Models Only)

<b>E8251A</b>	<b>E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓	✓	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

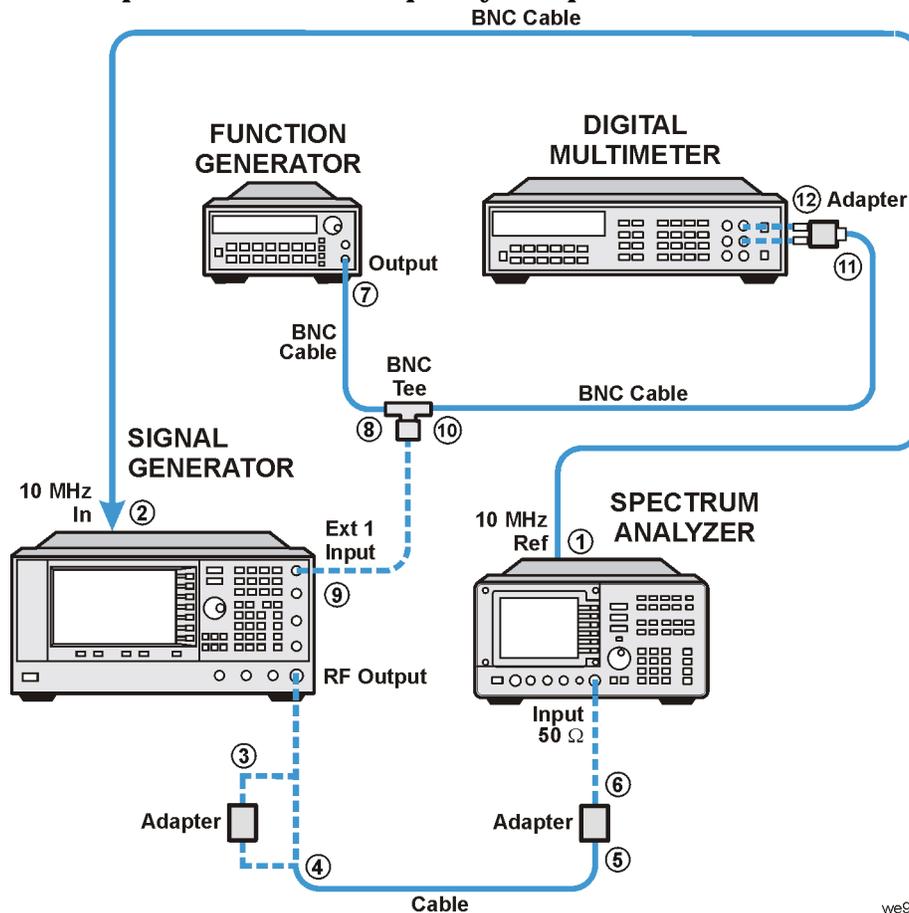
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-17 Setup for FM/PM YO Frequency Compensation Calibration**



we929a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## DC FM Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment generates a correction voltage that is used to null any voltage offsets that are created by the A6 Frac-N and A11 Pulse/Analog Modulation Generator when FM is enabled. Without this adjustment, small voltage offsets may be generated that tune the Frac-N VCO from the desired frequency.

During this adjustment, the instrument is set for a 1 GHz carrier at 0 dBm. Internal FM is turned on with the EXT1 FM input left open. The FM Deviation is set for 5.625 MHz and the FM1 path is selected with dc-coupling. The instrument performs an internal calibration, which generates a frequency-offset value. This value is loaded into a register in an Application Specific Integrated Circuit (ASIC) on the A6 Frac-N.

A frequency counter is used to verify the corrected frequency is within  $\pm 3\%$  of the theoretical value.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Frequency Counter, Channel 1: BNC (f) Channel 2: BNC (f) Channel 3: Type-N (f)	Agilent 53132A Option 010 and Option 050 frequency counter  Option 010 adds a High Stability Timebase, Option 050 adds Channel 3 (5 GHz)
✓	✓	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
	✓	Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)	✓	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

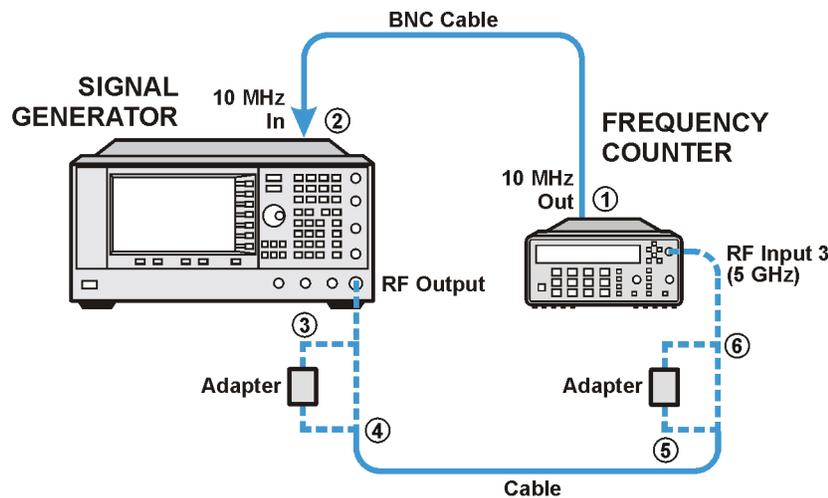
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-18 Setup for DC FM Calibration**



we916a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Low Frequency Output Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the LF Output path on the A11 Pulse/Analog Modulation Generator for an accurate output voltage.

During this adjustment, the source LF Output is connected to a DVM. One of the two internal modulators on the A11 Pulse/Analog Modulation Generator is set for a 1 kHz, 1 V-peak sinewave. The internal path is switched so that the modulator output is routed to the LF Output. A DVM reading is taken, the DAC is set to the new value, the LP Output voltage is measured to verify the adjustment, and calibration data is stored.

<b>E8251A</b>	<b>E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter  Option 002 adds a High Stability Timebase
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, Dual Banana to BNC (f)	Agilent E9637A Dual banana to BNC (f) adapter

## Connections and Setup Procedures

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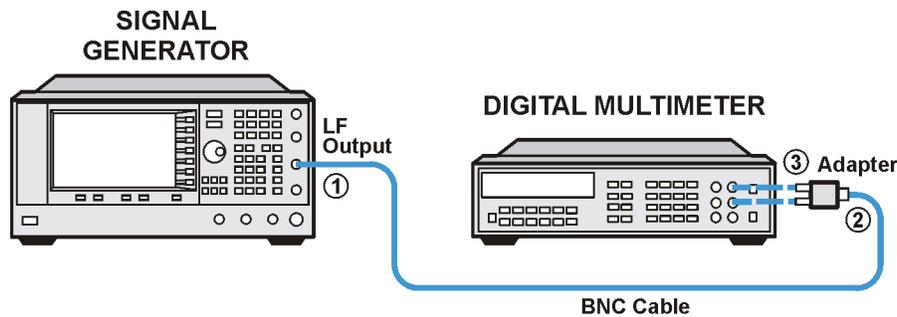
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

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1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-19 Setup for Low Frequency Output Calibration**



we925a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies”](#) on [page 5-2](#).

## External Input Peak Detector Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment establishes a threshold voltage for the over modulation indicator to turn on. A function generator generates a 1 kHz 1.03 V<sub>p</sub> sine wave to bias the EXT1 and EXT2 inputs. The multimeter measures the RMS value of the function generator to ensure amplitude accuracy. The signal generator FM is enabled and set for 100 kHz deviation.

During this adjustment, there are two EXT\_PEAK\_VREF\_DACs on the A11 Pulse/Analog Modulation Generator, one for each EXT input. After the hardware is configured, the DACs are set to 255 and decreased until the over modulation indicator comes on. The DAC is decreased another 10 values and then incremented. The DAC value which causes the over modulation indicator to go out is stored.

If the DAC value is below 20 or above 200, the calibration fails.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓	✓	Digital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter Option 002 adds a High Stability Timebase
✓ (Qty 3)	✓ (Qty 3)	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
✓	✓	Adapter, BNC (f) to Dual Banana	Agilent E9637A BNC (f) to dual banana adapter

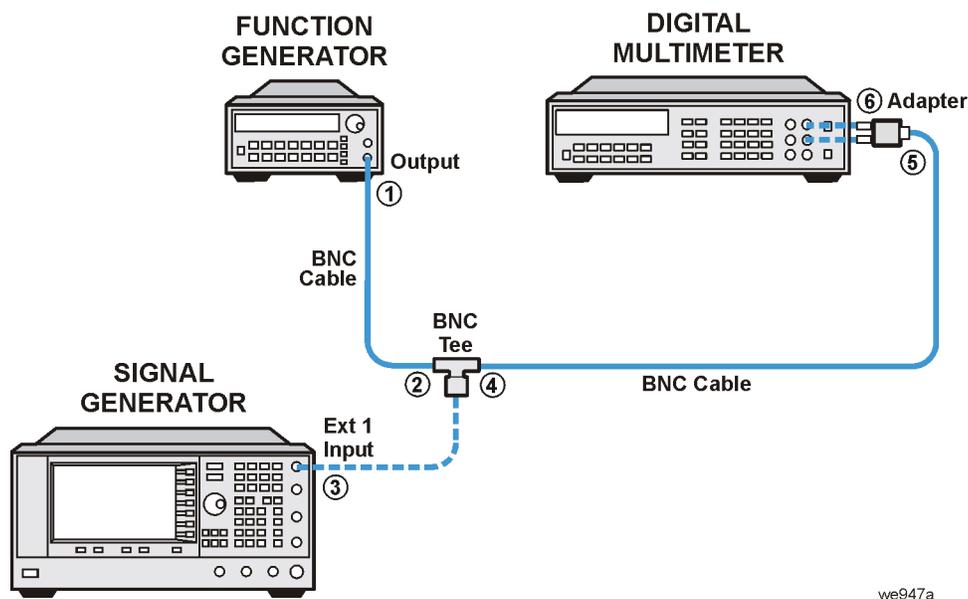
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-20 Setup for External Input Peak Detector Calibration**



we947a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to "Getting Started" in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to ["Contacting Agilent Technologies"](#) on page 5-2.

## ALC Dynamic Calibration

**NOTE** Because this procedure defaults to the calibration data for the ALC power flatness, the Power Flatness Calibration must be performed after this adjustment.

This adjustment calibrates the ALC at a single frequency in lowband and a single frequency in highband.

During this adjustment, a power meter is used to measure the RF output level. The LVL\_DAC used for setting power level is set to nominal values that have an expected RF output power of 0, -10, +10, or +20 dBm.

A description of each adjustment is as follows:

- **OFFSET:** The LVL\_DAC is set for an expected 0 dBm RF output. The LVL\_DAC is then changed to obtain 0 dBm as measured by the power meter. The difference between the two DAC settings is used by an internal calibration array to offset the ALC.
- **GAIN:** The LVL\_DAC is set for an expected -10 dBm RF output. The LVL\_DAC is then changed to obtain -10 dBm as measured by the power meter. The difference between the two DAC settings is used by an internal calibration array as a gain factor for the ALC.
- **LOG BREAKPOINT:** The LVL\_DAC is set for an expected +10 dBm RF output. The LOG\_BRKPT\_DAC is then adjusted to obtain +10 dBm as measured by the power meter.
- **HIGH POWER:** The LVL\_DAC is set for an expected +20 dBm RF output. The HIPWRCAL\_DAC is then adjusted to obtain +20 dBm as measured by the power meter.

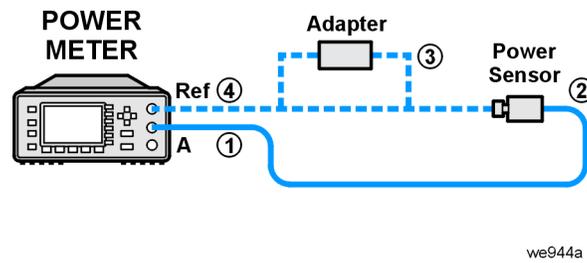
<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter or Agilent E4419A/B E-Series power meter
✓		Power Sensor, Input: Type-N (m)	Agilent E9304A E-Series power sensor
✓		Power Sensor, Input: APC 3.5 (m)	Agilent E4413A E-Series power sensor
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487A Option H84 power sensor  Option H84 adds a Standards Lab Calibration
	✓	Adapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

## Connections and Setup Procedures

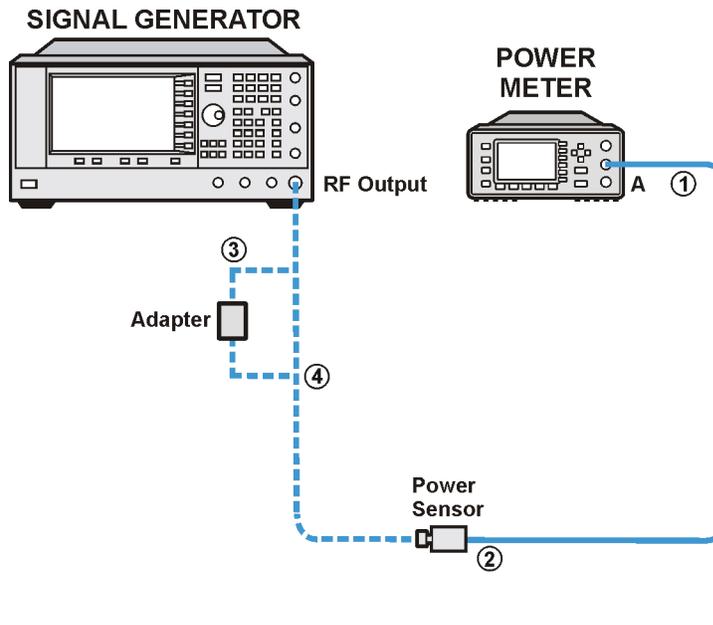
**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.  
In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-21 Setup for Power Meter Calibration**



**Figure 4-22 Setup for ALC Dynamic Calibration**



## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Power Flatness Calibration

**NOTE** Before this adjustment is performed, the ALC Dynamic Calibration must already be successfully completed.

This adjustment calibrates the ALC at +5 dBm across the frequency range of the signal generator being calibrated.

During this adjustment, the power meter is zeroed and calibrated and the power flatness calibration array is zeroed. The signal generator is set to a power level that ensures the step attenuator is set to the zero dB step, and the Attenuator Hold function is set on. The power level is then set to 5 dBm.

Absolute power measurements are made with the power meter at many frequency points across the full signal generator frequency range. The difference between the measured power level and the set amplitude is stored in an array to correct absolute power level when the attenuator is in the zero dB step.

Power sensors are changed at 3.2 GHz to cover the full frequency range.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter
✓		Power Sensor, Input: Type-N (m)	Agilent E9304A E-Series power sensor
✓		Power Sensor, Input: Type-N (m)	Agilent 8482A power sensor
✓		Power Sensor, Input: APC 3.5 (m)	Agilent 8485A power sensor  This power sensor can be used in place of the Agilent 8487A Option H84 power sensor in some adjustments. It is not an alternate model because some performance tests can not use the Agilent 8485A power sensor.
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487A Option H84 power sensor  Option H84 adds a Standards Lab Calibration
✓ (Qty 2)		Adapter, 2.4 mm (f) to Type-N (m)	Agilent 11903D 2.4 mm (f) to Type-N (m) adapter
	✓	Adapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter
✓		Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter
✓		Adapter, APC 3.5 (f) to Type-N (f)	Agilent 1250-1745 APC 3.5 (f) to Type-N (f) adapter

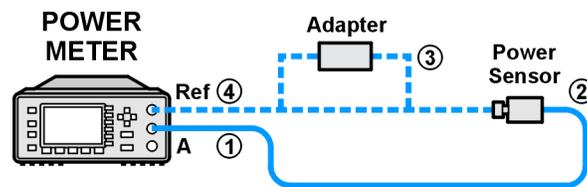
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

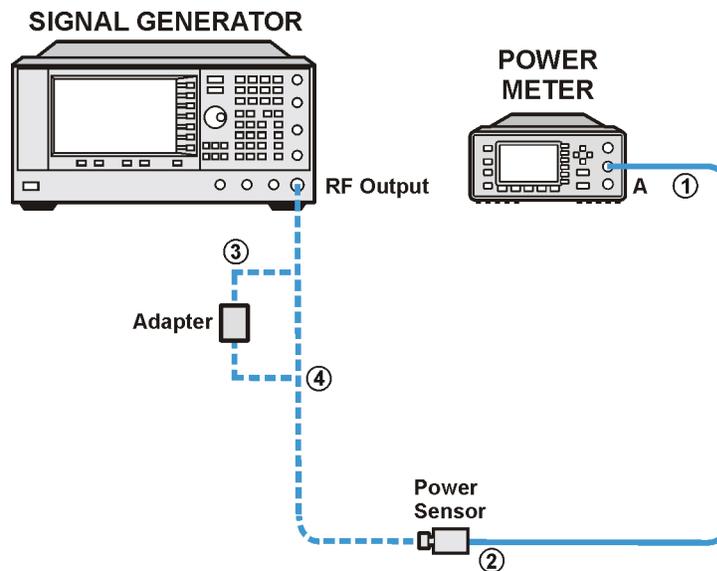
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-23 Setup for Power Meter Calibration**



we944a

**Figure 4-24 Setup for Power Flatness Calibration**



we91a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Attenuator Calibration - Low Band and High Power

**NOTE** Performance of this adjustment may affect power level accuracy at low power levels. The Attenuator Calibration - Low Band and Low Power must also be performed.

This adjustment calibrates the step attenuator accuracy over the 100 kHz to 3.2 GHz frequency range and 5 dB to 55 dB step attenuator range in 10 dB steps.

During this adjustment, this adjustment uses a power meter with a calibrated power sensor. The signal generator is set to +10 dBm amplitude with the step attenuator set to 0 dB. Absolute power measurements are made over the low-band frequency range and stored as a reference.

The step attenuator is then switched to the 5 dB step and power measurements are repeated. The difference between the 0 dB and the 5 dB measurement is the actual attenuation of the attenuator step. Correction factors are calculated and stored in the signal generator. This is repeated for each attenuator step between 5 and 55 dB.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter
✓		Power Sensor, Input: Type-N (m)	Agilent E9304A E-Series power sensor
✓		Power Sensor, Input: Type-N (m)	Agilent 8482A power sensor
	✓	Adapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter
✓	✓	Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

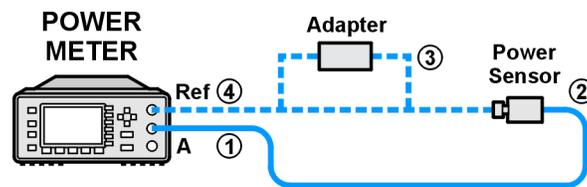
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

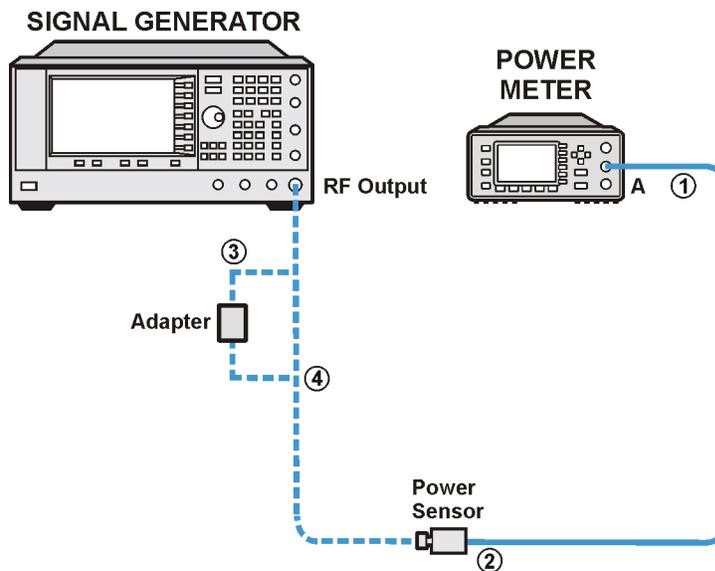
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-25 Setup for Power Meter Calibration**



we944a

**Figure 4-26 Setup for Attenuator Calibration - Low Band and High Power**



we91a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2.](#)

## Attenuator Calibration - High Band and High Power

**NOTE** Prior to this calibration, the Attenuator Calibration - Low Band and High Power must have been successfully completed.

This adjustment calibrates the step attenuator accuracy over the 100 kHz to 3.2 GHz frequency range and 65 dB to 115 dB attenuator range in 10 dB steps. The correction value of the 55 dB step attenuator is used in the calculation for each attenuator step.

During this adjustment, for frequencies < 10 MHz the measurement is made directly with a vector signal analyzer. A low frequency Low Noise Amplifier (LNA) is used to amplify the signal level; this keeps the signal level well above the vector signal analyzer noise floor with large attenuator steps.

For frequencies  $\geq$  10 MHz, a spectrum analyzer downconverts the signal generator frequency to 310.4 MHz. This extends the measurement system frequency range to that of the spectrum analyzer (for example, 40 GHz). A higher frequency LNA is used in this test setup.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter
✓		Power Sensor, Input: APC 3.5 (m)	Agilent E4413A E-Series power sensor
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487A Option H84 power sensor  Option H84 adds a Standards Lab Calibration
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487D Option H84 power sensor  Option H84 adds a Standards Lab Calibration
	✓	Adapter, 2.4 mm (f) to Type-N (m)	Agilent 11903D 2.4 mm (f) to Type-N (m) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter
✓		Adapter, APC 3.5 (f) to Type-N (f)	Agilent 1250-1745 APC 3.5 (f) to Type-N (f) adapter

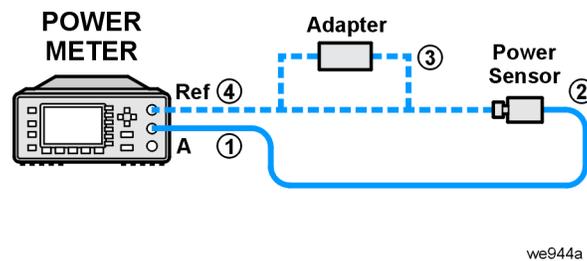
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

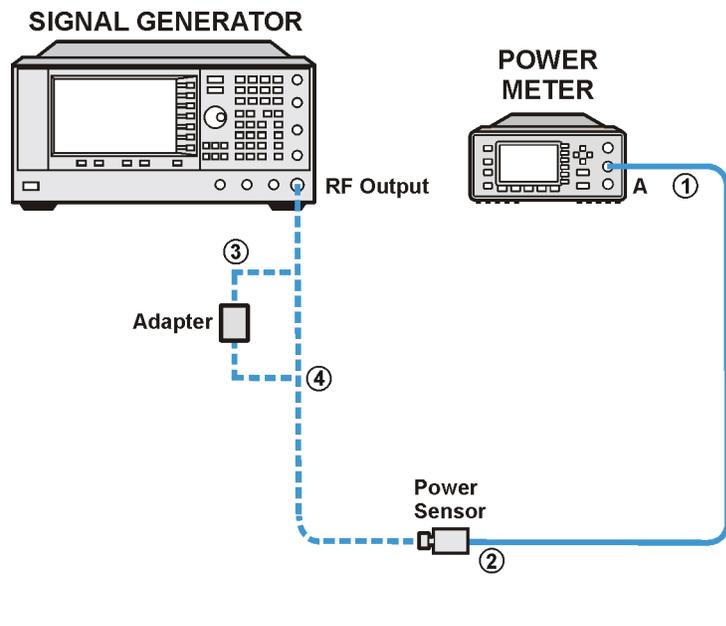
In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-27 Setup for Power Meter Calibration**



**Figure 4-28 Setup for Attenuator Calibration - High Band and High Power**



## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Attenuator Calibration - Low Band and Low Power

**NOTE** Prior to this calibration, the Attenuator Calibration - Low Band and High Power and Attenuator Calibration - High Band and High Power must have been successfully completed.

This adjustment calibrates the step attenuator accuracy over the 100 kHz to 3.2 GHz frequency range and 65 dB to 115 dB attenuator range in 10 dB steps. The correction value of the 55 dB step attenuator is used in the calculation for each attenuator step.

During this adjustment, for frequencies < 10 MHz the measurement is made directly with a vector signal analyzer. A low frequency Low Noise Amplifier (LNA) is used to amplify the signal level; this keeps the signal level well above vector signal analyzer's noise floor with large attenuator steps.

For frequencies  $\geq$  10 MHz, a spectrum analyzer downconverts the signal generator frequency to 310.4 MHz. This extends the measurement system frequency range to that of the spectrum analyzer (for example, 40 GHz). A higher frequency LNA is used in this test setup.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter
✓	✓	Power Sensor, Type-N (m)	Agilent E9304A E-Series power sensor
✓		Power Sensor, APC 3.5 (m)	Agilent E4413A E-Series power sensor
	✓	Power Sensor, 2.4 mm (m)	Agilent 8487A Option H84 power sensor  Option H84 adds a Standards Lab Calibration
	✓	Power Sensor, 2.4 mm (m)	Agilent 8487D Option H84 power sensor  Option H84 adds a Standards Lab Calibration
✓		Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer  Option 001 adds a Second IF Output

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Vector Signal Analyzer, Input: Type-N (f) Output: BNC (f)	Agilent 89441A vector signal analyzer
✓	✓	Power Supply	Use any generic power supply capable of supplying +15 Vdc @ 300 mA.
✓	✓	Low Frequency LNA, Input: BNC (f) Output: BNC (f)	Advanced Control Components W50ATC low frequency low-noise amplifier (LNA)
✓ (Qty2)	✓ (Qty2)	High Frequency LNA, Input: APC 3.5 (f) Output: APC 3.5 (f)	MITEQ Inc. AFS3-00010300-18-5P-4 high frequency low noise amplifier (LNA)
✓	✓	10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
✓ (Qty 3)	✓ (Qty 2)	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable, 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓ (Qty 6)	✓ (Qty 6)	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable, or Agilent 10503A BNC (m) to (m) cable
✓ (Qty 2)	✓ (Qty 2)	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
✓ (Qty 2)	✓ (Qty 2)	Adapter, BNC (f) to BNC (f)	Agilent 1250-0080 BNC (f) to BNC (f) adapter
✓	✓	Adapter, BNC (m) to SMA (f)	Agilent 1250-2015 BNC (m) to SMA (f) adapter
✓	✓ (Qty 2)	Adapter, BNC (m) to mini-grabbers	Agilent 8120-2337 BNC (m) to mini-grabbers adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓	✓	Adapter, APC 3.5 (m) to (m)	Agilent 1250-1748 APC 3.5 (m) to (m) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

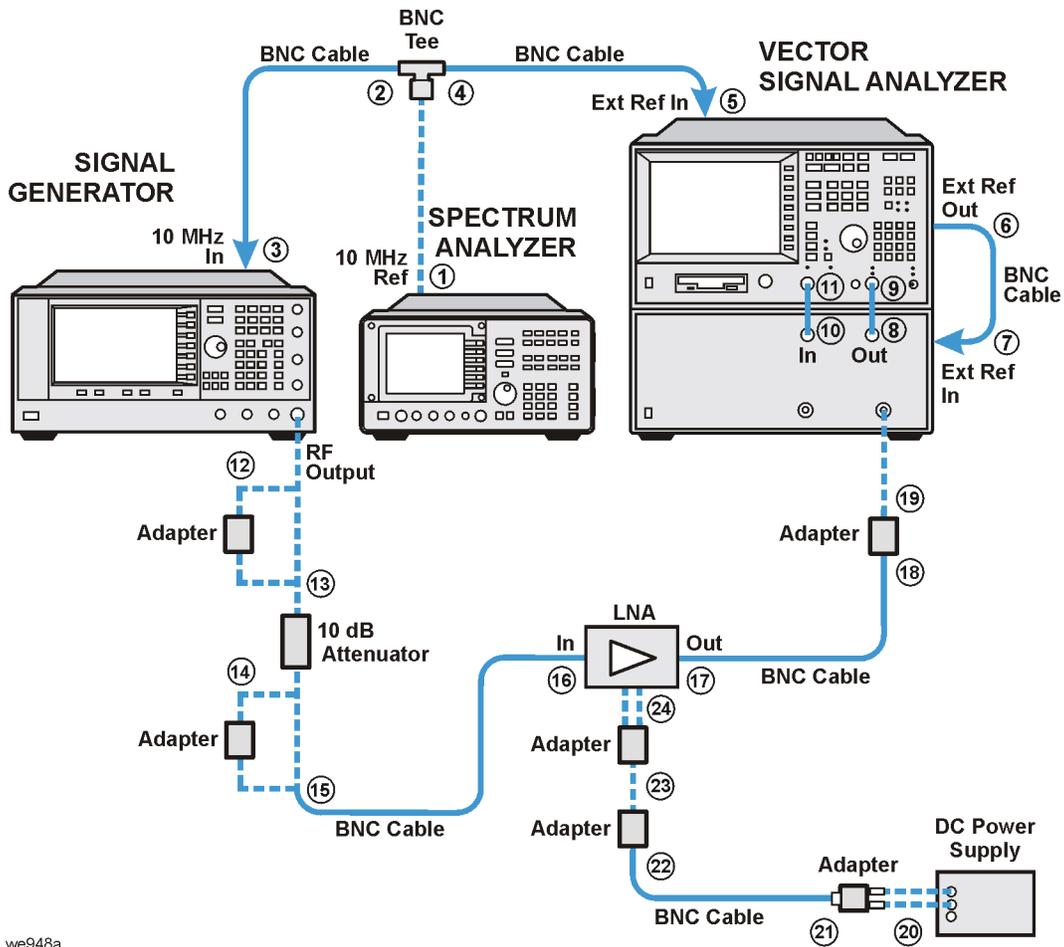
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

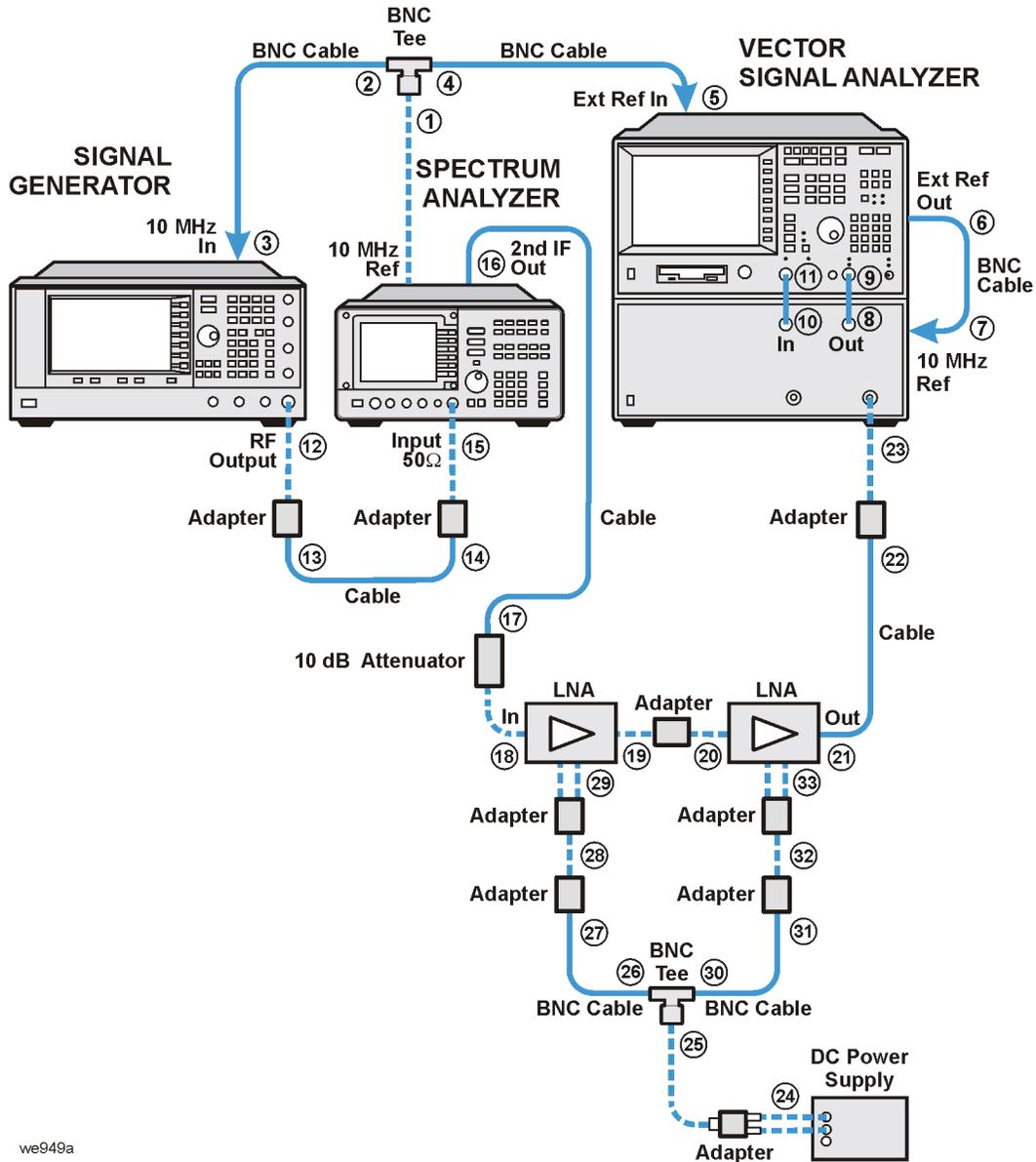
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-29 Setup for Attenuator Calibration - Low Frequency and Low Power**



we948a

**Figure 4-30 Setup for Attenuator Calibration - High Frequency, Low Power**



we949a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2.](#)

## Attenuator Calibration - High Band and Low Power

**NOTE** Prior to this calibration, the Attenuator Calibration - Low Band and High Power, Attenuator Calibration - High Band and High Power, and Attenuator Calibration - Low Band and Low Power must have been successfully completed.

This adjustment calibrates the step attenuator accuracy over the 3.2 to 20 GHz (or 3.2 to 40 GHz) frequency range and 65 dB to 115 dB attenuator range in 10 dB steps. The correction value of the 55 dB step attenuator is used in the calculation for each attenuator step.

During this adjustment, a spectrum analyzer downconverts the signal generator frequency to 310.7 MHz. This extends the measurement system frequency range to that of the spectrum analyzer (for example, 40 GHz). A Low Noise Amplifier (LNA) is used in this test setup to amplify the 310.7 MHz signal level; this keeps the signal level well above the vector signal analyzer's noise floor with large attenuator steps.

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter
✓	✓	Power Sensor, Type-N (m)	Agilent E9304A E-Series power sensor
✓		Power Sensor, APC 3.5 (m)	Agilent E4413A E-Series power sensor
	✓	Power Sensor, 2.4 mm (m)	Agilent 8487A Option H84 power sensor  Option H84 adds a Standards Lab Calibration
	✓	Power Sensor, 2.4 mm (m)	Agilent 8487D Option H84 power sensor  Option H84 adds a Standards Lab Calibration
✓	✓	Spectrum Analyzer, Input: Type-N (f) Option 001 Output: APC 3.5 (f)	Agilent 8563E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Spectrum Analyzer, Input: 2.4 mm (m) Option 001 Output: APC 3.5 (f)	Agilent 8564E Option 001 spectrum analyzer or Agilent 8565E Option 001 spectrum analyzer  Option 001 adds a Second IF Output
✓	✓	Vector Signal Analyzer, Input: Type-N (f) Output: BNC (f)	Agilent 89441A vector signal analyzer

<b>E8241A E8251A</b>	<b>E8244A E8254A</b>	<b>Test Equipment</b>	<b>Preferred Model or Alternate Model</b>
✓	✓	Power Supply	Use any generic power supply capable of supplying +15 Vdc @ 300 mA.
✓	✓	Low Frequency LNA, Input: BNC (f) Output: BNC (f)	Advanced Control Components W50ATC low frequency low-noise amplifier (LNA)
✓ (Qty 2)	✓ (Qty 2)	High Frequency LNA, Input: APC 3.5 (f) Output: APC 3.5 (f)	MITEQ Inc. AFS3-00010300-18-5P-4 high frequency low noise amplifier (LNA)
✓	✓	10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
✓ (Qty 3)	✓ (Qty 2)	Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable, 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓ (Qty 5)	✓ (Qty 5)	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable, or Agilent 10503A BNC (m) to (m) cable
✓ (Qty 2)	✓ (Qty 2)	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
✓ (Qty 2)	✓ (Qty 2)	Adapter, BNC (f) to BNC (f)	Agilent 1250-0080 BNC (f) to BNC (f) adapter
✓	✓	Adapter, BNC (m) to SMA (f)	Agilent 1250-2015 BNC (m) to SMA (f) adapter
✓ (Qty 2)	✓ (Qty 2)	Adapter, BNC (m) to mini-grabbers	Agilent 8120-2337 BNC (m) to mini-grabbers adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓	✓	Adapter, APC 3.5 (m) to (m)	Agilent 1250-1748 APC 3.5 (m) to (m) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓ (Qty 2)		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

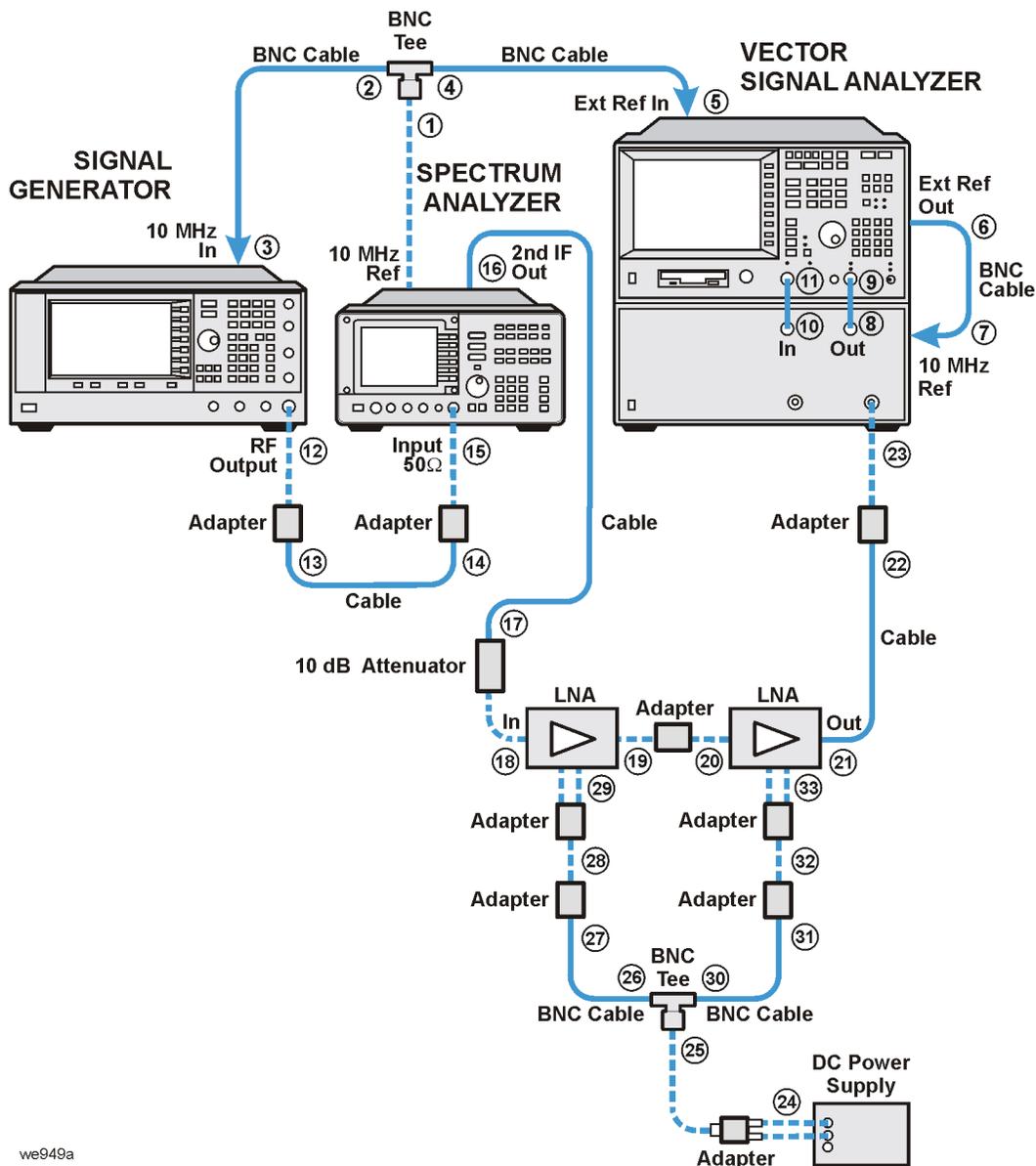
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-31 Setup for Attenuator Calibration - High Band and Low Power**



we949a

## In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to "Getting Started" in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to ["Contacting Agilent Technologies" on page 5-2](#).

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## ALC Modulator Calibration

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**NOTE** Prior to this calibration, ALC Dynamic Calibration and Power Flatness Calibration must have been successfully completed.

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This adjustment calibrates the high band and low band modulator's gain, bias, and high-band modulator linearity. These adjustments are made on the A8 Output and A10 ALC. The low-band modulator is located on the A8 Output and the high-band modulator is located on the A30 Modulator Filter with High Power.

During this adjustment, no test equipment is required. The calibrations are performed at multiple frequency points. Voltage measurements are made on the A10 ALC, at the ALC integrator loop output, using ABUS node INT\_OUT.

Gain adjustments are made by switching between two RF power levels and adjusting for a 0 V difference at the ALC loop integrator output. The ALCMODGAIN\_DAC, on the A10 ALC, sets the gain for frequencies above 3.2 GHz. The ALC\_MOD\_Driver\_GAIN\_DAC, on the A8 Output, sets the gain for frequencies below 3.2 GHz.

Linearity is adjusted to minimize the difference in voltages at the ALC loop integrator output between three power levels (high, medium, and low). The ALCMOD\_LIN\_DAC, on the A10 ALC, sets the linearity for frequencies above 3.2 GHz.

Bias is adjusted for a level of 0 V at the ALC loop integrator output with a power level of 0 dBm. The ALCMOD\_BIAS\_DAC, on the A10 ALC, sets the bias for frequencies above 3.2 GHz. The ALC\_MOD\_DRIVER\_BIAS\_DAC, on the A8 Output, sets the bias for frequencies below 3.2 GHz.

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to "Getting Started" in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to ["Contacting Agilent Technologies" on page 5-2](#).

## AM Gain Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the AM signal paths on the A11 Pulse/Analog Modulation Generator. A total of 16 paths and modes are calibrated. They are derived from two internal sources, two external inputs, two internal paths, and linear and exponential AM modulation modes.

During this adjustment, a function generator in dc mode is used to provide a signal to EXT 1 and EXT 2 inputs for the external path adjustments. The function generator output is also routed to a digital multimeter to ensure the desired dc level is achieved. The A11 Pulse/Analog Modulation Generator provides the signals required for the internal path adjustments.

External and internal linear modes are adjusted for 50% depth (-6.0206 dB). External and internal exponential modes are adjusted for -25 dB depth. Adjustments are made at 3.5 GHz and at a power level of 10 dBm. AM1\_DAC and AM2\_DAC on the A11 Pulse/Analog Modulation Generator are used to adjust the modulation signal level for the correct RF output level.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	Power Meter	Agilent E4418B E-Series power meter, or Agilent E4419A/B E-Series power meter
✓		Power Sensor, Input: Type-N (m)	Agilent E9304A E-Series power sensor
✓		Power Sensor, Input: APC 3.5 (m)	Agilent E4413A E-Series power sensor
	✓	Power Sensor, Input: 2.4 mm (m)	Agilent 8487A Option H84 power sensor  Option H84 adds a Standards Lab Calibration
✓	✓	Function Generator, Output: BNC (f)	Agilent 33120A function generator
✓	✓	XXDigital Multimeter, Input: Dual Banana Plug	Agilent 3458A Option 002 digital multimeter  Option 002 adds a High Stability Timebase
✓ (Qty 2)	✓ (Qty 2)	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable, or Agilent 10503A BNC (m) to (m) cable
✓	✓	Adapter, BNC Tee (m) (f) (f)	Agilent E9625A BNC Tee (m) (f) (f) adapter
	✓	Adapter, 2.4 mm (f) to Type-N (f)	Agilent 11903B 2.4 mm (f) to Type-N (f) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

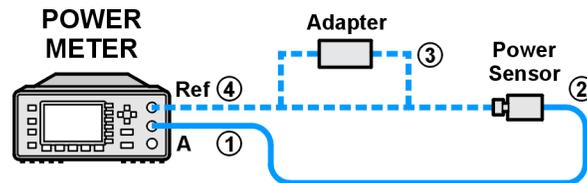
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

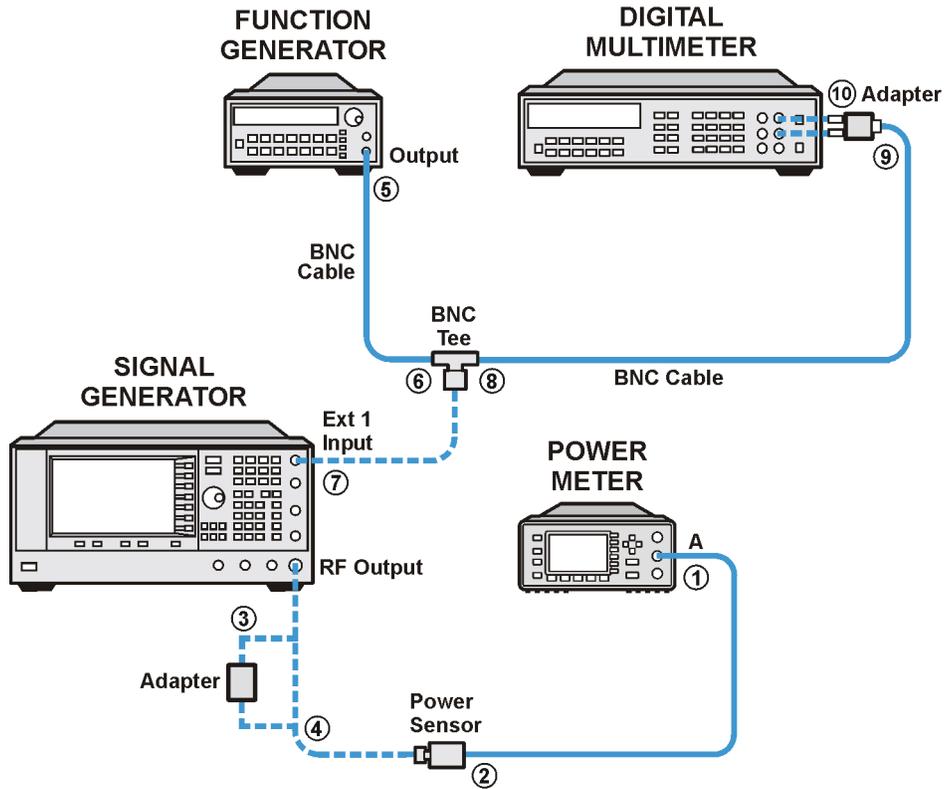
1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-32 Setup for Power Meter Calibration**

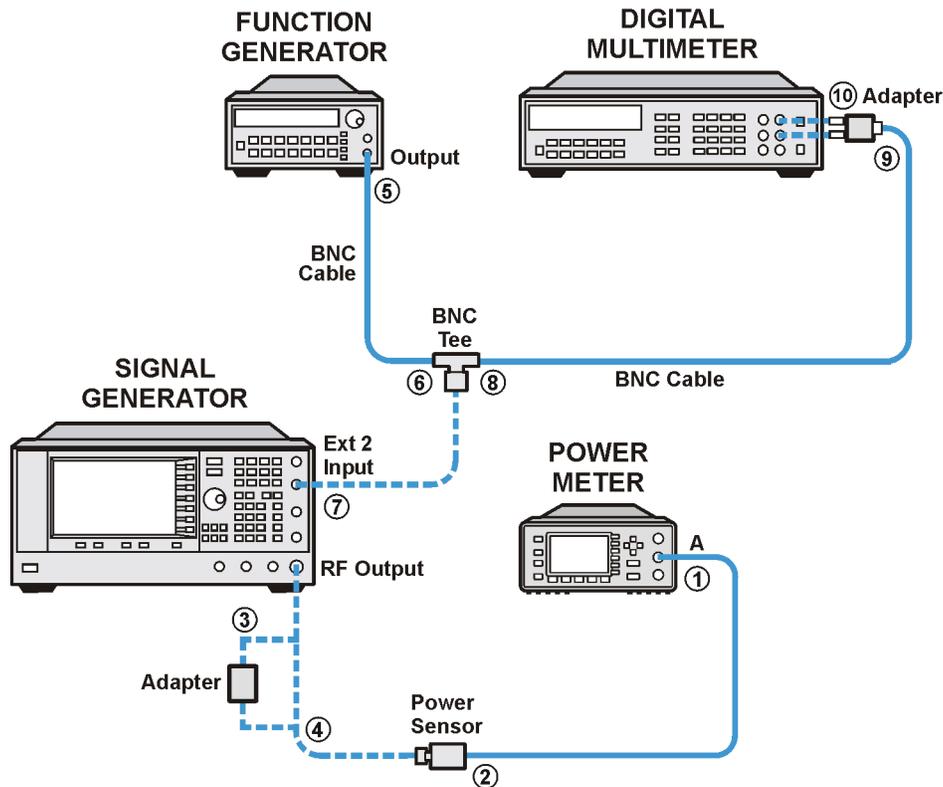


we944a

**Figure 4-33 Setup for Ext 1 Input**



we933a

**Figure 4-34 Setup for Ext 2 Input**

we936a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

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## Gain Adjustment Bypass Calibration (Adjustment for Frequencies < 3.2 GHz)

This adjustment calibrates the ALC modulator pre-level circuit on the A23 Low Band Coupler/Detector. The pre-level circuit maintains a constant power level to the low band ALC modulator.

During this adjustment, no test equipment is required. In a known condition, the available power to the ALC modulator is measured using the ABUS circuit and then set to a targeted level using the PRE\_LEVEL\_DAC. Next, the overall power level out of the low band loop is set using the GAIN\_ADJUST\_DAC. The next frequency point is selected and the routine repeated. After all frequency points have been measured, the calibration data is stored.

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to “Getting Started” in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to [“Contacting Agilent Technologies” on page 5-2](#).

## Pulse Width Calibration (Adjustment for E8251A and E8254A Models Only)

This adjustment calibrates the A11 Pulse/Analog Modulation Generator DAC for minimum pulse width error at a fixed pulse width and period.

During this adjustment, the Pulse Sync Out and the RF output are connected to a high frequency oscilloscope. The signal generator is set to a low band frequency, the RED\_VREF\_DAC is set to a low value, and a measurement is performed. The RED\_VREF\_DAC is set to a high value and a second measurement is performed. These measured values are used to estimate a new value; the new value is verified and stored. This process is repeated at a high band frequency using the FED\_VRED\_DAC.

E8251A	E8254A	Test Equipment	Preferred Model or Alternate Model
✓	✓	High Frequency Oscilloscope Mainframe	Agilent 54750A high frequency oscilloscope mainframe
✓	✓	Oscilloscope Plug-In, Chan 1/3 Input: 2.4 mm (m) Trigger Input: APC 3.5 (m)	Agilent 54752A/B oscilloscope plug-in
✓		10 dB Attenuator APC 3.5 (f) to (m)	Agilent 8493C Option 010 fixed attenuator
	✓	10 dB Attenuator 2.4 mm (f) to (m)	Agilent 8490D Option 010 fixed attenuator
✓		Cable, APC 3.5 (m) to (m)	Agilent 8120-4921 APC 3.5 (m) to (m) cable
	✓	Cable, 2.4 mm (m) to (f)	Agilent 8120-6164 2.4 mm (m) to (f) cable
✓	✓	Cable, BNC (m) to (m)	Agilent 8120-1840 BNC (m) to (m) cable, or Agilent 10503A BNC (m) to (m) cable
✓		Adapter, 2.4 mm (f) to APC 3.5 (f)	Agilent 11901B 2.4 mm (f) to APC 3.5 (f) adapter
	✓	Adapter, 2.4 mm (f) to (f)	Agilent 11900B 2.4 mm (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to (f)	Agilent 1250-1749 APC 3.5 (f) to (f) adapter
✓		Adapter, APC 3.5 (f) to Type-N (m)	Agilent 1250-1744 APC 3.5 (f) to Type-N (m) adapter

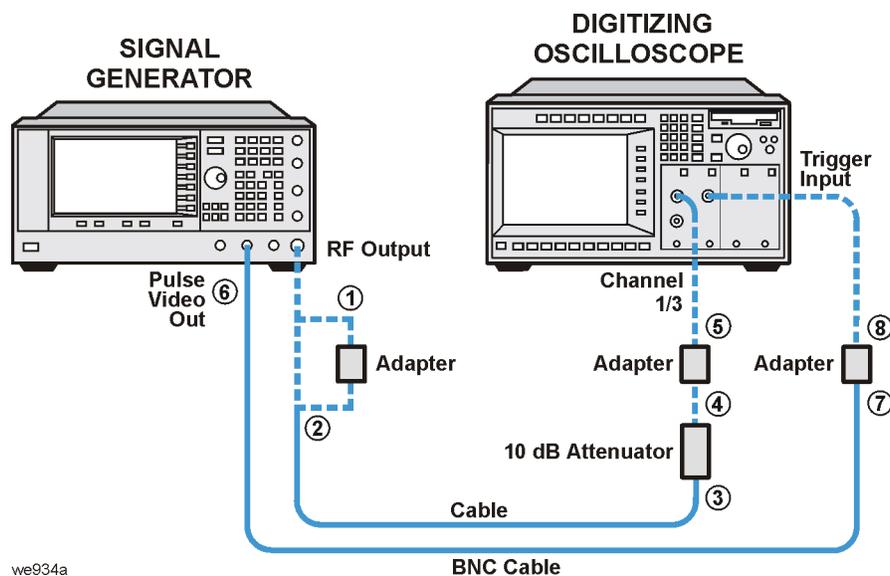
## Connections and Setup Procedures

**NOTE** All test equipment requires a 30 minute warm-up period to ensure accurate performance.

In the following test setup: cables are designated as solid lines, direct connections are designated as dashed lines, and circled numbers correspond with connections that are called out in the test software.

1. Connect all test equipment as shown.
2. Connect GPIB cables to all GPIB-controlled test equipment.
3. While performing this adjustment, follow all instructions on the controller display.

**Figure 4-35 Setup for Pulse Width Calibration**



we934a

### In Case of Difficulty

If this adjustment fails, perform the following:

- Verify that the equipment is set up as shown in the equipment setup for this adjustment.
- Turn to "Getting Started" in the troubleshooting section of the service guide. If you do not have a hard copy of the service guide (Option OBW), refer to the .pdf file available on the CD-ROM that came with your shipment.
- If necessary, obtain service from Agilent Technologies. Refer to ["Contacting Agilent Technologies" on page 5-2](#).

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## **5 Contacting Agilent Technologies**

## Contacting Agilent Technologies

You can obtain up to date product information, from Agilent Technologies, about your signal generator over the internet at: <http://www.tm.agilent.com>. Once the page is open in your browser, point to the **Products and Services** tab, point to **Test and Measurement**, and point to and select **RF and Microwave**. Once the page is open in your browser, select **Signal Sources**.

A current list of Agilent Technologies Sales and Service Offices can be accessed on the internet at: <http://www.agilent.com/find/assist>.

If you do not have access to the internet, one of the following Agilent Technologies locations can direct you to your nearest Agilent Technologies representative:

<b>United States</b> (tel) 1 800 452 4844	<b>Latin America</b> (tel) (305) 269 7500 (fax) (305) 269 7599	<b>Canada</b> (tel) 1 877 894 4414 (fax) (905) 282-6495	<b>Europe</b> (tel) (+31) 20 547 2323 (fax) (+31) 20 547 2390
<b>New Zealand</b> (tel) 0 800 738 378 (fax) (+64) 4 495 8950	<b>Japan</b> (tel) (+81) 426 56 7832 (fax) (+81) 426 56 7840	<b>Australia</b> (tel) 1 800 629 485 (fax) (+61) 3 9210 5947	

Asia Call Center Numbers		
Country	Phone Number	Fax Number
Singapore	1-800-375-8100	(65) 836-0252
Malaysia	1-800-828-848	1-800-801664
Philippines	(632) 8426802 1-800-16510170 (PLDT Subscriber Only)	(632) 8426809 1-800-16510288 (PLDT Subscriber Only)
Thailand	(088) 226-008 (outside Bangkok) (662) 661-3999 (within Bangkok)	(66) 1-661-3714
Hong Kong	800-930-871	(852) 2506 9233
Taiwan	0800-047-866	(886) 2 25456723
People's Republic of China	800-810-0189 (preferred) 10800-650-0021	10800-650-0121
India	1-600-11-2929	000-800-650-1101

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